

Serial Collusion by Multi-Product Firms¹

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Abstract

We provide empirical evidence that many multi-product firms have each participated in several cartels over the past 50 years. Standard analysis of cartel conduct, as well as enforcement policy, is rooted in the presumption that each cartel in which a given firm participates is a singular activity, independent of other cartel conduct by the firm. We argue that this analysis is substantially deficient in many aspects in the face of serial collusion by multi-product firms. We offer policy recommendations to reign in serial collusion, including a mandatory coordinated effects review for any merger involving a serial colluder, regardless of the apparent nature of the merger.

I. Introduction

“Thus, every agreement both helps to shape, and itself fits into, a logical pattern of cartel control. By defining for each company its area of operation, its duties and its rights, an agreement makes it possible for all companies to plan, individually and in concert, with some assurance of how each will behave. By limiting and regulating the activities of chemical companies, cartel agreements get rid of the uncertainties of a freely competitive market. The cartels provide a relatively stable framework within which conflicting interests may be reconciled by maneuver, bargain, and compromise.”⁵(Stocking and Watkins, page 516)

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⁵ Stocking, George W. and Myron W. Watkins, 1991, “Cartels in Action: Case Studies in International Business Diplomacy”, William S. Hein and Co, Inc, Buffalo, NY.

A rapidly emerging view holds that American markets have grown steadily more concentrated over the last twenty years.⁶ The evidence shows that a small number of firms dominate sales across most markets, not just high-tech markets.⁷ This trend is also evident globally, and in most other leading economies.⁸ Growing concentration is accompanied by growing mark-ups and profits.⁹ There are many theories about why competitiveness has declined, but no consensus. One theory holds that lax antitrust enforcement over the past two decades is a significant factor.¹⁰

Critics of antitrust enforcers focus on lax merger enforcement and tolerance of alleged abuses of dominant positions by high-tech firms. Other economists theorize that rising concentration is best explained by the growing importance of network effects, the growing importance of investments in information technology, and various other factors.¹¹

We take no position in this Article on what has caused increased concentration, nor do we take a position on the merits of antitrust enforcement against abuse of dominance. Instead, we hope to shed some light on possible failings in a domain of antitrust enforcement that most commentators believe has been quite successful over the past two decades – anti-cartel enforcement. We analyze enforcement improvements that could better deter cartel formation and ward off the associated suppression of competition.

We applaud increased vigor in global anti-cartel enforcement, and we do not dispute there have been remarkably successful prosecutions of global price-fixing in recent years. But certain patterns revealed by these prosecutions make us worry about what more might be out there. We wonder whether aggressive enforcement has deterred most price fixing or if instead, sprawling price fixing agreements remain hidden to enforcers who have become complacent.

The evidence of serial collusion by major multi-product firms is readily observable from the public record.¹² In the chemical industry, focusing solely on European Commission decisions, the following firms have been caught colluding in at

⁶ Autor et al. (2017)

⁷ Id.

⁸ Id.

⁹ Rognlie (2015), Barkai (2016), and de Loecker and Eeckhout (2017)

¹⁰ Grullon et al. (2016)

¹¹ Autor et al. (2017); Bessen (2017).

¹² It is important to note that a large multi-product serial colluder often has co-conspirators that are single product firms. When we use the terminology “serial multi-product cartels” we mean that there is at least one firm in the cartel that is a large multi-product firm and that has been involved in cartels in different product areas through time. Connor examined cartel convictions from 1990 to 2009 and found that “52 firms were members of seven or more cartels; 26 were in ten or more cartels; and six companies engaged in 20 or more cartels.... These top recidivists are primarily headquartered in the EU.” John M. Connor, *RECIDIVISM REVEALED: Private International Cartels 1990-2009* at 16. *See* Section II for more detailed empirical evidence regarding “serial multi-product cartels”.

least four products since 1955 – Akzo Nobel, BASF, Solvay, Bayer, Degussa, Hoechst, Arkema/Atofina, Shell, Rhone Poulenc/Aventis, ICI, Elf Aquitaine, and Atochem. In the electronics industry, focusing solely on European Commission decisions, the following firms have been caught colluding in at least four products since 1980 – Hitachi, Samsung, Mitsubishi, Toshiba, and Panasonic. In the auto parts industry, including European Commission and Department of Justice cases, the following firms have been caught colluding in at least three products since 2000 – Hitachi, DENSO, Autoliv, TRW, NGK Spark Plug, Mitsubishi, Mitsuba, Robert Bosch, Toyota, Panasonic, Valeo, and Yazaki. In the financial industry, focusing solely on European Commission decisions, the following firms have been caught colluding in at least three products since 2000– JP Morgan, Royal Bank of Scotland (RBS), and Union Bank of Switzerland (UBS). In the graphites industry, including European Commission and Department of Justice cases, SGL has been caught colluding in three products since 2000. Disturbingly, many of these firms have been caught colluding in substantially more than four products – for Hitachi the number is sixteen, for Akzo Nobel the number is nine.¹³

Note that these are the cartels that have been *detected*. Effective collusion is clandestine; these firms could be participating in many other undetected cartels. Because of this detection problem credible empirical work that estimates the magnitude of unobserved cartels is difficult.¹⁴ At any rate, the collusion in at least three of the industries persists – new investigations have recently been opened regarding collusion in the chemical, auto parts, and financial products markets.¹⁵

Evidence that serial collusion predominates over one-shot cartels should help change beliefs about why firms fix prices and violate antitrust law. Many commentators believe that organizational failures within firms are the primary causes of collusion. They argue that lax monitoring and inappropriate incentives allow and encourage *rogue* division managers to fix prices. Yet, the typical responsible managers who are identified in price fixing investigations do not seem to be rogues, and seem instead to be top officers of the accused firms.¹⁶ To be sure, the rogue manager scenario serves the interests of both serial colluding firms and enforcement authorities. Serial colluding firms can declare each episode of the conduct “rogue” and somehow avoid probing inquiries as to whether they have a business model that embraces explicit collusion. Public authorities, whose interests with antitrust enforcement should be at odds with serial

¹³ More details will follow in Section II. In some cases we include cartel participation by predecessor firms that were acquired by the named firm. Connor reports that Hitachi participated in 20 international cartels with 18 of those ending in the current millennium. John M. Connor, RECIDIVISM REVEALED: Private International Cartels 1990-2009 at 29.

¹⁴ A literature review indicates that “[c]artel studies generally conclude that only about 10 percent to 30 percent of all such conspiracies are discovered and punished.” John M. Connor, RECIDIVISM REVEALED: Private International Cartels 1990-2009 at 14. But we read these studies with caution.

¹⁵ Allissa Wickham, *EU Fines Ball Bearing Makers \$1.3B For Price-Fixing*, Law360, March 19, 2014, <https://www.law360.com/articles/519825/eu-fines-ball-bearing-makers-1-3b-for-price-fixing> (“To date, more than 100 products and 70 companies have been investigated in the commission’s car parts probe, according to Almunia. He noted that the EC is still examining alleged cartels in seat belts, air bags, steering wheels, air conditioning parts and lighting systems, among other car products.”) Add cites for chemicals and financial products.

¹⁶ See *infra* section III.D.

colluders, have almost never pointed to the multiple episodes of cartel conduct by these major multi-product firms as a separate and distinct concern because it is in their interest to tout their great success with cartel law enforcement, one case at a time.

The operation of serial collusion belies the rogue manager story and suggests instead that collusion is simply a way of doing business for many firms. Consider for example serial collusion in the chemical industry. Firms in this industry relied on the consulting firm, Fides/AC Treuhand, to facilitate, implement, and run seven chemical cartels.¹⁷ Every chemical firm listed above was in a cartel that used the services of Fides/AC Treuhand. How would rogue division managers, acting on their own and thus without support from anyone inside their firm, gain access to the cartel consulting services of Fides/AC Treuhand? Would they make an “out of the blue” phone call or knock on the door of Fides/AC Treuhand, without introduction of any kind, and ask for Fides/AC Treuhand to help them form and run a cartel? The regular use of Fides/AC Treuhand by large multi-product chemical firms suggests, as a reasonable conjecture, that (i) each firm has institutional knowledge of the value provided by Fides/AC Treuhand in assisting with suppression of interfirm rivalry, (ii) new division managers are trained to be aware of this value, and (iii) introductions to Fides/AC Treuhand are done by more senior people at the firm who have previous experience with Fides/AC Treuhand.

Collusion across a broad range of products by large multi-product firms creates many more degrees of freedom in addressing standard cartel problems than is available to single product firms engaged in collusion. The central problem of a cartel is secret deviations by members. All cartel members have an incentive to cheat on the collusive agreement, to sell more at elevated prices than what the cartel agreement specifies for them. To address this central problem, cartels implement structures, if they do not already exist, for pricing, allocation of the collusive gain, and enforcement of the cartel agreement. If two large multi-product firms are colluding across many product lines, they may, for example, make side payments to one another across product lines, have one firm exit one product and compensate that firm with the accommodation of entry by their co-conspirator in another, and sacrifice the profits in one cartel to punish deviant behavior by a single product co-conspirator as a warning signal to other single product firms with whom they are colluding in other products. None of these kinds of conducts are available or make sense for single product cartel members. Again, multi-product serial colluders have a greatly expanded set of actions they can take to enhance cartel profits across their portfolio of cartels. It is important to recognize the possibility that large multi-product serial colluders are managing a portfolio of cartels, not a single cartel.

The expanded set of opportunities available to firms that are managing a portfolio of cartels makes such cartels, on average, more profitable, stable, and long lasting. Thus, serial collusion likely causes more social harm and is harder to deter than one-shot collusion. All else equal, socially optimal enforcement efforts should be more rigorous in

¹⁷ European Commission cartel decisions document Fides/AC Treuhand’s involvement in seven chemical cartels (and another two in the wood products industry). We discuss this in detail in sections II and IV.B.

a world of serial collusion as compared to a world with equally frequent one-shot collusion.

Simply asking enforcement agencies and courts to take off their blinders and pay attention to serial collusion could help achieve greater rigor. Courts sometimes dismiss evidence of a history of collusive conduct as irrelevant or as lacking sufficient relevance to offset its potential for prejudice. They should not; this evidence is highly relevant.¹⁸ A history of serial collusion should also be used by enforcement agencies when deciding whether to launch price fixing investigations and especially when reviewing mergers that could facilitate future cartel activity.

We propose four reforms to improve anti-cartel enforcement. First, we spell out a new cartel reconstruction program. Enforcers should work with colluding firms to learn how each cartel worked, who was responsible, and what other markets might be affected. Second, more extensive monitoring should be imposed on serial colluders in sentencing, and settlement or plea agreements. A better understanding of the nature of serial collusion is needed to guide enforcers to find the red flags that monitors should watch for. Information from monitoring might trigger an investigation, and can also guide merger review where it intersects with anti-cartel enforcement. Third, we discuss problems with current leniency programs and explain why enforcers should complement leniency programs with bounty programs aimed at peeling small firms away from cartels. A successful bounty program would make small firms unappealing members for inclusion in a cartel which could destabilize a cartel or at least limit its ability to raise prices.

Finally, we favor a mandated review of mergers from a coordinated effects perspective whenever a serial colluder submits a merger for review. Cartelization might be facilitated even when the merging parties do not compete directly. For example, if firm A proposes a merger with firm B, and firm A makes products 1 to 50 while B makes products 51 to 100 there may appear to be, on the surface, no coordinated effects issue. However, if firm A is a serial colluder that has regularly colluded with firm C, and firm C makes many of the products that firm B makes, then a very real concern arises about the potential post-merger expansion of the portfolio of cartels involving A and C.

The paper is organized as follows. In Section II we provide more detail regarding the empirical evidence of serial collusion. In Section III we review the economic and legal analysis of single product collusion. In Section IV we extend the standard law and economic analysis of collusion, which is predicated on all collusion being singletons, to multi-product firms engaged in collusion across a broad range of products. In Section V we flesh out policy recommendations. In Section VI we offer concluding comments.

II. Empirical Evidence of *Serial* Collusion

¹⁸ See Christopher Leslie, Duke L. J. (2017)

The label “serial collusion” requires further examination. Multiple cartel episodes by a given firm occurring over the same time interval where this time interval is relatively short would not constitute serial collusion. For example, suppose a firm was found to have participated in six cartels that each lasted 18 months from January 2000 until June 2001. We display this possibility in the Hypothetical Duration Chart below. Collusive behavior of this sort might be explained by a single top executive who experimented briefly with explicit collusion, and the firm stopped the collusion when it was uncovered by other officers or directors. This pattern does not suggest the firm has adopted collusion as a way of doing business and the label *serial* collusion does not fit this hypothetical.

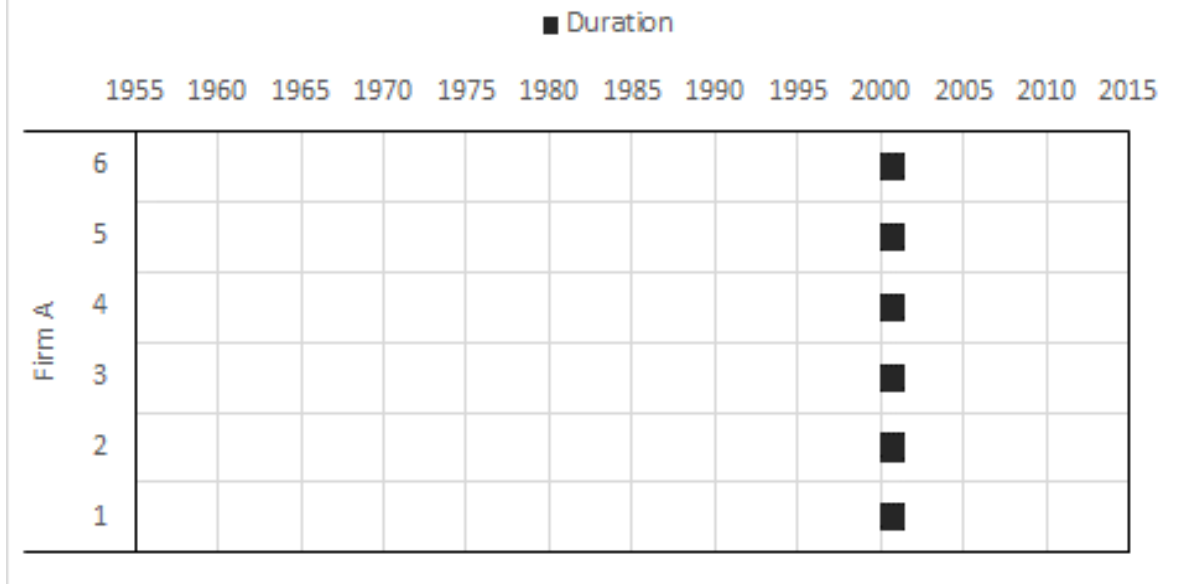
Figures 1A, 1B, 2, 3 and 4 display cartel duration charts in the chemical, electronics, auto parts, and financial products markets. The charts for the chemical, electronics, and financial products markets do not look at all like the Hypothetical Duration Chart. There is considerable variation in the start and end dates of the cartels across different product lines.¹⁹ The data in these charts is consistent with the view that firms are serial colluders in the sense that they move into cartels when they have the opportunity and move out of cartels when they collapse because of cheating or detection. The auto parts cartels shows less heterogeneity with respect to duration though we suspect serial collusion is also present in this industry, we will comment further on that industry below. We present additional evidence later in this section that over the span of decades certain serial colluders, especially in chemicals and electronics, have repeatedly restarted cartels after earlier episodes of serial collusion have collapsed.

Besides examining cartel duration we believe it is also important to study the pattern of cartel membership across the range of product markets present in an industry. If collusion occurs exclusively between small subsets of the firms in an industry, and these subsets stayed relatively isolated from one another, then this would be less concerning than collusion across a broad range of firms through time. Collusion across a broad range of firms would imply that all participating firms saw the value of collusion across their many product lines and, additionally, cartel issues could be resolved across products rather than solely within a given product.

The Hypothetical Cartel Involvement Table below displays a pattern in which the colluding firms have formed collusive subsets that are isolated from each other. This

¹⁹ Zhou (2016) p. 381 (“[C]artels with different markets but a common colluder usually start sequentially, with, on average, approximately 3 years between each starting date. A similar pattern exists for cartel dissolution where there is an overlap in membership between different cartels: there are, on average, approximately two-and-a-half years between each dissolution date.”)

Hypothetical Duration Chart



pattern of behavior provides fewer benefits to cartel members in terms of stabilizing and increasing the profitability of collusion, and thus it is less problematic. Figures 5-9 later in this section display cartel involvement tables for the chemical, electronics, auto parts, and financial products industries. The tables show a complex web of connections between firms that substantially diverges from the Hypothetical Cartel Involvement Table.

Now we will take a closer look at the duration charts in Figures 1A, 1B, 2, 3, and 4. Figures 1A and 1B are for the chemical firms listed in the introduction. Time in years is plotted on the horizontal axis. A number identifying separate cartels is on the vertical axis. The numbers correspond to the cartels identified in Appendix A. The cartels are grouped by multi-product firms. For Akzo Nobel, the first firm in Figure 1A, we see a horizontal bar for the first cartel, cartel 19, which is the Organic Peroxides cartel. The solid line shows the duration of the cartel as reported in the EC decision. The Organic Peroxides cartel lasted nearly 30 years, starting in the early 1970's. It would be difficult to credibly attribute a 30 year cartel to a single rogue division manager. Also, it seems difficult to imagine that a cartel could function for 30 years without the knowledge of top management at Akzo. It is clear that there are a range of start dates for the Akzo cartels, from the early 1970's to approximately 2005. The durations are 6 to 8 years for many cartels. The range of start dates as well as the durations leads us to reject the notion that there was a single top executive who tried collusion briefly across many product lines. As

we look through the rest of the firms in Figure 1A and 1B we see a pattern of cartel conduct similar to the conduct of Akzo.²⁰

Hypothetical Cartel Involvement Table

Product Market	Product Market																			
	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6	Product 7	Product 8	Product 9	Product 10	Product 11	Product 12	Product 13	Product 14	Product 15	Product 16	Product 17	Product 18	Product 19	Product 20
Company	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Firm 1																				
Firm 2																				
Firm 3																				
Firm 4																				
Firm 5																				
Firm 6																				
Firm 7																				
Firm 8																				

²⁰ The European Commission recently carried out unannounced inspections of chemical firms that purchase styrene monomers as part of an investigation of potential cartel conduct. The names of the raided firms was not released by the European Commission. See <https://www.icis.com/resources/news/2018/06/08/10229758/european-commission-inspects-styrene-monomer-purchasing-firms-suspected-of-antitrust-breaches/> accessed June 23, 2018.

