

PRICE-FIXING OVERCHARGES:

REVISED 3rd EDITION

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Abstract

Many jurisdictions fine illegal cartels using penalty guidelines that presume an arbitrary 10% overcharge. This paper surveys more than 700 published economic studies and judicial decisions that contain 2,041 quantitative estimates of overcharges of hard-core cartels.

The primary findings are: (1) the *median* average long-run overcharge for all types of cartels over all time periods is 23.0%; (2) the *mean* average is at least 49%; (3) overcharges reached their zenith in 1891-1945 and have trended downward ever since; (4) 6% of the cartel episodes are zero; (5) median overcharges of international-membership cartels are 38% higher than those of domestic cartels; (6) convicted cartels are on average 19% more effective at raising prices as unpunished cartels; (7) bid-rigging conduct displays 25% lower mark-ups than price-fixing cartels; (8) when cartels operate at peak effectiveness, price changes are 60% to 80% higher than the whole episode; and (9) laboratory and natural market data find that the Cartel Monopoly Index (CMI) varies from 11% to 95%. Historical penalty guidelines aimed at optimally deterring cartels are likely to be too low.

Key words: cartel, collusion, price fixing, overcharge, antitrust, optimal deterrence

JEL Classifications: L12, L42, K22, B14, F29

- The author is Professor Emeritus at Purdue University, West Lafayette, Indiana. He is indebted to Professor Robert H. Lande, who worked with the author on law review articles on cartel overcharges; he also was responsible for locating several overcharges from antitrust verdicts in U.S. courts. Anonymous reviewers of subsequent publications made a large number of constructive suggestions, for which I am grateful. My students Jeff Zimmerman, David Ubilava, and Yuliya Bolotova assisted in coding early versions of the *Master Data* spreadsheet summarizing these data. Numerous spreadsheet users have provided useful feedback as well.

PREFACE TO THE THIRD EDITION

The first edition of this working paper was prepared in 2004 and published in 2005 (Connor 2005a). It contained **884** overcharge estimates (674 long-run “episodic” and 210 short-run “peak” observations) from 332 episodes of 237 cartelized markets.

Since 2004, antitrust convictions of cartels and the economics literature on the price effects of cartels have exploded. Between 2004 and December 2013, I collected 1200 additional observations of cartel overcharges, a 142% increase in the sample. The lion’s share of the added estimates come from enforcement actions concerning hard-core cartels punished by antitrust authorities in the past 20 years. Besides a greatly expanded sample, this edition cites new research and includes some new topics on hard-core cartels, such as laboratory experiments, buyers’ cartels, and duration. These overcharges data have been cited in almost 900 scholarly publications (see <http://scholar.google.com>) and have been used for analyses in:

- Five Myths About Antitrust Damages. *USFL Review* 40 (2005): 651.
- How High Do Cartels Raise Prices? Implications for Optimal Cartel Fines, *Tulane Law Review* 80 (December 2005): 513-570.
- Cartel Overcharges: Survey and Meta-Analysis, *International Journal of Industrial Organization* 24 (Nov. 2006): 1109-1137.
- Factors Influencing the Magnitude of Cartel Overcharges: An Empirical Analysis of Food-Industry Cartels, *Agribusiness: An International Journal* 23 (Winter 2006-2007): 17-33.
- Price-Fixing Overcharges: Legal and Economic Evidence, Chapter 4, pp. 59-153 in John B. Kirkwood (editor), Volume 22 of *Research in Law and Economics*. Oxford, Amsterdam, and San Diego: Elsevier (January 2007).
- Cartel Overcharges: Implications for U.S. and EU Fining Policies, *Antitrust Bulletin* 51 (January 2007): 983-1022.
- Factors Influencing the Magnitude of Cartel Overcharges: An Empirical Analysis of the US Market. *Journal of Competition Law and Economics* Vol. 5, No. 2 (June 2009): 361 - 381.
- Optimal Cartel Fines, Chapter 88, pp. 2203-2218, *Issues in Competition Law and Policy: Volume III*, Wayne Dale Collins (editor). Chicago: Section of Antitrust Law of the American Bar Association (July 2008).
- Cartel Overcharges: An Empirical Analysis. *Journal of Economic Behavior and Organization* 70 (May 2009): 321-41.
- Strategic leniency and cartel enforcement. *American Economic Review* (2009): 750-768.
- *Governments as Cartel Victims: American Antitrust Institute Working Paper*. (2009).
- About cartel overcharges: Kroes is correct. *Concurrences* 1-2010 (2010): 1-6.
- *What could anti-trust in the OECD do for development? ISS Working Paper Series/General Series* 473 The Hague: Institute of Social Studies. (2010).
- *Fighting Hard Core Cartels: ZEW Discussion Papers No. 10-084*. (2010).
- Industrial Diplomacy and Economic Integration: The Origins of All-European Paper Cartels, 1959-72. *Journal of Contemporary History* 46 (2011): 179-202.
- Price Effects of International Cartels in Markets for Primary Products, Chapter 4 in *Trade, Competition, and the Pricing of Commodities*, Simon J. Evenett and Frédéric Jenny editors). London: CEPR (Feb. 2012).
- *Cartel overcharges and the deterrent effect of EU competition law: ZEW-Centre for European Economic Research Discussion Paper 12-050* (2012).