Figure 1A: Cartel Participation Durations for Chemical Firms Participating in Four or More Cartels since 1955

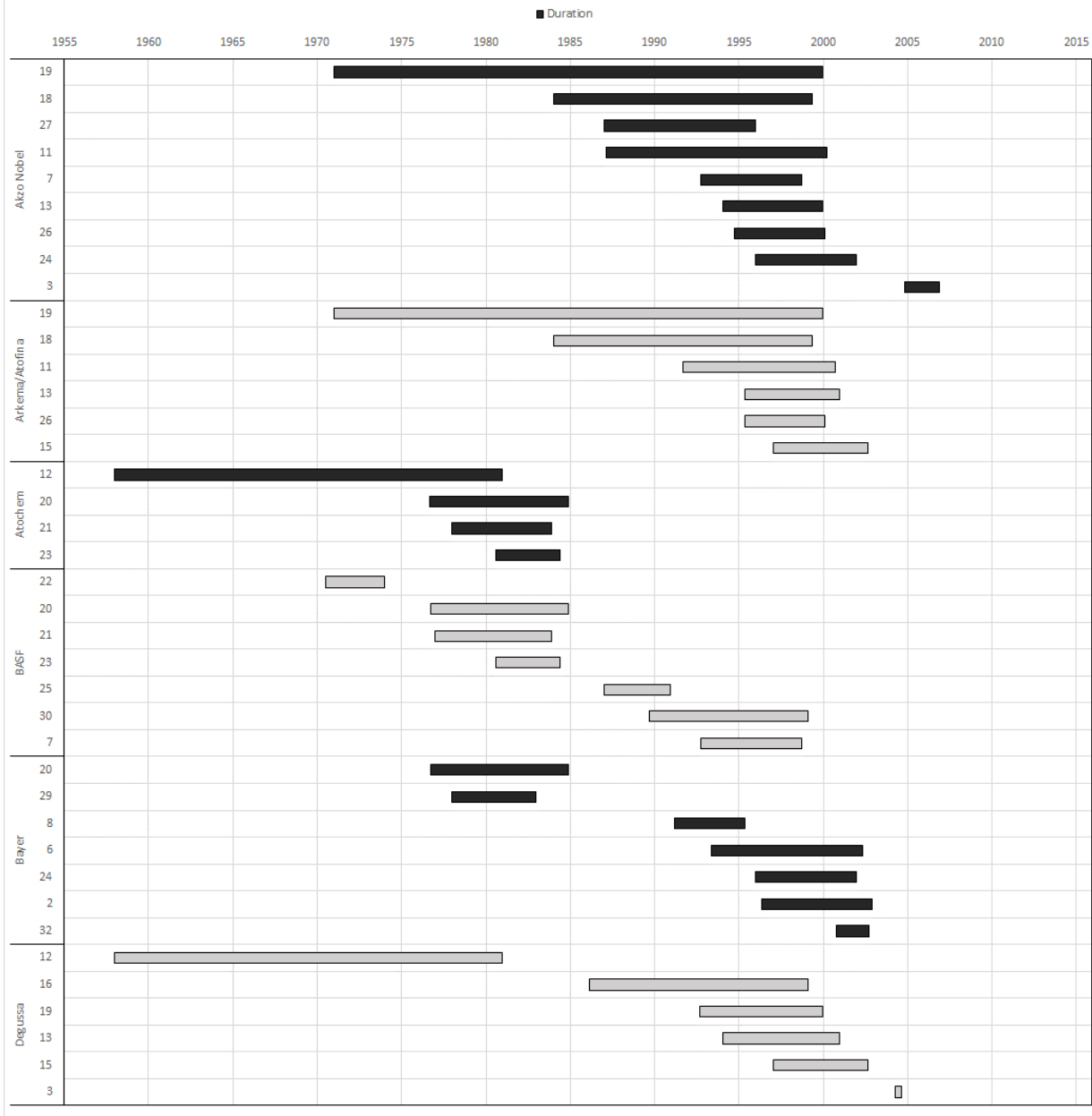
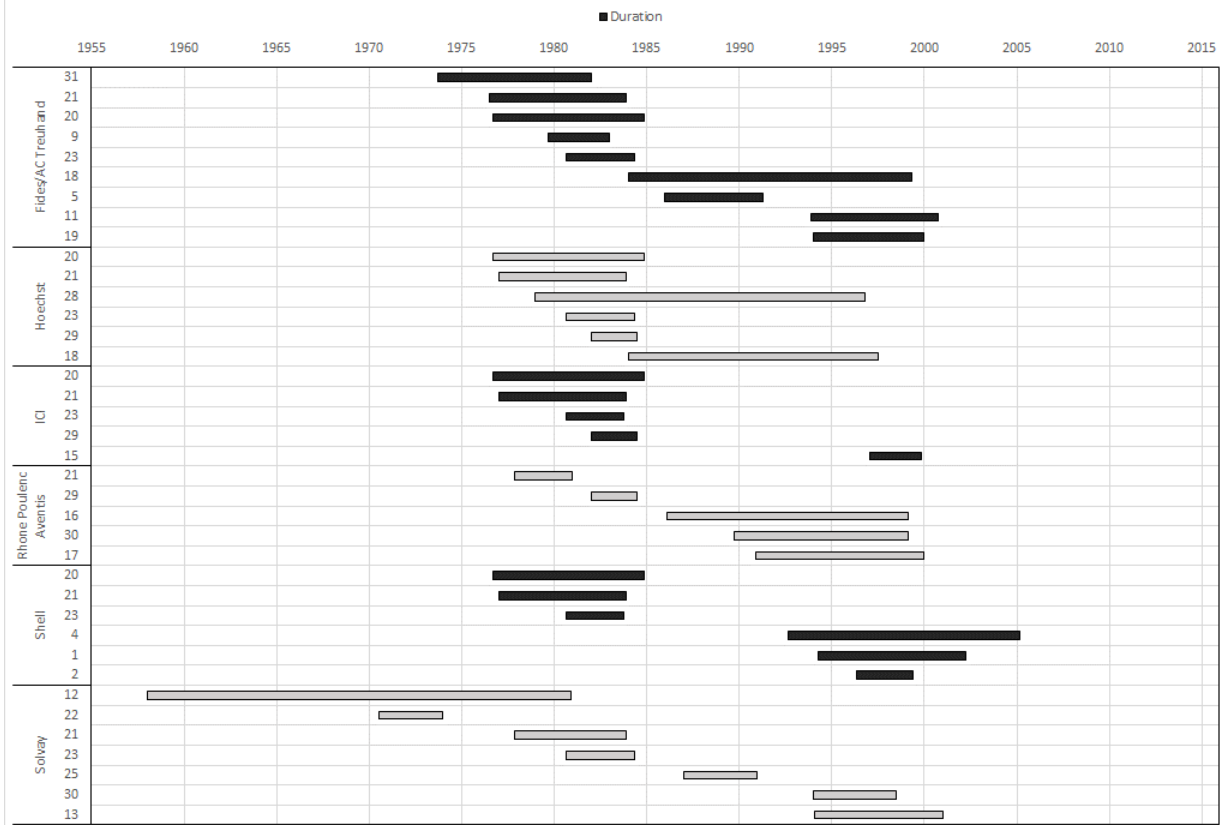


Figure 1B: Cartel Participation Durations for Chemical Firms, and Fides/AC Treuhand, Participating in Four or More Cartels since 1955



The first firm in Figure 1B is not a chemical firm. It is Fides/AC Treuhand. According to its webpage, Fides/AC Treuhand is an association management company, providing management services to trade associations, professional societies, and similar organizations. For many of the European chemical cartels it managed and facilitated a broad range of cartel activities such as coordination of price increases, cartel-related communications, monitoring of compliance with the cartel agreement, and adjustment of members' share allocations.²¹

It is evident from Figure 1B that Fides/AC Treuhand has played the role of cartel facilitator for many years, for prolonged periods of time within each cartel, and across a range of products.²² It is interesting to note that only seven of the nine cartels listed for Fides/AC Treuhand are in the chemical industry. The other two are in the wood products industry. Apparently the value of Fides/AC Treuhand as a cartel facilitator is understood in industries beyond chemicals.

Figure 2 provides the duration information for the electronics firms identified in the introduction. Note that the time scale starts in 1980, not 1955. The cartels start at different dates and they last for up to 15 years.

²¹ See, Eric Janssen, *AC Treuhand And The Facilitating Of Cartels*, Legal Knowledge Portal, Nov. 6, 2015, <https://legalknowledgeportal.com/2015/11/06/ac-treuhand-and-the-facilitating-of-cartels/> ("AC Treuhand had detailed knowledge of the content of the cartel agreements and in fact had formulated and distributed all the information regarding prices, quota and customers. It was allowed to carry out audits in the offices of the cartel members. Only the data which had ultimately been approved by AC Treuhand could serve as the basis for the negotiations and the agreements. AC Treuhand had made its business premises available to keep the cartels hidden. According to the European Commission, it was the task of AC Treuhand to prevent the discovery of the two cartel infringements.")

²² See, Rick Busscher, Martin Herz, and Hans Vedder, *The Shortest Competition Judgment Ever; AC Treuhand II*, European Law Blog, Nov. 9, 2015, <http://europeanlawblog.eu/2015/11/09/the-shortest-competition-judgment-ever-ac-treuhand-ii/> ("...as with any cartel, there needs to be supervision and enforcement. This is tricky for cartelists themselves, as the supervisor is exposed to the risk of being qualified as a ringleader, negating the possibility of immunity under the Leniency Guidelines. Hence, the heat stabilisers cartel thought of a better way, namely hiring an independent firm to ensure that parties stick to the cartel.")

Figure 2: Cartel Participation Durations for Electronics Firms Participating in Four or More Cartels since 1980

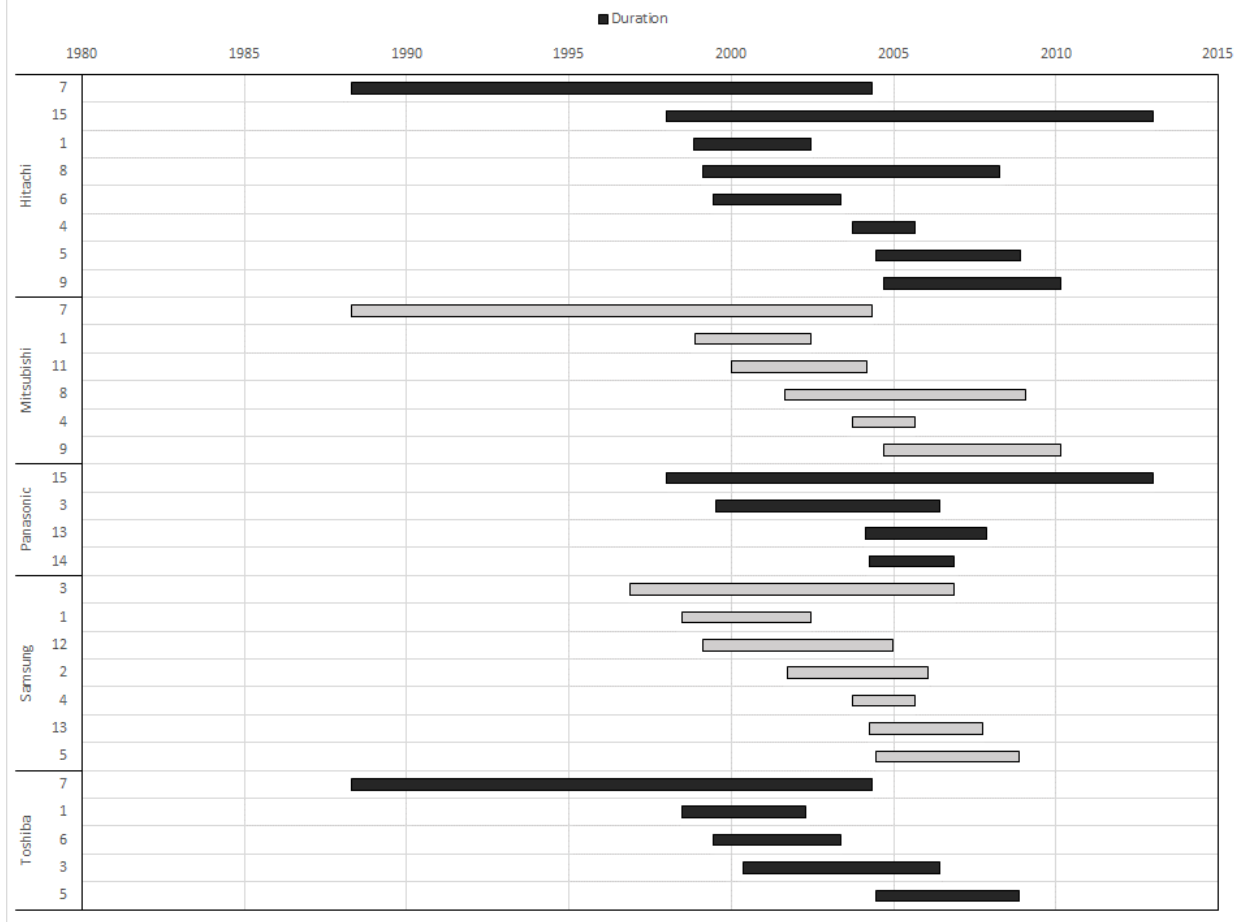


Figure 3 presents the information for the auto parts cartels. The durations are coincident for several of the cartels. For example, the first bar for Hitachi pertains to 7 cartels, all of which have the same duration. Note that the time range for the figure is 1995 to 2015. The auto parts cartels, viewed in isolation, leans away from an interpretation of serial collusion since many of the cartels started at the same time. However, the durations of many of the cartels is 10 years, which is difficult to explain as being the action of a single rogue division manager.

Note that Hitachi appears in both the electronics and auto parts cartels. Altogether, Hitachi participated in 16 cartels. Similarly, aggregating across electronics and auto parts, Mitsubishi participated in 8 cartels and Panasonic in 8. Thus, it is reasonable to conjecture that these three firms brought their prior experience with collusion in electronics to auto parts.

Figure 3: Cartel Participation Durations for Auto Part Firms Participating in Three or More Cartels since 1995



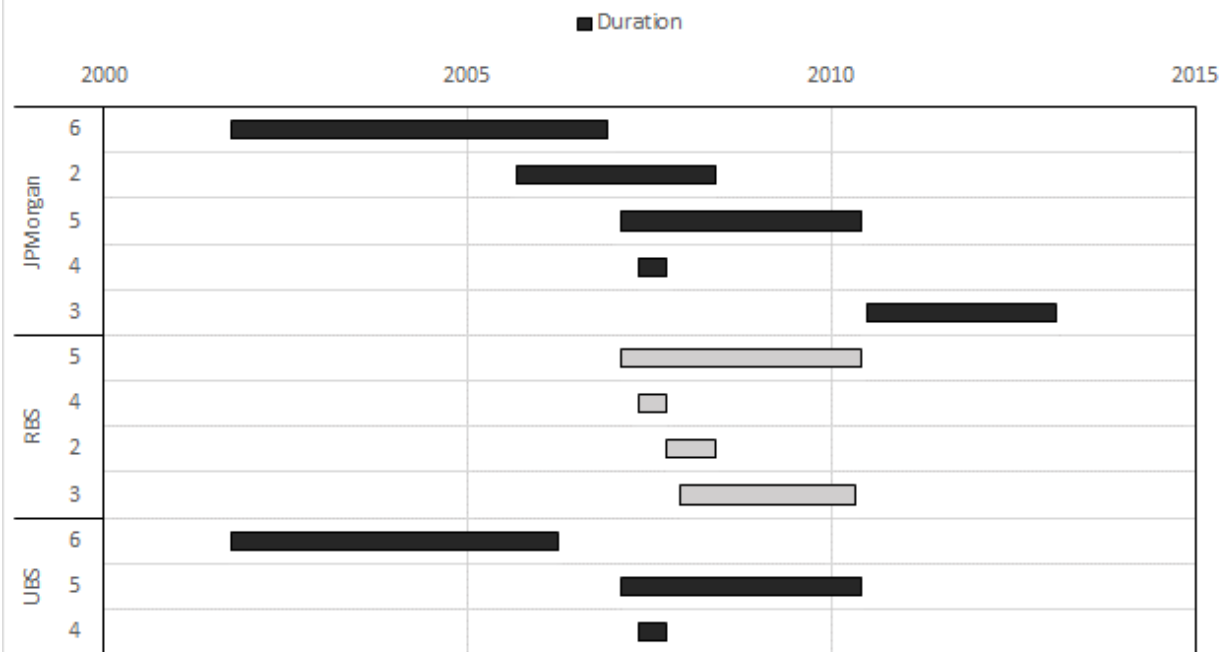
Finally, in the financial services industry, there have been fewer cartels detected than in chemicals, electronics, or auto parts. Figure 4 presents information for the financial services cartels.²³ Note that the time range in the figure is 2000 to 2015. JP Morgan has participated in 5 cartels,²⁴ RBS in 4, and UBS in 3.²⁵ The start dates have substantial variation and the durations are mostly on the order of 3 years.

²³ Euro Interest Rate Derivatives Cartel involved seven banks: Barclays, Deutsche Bank, The Royal Bank of Scotland, Societe Generale, Credit Agricole, HSBC, JPMorgan Chase. The first four banks settled with the EC in December 2013 and paid over €820 million in total. The last three paid €484 in total in December 2016 after refusing to settle. Swiss Franc Interest Rate Derivatives two price fixing agreements were prosecuted. The Royal Bank of Scotland and JPMorgan Chase were identified when RBS applied for immunity on August 9, 2011. RBS received full immunity and JPMorgan Chase was fined over €61 million. The Yen Interest Rate Derivatives Cartel involved the United Bank of Switzerland, the Royal Bank of Scotland, Deutsche Bank, Citigroup, JPMorgan, RP Martin, and ICAP.

²⁴ Evidence of collusion within municipal bonds from JP Morgan was assembled through DOJ cases concerning bid rigging among individuals, James L. Hertz and Alexander Wright, who worked for JP Morgan. However, within these cases, the name of the financial institution was redacted from the public release. It can be found from this [Forbes](#) article and this [SEC](#) press release that James L. Hertz and Alexander Wright, respectively, worked for JP Morgan during the duration of the cartel.

²⁵ Press releases for contract fraud in relation to the Investment of Municipal Bonds within UBS were distributed by the Department of Justice. The individuals that were mentioned in the press releases were Gary Heinz, Peter Ghavami, Michael Welty, and Mark Zaino who were all convicted in counts of wire fraud when employed at UBS.

Figure 4: Cartel Participation Durations for Financial Firms Participating in Three or More Cartels since 2000



We now return to the chemical industry and examine the pattern of firm involvement with other firms across these cartels. Figure 5 presents that information with firm names on the rows and cartel names in the columns. It is clear that the cartel participation is not concentrated within specific pairs of firms but extends broadly across many firms. It is important to note that every chemical firm in Figure 5 has been involved in at least one cartel where Fides/AC Treuhand was a cartel facilitator.

Figure 6 presents the pattern of cartel involvement for the firms in the electronics industry. Again, there is broad participation across the firms. In fact, Hitachi has conspired with each of the other four firms in at least one cartel as has Samsung and Toshiba.

Figure 5: Cartel Involvement for Chemical Firms

Product Market	Company																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Row Sum		
Bitumen																																			
Butadiene Rubber																																			
Calcium Carbide																																			
Candle Waxes																																			
Cartonboard																																			
Chloroprene Rubber																																			
Choline Chloride																																			
Citric Acid																																			
Fatty Acids																																			
Food Flavour Enhancers																																			
Heat Stabilizers																																			
Hydrogen Peroxide 1984																																			
Hydrogen Peroxide 2006																																			
Lysine																																			
Methacrylates																																			
Methionine																																			
Methylglucamine																																			
Monochloroacetic Acid																																			
Organic Peroxides																																			
Polyethylene																																			
Polypropylene																																			
Potash																																			
PVC																																			
Rubber Chemicals																																			
Soda Ash																																			
Sodium Chlorate																																			
Sodium Gluconate																																			
Sorbitates																																			
Synthetic Fibers																																			
Vitamins																																			
Woodpulp																																			
Nitrile Butadiene Rubber																																			
Company	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Row Sum		
Akzo Nobel																																			9
Fides/Treuhand																																			9
BASF																																			7
Bayer																																			7
Solvay																																			7
Arkema/ Atofina																																			6
Degussa																																			6
Hoechst																																			6
Shell																																			6
Elf Aquitaine																																			5
ICI																																			5
Rhone Poulenc/Aventis																																			5
Atochem																																			4

Figure 6: Cartel Involvement for Electronics Firms

Product Market	Company															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Row Sum
DRAMs																
LCD Panels																
Computer/TV Monitor Tubes																
Smart Card Chips																
Optical Disk Drives																
Power Transformers																
Insulated Switchgears																
Power Cables																
Alternators and Starters																
Videotapes																
Elevators/Escalators																
CRT Glass																
Rechargeable Batteries																
Refrigeration compressors																
Capacitors																
Company	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Row Sum
Hitachi																8
Samsung																7
Mitsubishi																6
Toshiba																5
Panasonic																4

Figure 7: Cartel Involvement for Auto Part Firms

Company	Product Market																																				
	1	2	3	4	5	6	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	Row Sum			
Hitachi																																				9	
DENSO																																					7
Toyoda																																					4
Panasonic																																					3
Robert Bosch																																					3
TRW																																					3
Autoliv																																					3
NGK Spark Plug																																					3
Mitsubishi																																					3
Mitsuba																																					3
Valeo																																					3
Yazaki																																					3

Figure 8: Cartel Involvement for Financial Firms

Company	Financial Market						
	1	2	3	4	5	6	Row Sum
JPMorgan							5
RBS							4
UBS							3

Figure 7 and 8 present the structure of involvement of relevant firms in the auto parts and financial services cartels. There is an important caveat regarding these figures. Unlike chemicals and electronics, the auto parts and financial services cartel cases are sometimes drawn from the DOJ pleadings and admissions. The EC prohibition decisions will enumerate all firms participating in a cartel but the DOJ will typically only identify the firm that is pleading or admitting culpability. Thus the involvement matrices for auto parts and financial services are truncated in contrast to the matrices for chemicals and electronics. Of course, this is true for the duration figures as well. Namely, the firms not identified by the DOJ in the auto parts and financial services cases are not in the duration plots.

Overall, the frequency of collusion by this collection of firms across chemical, electronics, auto parts, and financial product markets is striking. Despite additional penalties imposed by some competition law systems for recidivism, many of these firms chose to engage in a series of collusive schemes over a significant period of time.²⁶ The

²⁶ Other researchers have documented repeat cartel offenses by many firms. Connor notes that “[d]uring 1990-2009 the French petrochemical company Total SA participated in 27 cartels with 24 of those ending in the current millennium. The French pharmaceutical firm Sanofi-Aventis participated in 22 with 8 of those ending in the current millennium. The German chemical company BASF participated in 21 with 17 of those ending in the current millennium. The French cement company Lafarge SA participated in 21 with 16 of those ending in the current millennium. The German pharmaceutical company Bayer AG participated in 20 with 5 of those ending in the current millennium. The Japanese conglomerate Hitachi Ltd. participated in 20 with 18 of those ending in the current millennium.” John M. Connor, *RECIDIVISM REVEALED: Private International Cartels 1990-2009* at 29.

“In the set of 510 cartel members fined by the EC in 1998-2014, Marvão (2015) identifies 89 “multiple offenders” (firms fined for collusion more than once), 10 “repeat offenders” (firms which initiate a cartel after being investigated for another cartel), and 5 recidivists following the definition from Werden et al. (2011): firms which initiate a cartel after being fined for another cartel. The DOJ dataset compiled by Levenstein and Suslow (2015), spanning 1961-2013, preliminarily finds 113 “multiple offenders” but only 14 “repeat offenders”. Of these 14 firms, 5 that had been previously indicted were caught in the 1990s, but none was indicted again by the DOJ in the 2000s. Although the number of (discovered) “true recidivists” is not zero, it is less than 1% in these two samples (EU, US). Recidivism seems to arise when there are lapses in enforcement; not surprisingly, some firms take advantage of these lapses to return to old behaviors. Designing policies that are able to prevent recidivism requires understanding whether this is an industry or firm-level phenomenon.” Catarina Marvão, *The Issue of Repeat Cartel Offences*, Free Policy Network, Feb. 1, 2016, <http://freepolicybriefs.org/2016/02/01/the-issue-of-repeat-cartel-offences/>

Marvão describes her work with Levenstein and Suslow and concludes: “The authors show that there is a large share of repeat and multiple offenders in chemicals and a surprisingly high proportion of repeat offenders in the manufacture of transport and electrical equipment. The highest proportion of multiple offenders is found in pharmaceuticals and refined petroleum products. The transportation and storage market is a sector with a high incidence of collusion (83 convicted cartel members), but no repeat offenders.” Marvão discussing Levenstein, M., Marvão, C., Suslow, V., 2015. *Serial Collusion in Context: Repeat Offenses by Firm or by Industry?* OECD Global Forum on Competition. DAF/COMP/GF(10/2015).

Levenstein and Suslow (2015) p. 3 (finding 23 chemical cartels and involving 106 firms fined by the EU between 1998 and 2014) p. 4 (“These cartels were broad in their geographic impact – 16 were also convicted in the U.S. – and long in duration, as the average duration was 94 months.”) Examining cartel conviction from 1990 to 2009 reveals “52 firms were members of seven or more

firms active in each cartel change from cartel to cartel because these firms manufactured different portfolios of products. Many firms encountered one another in two or more cartels. Furthermore, for the chemical cartels there is the ongoing use of a cartel facilitator.

Thus far our discussion has concentrated on recent cartel activity in four industries for which we have the best data on participation and duration. We conclude this section by highlighting other instances of serial collusion. Our discussion suggests that serial collusion has been a global problem almost since the chemical industry was established in Germany before 1900. Episodes of serial collusion centered in the United States are also well represented in the history of price fixing.

Figure 9: Cartel Involvement for 1950s Electrical Firms

Product Market										Row Sum
	Switchgear	Circuit Breakers	Insulators	Lightning Arresters	Open Fuse Cutouts and Acc.	Bushings	Isolated-Phase Buses	Navy and Marine Switchgear	Transformers	
Company	1	2	3	4	5	6	7	8	9	
Westinghouse Electric Corp.										9
General Electric Co.										9
I-T-E Circuit Breaker Co.										6
H. K. Porter Co., Inc.										4
Allis-Chalmers Mfg Co.										3
McGraw-Edison Co.										3
Ohio Brass Co.										3
Joslyn Mfg. & Supply Co.										3
Federal Pacific Electric Co.										2
Lapp Insulator Co.										2
A.B. Chance Co.										2
Southern States Equipment Corp.										2
Hubbard & Co.										2
Moloney Electric Co.										1
Wagner Co.										1
Porcelain Insulator Co.										1
Schwager-Wood Corp.										1
Kuhlman Electric Co.										1

We begin by returning to collusion in the electronics industry. In Figures 2 and 6 we presented information about electronics cartels spanning twenty-five years starting in

cartels; 26 were in ten or more cartels; and six companies engaged in 20 or more cartels.... These top recidivists are primarily headquartered in the EU.”

Finally, Zhou observes: “Cartels often involve firms that collude in more than one market...European Commission ... cartel decisions for 1985-2014 shows that 112 (71%) of the prosecuted cartels involved multi-market colluders.” Zhou (2016) p. 381.

the late 1980s. Figure 9 presents the pattern of cartel involvement in the electrical industry that was uncovered in the U.S. in the late 1950s. The products in those earlier cartels tended to relate more to electricity generation rather than components in consumer electronics products featured in the more recent cartels.

The duration of these cartels is not clear, but two of the leading cartel members, General Electric and Westinghouse were frequently investigated and prosecuted for antitrust violations, including price fixing, in the decades leading up to and following the 1950s electrical equipment conspiracy.²⁷ Twice before the electrical equipment conspiracy General Electric and Westinghouse were sued for using patent licenses to facilitate price fixing in electrical products. In a close and controversial case the companies were acquitted in the first suit, *U.S. v. General Electric* (1924), but they were found liable for price fixing in 1948 in *U.S. v. Line Material*. Southern States Equipment Co., another one of the colluding firms listed in Figure 9, was also found liable in 1948. Finally, in 1976 the DOJ reached a settlement agreement with GE and Westinghouse that modified the 1962 consent decree.²⁸ The settlement was reached in response to complaints by the electric utility industry that the companies continued to fix prices.²⁹

Steel is another industry that seems to have been plagued by serial collusion.³⁰ A steel cartel was established in Western Europe during the late 1920s to cover exports of various steel products.³¹ American companies joined European companies to reestablish a steel cartel from 1933 – 1938. It covered the same products as the 1920s cartel and several additional products.³² “[I]n 1938, almost ninety-eight percent of world steel exports were regulated by restrictive production and marketing arrangements.”³³ After World War II, U.S. Steel and Bethlehem Steel lead six different multi-market price-fixing schemes.³⁴ “VSL construction was similarly involved (including as a leader) in multiple

²⁷ Westinghouse had twenty and General Electric had nineteen antitrust convictions from 1955-1980. JAMES M. CLABAULT & MICHAEL K. BLOCK, *SHERMAN ACT INDICTMENTS: 1955-1980*, at 905-11 (1981). Cited in John M. Connor, *RECIDIVISM REVEALED: Private International Cartels 1990-2009*

²⁸ <Explain 1962 decree and settlement modification>

²⁹ Luis Cabral, *General Electric and Westinghouse*, NYU Stern (2010).

³⁰ U.S. Steel had eleven and Bethlehem Steel had seven antitrust convictions from 1955-1980. JAMES M. CLABAULT & MICHAEL K. BLOCK, *SHERMAN ACT INDICTMENTS: 1955-1980*, at 905-11 (1981). Cited in John M. Connor, *RECIDIVISM REVEALED: Private International Cartels 1990-2009*.

³¹ Stocking and Watkins (1946) at 186 “Syndicates were set up to sell semifinished steel, structural steel, merchant bars, hoops and strips, and plates in export markets for all cartel members at uniform prices.”

³² Stocking and Watkins (1946) at 187-189 Second international steel cartel included American and European companies from 1933 through 1938. It controlled semifinished steel, structural steel, merchant bars, cold rolled bands and strips, hot rolled bands and strips, and medium plates, thick plates, galvanized plates, tin plates, wired rods, tubes and other products.

³³ Martin J. Rosent, *The Brussels Entente: Export Combination in the World Steel Market*, 106 U. Penn. L. Rev. 1079 (1958).

³⁴ Levenstein and Suslow. (2015) p. 7 (“the firm U.S. Steel was involved in six different conspiracies between 1948 and 1969, some of which involved traditional steel products and producers, as in a 1963 case in which U.S. Steel, Bethlehem Steel and others were convicted of conspiring to eliminate competition in the production of wheels, others were less finished steel products, and yet others were in plastics. Some involved the same co-conspirators, but others were an entirely new set of firms.”)

US cartels across several decades with distinct, but overlapping partners.”³⁵ In the post-war U.S., Hay and Kelley uncovered ten distinct price fixing agreements related to steel products, two were regional in scope and the other eight had a national scope, the products were: wrought steel wheels, rolled steel pipe flanges and rings, bed springs, metal library shelving, fabricated structural steel, carbon steel sheets, stainless steel welding electrodes, and wholesale distribution of steel products.³⁶ In the new century, suits have been brought against steel product price fixers in both the Europe and the U.S. “The European Commission has fined 17 producers of prestressing steel a total of €458,410,750 for operating a cartel that lasted 18 years until 2002 and covered all but three of the then European Union Member States.”³⁷ “Eight steel producers were accused of price fixing in a private suit filed by U.S. steel purchasers in 2008. Five of the defendants settled for a total of \$103.7 million.”³⁸ Finally, “German authorities announced an investigation of seven makers of flat steel for price fixing in the fall of 2017.”³⁹

Multi-product collusion has a long history in the chemical industry going back to the 1880s and appearing in most decades since then. A central player is the German chemical company I.G. Farben, its predecessors and its offspring.⁴⁰ Three of the chemical companies listed in Figure 5 were at the core of I.G. Farben. Bayer, Hoechst, and BASF merged (along with three other firms) to form it in 1925. And those three firms reemerged during the liquidation of I.G. Farben at the end of World War II. Stocking and Watkins observed that: “The breadth of its chemical interests has led IG [Farben] into agreements with every major world chemical producer, covering together virtually every branch of chemical manufacturing.”⁴¹ Although the system of cartels was based in Europe, it included American firms in global export cartels and reached directly into the domestic American markets. A German-American cartel was formed in magnesium powder and fabricated magnesium that included I.G. Farben, Dow, and Alcoa.⁴² DuPont found English and Swedish partners to implement global cartels in other markets. In the interwar period duPont and Nobel extended their global cartel from explosives to “dyestuffs, artificial leather, celluloid” and it eventually “embraced all products in the sale of which the two companies, save for the agreement, would have been

³⁵ Catarina Marvão, The Issue of Repeat Cartel Offences, Free Policy Network, Feb. 1, 2016, <http://freepolicybriefs.org/2016/02/01/the-issue-of-repeat-cartel-offences/>

³⁶ George A. Hay and Daniel Kelley, An Empirical Survey of Price Fixing Conspiracies, 17 J. L. & Econ. 13 (1974).

³⁷ Antitrust: Commission fines prestressing steel producers € 458 million for two decades long price-fixing and market-sharing cartel, Brussels, 06 October 2010, file:///Users/meurer/Downloads/IP-10-1297_EN.pdf

³⁸ Nick St. Denis, Three Steel Companies Hold their Ground in Price-Fixing Lawsuit, November 30, 2015 <https://www.usglassmag.com/2015/11/three-steel-companies-hold-their-ground-in-price-fixing-lawsuit/>

³⁹ Reuters, German cartel office deepens steel investigation, searches firms, Sept. 4, 2017 <https://www.reuters.com/article/us-steel-antitrust/german-cartel-office-deepens-steel-investigation-searches-firms-idUSKCN1BF1E1>

⁴⁰ Stocking and Watkins (1946).

⁴¹ Stocking and Watkins at 466.

⁴² Stocking and Watkins (1946) at 274-303.

competitors.”⁴³ In the late 1930s du Pont and ICI updated their chemical cartel agreement with “the inclusion of new products, many of which were already being treated as though they were included – notably certain chlorine products, antiknock compounds, synthetic resins and plastics, pharmaceuticals, Neoprene (du Pont’s synthetic rubber), and nylon.”⁴⁴

III. A Framework for Analyzing Single Product Explicit Collusion

Global acceptance of an anti-cartel norm is perhaps the most important development in competition law and policy in the past 20 years.⁴⁵ For most of the 20th century, the prosecution of cartels was largely the preoccupation of U.S. enforcement agencies. Most jurisdictions regarded supplier collusion as a secondary priority. Some actively resisted U.S. efforts to chase cartels outside its own borders.

In the late 1990s, the lysine and vitamins cartel prosecutions changed all of that. The Department of Justice (DOJ) recovered massive, unprecedented fines against the participants in both collusive schemes, whose audacity, complexity, and effectiveness startled the antitrust world.⁴⁶ Shamed by their earlier complacency and lured by the prospect of immense financial recoveries, many competition agencies boarded the anti-cartel bandwagon. Today agency leaders regularly call cartels the worst competitive scourge of the market place.⁴⁷

In the past twenty years anti-cartel enforcement has been modernized in important ways, especially through diffusion of vigorous enforcement policies in many other countries, and in the widespread adoption of leniency programs.⁴⁸ By some measures, the resulting international campaign against cartels seems to be working. Enforcement agency bar charts tracing total cases, civil fines, criminal fines, and prison sentences climb impressively upward.⁴⁹ Enforcement officials in the European Union and the

⁴³ Stocking and Watkins (1946) at 448.

⁴⁴ Stocking and Watkins (1946) at 454

⁴⁵ This trend is reflected in the proceedings, recommendations, and reports of international organizations that seek to promote the development of global competition policy norms. See International Competition Network, Cartel Working Group, Setting of Fines for Cartels in ICN Jurisdictions (2017); International Competition Network, Cartel Working Group, Compilation of Good Practices from the Anti-Cartel Enforcement Manual (Nov. 25, 2016); Organization for Economic Cooperation and Development, Fighting bid rigging in public procurement: report on implementing the OECD recommendation (2016); Organization for Economic Cooperation and Development, Hard Core Cartels: third report on the implementation of the 1998 OECD recommendation (2005); United Nations Conference on Trade & Development, Model Law on Competition (2010).

⁴⁶ Andrew I. Gavil et al., ANTITRUST LAW IN PERSPECTIVE: CASES, CONCEPTS AND PROBLEMS IN COMPETITION POLICY 6-17 (West Publishing, 3d Ed., 2017).

⁴⁷ William E. Kovacic, Chairman, U.S. Federal Trade Commission, *Competition Policy in the European Union and in the United States: Convergence or Divergence?* (June 2, 2008) (Bates White 5th Annual Antitrust Conference, Washington, D.C.)

⁴⁸ ANTI-CARTEL ENFORCEMENT IN A CONTEMPORARY AGE: LENIENCY RELIGION (Caron Beaton-Wells & Christopher Tran, eds. Hart Publishing, 2015) .

⁴⁹ 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 PROTECTION, CHANGES IN

United States point with evident pride to the greater severity of sanctions imposed on cartel offenders.⁵⁰ Agency press releases speak in the language of sports: new heights in recoveries are “records” akin to achieving the largest number of goals scored in a season or a career.⁵¹ Newer authorities underscore their own progress by pointing to a higher tempo of prosecutions, increased recoveries, and enhanced enforcement tools. The drive to achieve higher recoveries and more convictions derives encouragement from commentators, journalists, and political leaders who regard higher activity levels as good measures of agency performance.⁵² In addition, huge damage awards in private cases, and the gradual global adoption of private rights of action, reinforce the impression of increasing enforcement effectiveness.

The traditional activity-based measures of enforcement performance accurately suggest that the hazards for cartel participants are greater today than they were a few decades ago. The expansion of anti-cartel enforcement is an impressive public policy accomplishment, and the enhancement of modern enforcement tools – notably, the development of more powerful leniency mechanisms⁵³ – present admirable progress in policymaking.

Despite these accomplishments, reasons for discomfort about the effectiveness of anti-cartel programs remain.⁵⁴ The volume of fines and prison sentences are badly imperfect proxies for gains in social welfare. They do not indicate whether antitrust enforcement is achieving one of its central aims: to deter firms from engaging in illegal collusion in the first place. Indeed, climbing levels of prosecutions and punishments are ambiguous evidence of effectiveness; they could be taken to suggest that a significant

COMPETITION POLICY OVER THE LAST TWO DECADES 11 (Malgorzata Krasnodebska-Tomkiel ed., 2010).

⁵⁰ See, e.g., European Commission, Press Release, Statement by Commissioner Vestager on Commission decision to fine seven companies for participation in four cartels (Feb. 21, 2018), available at europa.eu/rapid/press-release_STATEMENT-18-1022_en.htm.

⁵¹ See European Commission, Statement by Commissioner Vestager on fining Scania for participating in trucks cartel (Sept. 27, 2017), available at europa.eu/rapid/press-release_STATEMENT-17-3509_en.htm. In describing developments in the prosecution of a European truck manufacturers cartel, Margrethe Vestager, the Commissioner for Competition, said “We have fined the six companies of Euros 3.8 billion – a record fine for a cartel in the EU’s 60 year history.”

⁵² On the popularity of these measures of effectiveness, see William E. Kovacic, Rating the Competition Agencies: What Constitutes Good Performance?, 16 *Geo. Mason L. Rev.* 903 (2009).

⁵³ The establishment of the modern leniency mechanism by the U.S. Department of Justice in 1993 is an impressive example of what Philip Weiser has called “entrepreneurial administration.” Philip J. Weiser, *Entrepreneurial Administration*, 97 *B.U. L. Rev.* 2011 (2017).

⁵⁴ We share the concern of other commentators who have questioned how successful enforcement has been and whether deterrence is currently adequate. Louis Kaplow, *An Economic Approach to Price Fixing*, 77 *Antitrust L. J.* 343 (2011) p. 424-425 “Although subject to reservations and some ambiguity, it appears that both law and practice base the fine on something closer to a fixed fraction of firms’ revenues in the affected markets, with little or no adjustment to reflect the actual price elevation. ... Accordingly, setting to the side other penalties (which may be substantial in the United States because of private suits, but less so elsewhere), deterrence is likely to be highly inadequate when large overcharges occur since fines will be less than firms’ profits, even ignoring any probability discount.”

number of firms regard the possibility of detection and prosecution to be acceptable business risks.⁵⁵

In this section, we sketch the design and enforcement of the legal framework that applies to collusive agreements. Here we also describe the economics regarding the formation and operation of cartels. Our focus in this section is one in which rival firms engage in explicit collusion (i.e., they resort to an express exchange of assurances) with regard to a single product. This provides valuable background for our consideration of multi-product collusive arrangements in Section IV below.

Five major themes emerge from our review of the economics and law related to single product collusion. First, we wish to underscore the difficulties associated with forming and implementing a successful cartel. These include the three tasks made famous by George Stigler (forming a consensus, detecting cheating on the consensus, and punishing deviations)⁵⁶ and the likewise important suppression of external threats (most important, buyer resistance, new entry, and the incursion of substitute products) illuminated in Michael Porter's "five forces" model of business strategy.⁵⁷ As we have

⁵⁵ In this respect, we are intrigued by the European Commission's recent prosecutions of manufacturers of heavy trucks for colluding to coordinate pricing and to time the introduction of emissions abatement technology. European Commission, Press Release, Antitrust: Commission fines Scania for participating in trucks cartel (Sept. 27, 2017), available at Europa.eu/rapid/press-release_IP-17-3502_en.htm. Through September 2017, the Commission had reached settlements totaling nearly 3 billion euros with MAN, DAF, Daimler, Ivaco, and Volvo/Renault and had imposed a fine of 880 million euros on Scania. The alleged cartel participants are substantial enterprises. By any measure, the firms involved are well versed in the rules of competition law by reason of having substantial in-house legal departments and access to law firms with the best competition law practices. The cartel is alleged to have begun in 1997 and run through at least early January 2011, a period in which the European Commission's Directorate for Competition was visibly ramping up its cartel enforcement program and bringing high profile cases. In the trucks matter the Commission carried out a dawn raid in January 2011 after receiving a leniency application from MAN. Why did these large companies execute an illicit scheme in the face of easily recognized and progressively more aggressive efforts by the European Commission to prosecute cartels? Two explanations come to mind. First, the theory of the case may have involved a Commission effort to expand the zone of behavior deemed to be improper collusion – perhaps, a bolder effort to treat information exchanges as proof of improper coordination. If the prosecution indeed represented an outward extension of the existing law enforcement perimeter, one can understand that the firms may have thought that their behavior, though risky from an antitrust point of view, would not be treated as a hard core infringement. If the Commission was using a novel theory of illegality, why wouldn't all six firms resist instead of settling? Five firms may have thought the settlement amount was better than the risk of a still higher fine (the EU maximum is ten percent of global turnover). Scania alone is contesting the charges. A second explanation is that the firms are accused of forms of conduct that the Commission previously and clearly had treated as illegal collusion. If this is the case, one must ask again why the companies would persist in the behavior through the 2000s in the face of increasingly stringent EC anti-cartel enforcement? In this scenario, there is the sobering possibility that the massive settlement amounts are not a sign of policy success but instead suggest a fundamental failure of deterrence.

⁵⁶ George J. Stigler, A Theory of Oligopoly, 72 J. Pol. Econ. 44 (1964). For a vivid illustration of the difficulties that a cartel can face in setting output limits and allocating market shares among the participants, see *United States v. Andreas*, 216 F.3d. 645 (7th Cir. 2000).

⁵⁷ Michael E. Porter, *COMPETITIVE STRATEGY: TECHNIQUES FOR ANALYZING INDUSTRIES AND COMPETITORS* 4 (Free Press 1980)

said in previous work, nothing about this is easy.⁵⁸ Rivals who gather furtively in a hotel conference room or a restaurant to declare their commitment to raise prices, yet do not devise plans over the course of the operation of the cartel to surmount all of these obstacles, either by themselves or with the assistance of expert advisors, have taken grave risks with little prospect of success.

Our second observation is that the difficulty and complexity of cartel formation and management tasks require considerable technical and managerial skill – for example, in devising and adjusting the assignment of market shares, in tracking sales volumes by individual cartel members, or in constructing methods for executing the side payments that ensure fidelity to the common scheme. As with any other dimension of organization and management, there are benefits from the learning – the repeated performance of the same tasks over time. Cartel members could realize these benefits either by repeated participation in collusive schemes (among themselves or with other firms) or by engaging third parties (e.g., an accounting firm such as Fides/ AC Treuhand) which have broad experience in assisting cartels.

The third major point from our research, explored more fully below in Section IV, is that the involvement of senior company officials is typically important for effective cartel coordination. The complexity, durability, and scope of many cartels likely requires commitment at the highest level of the company and the participation of key senior officials, as well as middle managers. We can imagine that low level subordinates in some instances devise and execute collusion schemes without the knowledge or acquiescence of top management. This is unlikely to be the main case, especially for the massive, intricate, long-lived arrangements that figure so often in modern cartel prosecutions. Without high level involvement, such schemes would likely not be possible.

Our fourth observation is that cartel members cannot perform the collection of complex, difficult cartelization tasks without continuing engagement. The “contract” that represents the shared commitment to raise prices is by necessity highly relational. It must be flexible to adapt to changed circumstances (e.g., an increase in demand that was not anticipated when the colluding firms first allocated market shares among themselves) and to respond to external threats to the operation of the collusive scheme (e.g., a move by a major purchaser to vertically integrate into the production of the input currently controlled by the cartel). Adaptation and adjustment require consultations for the group to determine how to proceed. Moreover, there is an inherent degree of incompleteness in all contracts, owing to compromises that inject ambiguity into certain terms or to the inability of the parties to anticipate and address all contingencies. Like legitimate contracts, cartel agreements are incomplete for the same reasons. To address the consequences of incompleteness as performance of the agreement takes place, cartel

⁵⁸ Robert C. Marshall & Leslie Marx, *THE ECONOMICS OF COLLUSION* (MIT Press 2012); William E. Kovacic et al., *Bidding Rings and the design of anti-collusion measures for auctions and procurements*, in *HANDBOOK OF PROCUREMENT* 149 (Nicolas Dimitri et al. eds., Cambridge University Press, 2006); Randal Heeb et al., *Cartels as Two-Stage Mechanisms: Implications for the Analysis of Dominant-Firm Conduct*, 10 *Chicago J. Int’l L.* 213 (2009).

participants often communicate with each other – to devise solutions to unexpected contingencies or to confront ambiguities or disagreements that the parties sidestepped when they entered the scheme.

The importance of continued engagement and communications among participants suggests a fifth theme, developed more extensively in Section IV. Communications can be improved, and the performance of the cartel’s key operational tasks can be enhanced, as the range of the firms’ interaction expands in time and scope. The performance of a single cartel generates considerable knowledge, trust, and understanding that can be applied usefully in additional cartels. Repeated interaction over time in new collusive episodes helps the cartel refine its operational techniques, improve means of communication, increase understanding of each firm’s culture, conduct, and intentions (to improve the ability of each firm to anticipate and interpret the moves of its counterparts), and, where suspicion and doubt always lurk in the background, to strengthen trust. Engagement across a broader scope of products provides additional contact points that can enhance coordination – for example, by providing more avenues to make side payments, more possibilities for punishing deviations, and more means to use leniency strategically to channel the attention of enforcement agencies toward a decaying or dead cartel and away from a vibrant or promising collusive arrangement.

The phenomena described above place a premium on establishing a framework of legal rules and enforcement mechanisms that accounts for the dynamism of cartel behavior and makes the fullest possible use of knowledge gained about how cartels operate and how they respond to new advances in enforcement methods. We emphasize that, although the formation and execution of a cartel is no easy task, the rewards for successful cartelization are substantial. The history of antitrust policy since the late 19th century demonstrates that firms have responded to enhancements in the law enforcement regime – the bolstering of substantive legal commands, sanctions, and methods of detection – with a host of countermeasures to avoid detection or blunt the impact of more severe punishments. This history suggests that the arms race between law enforcement and cartelists has not subsided. Competition agencies must be no less adaptive or ingenious than the cartelists they are seeking to apprehend and, better, deter.

A. Antitrust Law and the Treatment of Collusive Horizontal Agreements

As suggested above, the prohibition of cartelization is at the heart of antitrust law.⁵⁹ By statute, by jurisprudence, or by both, the definition of the offense has evolved in stages. In the United States, early cases confronted and condemned the setting of the complete price of the product or service.⁶⁰ In fits and starts, the U.S. jurisprudence

⁵⁹ The developments covered here are examined in more detail in Alison Jones & William E. Kovacic, Identifying anticompetitive agreements in the United States and the European Union: Developing a Coherent analytical framework, 62 Antitrust Bull. 254 (Issue 2, 2017); Alison Jones, Analysis of Agreements under U.S. and E.U. antitrust law – Convergence or divergence?, 57 Antitrust Bull. 691 (Issue 4, 2006).

⁶⁰ *United States v. Trans-Missouri Freight Ass’n*, 166 U.S. 290 (1897).

gravitated, by the late 1930s and early 1940s, toward the establishment of a categorical prohibition (a “per se” rule) against horizontal price fixing.⁶¹ The principle of strict prohibition was extended to encompass restrictions that affect the final price and quality of the product or service; these include customer and territorial allocations,⁶² agreements to restrict the use of certain product inputs,⁶³ the fixing of one element of the total price (e.g., financing terms).⁶⁴ Most recently, the U.S. Department of Justice and the Federal Trade Commission have announced that both agencies will prosecute, as per se offenses, “no-poaching” agreements by which firms agree not to make unsolicited calls to recruit employees of their rivals.⁶⁵ The delineation of agreements subject to summary condemnation has been accompanied by, and sometimes has followed, developments in academic literature and professional commentary about the economic impact of the challenged practices.

As a consensus has developed about the economic and social harm associated with cartels, there has been a progressive increase in sanctions and methods of detection, with the most extraordinary enhancements taking place in the past half-century. In the United States, criminal prosecution of cartel agreements is routine practice. Individual defendants face maximum prison terms of ten years, and those convicted of cartel offenses, or who plead guilty, are likely to spend at least two years in prison. Monetary fines now can run into the hundreds of millions – indeed, billions – of dollars as a result of fining mechanisms that allow the Justice Department to collect double the gain to violators or double the loss to victims.

Detection techniques have been enhanced hand in hand with the increase in sanctions. DOJ introduced its modern leniency program in 1993 and since has introduced a series of enhancements. DOJ and the FBI use the full range of electronic surveillance and related information gathering methods available for the investigation of organized crime. Over 60 jurisdictions worldwide have adopted leniency programs, and the use of search warrants to gather information from business premises is a common element of global antitrust law enforcement.

Two major issues have accompanied the elaboration of the substantive principles and enforcement methods described above. The first is the definition of what constitutes a collusive scheme worthy of summary condemnation. Courts have recognized that agreements to set prices or other terms of trade are worthy of fuller analysis, and sometimes deserve approval, when they facilitate the development of a new product or service or enable firms to generate efficiencies for consumers that otherwise would not be available in the absence of the restrictions.⁶⁶ Modern U.S. jurisprudence makes clear that

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

⁶² *Timken Roller Bearing Co. v. United States*, 341 U.S. 593 (1951).

⁶³ *National Macaroni Manufacturers Ass’n v. Federal Trade Commission*, 345 F.2d 421 (7th Cir. 1965).

⁶⁴ *Catalano, Inc. v. Target Sales, Inc.*, 446 U.S. 643 (1980).

⁶⁵ United States Department of Justice, Press Release, Justice Department and Federal Trade Commission Release Guidance for Human Resource Professionals on How Antitrust Law Applies to Employee Hiring and Compensation (Oct. 20, 2016). In the announcement, the Justice Department stated its intention to prosecute infringements of this policy as crimes.

⁶⁶ See Jones & Kovacic, *supra* note XX.

firms always have the opportunity to introduce cognizable, plausible efficiency rationales for challenged restrictions, and that the presence of such rationales precludes per se condemnation.

The second pivotal issue is the definition of what constitutes concerted action. If no efficiency rationales are present, the key issue in the case will be whether the firms acted alone or in concert.⁶⁷ The enhancement of sanctions and means of detection has led firms to take various steps to mask their coordination. Many of the government's cartel prosecutions and private antitrust cases hinge on decisions about what types of evidence (known as "plus factors"), when added to the fact of parallel conduct, permit a judge or a jury to infer agreement. As set out below in Section IV and in our earlier work, we argue that careful examination of past cases and investigations yields valuable insights about which types of behavior deserve emphasis as plus factors.

In the discussion of policy recommendations that concludes this paper, we propose that government agencies and researchers undertake larger efforts to collect data on the origins and operations of specific cartels for three purposes: (1) to identify promising focal points for investigations; (2) to increase our understanding of which types of observed conduct should be treated as plus factors to sustain an inference of agreement; and (3) to improve the operation of compliance programs through which government agencies and firms monitor adherence to the law against collusion.

B. The Effects of Collusion

Competition among vendors has two main advantages. First, it reveals information to a buyer that it might not be able to discover on its own. Second, it helps a buyer get greater quantity or better quality than it could in the absence of competition. To illustrate these advantages, and thus the justification for the prohibition against price fixing, consider an example in which a medical supply firm buys chairs for its new offices.

Suppose a firm wants to acquire one wooden office side chair of a given pre-specified size and quality. Suppose the firm can purchase the chair from a local office furniture supplier for \$250. In contrast, suppose the firm wants to buy at least 2,000 such chairs. If the purchase of a single chair of a given quality costs \$250 what should the firm expect to pay for 2,000 such chairs? Should the firm expect to pay, per chair, \$250 or something less than that, perhaps even quite a bit less than that? A medical supply firm has no expertise to assess what 2,000 office chairs should cost. So, the firm uses competition to learn about the market price for such chairs, inviting all qualified vendors of such chairs to submit bids for the provision of at least 2,000 chairs. Each invited supplier will know that they are competing with others in their industry for the contract. The competition between the vendors is such that, although winning with a high bid would be quite profitable, each vendor realizes that a high bid has a low probability of winning. To enhance the probability of winning each vendor will consider submitting low

⁶⁷ See Kovacic, Marshall, Marx & White, *supra* note XX.

bids. The bids of each bidder will be bounded – no bidder will want to earn negative profits by winning. Also, the greater the number of bidders the more aggressive each bidder will need to be to enhance their chance of winning. Suppose there are five vendors invited to bid and the low bid turns out to be \$125 per chair. Competition among the vendors has revealed to the purchasing firm information that they would not have been able to acquire on their own – namely, that 2,000 chairs can be acquired at half the per chair cost of buying a single chair.

But there is an additional benefit of the competition. The bid solicitation had specified the purchase of *at least* 2,000 chairs. With a winning bid of \$125 per chair, which may be quite a bit lower than the prior belief that the firm had about what they would pay for the chairs, the firm may decide to purchase an additional 200 chairs.

The winning bid of \$125 may not leave much of a profit margin for the winning vendor. The five invited bidders each realize that the competition amongst them will negatively impact their profits. If the five vendors met prior to submitting bids they may reach an agreement to suppress their rivalry and share in the incremental profits from doing so. The five bidders may agree that Bidder A will submit the low bid of \$187.50 per chair and each of the other four bidders will submit bids ranging from \$190 to \$230 per chair. Each of the four losing bidders may be compensated by Bidder A for suppressing their rivalry with direct cash payments, subcontracts, or agreements for other bidders to be the designated winners on future procurements.

The explicit collusion just described is clandestine, unknown to the purchasing firm. The five bidders are pretending to act competitively in the submission of their bids. The purchasing firm, who does not know there is collusion by the bidders and is relying on competition to reveal information about what should be paid for 2,000 chairs, believes that the price of \$187.50 per chair has been revealed through legitimate competition to be the lowest price that can be paid for the chairs. At that price, the firm may buy 2,000 chairs, but not more. An important incremental loss from the collusion is the reduction in the number of chairs purchased. At the competitive price of \$125 the firm bought 2,200 chairs, but at a price of \$187.50 the firm buys 200 fewer chairs. Mutually beneficial transactions are not occurring due to the collusion by the bidders. This is a social loss. The fundamental points of the chair purchase example above are not special – they apply across all products and markets. Antitrust laws are designed to prevent, or at least mitigate, the loss that occurs from the reduced output sold in the market as well as assure market participants that competition will produce reliable price discovery.⁶⁸

C. The Machinery of Collusion

Cartels use various techniques to achieve price elevation and/or output reduction. Naturally, cartels sometimes reach a simple agreement to fix an agreed price (or related terms such as discounts, interest rates, credits, rebates etc.). For various reasons cartels

⁶⁸ Antitrust law assumes there are not likely to be offsetting social gains that could excuse price-fixing. There are exceptional cases -- collective rights organizations like ASCAP and BMI, or restrictive agreements in patent licenses. [More.]

sometimes use highly related but alternative pathways to raise prices for example by agreeing to output restrictions, allocation of customers or territories, or to rig bids at an auction or procurement.

Antitrust law distinguishes illegal price fixing from merely parallel behavior and requires that plaintiffs and prosecutors prove that the accused competitors reached an agreement to fix prices. The agreement requirement is justified on the grounds that merely parallel behavior is less likely to generate the high prices and output restrictions that competitors can achieve via agreements to explicitly collude. Further, the risk of chilling pro-competitive behavior is likely greater if the law attempts to regulate parallel pricing in the absence of agreement.⁶⁹ Thus, a key assumption supporting this distinction is that successful collusion is unlikely unless the firms communicate and reach an agreement.

Explicit collusion is different from tacit coordination. Tacit coordination in an oligopoly with firms that recognize their mutual interdependence is just rational non-cooperative interaction. On the other hand, an agreement among competitors that relies on interfirm communication and/or transfers to suppress rivalry is explicit collusion, and we refer to the firms involved in the conspiracy as a cartel.⁷⁰ The communication regarding the agreement can occur at the initiation phase of the explicit collusion and also at the implementation phase.⁷¹

Since explicit collusion is illegal the agreement must be self-enforcing. Put differently, during the course of the conspiratorial agreement each co-conspirator will be contemplating if their own profits can be increased by not complying with the agreement. But non-compliance that is observable to fellow co-conspirators will potentially result in punitive actions within the cartel or even the dissolution of the agreement. After the initial collusive agreement is implemented further communication may be required to

⁶⁹ In theory monopoly prices could be achieved by tacit coordination and such parallel behavior is outside the scope of the price fixing prohibition. The pragmatic judgment made by antitrust law is that the expected costs from chilling desirable behavior exceed the expected gains from deterring tacit collusion.

⁷⁰ See Marshall and Marx (2012), page ix. Recent research illustrates how communication can be used to support output restriction and price increases. See Gaurab Aryal, Federico Ciliberto, Benjamin T. Leyden, *Public Communication and Collusion in the Airline Industry*, (Feb. 12, 2018) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3123972. The authors study communications used in the airline industry to communicate plans to reduce capacity on competitive routes. Specifically, they find that earnings calls from top managers to the investing public contained comments about capacity that served as a communications channel between competing airlines. The capacity comments apparently convey information about demand conditions that is hard for other airlines to observe directly. Their econometric analysis indicates “that when all legacy carriers operating in an airport-pair market communicated about capacity discipline in a given quarter, the average number of seats offered in those markets decreased by 1.45% in the next quarter.” (Aryal, et. Al. page 4) Given a history of price-fixing agreements in this industry, antitrust enforcers should look for evidence of agreement that would violate antitrust law, though we hasten to note that merely parallel behavior with respect to announcements and output restriction does not amount to violation of the law.

⁷¹ See Green, Marshall, and Marx (2014) for a discussion of the distinction.

counter the temptation of cartel members to cheat.⁷² Therefore, secret non-compliance is the central problem of all cartels.

An illustration may be helpful. Suppose that a homogeneous product is made by four firms and some smaller foreign fringe firms, where the four large firms produce 85% of total world output. Initially, the four firms are not in a cartel and the price in the market place is \$10 per unit. The four firms meet and agree that they will all be better off selling at \$25 per unit.⁷³ So, each cartel firm announces a new price of \$25. But, the buyers of such a product are not passive in paying the higher price, especially the larger buyers. Suppose a large buyer that has typically bought from firm A approaches firm B and offers to buy a large quantity at a price of \$20. Since it had been profitable to sell at \$10 it is even more profitable to sell at \$20. Firm B's only introspective question is whether the sale to the large buyer would be detected by the other cartel firms. Certainly, firm A will know that it lost the business of the large buyer, but to whom? Did the large buyer acquire most of its needs from foreign fringe firms or was there a defection by a cartel firm? If firm B's defection will go undetected then it will take advantage of the opportunity to sell incremental quantity to a new buyer. But the other cartel firms will be receiving similar offers from buyers. Quickly the price in the market will not be \$25 but \$20. As the price descends there will more offers by buyers at even lower prices. The price will continue to descend towards \$10. This is natural with unconstrained secret deviations.

A cartel can be effective in mitigating secret deviations and thus generating a sustainable material profit above non-collusive levels if it implements certain structures, referred to as pricing, allocation, and enforcement structures.⁷⁴ Pricing structures include explicitly coordinated price announcements, rigged bids, or quantity restrictions. Also, to facilitate the implementation of these prices, the incentives of the sales staff may be altered to "price before volume" from the standard incentive of seeking incremental volume by undercutting rivals. Allocation structures refer to the division of the collusive gain. These may include, but are not limited to, market share allocations, customer allocations, geographic allocations, or combinations of the three. Allocation structures also include transfers between firms to rectify inadvertent deviations from the agreement

⁷² Cartel stability is promoted by frequent exchange of price, quantity and other information. When information is not exchanged or exchanged infrequently, then cartel members are less certain of whether a decline in the market price was caused by defection or unfavorable shift in demand. If cartel members mistakenly fear others are cheating this may cause cooperation to unravel.

⁷³ A cartel does not always need to seek a price increase. In industries where prices naturally fall under competitive conditions, a cartel may instead attempt to slow the rate of decline. If the cartel is effective, the price descent will be less severe than in the absence of explicit collusion as was the case for DRAM products during that conspiracy. See European Commission Prohibition Decision 19 May 2010, Comp 38511/DRAM, http://ec.europa.eu/competition/antitrust/cases/dec_docs/38511/38511_1813_8.pdf Accessed Sept 28, 2017.

⁷⁴ See Marshall and Marx (2012) Ch. 6. There are product/industry/markets where some structures are in place prior to cartel formation so the cartel need not be concerned with the implementation of those. For example, the requirements of the Federal Acquisition Regulations that all bids be revealed at the end of a competitive bidding process eliminates the need for a cartel to invest in ex post monitoring of bids for compliance with the cartel agreement.

or address new issues associated with the division of the collusive gain. Enforcement structures include monitoring mechanisms that assure each cartel firm that others in the agreement are keeping their commitments regarding pricing, quantities, and the sharing of the collusive gain. Investment in monitoring can be extensive. Enforcement structures also include the penalties for breaches of the agreement.

If good collusive structures are in place then secret deviations can be greatly mitigated. The collusive structures that are effective in one product/industry/market may not be effective in another. It is obvious from the history of cartel agreements that a rich diversity of cartel structures have been implemented.

When a cartel implements effective collusive structures there are conducts and outcomes that emerge that are largely inconsistent with unilateral action but consistent with explicitly coordinated action. These conducts and outcomes are above and beyond parallel movements in price that could be occurring for legitimate unilateral reasons, and thus they are referred to as “plus factors”. When the conducts and outcomes are such that it is highly unlikely they are the product of unilateral action but, instead, are most likely the result of explicit coordination to reduce interfirm rivalry, then they are referred to as “super plus factors”. Kovacic et. al. (2011) enumerate seven examples of super plus factors.⁷⁵ We will return to super plus factors in the policy recommendation section of the paper.

The strength of the incentive to consider explicit collusion depends upon the characteristics of a given product/industry/market. It is useful to organize thinking on this issue through the use of Porter’s Five Forces. The center force is interfirm rivalry. The

⁷⁵ Kovacic, William E., Robert C. Marshall, Leslie M. Marx, and Halbert L. White “Plus Factors and Agreement in Antitrust Law”, 2011, Michigan Law Review, vol. 110, No. 3. P. 393-436. The seven super plus factors identified by the authors are as follows.

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.

perimeter forces are the threat of entry, the presence of good substitute products, bargaining power of suppliers, and bargaining power of buyers. For a given product/industry/market, the following perimeter forces lead to low profits

- Entry is relatively easy
- Good substitutes are available
- Suppliers have bargaining power
- Buyers have bargaining power.

The converse leads to high profits

- Entry is difficult
- There are no good substitutes
- Suppliers have little bargaining power
- Buyers have little bargaining power

If a given product/industry/market has perimeter forces that lead to high profits, but the few firms in the industry are making a homogenous product and competing largely on the basis of price, we then have a scenario where the suppression of rivalry through explicit collusion potentially generates a large payoff. The perimeter forces are like a protective wall that the firms can take advantage of if they just bring their interfirm rivalry under control. Bringing interfirm rivalry under control does little good if there is a gaping hole in the wall such as the availability of very good substitutes, extremely low entry barriers, or powerful buyer resistance. If the product is differentiated and competition is largely not based on price there can still be plenty of profit opportunities from explicit collusion if the wall is high enough, albeit the suppression of rivalry may be more complicated.

Often cartels are not all-inclusive. An outside firm may have been asked to join the cartel but chose not to, or, the cartel may not have invited some firms to join the cartel. The presence of non-cartel firms can be corrosive to a cartel in the long-run. But if a cartel is effective in suppressing interfirm rivalry amongst its members, then the cartel may begin to function as a dominant firm. As a dominant firm it may exert pressure on corrosive non-cartel firms to join the cartel or just try to eliminate them from the market.

Also, as cartel profits rise the protective wall of the perimeter forces may become a focus of attention. For example, the cartel may invest in conducts to raise entry barriers or degrade the perception of substitute products in the market.

As an extra source of incremental profits, sophisticated cartels sometimes implement policies that discourage entry. These policies include capacity investments, lobbying for favorable laws and regulations, or making some other investment that preserves their cartel profits by discouraging entry into the cartelized market. Coordinating these investments is likely to require significant planning and

communication.⁷⁶ A similar need for communication arises when a cartel must decide how to respond to potential or actual entry. For example, in the global alkali cartel of the interwar era a leading cartel member predatorily cut prices in the local market of a South American entrant⁷⁷ and it then contacted another cartel member that was irritated by the price cut to explain the cut was temporary and was being used to drive out an entrant.⁷⁸

Extensive communication is often important for a stable and profitable cartel, but it is also a major hazard. Records of cartel communications are used to establish the *agreement* required to prove a price fixing violation. As the volume of communication grows so does the risk of detection.⁷⁹ Clever price-fixers think carefully about the trade-off between the profit maximizing cartel structure and the desire to minimize the risk of cartel detection and conviction of cartel members. One of the main contributions of this Article, which we develop in Section IV, is an analysis of how this trade-off is improved for cartelists who are active in more than one market.

D. Limits to Deterrence

Antitrust enforcers are pleased when they successfully prosecute price fixing, but the overarching goal is to deter price fixing so that prosecution is unnecessary. Becker observed that rational violation of the law can be deterred if sufficiently large expected penalties are imposed on violators. Expected penalties are determined by the probability of detection and conviction, and the magnitude of the penalty. Thus, antitrust law can deter rational price fixers if the penalties and the probabilities of detection and conviction are sufficiently large.⁸⁰ In this Article we explore reforms that tailor enforcement policy to better deter serial collusion by large multi-product firms.

Obviously, a low probability of detection does not necessarily preclude effective deterrence of price fixing. As long as any cartel can be detected with positive probability then very large penalties can be chosen to make the expected penalty large enough to deter. Block and Sidak addressed this issue and facetiously asked: “Why Not Hang a

⁷⁶ As noted in the introduction to this Section, the difficulties associated with successful cartel formation and operations can be significant.

⁷⁷ <Explain why it is the market of an entrant and not the market of the incumbent – a geographic market where a new firm entered?>

⁷⁸ Stocking and Watkins at 437.

⁷⁹ It is easy to understand why the risk of detection and conviction increases with the volume of cartel communication. More communication likely means more people become aware of the cartel and more incriminating documents or recordings are produced and stored. This increases the risk that an innocent insider will discover and expose the cartel and the risk that a cartel investigation started for some other reason will uncover damning evidence of the agreement.

⁸⁰ Landes, William M. (1983), *Optimal Sanctions for Antitrust Violations*, University of Chicago Law Review 50:652-678; John M. Connor *Recidivism Revealed: Private International Cartels 1990-2009* (“In the case of collusive group crimes like price-fixing, deterrence means that companies or individuals, after weighing the probable gains versus expected losses associated with overt collusion, decide that it would be less profitable to form a cartel (or join an existing cartel) than to adopt a form of business conduct that does not involve illegal manipulation of markets.”)

Price Fixer Now and Then?”⁸¹ We don’t and we won’t. Thus, the initial task for antitrust scholars is to explain the limits on the magnitude of penalties.

Fairness and efficiency both support limits on maximum penalties. Penalties must be proportional to the culpability of the defendant to stay within the bounds of the Eighth Amendment. Policymakers should be especially concerned about severity of penalties if there is a risk of mistaken conviction. Harsh penalties may be inefficient if they crowd out the possibility of implementing marginal deterrence of additional or aggravated violations of the law. In the cartel setting, an escalating schedule of penalties might be used to marginally deter firms who are colluding in product 1 from extending their collusive agreement to product 2. Also, the incremental deterrent effect of increased financial penalties disappears as defendants near the point of being judgment-proof.

Antitrust scholars most often cite concerns about the chilling effects of severe antitrust sanctions as a reason to limit the severity of penalties.⁸² The specter of severe penalties combined with the possibility that competitive behavior could mistakenly be labeled collusive by a court might discourage socially desirable behavior.⁸³ For example, earnings calls by executives are possibly tools used to facilitate cartel behavior, but generally, earnings calls provide socially valuable information to investors and improve the efficiency of securities markets. Possibly aggressive pursuit of potential price-fixers could chill disclosures in future earnings calls.⁸⁴

Expected penalties can be calibrated by adjusting the magnitude of penalties or by adjusting the probability of detection and conviction. Adjustment of penalties is straightforward, but it is less clear how to adjust probabilities of detection and conviction. One possibility is to relax the rules characterizing behavior as price fixing to make it easier to convict an alleged price-fixer. For example, the law could eliminate the requirement that plaintiffs prove an agreement exists and simply provide evidence of parallel behavior. Concern about over-breadth make this sort of reform unrealistic and we will focus instead on choices by enforcement agencies that increase the probability of discovering signs of collusion and evidence that could be used to establish agreement.

Historically, antitrust enforcers relied mostly on disclosures from insiders or complaints from buyers to identify possible collusion. Enforcement agencies are poorly

⁸¹ Michael K. Block & Joseph Gregory Sidak, *The Cost of Antitrust Deterrence: Why Not Hang a Price Fixer Now and Then?* 68 *Geo. L. J.* 131, 138-39 (1980)

⁸² *Id.*

⁸³ Chilling effects also shape the types of proof relied on by antitrust courts. See, Louis Kaplow, *An Economic Approach to Price Fixing*, 77 *Antitrust L. J.* 343 (2011) p. 366 (“Whether and what sorts of chilling effects may arise depend on what forms of proof are employed. Suppose, for example, that sudden, substantial price increases are considered as possible evidence of coordinated oligopolistic price elevation.”)

⁸⁴ Chilling effects are easy to describe but difficult to quantify. See, Louis Kaplow, *An Economic Approach to Price Fixing*, 77 *Antitrust L. J.* 343 (2011) p. 366 (“The chilling of desirable behavior is a concern that strongly motivates past discussions of price-fixing rules but almost always remains implicit, which makes it difficult to assess its importance and how the magnitude of the problem is influenced by the nature of the rules that are adopted.”)

positioned to access information suggestive of collusion. Successful cartels are careful to hide their agreements and as best they can – hide the implementation of the agreement. Economists have labored to identify collusion econometrically through publicly available data, but thus far the research has not translated into significant improvements in agency monitoring. There is one recent policy innovation that has generated many leads for enforcement agencies – the leniency program, we will discuss that program in Section IV.B.

Now that we have discussed policy tools that can be used to calibrate cartel deterrence, we move to the question of whether deterrence is adequate today. The short answer is – no one knows, we lack both theory and especially the data to answer that question. We do want to make two crucial observations though. First, many antitrust commentators worry that expected penalties are too low to adequately deter price fixing.⁸⁵ And second, current analysis of deterrence is guided by analysis of price fixing in the context of an isolated product or market. We conjecture that multi-product price fixing is more difficult to deter than price fixing in an isolated product, and thus join the ranks of commentators who favor more vigorous enforcement against cartels.⁸⁶

In Section IV we will explain that when multi-product competitors collude in multiple products or markets they may be able to increase the stability and profitability of their collusive agreement and possibly decrease the probability of detection. We explain how multi-market price fixing provides benefits in terms of economies of scope, better opportunities to hide the implementation of the collusive agreement and improved cartel stability in the face of external shocks.⁸⁷

To preview the argument that deterrence is more difficult in the multi-product context consider the following example. Suppose firms A, B, and C agree to fix prices of product 1 and they each expect to earn \$100 million from the agreement. Also, firms X,

⁸⁵ See e.g., Louis Kaplow, *An Economic Approach to Price Fixing*, 77 *Antitrust L. J.* 343 (2011) p. 370 (“Limited evidence to date suggests that the probability of detection is quite low.” “In contrast, an approach that makes the penalty largely independent of the overcharge (a tendency under guidelines for fines in the United States and the European Union, discussed in subsection IV.A.3) will levy relatively harsher sanctions in [cases with small price increases], increasing the magnitude of chilling effects—and also producing less deterrence in cases with unusually large price elevations, which are less likely to involve false positives.” p. 372 “Given the extent of oligopolistic price elevation and the number of successful prosecutions of explicit price-fixing arrangements involving substantial overcharges, it seems safe to conclude not only that, in the absence of enforcement, there would be a significant problem but that, even with substantial modern enforcement and penalties much stiffer than had existed in the past, the existing level of deterrence may be insufficient. Indeed, even detected and punished cartels may suffer little or realize net gains.” p.372 “Limited evidence to date suggests that the probability of detection is quite low.”

⁸⁶ William H. Page, *Optimal Antitrust Remedies: A Synthesis* (“the formula used to calculate fines is only weakly related to the optimal penalty.”) (compliance “programs may be less effective in controlling price fixing than exclusionary practices, because price fixing is necessarily clandestine... A manager may get the idea that he or she can surreptitiously fix prices and enhance the profitability of his or her division (and compensation) without drawing the notice of supervisors and antitrust counsel”)

⁸⁷ Much of our thinking runs parallel to the analysis by Bernheim and Whinston of multi-market contact in the context of oligopoly pricing.

Y, and Z agree to fix prices of product 2 and similarly they each expect to earn \$100 million from the agreement. Suppose the probability of detecting the collusion in each product is $\frac{1}{4}$. Then, a penalty on each firm greater than \$400 million if they are caught and convicted would be sufficient to deter a risk neutral decision maker acting on behalf of each firm.

How does the story change if the firms merge in a pair-wise fashion so that A and X combine, B and Y combine, and C and Z combine? If they choose to collude in only one of the two products, then the analysis is unchanged. What if they choose to collude in both products? Each merged firm earns \$200 million from the collusive agreement. Let us suppose that the penalty would be \$800 million if they are caught and convicted of collusion in both products. It is not so clear what the probability of detection and conviction is likely to be in this new environment. Is it possible that competition authorities might detect collusion in one product, but not the other? If yes, how are the probabilities of detection in each product related? Perhaps the probability of detection declines because multi-product collusion is more stable,⁸⁸ or because tactics to evade detection are more effective in the multi-product setting.⁸⁹ In Section IV we suggest that the probability of detection may go down, and is not likely to rise very much. We also conclude that the average duration and per period profit from collusion is likely to grow and thus \$200 million understates the gain from price fixing in both products 1 and 2. Increased profit combined with a probability of detection that falls (or does not rise very much) means that deterrence would be more difficult.

E. Deterrence of Owners, Top Management, and Middle Managers

Our discussion of collusion in hypothetical products 1 and 2 supposed that the decision-maker who chose whether to collude was a faithful agent of the firm. Faithful in the sense that the decision-maker acted based on the expected costs and benefits to the firm. It may be the case that decisions to collude are made by managers who have different objectives from the owners of the firm. In extreme cases a manager might decide to collude because he or she will be rewarded for the short-term increase in firm profit. The manager might not care much or at all about the expected costs from detection especially if the manager plans to leave the firm soon. When these “rogue managers” are responsible for collusion it might be difficult or impossible to deter collusion with financial penalties on the firm.

⁸⁸ Cartel instability likely generates communications and defections that increase the probability of detection.

⁸⁹ For example, buyer resistance and complaints may be softer when buyers face rising prices in both product 1 and 2. They may be more likely to attribute the general price rise to exogenous factors and less likely to attribute it to collusion. On the other hand, multi-product price fixing may make detection more likely because more parties are privy to cartel-related communications.

Optimists believe that antitrust enforcement against cartels is functioning effectively and when a cartel is detected they attribute it to a rogue manager.⁹⁰ They believe that good corporate governance implies that top managers act on the preferences of owners⁹¹ and are adequately deterred from collusion given current enforcement practices. The optimists typically endorse compliance training and criminal punishment of rogue managers as enforcement tools that increase deterrence of rogues and mitigate agency problems within firms that sometimes allow rogues to flourish.

We agree that compliance training and criminal punishment of price fixing managers have social value as enforcement tools, but we also are concerned that compliance training is sometimes used to teach managers how to collude, and that penalties against rogue managers may be offset by indemnification or some form of compensation to managers who suffer personal penalties after a collusive agreement is uncovered.⁹² Furthermore, we are critical of commentators who place too much emphasis

⁹⁰ Kiran Desai, *Antitrust Compliance: The Effects of Perceived Regulatory Failure*, EUROPEAN ANTITRUST REVIEW 15, 17 (2010) (“In creating an antitrust programme it should be recognised that there may be personnel who act in bad faith, for which no amount of education and admonition will act as a deterrent. Sales targets and bonuses can be too much of an incentive to break the law. Indeed, some may even go to great lengths to hide their activities from in-house counsel.”); Theodore Banks, *The Trouble With Antitrust Compliance and 10 Ways to Fix It*, Corporate Counsel April 30, 2012 (expressing concern the price-fixing will arise through the actions of a rogue manager); Roger D. Blair and D. Daniel Sokol, *The Oxford Handbook of International Antitrust Economics* 265 (2014)

⁹¹ Antitrust studies find that cartel member firms have less vigilant directors than other firms and cartel employees exercise stock options more rapidly than employees in other firms. Cite. Also, Spagnolo (2005) *Eur. Econ. Rev.* shows that capped bonus plans and incumbency rents for managers encourage collusion by relaxing the incentive compatibility constraint.

The threat of shareholder derivative suits could be used to deter directors and top managers from embracing price fixing agreements. Derivative suits might be effective tools of corporate governance in this context. John M. Connor, *The Global Lysine Price-Fixing Conspiracy of 1992-1995*, 19 *Rev. of Agricultural Economics* 412, 420 (1997) (“ADM settled shareholders' suits for \$30 million”); James D. Cox, *The Social Meaning of Shareholder Suits*, 65 *Brook. L. Rev.* 3, 44 (1999) (“The need for such an inhibition was the basis raised in the petition for certiorari in *California Public Employees' Retirement System v. Felzen*. The derivative suit grew out of more than \$190 million Archer Daniels Midland (ADM) had paid to settle various civil and criminal antitrust cases for its alleged price fixing activities. The derivative suits alleged ADM's officers and directors had breached their fiduciary obligations in connection with the antitrust violations and sought to recover \$190 million.”)

⁹² “Senior management in EU cartels does not seem to suffer from their participation in cartels. For example, Robert Koehler became CEO of SGL Carbon in 2012, after being convicted in 1999 of price-fixing in the graphite electrodes cartel.” Catarina Marvão, *The Issue of Repeat Cartel Offences*, Free Policy Network, Feb. 1, 2016, <http://freepolicybriefs.org/2016/02/01/the-issue-of-repeat-cartel-offences/>

on the problem of rogue managers.⁹³ Widespread multi-product price fixing seems to be inconsistent with the notion that rogue managers are responsible for collusion.⁹⁴

Returning to our earlier observation, we note again that the features of the chemical cartel seem inconsistent with the notion that collusion arises independently at a division level. It seems unlikely that three different rogue managers from a company like BASF independently sought the services for Fides/AC Treuhand in aid of collusion. Further, the ways that Fides/AC Treuhand coordinated the activities of chemical manufacturers across different product lines suggests top management was likely involved in these cartels. If we are right, then enforcement policies that worry very much about addressing the problem of rogues are likely misguided.

We fear that inadequate deterrence means that top management and perhaps even shareholders⁹⁵ sometimes welcome price fixing agreements as a tool for increasing expected profits – even after factoring in the expected costs from detection and punishment.⁹⁶ Our fear grows out of the evidence we discussed in Section II concerning

⁹³ Harrington reviewed recent price-fixing investigations at the EU and found that in most cases top management was involved in the collusion. Cite. “The evidence on convicted cartelists suggests that rogue managers are in a minority. Cartel executives tend to have titles that place them in a company’s top layer of management.” John M. Connor, *RECIDIVISM REVEALED: Private International Cartels 1990-2009* at fn 53. Harry First, *Are Cartel Participants Rogues?*, June 2016, www.nortonrosefulbright.com/knowledge/publications/.../are-cartel-participants-rogues Harry First reviewed DOJ Antitrust Division press releases issued between March 2014 and March 2016 and found forty-seven named individuals involved in “major international cartels.” The industry distribution was: “twenty-seven in auto parts, seven in Libor, seven in ocean shipping, five in cathode display tubes, one in marine hose....” “[N]ot one person mentioned during this time period was in a low-level corporate position. Their described positions varied—executive, general manager, group and department manager, high-level manager, director of sales and marketing—and thirteen of them were identified either as president, CEO, owner, or chairman. These are not line-level employees.” “The evidence on convicted cartelists suggests that rogue managers are in a minority. Cartel executives tend to have titles that place them in a company’s top layer of management.” John M. Connor, *RECIDIVISM REVEALED: Private International Cartels 1990-2009* at fn 53.

⁹⁴ Our case study of price fixing in the chemical industry highlights three facts about price-fixing in the chemical industry that are hard to reconcile with the assumption that collusion is accomplished strictly (or mostly) by middle managers: (1) repeated price-fixing, (2) coordination of price-fixing across different product lines, and (3) the use of outside consultants for addressing the double marginalization problem by coordinating cartel conduct between upstream and downstream cartels and organizing other kinds of coordination..

⁹⁵ If deterrence is sufficient to make price-fixing unattractive to shareholders then good corporate governance would be the key to inducing top management to take the steps necessary to stop price fixing. There is evidence that good governance, in the form of a significant presence of outside directors on the Board leads to better cooperation with cartel enforcers once collusion is found., Campello, Ferres & Ormazabal (2017) (Independent directors pay a reputational price when their firm is prosecuted for collusion. They “lose a significant number of directorships at other firms.”) p. 244 (Firms with a higher proportion of outside directors are more likely to seek leniency and more likely to fire the CEO responsible for collusion.) p. 244

⁹⁶ “In such a case, the leadership of the organization expects managers to collude, and collusion occurs in many markets in which the firm operates. Firm norms and expectations of managerial behavior can repeatedly encourage collusion and “disregard” previous fines, as illustrated in the ADM case (Eichenwald, 2000).” Catarina Marvão, *The Issue of Repeat Cartel Offences*, Free Policy Network, Feb. 1, 2016, <http://freepolicybriefs.org/2016/02/01/the-issue-of-repeat-cartel-offences/>

persistent serial collusion across a variety of industries. If top management is thoroughly implicated in serial collusion then perhaps it would be desirable to impose tougher sanctions on corporate officers responsible for price fixing.⁹⁷

IV. Serial collusion by multi-product firms – why is it different?

Suppose a large multi-product firm manufactures and sells well over fifty products and suppose that the same firm is engaged in explicit collusion with rivals at any point in time in ten of those products. The large multi-product firm can clearly treat each cartel as a separate independent collusive activity, and thus the analysis of the previous section would be directly relevant, ten times. However, by viewing the ten cartels together, and solving cartel problems across the ten cartels, or some subset of those cartels, the large multi-product firm can increase the aggregate profitability of the ten cartels, decrease detection risk, and resolve the problems of a given cartel more easily.

A. Resolving the Issues of a Given Cartel across Cartels

Serial multi-product cartels are likely to be more resilient to economic shocks and defection by cartel members who may be tempted to depart from the cartel or cheat other cartel members. One reason is that multi-product cartel members that defect face stronger punishment – the potential loss of cartel profit in multiple products, not just one.⁹⁸

⁹⁷ “Imposing tougher sanctions, such as individual prison sentences or disqualification of senior executives from employment in their sector or role, may prevent repeated collusive behaviors (in new firms) and thus, increase deterrence levels.” Catarina Marvão, *The Issue of Repeat Cartel Offences*, Free Policy Network, Feb. 1, 2016, <http://freepolicybriefs.org/2016/02/01/the-issue-of-repeat-cartel-offences/>

⁹⁸ Bernheim and Whinston explain how multimarket contact facilitates price fixing by strengthening the threat of punishment faced by potential defectors – if a firm defects in one market then it will suffer in the future when it gets punished in the market in which it defected but also in other markets in which it is participating in a cartel. See Bernheim & Whinston, *Multimarket Contact and Collusion* *Rand J. Econ.* Econometric research largely confirms the role of multimarket contact in facilitating higher prices, but the research has looked at firms competing across a number of geographic markets rather than across different product lines. Bernheim and Whinston’s model suggests the effects are likely to be stronger across product lines assuming that various product lines are more heterogeneous than various geographic markets.

Hay and Kelley examine all U.S. price fixing cases from 1963 to 1972 and find that collusion in one geographic market is associated with collusion in other geographic markets. George A. Hay and Daniel Kelley, *An Empirical Survey of Price Fixing Conspiracies*, 17 *J. L. & Econ.* 13, 27-28 (1974). Work finding that multimarket contact across separate geographic markets leads to higher prices includes: Jans and Rosenbaum, *Multimarket Contact and Pricing: Evidence from the US Cement Industry* (1994) (multimarket contact associated with higher cement prices); Evans and Kessides (1994) (multimarket contact tends to increase airline ticket prices); Philip M. Parker, Lars-Hendrik Roller, (1997) (multimarket contact associated with higher prices in the mobile phone industry); Fernandez and Marin, *Market Power and Multimarket Contact: Some Evidence from the Spanish Hotel Industry*, (1998) (multimarket contact associated with higher prices in the Spanish hotel market); Busse, *Multimarket Contact and Price Coordination in the Cellular Telephone Industry*, (2000) (multimarket contact associated with a pattern of setting higher identical prices across markets); Ciliberto & Williams (2014) (carriers with a significant amount of multimarket contact can sustain

Alternatively, cartels may find it easier to mollify potential defectors by making side-payments in one product to offset losses they might suffer in another product. Multi-market contact provides greater opportunities to hide these side payments from antitrust enforcers; they may be disguised in subcontracts, joint marketing arrangements or patent licenses. The opportunities for such hidden transfers may exist in single-product cartels but they are likely to be more available and can take more complex forms in multi-product cartels.

The European Commission noted in the vitamins conspiracy decision that BASF exited the production of thiamin (vitamin B1) in 1989.⁹⁹ At the same time, Roche, who was a duopolist in the production of beta carotene, accommodated the expansion of BASF's market share of beta carotene from 12% of worldwide market in 1988 to 17% in 1989, and an average share of 22% for 1990 to 1998.¹⁰⁰ The Commission decision does not connect these two events. However, a *unilateral* decision by BASF to exit thiamin production in the midst of a conspiracy that would have increased thiamin profits does not make sense.¹⁰¹ Furthermore, it makes little more sense for Roche to *unilaterally* accommodate the expansion of beta carotene production by BASF when Roche was dominant in that product, and thereby erode near-monopoly profits. More plausibly there was a *mutual* agreement among the two leading vitamin cartel firms to have one exit the thiamine market and get compensated with accommodation of their share expansion in the beta carotene market.¹⁰²

Coordinated product exit/contraction and entry/expansion is difficult to observe. For large multi-product serial colluders, exit from a single product line and entry into a different product line would likely be viewed as immaterial, and thus not included in filings to the SEC or other regulatory bodies. But we have some window into this potential tactic through European Commission cartel decisions. The four chemical cartel cases listed below featured exit by a large multi-product cartel participant from one of the cartelized markets in the midst of the explicit collusion. Given a well-functioning cartel, it is unlikely that the cartel price was so low that continued sales were unprofitable for the exiting firm.¹⁰³ It also seems unlikely that the exit was rooted in a fear of being caught, especially since the exiting firm joined the cartel at or near its inception. Given that each of the exiting firms is a potential serial colluder, it seems unlikely that collusion was discovered internally in the midst of the collusion and upper management insisted on exit

"near-perfect" cooperation in setting fares); Lin and McCarthy (2017) (multimarket contact responsible for higher health insurance premia). But Waldfogel and Wulf find only a small effect on radio advertising revenue. See, Waldfogel and Wulf, *Measuring the Effect of Multimarket Contact on Competition: Evidence from Mergers Following Radio Broadcast Ownership Deregulation* (2006).

⁹⁹ "BASF ceased its own production of vitamin B1 in 1989 but continued to act as a major supplier selling product bought in from other producers." (EC Decision in *Vitamins* at para. 84) BASF continued to bid for Thiamin business. When it won a contract the order would be fulfilled by Roche.

¹⁰⁰ Expert Report of B. Douglas Bernheim, p. 93

¹⁰¹ See Marshall, Marx, and Raiff (2008) for economic circumstantial evidence that the vitamins conspiracy started in 1985.

¹⁰² Zhou (2016) p. 382 (EC investigation of one market decreases entry and increases exit from other cartelized markets.) p. 383

¹⁰³ We do not observe the price at which the transactions occurred.

from the product in question. In this light we conjecture a cartel portfolio explanation – namely, there is some hidden countervailing transaction in another product, perhaps accommodated entry, that compensates these firms for exiting the products listed below.

- For the Butadiene Rubber and ESBR cartel, the duration of the infringement was 5/20/1996 to 11/28/2002.¹⁰⁴ Shell and Dow were participants in the cartel at the start. Shell's market share was larger than Dow's. Nevertheless, Shell sold its entire synthetic rubber business to Dow in the middle of 1999.¹⁰⁵
- For the Methacrylates cartel, the duration of the infringement was 1/23/1997 to 9/12/2002.¹⁰⁶ ICI, Degussa, and Elf Aquitaine were participants from the start. Nevertheless, ICI sold the entirety of its business to Lucite on 11/1/1999, and from that date forward Lucite was a participant in the cartel.¹⁰⁷
- For the MCAA cartel, the duration of the infringement was 1/1/1984 to 5/7/1999.¹⁰⁸ Akzo, Arkema., Elf Aquitaine and Hoechst were participants from the start. Nevertheless, Hoechst sold its MCAA business to Clariant on 7/1/1997 and then Clariant participated in the cartel until 5/7/1999.¹⁰⁹
- For the Polypropylene cartel, the duration of infringement was 1977 to 1983.¹¹⁰ Rhone Poulenc was a member of the cartel from the start, however, Rhone Poulenc sold its polypropylene business to BP in 1980.¹¹¹

Besides using coordinated entry and exit decisions to reallocate cartel profit across cartel members, multi-product cartels can use joint ventures, subcontracts, and patent licenses to reallocate profits internally. Joint ventures were common among members of recent electronics cartel. For example, LG began participation in the cathode ray tube cartel in December of 1997. In April of 2001 it formed a production joint venture with another cartel member, Phillips, and the joint venture became a cartel member. When cartel members form production and marketing joint ventures that displace their own production and marketing of a cartel product it provides a great opportunity to adjust output and reallocate cartel profit. By comparing European Commission cartel decisions to joint venture approvals we were able to identify six other joint ventures between electronics cartel members covering a cartelized product that started before or during the cartel: NEC and Hitachi joint venture in DRAMs, LG and Phillips joint venture in LCDs, Hitachi and Mitsubishi joint venture in smart card chips, Hitachi and LG joint venture in optical disk drives, Toshiba and Samsung joint venture in optical disk drives, and Sony and NEC joint venture in optical disk drives.¹¹²

¹⁰⁴ EC Decision in *Butadiene Rubber and Emulsion Styrene Butadiene Rubber* at Article 1 in Decision, p. 62

¹⁰⁵ EC Decision in *Butadiene Rubber and Emulsion Styrene Butadiene* at para. 286

¹⁰⁶ EC Decision in *Methacrylates* at Article 1 in Decision, p. 74

¹⁰⁷ EC Decision in *Methacrylates* at para. 30

¹⁰⁸ EC Decision in *MCAA* at Article 1 in Decision, p. 63

¹⁰⁹ EC Decision in *MCAA* at para. 16

¹¹⁰ EC Decision in *Polypropylene* at Article 1 in Decision, p. 36

¹¹¹ EC Decision in *Polypropylene* at para. 19

¹¹² We counted more than fifteen other joint ventures involving firms that were members of the electronics cartel but the joint ventures did not consolidate production or sales between the cartel members. These joint ventures can also be used to reallocate cartels profits assuming the joint ventures generated a profit, the parties can always agree to any profit share or cost share they desire.

Joint ventures may be subject to regulatory scrutiny and we would hope that a vigilant competition authority would not approve joint ventures that facilitate cartel activity,¹¹³ but the other tactics for reallocating cartel profits are not likely to face regulatory scrutiny. Exit/contraction properly crafted, is not reviewable by any regulatory authorities.¹¹⁴ Entry/expansion is invariably viewed as a unilateral decision of a firm that is considered to be part of the normal workings of the marketplace. Thus, coordinated exit/contraction and entry/expansion decisions are almost invisible to enforcement authorities. Also, we are unaware of any inquiry regarding such conduct in civil litigation.¹¹⁵ Patent licenses have been used to implement cartels and cross-licensing agreements can certainly be used to reallocate profit within a cartel.¹¹⁶ Subcontracts are sometimes used to reallocate cartel profit,¹¹⁷ but really any sort of contract relationship between cartel members might serve that purpose. When multi-product serial colluders enjoy a dense set of contractual relationships (joint ventures, patent licenses, subcontracts, or other) it makes it easier to hide cartel side-payments, and, as a bonus to the cartel, the threat of losing these other contractual relationships in response to cheating helps stabilize cartels.

A different sort of benefit that arises from serial multi-product collusion concerns strategies that reduce the risk of cartel detection. Multi-product cartels can better hide price increases from buyers compared to single-product collusion. Buyer resistance to price increases may diminish because multi-product collusion can remove the competitive benchmarks that buyers use to make judgments about the presence of a cartel. They have more trouble judging whether a price is “too high” and whether price increases are the result of cartelization or some other cause. Coordinating price increases across multiple products enhances the credibility of sellers’ assurances that price increases are grounded in genuine overall cost and demand pressures. A procurement division of a large buyer that gets a common justification for price increases across multiple products lines may be more willing to accept the price increases than resist them.

B. Strategic Use of Amnesty to Punish Deviators – the “Chain Store Paradox” for Serial Multi-Product Colluders¹¹⁸

¹¹³ The Europe Commission does not have a good track record on this front. See Marx and Zhou (2015) (“[I]n over one-third of the cartels discovered by the European Commission ... between 1985 and 2012, conspirators sold majority shares or relocated major production and sales capacities to their co-conspirators.”)

¹¹⁴ If exit occurs through a merger or takeover then it is reviewable. But a multi-product firm can often convert a production process for one product into that for another. Or, alternatively, sell off piecemeal the capital stock.

¹¹⁵ And even if such an inquiry were made it would likely remain unanswered on the grounds of being beyond the scope of the current cartel inquiry.

¹¹⁶ U.S. v. Line Material (1942); U.S. v. Harford Empire (19??).

¹¹⁷

¹¹⁸ <cite for Chain Store Paradox plus intuition of result>

A different version of our argument about more vigorous punishment in multi-product cartels is based on antitrust leniency programs. The leniency program allows a cartel member to avoid criminal liability for price fixing by making the first disclosure of the cartel to enforcement officials. In a single-product setting this policy works well to destabilize cartels.¹¹⁹ In the case of serial multi-product collusion, it might be used by a prominent cartel member to punish defectors by sacrificing collusive profit in one product, with the goal of strengthening the punishment threat and the stability of the cartel in another product.

Amnesty is typically characterized as a race to the antitrust authority, where the payoff for being first to admit to a conspiracy is the absence of a fine, provided that compelling evidence of a conspiracy is put forward. In other words, it is typically seen as a unilateral decision with no benefit to the amnesty awardee beyond the current cartel in question. However, if the amnesty applicant is a large multi-product firm that is running tens of cartels in diverse products, is there a benefit to amnesty beyond the one cartel for which it sought amnesty? Often large multi-product firms engage in explicit collusion with smaller firms, perhaps firms that make a single product. A large multi-product firm may be involved in a cartel in vitamins, a cartel in concrete additives, and a cartel in synthetic rubber. Small single product firms in each of the cartels may make only a certain range of vitamin products, or only concrete additives, or only synthetic rubber. There is no reason to believe that these smaller firms would have knowledge of cartels in other products, and these firms may not even be aware that the large multi-product firms in their cartel makes these other products.

Recall that the central problem of explicit collusion is – cheating by members. If a small cartel firm with an 8% market share within the cartel cheats on the cartel agreement, expanding its market share to as much as 10%, it may not be worthwhile for a large multi-product firm with a within-cartel share of 40% to punish the deviating smaller firm. Across tens of cartels this kind of conduct by small single product firms can be, in aggregate, very costly in terms of foregone collusive profits to the large multi-product cartel firm. Prior to amnesty, how would a large multi-product serial colluding firm mitigate this kind of conduct by small single product firms? A punishment within one cartel would be almost surely invisible to any other cartel since the small single product firms operate in different product markets. Even intentionally revealing a cartel to authorities would not get much attention since prior to amnesty such an action would likely be viewed as an accidental detection or a one-off incident.

However, amnesty can be used by a large multi-product firm to greatly mitigate cheating by small single product firms across its portfolio of cartels. The European

¹¹⁹ Theoretical work shows that well designed leniency programs facilitate cartel detection in the single-product setting. For a survey, see Spagnolo (2008). Poorly designed leniency programs that are too generous to cartel members undercut deterrence. There is reason to be concerned that the EU may be too generous with its grants of leniency. “[A] firm received a 100 percent reduction in the fine through the leniency program in 55 (54 percent) of the 101 products in which firms were prosecuted” in the EU between 2001 and 2012. Marx, Mezzetti, & Marshall (2015). See also, Marvão and Spagnolo (2015) (average reduction in fines is 45% and 52% of convicted cartel members receive some benefit).

Commission makes it clear in their decisions who is receiving full amnesty and their decisions are in the public domain. It is reasonable to presume that any small firm that is engaged in a conspiracy with a large multi-product firm will be aware that their large multi-product co-conspirator has sought amnesty in a different cartelized product. In light of this information, the small single product firm will likely inquire of their large multi-product co-conspirator why they took such an action. The large multi-product firm will explain that they are not willing to tolerate deviations by small firms in their cartels and when these deviations occur they will seek amnesty.

This reputation for toughness by the large multi-product serial colluders can have two benefits for cartel payoffs.¹²⁰ First, cheating by small co-conspirators will be substantially deterred across their entire portfolio of cartels. Second, if there are products that the large serial colluding firm wants to cartelize, but smaller firms in that industry have been reluctant because they believe cheating by others will greatly reduce cartel payoffs making the prospective venture not worth the risk, then for those products, cartels will be more likely to form. One would expect a large multi-product serial colluder to account for the external benefits to other existing and potential cartels when seeking amnesty in a single cartel.

This line of argument might explain why two multi-product chemical firms, Akzo Nobel and Degussa, applied for and received full amnesty in particular chemical product cartels. First, Akzo sought amnesty for a cartel in which Degussa was a member.¹²¹ But Akzo and Degussa were participating in more than that one cartel together at the time of the Akzo amnesty application. If Akzo was motivated by the standard unilateral logic for seeking amnesty, why didn't Akzo report the other cartels at that time? Shortly thereafter Degussa sought and received full amnesty for their participation in a second cartel in which Akzo was a participant.¹²² Note that the cartels in which Akzo and Degussa were participating at the time did not end when Akzo first applied for amnesty. Soon after Degussa's application for amnesty in the second product Akzo applied for and received amnesty for yet a third cartel, which begs the question why didn't Degussa report the cartel in the third product when it applied for amnesty in the second product?¹²³ It is a reasonable conjecture that Akzo and Degussa were working together to send warning signals to deviant firms. It is also reasonable to conjecture that Akzo and Degussa applied for leniency in the markets sequentially to escalate the punishment, alternating applications to share the benefit from leniency.

¹²⁰ See Isogai and Shen (2017) for a model where a multi-product firm uses amnesty to signal intolerance for deviant conduct to members of its many other cartels. "Marvão (2015) shows that repeat offenders appear to receive larger EC leniency reductions, which suggests that firms can learn the "rules of the game", colluding repeatedly and reporting the cartel to reduce their penalties. As such, fines need to be tougher and recidivism needs to be dealt with differently." Catarina Marvão, The Issue of Repeat Cartel Offences, Free Policy Network, Feb. 1, 2016, <http://freepolicybriefs.org/2016/02/01/the-issue-of-repeat-cartel-offences/>

¹²¹ Akzo received full amnesty in *Organic Peroxides* (EC Decision in *Organic Peroxides* at paras. 505-06)

¹²² Degussa received full amnesty in *Hydrogen Peroxide and Perborate* (EC Decision in *Hydrogen Peroxide and Perborate* at para. 501)

¹²³ Akzo received full amnesty in *Calcium Carbide* (EC Decision in *Calcium Carbide* at paras. 335-36)

C. Monitoring Compliance with Cartel Rules is Likely an Increasing Returns Technology

Economies of scale and scope are an easy to understand advantage of serial multi-product collusion. Likely, there are efficiencies associated with monitoring the actions of cartel members across multiple related product lines. In other words, checking firm A's prices for products 1 and 2 is probably less than twice as costly as simply checking firm A's price for product 1. Next, colluders and their allies (like Fides/AC Treuhand) likely get better at managing collusion with experience. Some aspects of corporate culture, corporate organization, and corporate incentives that work to stabilize collusion in product 1 may be transferred to product 2.¹²⁴ Finally, developing and using outside cartel consultants, like Fides/AC Treuhand, should be easier and less costly on a per cartel basis.¹²⁵

In the recently prosecuted chemical cartels the association management company Fides/AC Treuhand helped the colluding firms capture these benefits from economies of scale and scope. Fides/AC Treuhand gathered monthly reports on production, sales, and pricing, with the right to verify these reports via audit if necessary. It then disseminated the aggregate data to cartel members and advised the members about the *health* of the cartel.¹²⁶ On occasion, Fides/AC Treuhand served as a sort of a court to resolve disputes between cartel members. We conjecture that Fides/AC Treuhand was especially helpful to the cartel in dealing with disputes that arose when a cartelized chemical was used as an input in the manufacture of another chemical by a cartel member. When one cartel member buys a product from another cartel member it is likely the seller will discount the

¹²⁴ Levenstein and Suslow (2015) p. 8 ("There are cases where a firm's corporate culture encourages participation in cartels. In such a case, the leadership of the organization expects managers to collude, and we observe collusion in many markets in which the firm operates. Managers may learn to collude in one division and then take those practices to another. Firm norms and expectations of managerial behavior can encourage collusion, as the well-known ADM case illustrated (Eichenwald 2000). Van Driel (2000) analyzes the role that cultural and organizational factors played in a study of four European transportation cartels.")

¹²⁵ See, Rick Busscher, Martin Herz, and Hans Vedder, *The Shortest Competition Judgment Ever; AC Treuhand II*, European Law Blog, Nov. 9, 2015, <http://europeanlawblog.eu/2015/11/09/the-shortest-competition-judgment-ever-ac-treuhand-ii/> ("...as with any cartel, there needs to be supervision and enforcement. This is tricky for cartelists themselves, as the supervisor is exposed to the risk of being qualified as a ringleader, negating the possibility of immunity under the Leniency Guidelines. Hence, the heat stabilisers cartel thought of a better way, namely hiring an independent firm to ensure that parties stick to the cartel.")

¹²⁶ We expect that the information sharing fostered by Fides/AC Treuhand helped chemical firms coordinate on the initiation of cooperative pricing and to monitor for deviations. Shared information reduces the possibility of the misinterpretation of market-wide data. Recent papers by Awaya and Krishna (2015) and Spector (2015) show that information sharing among firms improves their ability to support elevated prices. Awaya and Krishna emphasize that information sharing improves monitoring, which reduces uncertainty and allows greater profits from coordination. Spector emphasizes that information sharing allows firms to detect deviations more quickly, making deviations less profitable and so reducing the incentive for firms to deviate in the first place.

price to the buyer, but the buyer would be expected to provide some form of compensation to the seller.¹²⁷

The involvement of Fides/AC Treuhand¹²⁸ in the implementation and operation of cartels is well documented in European Commission decisions, and this involvement can be characterized as substantial. The Organic Peroxide decision at paragraph 92 makes it abundantly clear that Fides/AC Treuhand had a thorough understanding of the pricing, allocation, and enforcement structures needed to avert secret deviations within the Organic Peroxide cartel and knew how to translate that understanding into actionable steps for the members of the cartel.¹²⁹

¹²⁷ Economists have identified an inefficiency called double marginalization that arises from successive monopolies. A cartel can increase overall profit by responding to this inefficiency. [More.]

¹²⁸ We refer to the firm as Fides/AC Treuhand because, “AC Treuhand is the result of a 1993 management-buyout of the division offering association-management within a company called Fides Trust AG.” (EC Organic Peroxide decision at para 20)

¹²⁹ Role in explicit collusion (from EC OP Decision at para 92):

- organised meetings of the members of the agreement, often in Zurich;
- produced, distributed and recollected the so called ‘pink’ and ‘red’ papers with the agreed market shares which were, because of their colour, easily distinguishable from other meeting documents and were not allowed to be taken outside the AC Treuhand premises;
- calculated the ‘pluses and minuses’, i.e. the deviations from the agreed market shares, which were used for compensations;
- reimbursed the travel expenses of the participants, in order to avoid traces of these meetings in the companies’ accounts;
- collected data on OP sales and provided the participants with the relevant statistics;
- stored the original agreement from 1971 and other relevant documents concerning the agreement in its safe and handed them over to PC;
- acted as a moderator in case of tensions between the members of the agreement and encouraged the parties to find compromises. AC Treuhand would try to stimulate the parties to work together and reach an agreement. *‘The message from AC Treuhand was that it would get worse for the participants if they discontinued the discussions.’* ;
- was actively involved in reshaping the arrangement among producers in 1998 during a bilateral meeting in Amersfoort between Akzo representatives and [...] of AC Treuhand. During this bilateral meeting a solution aimed at meeting Atochem’s demand was developed. The solution consisted of a proposal of AC Treuhand for the new quotas;
- AC Treuhand advised the parties whether or not to allow other participants into the agreement;
- instructed all participants on the legal dangers of parts of these meetings and on what measures to take to avoid detection of these arrangements’ bearing on Europe;
- participated mainly the ‘summit’ meetings but at least at once instance in the nineties attended also a working group meeting
- according to Akzo chaired at least some of the meetings, (AC Treuhand sees itself his in its reply to the SO not as chairman but as moderator);
- was aware of the Spanish sub arrangement and was asked to calculate the deviation between agreed quotas and effective sales in Spain
- organised the auditing of the data submitted by the parties
- calculated the new quotas after the acquisition and integration of competitors in the agreement.

Fides/AC Treuhand is the predominant firm in the European Commission decisions that we can identify that is in the business of assisting cartels, but it is not the only one.¹³⁰ Fides/AC Treuhand is an association management company (AMC). Many AMC's are primarily involved in the innocuous activity of helping professional and industry/product groups set up and run conferences and other meetings. These AMC's have the expertise and leverage to secure venues and the associated services for conferences and meetings that smaller professional organizations (say, a highly specialized group of surgeons) do not have the infrastructure to put together in a cost-effective manner. However, there are several AMC's that list services or market themselves on their websites in ways that go beyond organizing conferences and into the realm of potentially assisting cartels.¹³¹ Examples of some of these include¹³²:

- benchmarking services within a trade association and across members of an industry,
- facilitating collaboration among members of industry,
- promotion of information sharing, and
- finding joint solutions to problems within an industry.

Some of the Fides/AC Treuhand cartels overlap in terms of the cartel duration as determined by the European Commission.¹³³ Apparently, Fides/AC Treuhand is either not asked by the European Commission about any other cartels in which they are involved or they refuse to answer such queries by authorities. Large multi-product firms will often cite their vast size as being the reason they cannot know of every potential product division involved with collusion. Such a rationale is almost surely absent for a cartel consulting firm such as Fides/AC Treuhand – their cartel advising business is likely self-contained and senior management of that activity is likely aware of all cartels in which Fides/AC Treuhand is involved. The lack of revelation by Fides/AC Treuhand of their involvement with other cartels suggests the possibility that the extent of their historical involvement in assisting cartels may be much greater than what is observed in the EC Decisions.

V. Suggested Policy Reforms

¹³⁰ The EC decision in Marine Hoses as well as Yen Interest Rate Derivative make explicit note of a cartel facilitator. For Marine Hose the cartel consultant was Peter Whittle of PW Consulting. (see <https://www.justice.gov/atr/case-document/plea-agreement-peter-whittle> accessed on May 22, 2018). For Yen Interest Rate Derivatives the cartel consultant was the brokerage firm ICAP.

¹³¹ John M. Kuhlman, The Nature and the Significance of Price Fixing Rings, 2 Antitrust L. & Econ. Rev. 69 (1969) (examining 50 price fixing complaints and indictments in the 1960s and finding that 23 trade associations were named page 76); George A. Hay and Daniel Kelley, An Empirical Survey of Price Fixing Conspiracies, 17 J. L. & Econ. 13 (1974) ("The current study demonstrated that trade associations are often used as a coordinating device, especially when more than a given number of firms are involved." Page 28)

¹³² See http://www.2mpact.be/sites/default/files/AMSE_whitepaper2013_v2_0.pdf for a description of AMCs as well as a list of AMCs throughout Europe.

¹³³ <Provide examples>

With respect to policy reforms, it is worth keeping in mind that experienced cartel firms solve remarkably difficult problems in initiating and implementing a self-enforcing agreement to suppress rivalry. They use cartel structures that are tailored to the product/industry/market in question, and as conditions change they mutate the cartel structures to adapt. Any policy reform must account for the clever, malleable adaptability of experienced cartel firms.

This being said, there are some common features of cartel structures that can form the basis for meaningful policy reforms. A policy reform that will be difficult for cartel firms to use to their advantage should substantially encumber i) the ability of cartel firms to monitor one another, ii) the ability of cartel firms to rectify unintentional deviations, and iii) communication between cartel firms. A policy reform that will additionally be difficult for serial colluders to use to their advantage should empower cartel members that make a limited range of products, have smaller market shares, and have not been detected in previous cartels to be rewarded for revealing cartel conduct.

Competition law and policy could take several steps to address the phenomenon of serial collusion and create stronger incentives for firms to comply with the prohibition against agreements to set prices, output levels, or distort other dimensions of rivalry. We suggest that firms and enforcement agencies, as a condition of resolving cases, examine the causes of collusion. We also propose that convicted colluders be subject to heightened scrutiny and reporting obligations designed to deter future collusion. Finally, enforcement agencies should give heavier weight to collusion as a factor in evaluating mergers and treat repeated prior collusive behavior as an indicator that a merger may facilitate future collusive conduct.

A common thread that runs through these proposals is that competition authorities should collect and make better application of what might be called “antitrust big data.” A great deal of contemporary discussion about the information services sector focuses on how firms use data analytics to improve their capacity to understand markets and target potential consumers. Over the course of decades (or, in the case of the United States, over the course of a century), the operation of the competition system has generated an immense body of information about how firms form cartels and operate them. Before 1993, enforcement and litigation provided a crucial source of empirical knowledge about collusion. Scholarly studies such as Myron Watkins’s and Simon Whitney’s detailed industry case studies and popular accounts of cartels (for example, John Fuller’s study in the early 1960s of the electrical equipment cartel in the United States) drew chiefly upon the records of litigated cases and reports of government agencies, such as the Federal Trade Commission’s study from the late 1940s and early 1950s of the international petroleum cartel. The enforcement programs that developed after the early 1990s greatly expand the volume of publicly available information about how cartels take shape and operate.

The impact of this modern outpouring of information about cartels is evident in the new scholarship and popular literature about cartels. The revelations of the lysine cartel provided the foundation for a great book (Kurt Eichenwald’s *The Informant* in

2000), as well as a less successful movie of the same name, where Matt Damon's depiction of Mark Whitacre awkwardly straddles the boundary between drama and comedy. The landmark contributions of the modern scholarly literature about the operation of cartels, bid-rigging conspiracies, and the injury caused by illegal collusion frequently build on recent case records or enforcement agency decisions.

Thus, in the current environment, government agencies can make use of four significant information streams: (1) judicial decisions, and the publicly available record of litigated cases, involving prosecutions by government agencies or private parties; (2) nonpublic files that public agencies compile in the course of law enforcement investigations; (3) government reports on individual industries; and (4) academic research (such as individual company histories). The research presented in this paper draws on all of these sources, mainly the first, third, and fourth. We have identified patterns of firm behavior from our study of reported decisions involving cartel prosecutions, augmented by our own review of publicly available information about the relevant firms and government enforcement policy. We also use our experience in private litigation and in government agencies to interpret this information.

From this work, we are convinced that fuller study of these and related information sources would enable the competition community as a whole, and government agencies in particular, to improve their understanding of how cartels function and how public policy might be adjusted to deter them more effectively. Presented below are our proposals for measures that would expand the policy of available data and apply what we already know more effectively in law enforcement and other areas of policymaking.

A. Cartel Reconstructions

A cartel infringement reflects a serious failure of corporate governance, management, or operations. So long as human beings run companies, we cannot expect that firms will comply perfectly with all legal commands all the time. A realistic view of compliance is that firms can strive to minimize the severity of individual lapses and take measures to avoid the repetition of past infringements.

Firms periodically experience catastrophes – for example, transportation disasters that result in a large loss of life, or operational calamities (e.g., Deepwater Horizon) that cause death and massive injury to property. In most instances, companies and government agencies (such as the National Transportation Safety Board) respond to these events by carrying out intensive ex post investigations that reconstruct the circumstances that led to the failure and identify improvements for the future. Commercial airlines, for example, devote great effort to incorporate lessons from operational failures into the training of flight crews.

Cartel episodes should elicit the same effort by enforcement agencies and cartel participants to reconstruct the forces that led to the illicit collusion.¹³⁴ As a condition for participation in a leniency program or for entering a plea agreement, or as an element of sentencing in a contested case, we would require the culpable firms to engage in an externally audited reconstruction of the cartel and convey the results of the review to the Department of Justice. The inquiry would be supervised by a monitor appointed from within DOJ or by an expert outsider approved by the Department. The ex post review would identify who conceived the collusive scheme, who approved its implementation, who cooperated in its execution, what incentives inspired the cartel's formation, and which features of corporate management, governance, or culture facilitated participation in the cartel. Additionally, the review should reveal all individuals who provided advice and input regarding the initiation and implementation of the cartel. Importantly, the review must, when applicable, identify links between collusive activities related to the product under investigation, and activities that did in the past, or might in the future, facilitate collusion in other products that the defendant manufactures or otherwise controls.¹³⁵

We see the cartel reconstructions as serving three ends. The first is to provide greater insights for public enforcement agencies about how cartels take shape and how they operate. A better understanding about the formation and functioning of cartels would put the public agencies in a better position: to detect cartels by identifying behavior consistent with the coordination among rivals, and to devise superior remedies. We advocate that agencies augment stovepipe price-fixing investigations, expanding investigations across multiple product markets simultaneously.

The second result would be the opportunity for firms to develop more effective compliance strategies. A necessary starting point for responding to a serious failure is to understand its causes. As noted above, these include incentives that may have induced the firm's employees to engage in improper conduct, and weaknesses in internal monitoring and supervision that enabled wrongful agreements to form and prosper. An

¹³⁴ "After securing criminal convictions, the Division should also inquire, and publicly report details on, how cartels were able to collude and sustain their collusion." American Antitrust Institute, p. 26 https://www.antitrustinstitute.org/files/Cartels%20Chapter%20from%20%20AAI%20Transition%20Report_100520082109.pdf

¹³⁵ We have identified eight firms in the chemical or electrical cartel that applied for leniency for one (or more) cartel while still participating in other cartels: Akzo Nobel applied for leniency in the sodium gluconate cartel while still active in seven other cartels; Arkema/Atofina applied for leniency in the monochloroacetic acid and organic peroxides cartels while still active in three other cartels; Bayer applied for leniency in the citric acid cartel while still active in three other cartels; Bayer applied for leniency in the rubber chemicals cartel while still active in two other cartels; Degussa applied for leniency in the methionine cartel while still active in three other cartels; Degussa applied for leniency in the organic peroxides cartel while still active in one other cartel; Rhone Poulenc/Aventis applied for leniency in the methionine and vitamins cartels while still active in another cartel; Solvay applied for leniency in the vitamins cartel while still active in one other cartel; Hitachi applied for leniency in the power cables cartel while still active in two other cartels; Hitachi applied for leniency in the alternators and starters cartel while still active in one other cartel; and Samsung applied for leniency in the monitor tubes and smart card chips cartels while still active in another cartel.

enforcement agency might decide, in determining punishment, to give more credit to a compliance program that emerged from a determined firm effort to undertake a careful self-assessment and retool its operations to cure existing deficiencies.¹³⁶ Needless to say, certain firms may need stronger motivation to craft effective compliance programs and renounce price-fixing as a business model. For these firms, stronger deterrence via stiffer penalties, better detection, and an intensified threat of successful prosecution may be a desirable complement to the higher quality information disclosure that would come from cartel reconstruction.

The third result is to enrich scholarship about cartels by giving scholars better insight into how cartels are created and managed. The modern renaissance of cartel-related scholarship has built significantly upon reported records of cartel cases, especially decisions of the European Commission. Fuller disclosure of information about the architecture and machinery of cartels would propel further advances in this literature, which in turn would illuminate paths for enhancements of public policy and legal doctrine.¹³⁷

B. Settlement and Monitoring

Serial cartel participants should be subject to progressively more stringent monitoring by law enforcement institutions. Agreements reached in settlements or plea agreements or conditions imposed in sentencing should expand the ability of government agencies to monitor the behavior of cartelists. For a serial cartelist, either a DOJ official or a monitor approved by DOJ and/or the court could insist on regular reporting involving communications and transactions with competitors; adjustments in the incentives of sales personnel; and changes in capacity related to previously cartelized products.¹³⁸

If a multi-product firm has been found to have participated in multiple cartels, then it should be subject to additional requirements beyond standard penalties and

¹³⁶ Compare Sokol (2015) (discussing and supporting conditions in which a firm's maintenance of a robust compliance program should dictate a mitigation of punishment).

¹³⁷ "EU, U.K., Korean, and Canadian enforcers release far more details about the conduct and harm caused by cartels than does the Division. The information released by the Division rarely, if ever, includes data about unindicted coconspirators, affected sales, conduct, and injuries caused by cartels. The Division should reveal more of what it knows about these matters, either in plea agreements, informations, sentencing agreements, or in follow-up studies using anonymous data. It should publish all sentencing agreements, whether submitted to courts or not, on its Web page. This could be done in a manner that would not interfere with the Division's law enforcement efforts." American Antitrust Institute, p. 26
https://www.antitrustinstitute.org/files/Cartels%20Chapter%20from%20%20AAI%20Transition%20Report_100520082109.pdf

¹³⁸ "The Division could require in sentencing agreements that defendants turn over simple post-conviction reports for five years on their production costs, sales, and prices in the affected market. For a representative sample of successful cartel prosecutions, the Division should report on the state of competition in the affected industries." American Antitrust Institute, p. 25
https://www.antitrustinstitute.org/files/Cartels%20Chapter%20from%20%20AAI%20Transition%20Report_100520082109.pdf

requirements for antitrust compliance training as part of any plea agreement. It should be required to report to the General Counsel's office:

- Any and all communications to or from competitors, directly or indirectly, both within a product area and across product areas.
- Any and all transactions with competitors, directly or indirectly, both within a product area and across product areas. We define transactions broadly to include settlement of contract or other business disputes, intellectual property license, or in-kind transfer.

It should also be required to submit the above information for review by outside counsel to determine if there are any indications of anti-competitive conduct. If there are any indications of anti-competitive conduct then a report must be made to the relevant antitrust enforcement agency. Such a report would immediately trigger the following actions with regard to all products, directly or indirectly, potentially impacted by the anticompetitive actions.

- The firms under investigation will provide the relevant information and sufficient data that would allow for a rigorous econometric evaluation of product prices so that a but-for price can be calculated for the period of the potentially inappropriate actions. This but-for price will then be used to assess whether the actual prices during the period in question were elevated above non-collusive levels.
- The firms under investigation will provide all information regarding the involvement of third parties in assisting with potential anti-competitive conduct for all products under consideration.
- The firms under investigation will provide all information regarding changes to the incentives of their sales force that involve shifts away from the pursuit of market share and toward the maintenance of elevated prices.
- The firms under investigation will provide all information regarding capacity changes for all products potentially impacted by the possible anticompetitive conduct. Changes in capacity include exit from and entry to all products potentially impacted by the possible anticompetitive conduct.
- The firms under investigation will provide all information regarding any conduct that would be considered a dominant firm conduct for all products potentially impacted by the possible anticompetitive conduct.

C. Merger Review

Effective merger policy interacts with anti-cartel policy in two ways. First, absent compelling efficiencies, it should block horizontal mergers by firms attempting to regain the pricing discipline they had previously enjoyed until their cartel was uncovered and prosecuted. There has been a discouraging pattern of mergers in Europe following recent success prosecuting cartels.¹³⁹ These mergers may have compromised much of the competitive gain that consumers expected to see from vigorous anti-cartel enforcement by the European Commission. Second, and perhaps more importantly, effective merger policy should block mergers that stabilize or encourage cartels. This second concern is subsumed within a broader concern known as coordinated effects.¹⁴⁰ A coordinated effects problem arises if a merger “change[s] the competitive environment so that the remaining firms could or could more easily coordinate on price, output, capacity, or other dimension of competition.”¹⁴¹

Enforcement agencies should make use of cartel reconstructions and the results of expanded monitoring when reviewing mergers involving a serial cartelist. This is most important in building coordinated effects cases, where the propensity of firms to explore coordination with rivals, post-merger, should be a major factor in predicting whether a merger will have an adverse competitive effect. In the ordinary merger review, we propose that government agencies treat past collusive behavior as a serious indication of likely future anticompetitive effects.

The U.S. Horizontal Merger Guidelines already recognize that collusion may be relevant to a coordinated effects analysis.¹⁴² But “[m]erger policies in the EU, the US,

¹³⁹ Marx and Zhou at p 1 (Introduction of leniency in the EU in 1996 increased the pace of horizontal mergers involving cartelists. But the cartel settlement procedure slowed the pace.) “Competition authorities have repeatedly permitted mergers among former cartel members, often without review, let alone structural intervention. Davies et al. (2014) examine mergers among former cartel conspirators and conclude that only 29% of the mergers were investigated by the EC.” Catarina Marvão, *The Issue of Repeat Cartel Offences*, Free Policy Network, Feb. 1, 2016, <http://freepolicybriefs.org/2016/02/01/the-issue-of-repeat-cartel-offences/>

¹⁴⁰ Both the United States and the EU examine coordinated effects when deciding whether to approve horizontal mergers. The FTC advises that a horizontal merger may “lessen competition ... by creating or enhancing the ability of the remaining firms to act in a coordinated way on some competitive dimension.” <https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws/mergers/competitive-effects>. And the EC Horizontal Merger Guidelines - §22 state: “... horizontal mergers may significantly impede effective competition... by changing the nature of competition in such a way that firms that previously were not coordinating their behaviour, are now significantly more likely to coordinate and raise prices or otherwise harm effective competition. A merger may also make coordination easier, more stable or more effective for firms which were coordinating prior to the merger (coordinated effects).”

¹⁴¹ <https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws/mergers/competitive-effects>.

¹⁴² The Horizontal Merger Guidelines of 2010 recognize the significance of past collusion for a proper coordinated effects analysis. “The Agencies presume that market conditions are conducive to coordinated interaction if firms representing a substantial share in the relevant market appear to have previously engaged in express collusion affecting the relevant market, unless competitive conditions in the market have since changed significantly. Previous express collusion in another geographic market will have the same weight if the salient characteristics of that other market at the time of the collusion are comparable to those in the relevant market. Failed previous attempts at

and many other jurisdictions may not adequately take into account the collusive history of merging firms.”¹⁴³ Building analysis of collusive activity into coordinated effects review may be impeded if enforcers lack the sort of information that could be gathered in a cartel reconstruction or by monitoring the behavior of serial colluders. And such analysis is surely impeded by “stove-piping” which occurs for example when price fixing and mergers are handled by separate units in the Antitrust Division of the DOJ and those units do not communicate adequately.¹⁴⁴ “Remedies such as disclosure, divestiture of assets, selling minority shares in competitors, or licensure of intellectual property to competitors may change the nature of competition in the market and make collusion more difficult (see Marx & Zhou, 2015 regarding post-cartel mergers). This is particularly relevant if recidivism is industry-driven.”¹⁴⁵

D. Beyond Leniency

In Section IV.B we explained that leniency programs can be manipulated by serial colluders to intimidate small firms. Perhaps beefed up monitoring of serial colluders will minimize abuse of leniency, and antitrust authorities can implement a leniency program that destabilizes cartels without unintended consequences.

Regardless of how well manipulation of leniency programs can be controlled, we favor a complementary reform patterned after familiar bounty programs. We envision a bounty program that rewards certain small firms when they disclose they are participating with a serial colluder in a cartel. Specifically, the disclosing firm must have a relatively small market share, must make a limited range of products, must not be a cartel instigator, and must not have participated in any other cartels.¹⁴⁶ The disclosing firm

collusion in the relevant market suggest that successful collusion was difficult pre-merger but not so difficult as to deter attempts, and a merger may tend to make success more likely. Previous collusion or attempted collusion in another product market may also be given substantial weight if the salient characteristics of that other market at the time of the collusion are closely comparable to those in the relevant market.” Horizontal Merger Guidelines, U.S. Department of Justice and Federal Trade Commission, p. 25 August 19, 2010 <https://www.ftc.gov/sites/default/files/attachments/merger-review/100819hmg.pdf>

¹⁴³ Marx and Zhou (2015) at 24.

¹⁴⁴ “Price fixing and mergers are handled by separate units in the Division, yet the two may be related. A single horizontal merger in the United States or abroad can make formation of a cartel feasible. It is frequently the case that cartel convictions are followed by spin-offs and other industry restructuring. A history of collusion in an industry may signal that a rise in coordinated effects is likely after a proposed merger is consummated. The Division should study whether there is a pattern of cartel members’ acquiring rivals, large customers, or suppliers in the affected industry anywhere in the world before, during, or immediately after, the violation. Any negative findings should be incorporated into the Division’s enforcement decisions.” Page 25-26 American Antitrust Institute, p. 25

https://www.antitrustinstitute.org/files/Cartels%20Chapter%20from%20AAI%20Transition%20Report_100520082109.pdf

¹⁴⁵ Catarina Marvão, The Issue of Repeat Cartel Offences, Free Policy Network, Feb. 1, 2016, <http://freepolicybriefs.org/2016/02/01/the-issue-of-repeat-cartel-offences/>

¹⁴⁶ Note that we intend to limit this programs to disclosures that expose at least one serial colluder as a cartel member. Thus, the effectiveness of the program depends on transparent enforcement of anti-

should be treated as a qui tam relator, exempt from all criminal penalties and paid a percentage of the fines recovered by enforcement authorities from the other cartel members.

Of course, creating qui tam incentives for small cartel members will create a disincentive for large multi-product firms to include these smaller firms in cartels, which is socially beneficial. In the vitamins cartel it can be argued that Roche and BASF were colluding from 1985 to 1989 but then expanded the collusion to many other producers in the industry resulting in substantial price increases in vitamins from late 1989 to the end of the cartel. We conjecture that if Roche and BASF faced substantial disincentives to include smaller firms in the cartel then the social harm from the collusion would have been greatly reduced.

Given the disincentive to have smaller firms join the cartel, a natural response by serial colluders will be to attempt to force smaller firms from the market at the inception of the collusive conduct. But, as noted in Kovacic et. al. (Michigan Law Review 2011), predatory conduct against a small firm when no firm in the industry is a dominant firm is a super plus factor – it almost surely cannot occur without explicit collusion by the large firms in the industry. In fact, as a more general point, antitrust enforcement authorities should conduct an extensive review when a small firm in an industry is claiming predatory conduct by larger firms that are known serial colluders.

VI. Conclusions

We documented in this paper that many large multi-product firms have engaged in explicit collusion for extended periods of time across a variety of products with inclusive participation. Few of these cartels have short duration. The time periods of many of the cartels overlap but they are not coincident. We argued that this evidence points away from a rogue division manager explanation of price fixing. It fits better with our conjecture that many firms have embraced explicit collusion as a business model. The frequent use of an external cartel facilitator in the chemical industry provides further evidence for this conjecture.

We explained that large multi-product firms enjoy multiple advantages when embracing explicit collusion as part of their business model. First, as noted in Section IV, they can address cartel issues across their portfolio of cartels rather than within each cartel in isolation. Second, they can use their experience in previous collusive conduct to enhance the profits of current and future cartels in which they are involved. Third, serial colluders can take advantage of some antitrust enforcement tools, such as leniency programs.

cartel laws that clearly identify serial colluders. We leave open the question of exactly how the program would define serial colluders, and leave open the question of whether this sort of bounty program should be available more broadly. Counseling against broad availability of such a program is the risk of chilling desirable competitive behavior.

Our policy recommendations begin with two premises. First, given the obvious evidence of serial collusion, antitrust enforcement must expand beyond stovepipe investigations of collusive conduct.¹⁴⁷ Second, given that serial colluders are enormously clever and flexible, policy reforms must attack the underpinnings of cartel structures.

In this light, we recommend that large multi-product firms classified as serial colluders by enforcement authorities be required, as part of any antitrust plea or settlement, to provide a full reconstruction of the history of the cartel as well as detailed information going forward of any and all (i) communications and information exchanges with competitors, (ii) transactions and/or transfers, including settlements from litigation, with competitors, (iii) sufficient data required by authorities to construct a reliable econometric model to construct a but-for price to compare to actual prices, (iv) communications with third parties that provided advice regarding anti-competitive conduct, (v) changes to the incentives of their sales force, (vi) capacity changes, including entry and exit, in any and all products, and (vii) exit and entry by rival firms.

We also recommend that any serial colluder applying for a merger be subject to a mandatory coordinated effects review, even for products that are only produced by one of the merging parties.

Finally, we recommend that small firms with no record of serial collusion be given not just leniency for reporting a cartel to antitrust authorities but be actually rewarded with a share of the fines collected by enforcement authorities.

¹⁴⁷ To get a rough sense of the inattention shown by antitrust enforcers and antitrust law scholars to problems created by multi-market contact we compared citation patterns to two prominent articles from the industrial organization literature: Multi-market Contact and Collusive Behavior, (1990) by Bernheim and Whinston, and Raising Rivals' Costs (1983) by Salop and Scheffman. Even though the Bernheim and Whinston article was published seven years after the Salop and Scheffman article they have a roughly comparable number of citations in Google Scholar – 1536 for Salop and Scheffman compared to 1496 for Bernheim and Whinston. We interpret this to mean both articles are highly influential among economics and management scholars. Next we compared the citations to the two articles in the Hein Law Journal Library. Salop and Scheffman got 165 citations compared to only 25 citations for Bernheim and Whinston. Next we looked at Areeda and Hovenkamp, Antitrust Law: An Analysis of Antitrust Principles and found nine cites to Salop and Scheffman but no cites to Bernheim and Whinston – though we did find one cite to Bernheim and Whinston in Kaplow's Competition Policy and Price Fixing treatise. Finally, we examined documents posted on the websites of the FTC and the Antitrust Division of the DOJ and we found 35 citations to Salop and Scheffman and only 5 citations to Bernheim and Whinston. We take this citation pattern as evidence that antitrust enforcers and scholars think of price fixing as a one-shot phenomenon, if they better understood the multi-market contact associated with serial collusion they would show more interest in the Bernheim and Whinston article.

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Appendix

EC Decisions and Cartel Firms listed in Figures 1A and 1B

1. Bitumen: Case COMP / 38.456 – Bitumen - NL, September 13, 2006
 - a. Shell
2. Butadiene Rubber, Case COMP/F/38.638 – Butadiene Rubber and Emulsion Styrene Butadiene Rubber, November 29, 2006
 - a. **Bayer**, Shell
3. Calcium Carbide, COMP/39.396 – Calcium carbide and magnesium based reagents for the steel and gas industries, July 22, 2009
 - a. **Akzo Nobel**, *Degussa*
4. Candle Waxes, Case COMP/39181 – Candle Waxes, October 1, 2008
 - a. **Shell**
5. *Cartonboard, IV/C/33.833 - Cartonboard, July 13, 1994
 - a. Fides/AC Treuhand
6. Chloroprene Rubber, COMP/38629 - Chloroprene Rubber, December 5, 2007
 - a. **Bayer**
7. Choline Chloride: Case COMP/E-2/37.533 – Choline Chloride, Comm'n Decision, December 9, 2004
 - a. *Akzo Nobel*, *BASF*
8. Citric Acid: Case COMP/E-1/36.604 – Citric Acid, Comm'n Decision, 2002 O.J.(L239) 18. December 5, 2001
 - a. *Bayer*
9. *Fatty Acids: IV/31.128 — Fatty Acids, Comm'n Decision, December 2, 1986
 - a. Fides/AC Treuhand
10. Food Flavor Enhancers: Case COMP/C.37.671 – Food Flavour Enhancers, Comm'n Decision 2004 (L 75) December 17, 2002
 - a. <None from those listed in Figure 5>
11. Heat Stabilizers, COMP/38589 – Heat Stabilisers, November 11, 2009
 - a. Akzo Nobel, *Arkema/ Atofina, Elf Aquitaine*, Fides/AC Treuhand
12. *Hydrogen Peroxide, IV/30.907 — Peroxygen products, November 23, 1984
 - a. Atochem, Solvay, *Degussa*
13. Hydrogen Peroxide, Case COMP/F/38.620 – Hydrogen Peroxide and Perborate, May 3, 2006
 - a. *Akzo Nobel*, *Arkema/ Atofina*, **Degussa**, *Elf Aquitaine*, *Solvay*
14. Lysine, Case COMP/36.545/F3 . Amino Acids, June 7, 2000
 - a. <None from those listed in Figure 5>
15. Methacrylates, Case No COMP/F/38.645 — Methacrylates, May 31, 2006
 - a. *Arkema/ Atofina*, **Degussa**, ICI, *Elf Aquitaine*
16. Methionine: Case C.37.519 – Methionine, Comm'n Decision, 2002 (L 255) 1. July 2, 2002
 - a. *Degussa*, **Rhone Poulenc/Aventis**
17. Methylglucamine: Case COMP/E-2/37.978 – Methylglucamine, Comm'n Decision, November 27, 2002
 - a. *Rhone Poulenc/Aventis*
18. Monochloroacetic Acid: Case COMP/E-1/.37.773– MCAA, Comm'n Decision, January 19, 2005
 - a. *Akzo Nobel*, *Arkema/ Atofina*, *Elf Aquitaine*, Fides/AC Treuhand, Hoechst

19. Organic Peroxides: Case COMP/E-2/37.857 – Organic Peroxyde, Comm’n Decision, December 10, 2003
 - a. **Akzo Nobel**, *Arkema/Atofina*, Degussa, Fides/AC Treuhand,
20. *Polyethylene, IV/31.866, LdPE, December 21, 1988
 - a. Atochem, BASF, Bayer, Dow, Enichem, Fides/AC Treuhand, Hoechst, ICI, Repsol, Shell
21. *Polypropylene, IV/31.149 – Polypropylene, April 23, 1986
 - a. Atochem, BASF, Fides/AC Treuhand, Hoechst, ICI, Rhone Poulenc/Aventis, Shell, Solvay
22. *Potash, IV/795 – Kaliand Salz/Kali Chemie, December 21, 1973
 - a. BASF, Solvay
23. *PVC, IV/31.865, PVC, December 21, 1988
 - a. Atochem, BASF, Enichem, Fides/AC Treuhand, Hoechst, ICI, Shell, Solvay
24. Rubber Chemicals: Case COMP/F/38.443 – Rubber Chemicals, Comm’n Decision December 21, 2005 (summary at 2006 (L 353) 50)
 - a. **Akzo Nobel (through Flexsys)**¹⁴⁸, *Bayer*
25. *Soda Ash, COMP/33.133-B: Soda-ash, December 19, 1990
 - a. BASF, Solvay
26. Sodium Chlorate, Case COMP/38.695 – Sodium Chlorate, June 11, 2008
 - a. **Akzo Nobel**, *Arkema/Atofina*, Elf Aquitaine
27. Sodium Gluconate, http://europa.eu/rapid/press-release_IP-01-1355_en.htm?locale=en#file.tmp_Foot_1, March 19, 2002
 - a. *Akzo Nobel*
28. Sorbates: Case COMP/E-1/37.370 – Sorbates, Comm’n Decision October 1, 2003
 - a. *Hoechst*
29. *Synthetic Fibers, IV/30.810 - Synthetic fibres, July 4, 1984
 - a. Bayer, Hoechst, ICI, Rhone Poulenc/Aventis
30. Vitamins: Case COMP/E-1/37.512– Vitamins, Comm’n Decision, 2001 O.J. (L6) November 21, 2001
 - a. *BASF*, **Rhone Poulenc/Aventis**, *Solvay*
31. *Woodpulp, IV/29.725 - Wood pulp, December 19, 1984
 - a. Fides/AC Treuhand
32. Nitrile Butadiene Rubber, COMP/38.628 - Nitrile Butadiene Rubber, January 23, 2008
 - a. *Bayer*

EC Decisions and Cartel Firms listed in Figure 6

1. DRAMs, COMP/38511 – DRAMs, May 19, 2010
 - a. *Hitachi, Mitsubishi, Samsung, Toshiba*
2. LCD, COMP/39.309 – LCD - Liquid Crystal Displays, December 8, 2010
 - a. **Samsung**
3. TV and computer monitor tubes, AT.39437 – TV and computer monitor tubes, December 5, 2012

¹⁴⁸ EC Decision at para 13, “The holding company for Flexsys is Flexsys Holding B.V. of which Akzo Nobel Chemicals International B.V. holds 50%, the remaining 50% being held by Solutia Inc and Solutia Europe N.V. together.”

- a. Panasonic, *Samsung*, Toshiba
- 4. Smart Card Chips, AT.39574 – Smart Card Chips, September 3, 2014
 - a. Hitachi, Mitsubishi, *Samsung*
- 5. Optical Disk Drives, Case AT.39639 — Optical Disk Drives, October 21, 2015
 - a. Hitachi, Samsung, Sony
- 6. Power Transformers, COMP/39.129 - Power Transformers, October 7, 2009
 - a. Hitachi, Toshiba
- 7. Gas Insulated Switchgear, COMP/F/38.899 – Gas Insulated Switchgear, January 24, 2007
 - a. Hitachi, Mitsubishi, Toshiba
- 8. Power Cables, AT.39610 — Power Cables, April 2, 2014
 - a. *Hitachi*, Mitsubishi
- 9. Alternators and Starters, AT.40028 - Alternators and Starters, January 27, 2016
 - a. *Hitachi, Mitsubishi*
- 10. Professional Videotape, COMP/38.432 – Professional Videotape, November 20, 2007
 - a. <None from those listed in Figure 6>
- 11. Elevators and Escalators, COMP/E-1/38.823 - PO/Elevators and Escalators, February 21, 2007
 - a. *Mitsubishi*
- 12. CRT Glass, COMP/39605 CRT Glass, October 19, 2011
 - a. **Samsung**
- 13. Rechargeable Batteries, AT.39904 – Rechargeable batteries, December 12, 2016
 - a. *Panasonic, Samsung, Sony*
- 14. Refrigeration Compressors, COMP/39600 – Refrigeration Compressors, December 7, 2011
 - a. *Panasonic*
- 15. Capacitors, AT.40136 – Capacitors, March 21, 2018
 - a. **Panasonic, Hitachi**

DoJ Decisions and Cartel Firms listed in Figure 7

- 1. Airbags: Case 5:12-cr-20383-JCO-LJM, June 6, 2012
 - a. Autoliv
- 2. Airbags: Case 3:14-cr-00349-JZ, September 29, 2014
 - a. Toyota
- 3. Airbags: Case 2:12-cr-20491-BAF-LJM, July 30, 2012
 - a. TRW
- 4. Air Conditioning Systems: Case 2:13-cr-20713-GCS-PJK, September 26, 2013
 - a. Valeo
- 5. Air Flow Meters: Case 2:13-cr-20707-MOB-LJM, September 26, 2013
 - a. Hitachi
- 6. Alternators/Starters: Case 2:13-cr-20707-MOB-LJM, September 26, 2013
 - a. Hitachi
- 7. Alternators/Starters: Case 2:13-cr-20712-PJD-DRG, September 26, 2013
 - a. Mitsuba
- 8. Alternators/Starters: Case 2:13-cr-20710-RHC-MAR, September 26, 2013

- a. Mitsubishi
- 9. Alternators/Starters: Case 5:15-cr-20197-JCO-APP, March 31, 2015
 - a. Robert Bosch
- 10. Anti-Vibration Rubber Products: Case 3:14-cr-0068-JZ, February 13, 2014
 - a. <None from those listed in Figure 7>
- 11. Anti-Vibration Rubber Products: Case 3:13-cr-0059-JZ, February 6, 2014
 - a. <None from those listed in Figure 7>
- 12. Anti-Vibration Rubber Products: Case 3:13-cr-00439-JJH, September 26, 2013
 - a. <None from those listed in Figure 7>
- 13. Automotive Brake Hoses: Case 3:14-cr-00394-JJH, October 31, 2014
 - a. Hitachi
- 14. Automotive Brake Hoses: Case 3:14-cr-00349-JZ, September 29, 2014
 - a. Toyota
- 15. Automotive Wire Harnesses: Case 2:12-cr-20064-DML-MKM, January 30, 2012
 - a. Yazaki
- 16. Bearings: Case 1:13-cr-00104-HJW, September 26, 2013
 - a. <None from those listed in Figure 7>
- 17. Bearings: Case 1:13-cr-00103-HJW, September 26, 2013
 - a. <None from those listed in Figure 7>
- 18. Compressors/Condensers: Case 2:13-cr-20711-AJT-LJM, September 26, 2013
 - a. Mitsubishi
- 19. Electronic Control Units: Case 2:12-cr-20063-DML-DRG, January 30, 2012
 - a. Denso
- 20. Electronic Throttle Bodies: Case 2:13-cr-20707-MOB-LJM, September 26, 2013
 - a. Hitachi
- 21. Fan Motors: Case 2:13-cr-20712-PJD-DRG, September 26, 2013
 - a. Mitsuba
- 22. Fuel Injection Systems: Case 2:13-cr-20707-MOB-LJM, September 26, 2013
 - a. Hitachi
- 23. Fuel Ratio Sensors: Case 2:14-cr-20494-MOB-DRG, August 19, 2014
 - a. NGK Spark Plug
- 24. Fuel Senders: Case 2:12-cr-20064-DML-MKM, January 30, 2012
 - a. Yazaki
- 25. Heater Control Panels: Case 2:12-cr-20063-DML-DRG, January 30, 2012
 - a. Denso
- 26. Ignition Coils: Case 2:13-cr-20707-MOB-LJM, September 26, 2013
 - a. Hitachi
- 27. Ignition Coils: Case 2:13-cr-20710-RHC-MAR, September 26, 2013
 - a. Mitsubishi
- 28. Instrument Panel Clusters: Case 2:12-cr-20064-DML-MKM, January 30, 2012
 - a. Yazaki
- 29. Inverters: Case 2:13-cr-20707-MOB-LJM, September 26, 2013
 - a. Hitachi
- 30. Motor Generators: Case 2:13-cr-20707-MOB-LJM, September 26, 2013
 - a. Hitachi
- 31. Oxygen Sensors: Case 5:15-cr-20197-JCO-APP, March 31, 2015
 - a. Robert Bosch
- 32. Oxygen Sensors: Case 2:14-cr-20494-MOB-DRG, August 19, 2014

- a. NGK Spark Plug
- 33. Power Window Motors: Case 2:13-cr-20712-PJD-DRG, September 26, 2013
 - a. Mitsuba
- 34. Seatbelts: Case 5:12-cr-20383-JCO-LJM, June 6, 2012
 - a. Autoliv
- 35. Seatbelts: Case 2:12-cr-20491-BAF-LJM, July 30, 2012
 - a. TRW
- 36. Spark Plugs: Case 5:15-cr-20197-JCO-APP, March 31, 2015
 - a. Robert Bosch
- 37. Spark Plugs: Case 2:14-cr-20494-MOB-DRG, August 19, 2014
 - a. NGK Spark Plug
- 38. Speed Sensor Wire Assemblies: Case 2:12-cr-20215-MOB-LJM, April 3, 2012
 - a. <None from those listed in Figure 7>
- 39. Steering Angle Sensors and Switches: Case 2:13-cr-20540-SJM-MAR, July 18, 2013
 - a. Panasonic, Toyota
- 40. Steering Wheels: Case 2:12-cr-20491-BAF-LJM, July 30, 2012
 - a. TRW
- 41. Steering Wheels: Case 5:12-cr-20383-JCO-LJM, June 6, 2012
 - a. Autoliv
- 42. Steering Wheels: Case 3:14-cr-00349-JZ, September 29, 2014
 - a. Toyota
- 43. Variable Valve Timing Devices: Case 2:13-cr-20707-MOB-LJM, September 26, 2013
 - a. Hitachi

EC Decisions and Cartel Firms listed in Figure 7

- 44. Air Conditioning Systems: Case AT.39960 – Thermal Systems, August 3, 2017
 - a. **Denso**, *Valeo*
- 45. Alternators/Starters: AT.40028 – Alternators and Starters, January 27, 2016
 - a. *Hitachi*, *Mitsubishi*, **Denso**
- 46. Automotive Wire Harnesses: Case AT.39748 – Automotive Wire Harnesses, October 7, 2013
 - a. *Yazaki*
- 47. Bearings: Case AT.39922-Bearings, March 19, 2014
 - a. <None from those listed in Figure 7>
- 48. Compressors/Condensers: Case AT.39960 – Thermal Systems, August 3, 2017
 - a. **Denso**[†], *Valeo*, **Panasonic (e-compressors)**
- 49. Radiators/Fans: Case AT.39960 – Thermal Systems, August 3, 2017
 - a. **Denso**, *Valeo*
- 50. Spark Plugs: Case AT.40113- Spark Plugs, February 21, 2018
 - a. *Bosch*, **Denso**, *NGK Spark Plug*

EC Decisions and Cartel Firms listed in Figure 8

- 1. CEEMEA: Case 1:18-cr-00061-JSR – United States of America v. BNP Paribus USA, Inc., January 25, 2018
 - a. <None from those listed in Figure 8>
- 2. Euro Interest Rate Derivatives
 - a. JPMorgan - http://europa.eu/rapid/press-release_STATEMENT-16-4307_en.htm, December 7, 2016

- b. *RBS* – Case AT.39914, December 4, 2013
- 3. EUR – USD Forex
 - a. JPMorgan – Case 3:15-cr-00079-SRU, May 20, 2015
 - b. *RBS* – Case 3:15-cr-00080-SRU, May 20, 2015
- 4. Swiss Franc
 - a. *JPMorgan, RBS, UBS*
 - i. Case AT.39924, October 21, 2014
 - ii. Case AT.39924 (CHF LIBOR), October 21, 2014
- 5. Yen
 - a. JPMorgan, RBS, UBS
 - i. Case AT.39861, February 4, 2015
- 6. Municipal Bonds
 - a. JPMorgan
 - i. Hertz, James L. – Case 1:10-cr-01178, November 30, 2010
 - ii. Wright, Alexander – Case 1:12-cr-00551-SAS, July 18, 2012
 - b. UBS
 - i. Heinz, Gary – Case No. 15-432 – Gary Heinz, et. al. Petitioners v. United States of America
 - ii. Ghavami, Peter - Case No. 15-432 – Gary Heinz, et. al. Petitioners v. United States of America
 - iii. Welty, Michael - Case No. 15-432 – Gary Heinz, et. al. Petitioners v. United States of America
 - iv. Zaino, Mark – Case 1:10-cr-00434-TPG, May 19, 2010