- *On the Effectiveness of European Cartel Law Enforcement (Council Regulation 1/2003)–A Monte Carlo Simulation: SSRN Working Paper 2002034* (2012).
- Economic Approaches to Fight Bid Rigging. *Journal of European Competition Law & Practice* 4 (2013): 185-191.
- *Predicting U.S. Antitrust Fines on Corporate Participants of Global Cartels: SSRN Working Paper* (March 2013)
- *Predicting EC Antitrust Fines on Participants of Global Cartels: SSRN Working Paper* (March 2013)
- *Smokescreen: How Managers Behave When They Have Something To Hide: Working Paper No. w18886*. National Bureau of Economic Research (March 2013).
- *Heterogeneity of Penalties and Private Information: Journal Preprint*. Dublin: Economics Department, Trinity College (May 29, 2013).
- Quantification of Antitrust Damages, in David Ashton and David Henry (editors), *Competition Damages Actions in the EU: Law and Practice*. Edward Elgar (2013).
- Cartel Overcharges. *Review of Law and Economics* 29 (forthcoming 2014): 249-386.*

I am also gratified that overcharges reported in the publications above have informed numerous debates about strengthening anti-cartel laws around the world. Examples that have come to my attention include: the criminalization of antitrust violations in Australia and New Zealand; stiffening cartel fining guidelines in Japan, Finland, and Canada; the need for private rights of action in the EU (Oxera 2011, Renda *et al.* 2007); certain recommendations of the U.S. Antitrust Modernization Commission (2007); and anti-cartel policy guidelines prepared by the European Commission (EC 2013) and the International Competition Network (ICN 2005 and 2010). More than a dozen research projects and policy analyses (by academics, consultants, and antitrust authorities) that rely upon *Private International Cartels* spreadsheets are underway.

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* This Working Paper is a companion piece to the RLE article. Besides having additional explanatory text and more extensive appendices, it also reproduces in Data Appendix Tables 1 and 2 the raw overcharges data and the sources and methods used by the authors to compute the overcharges.

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INTRODUCTION

Since at least 1888, thousands of economists, historians, lawmakers, commissioners, and jurists have labored mightily to assess the effectiveness of cartels.¹ Several criteria that have been devised to assess effectiveness, including longevity, stability, efficiency, and profitability of these joint ventures, but by far the greatest attention has been lavished on market price effects.² The particular price effect of interest in cartel studies is the increase in selling prices³ caused by the collusive conduct of suppliers in a market.

Objective

The principal purpose of this paper is to assemble and analyze the most comprehensive collection of quantitative estimates of monopoly overcharges generated by private, hard-core cartels.⁴ Candidates are cartels that operated in all geographic locations of the world and in all historical eras. The estimates are assembled from serious published social-science studies by disinterested authors and from the decisions of competent judicial bodies (see Data Appendix). Although the sources met minimal quality standards, no effort was made to apply additional subjective quality filters during the collection phase. Later, however, the estimates were examined for systematic differences in reliability across types of sources or methods of calculating overcharges.

Analysis in this paper is limited to descriptive tabulations using categories that have been shown to be significantly different by more formal analyses. However, this paper attempts to convey its findings in a style approachable by practitioners and policy makers who may not be professional economists.

¹ I eschew the term “success” used by many authors of cartel studies, because it connotes the financial performance

² Longevity, also called duration, measures the lifespan of a cartel or, if it has more than one, the length of time of one episode. Some researchers use the term stability synonymously with duration, but more commonly it refers to the absence of price wars or other reversions to competitive conduct during a cartel’s time span. Stability is perhaps equivalent to low variation in a cartel’s “discipline,” where discipline may be measured by how close a cartel’s selling prices are to its desired target price or to the theoretical monopoly price. In the context of commodity agreements or marketing orders, stability will show up as lower variation in prices compared to the absence of such an agreement. Efficiency can refer to static allocative efficiency (low net social welfare loss) or, rarely, to technical efficiency or dynamic efficiency (rates of technological change). Allocative inefficiency is smaller than but closely correlated with the overcharge. *Ceteris paribus*, price increases will result in a parallel increase in the joint economic profits of the members of the cartel.

³ The *undercharge* from a buyers’ cartel is symmetrically defined as a price effectuated by buyers of an input purchased by companies acting as a cartel. For details, see the best legal-economic treatise on monopsony and oligopsony (Blair and Harrison 2010).

⁴ Private cartels are those not protected by treaties or sovereignty, and “hard-core” is overt price-setting or quantity-setting conduct. Such cartels are subject to the most severe penalties.

Compilation should serve two subsidiary concerns. First, the results of the survey can be used as benchmarks to assess the ability of current antitrust penalties to deter illegal cartels. Second, these data may demonstrate empirical regularities that may suggest hypotheses for formal economic model-building.

Overcharge Defined

The increase in purchase costs to buyers due to an effective sellers' cartel is customarily called an *overcharge* by economists and legal writers.⁵ When multiplied by the quantity sold by a cartel, it becomes the major portion of the key legal concept of *damages*.⁶ The *overcharge rate* is calculated by comparing actual cartel-enhanced prices to an appropriate non-collusive (competitive) *benchmark price*⁷ (Connor 2008).

To be precise, if a sellers' cartel is effective in raising the market price P_m for a period of time because of collusion, then the unit monetary overcharge is $P_m - P_c$, where P_c is the competitive or benchmark price that *would have been observed in the market* absent overt collusion.⁸ Given the quantity sold during the conspiracy (Q_m), the total overcharge is:

$$\text{Dollar Overcharge} = (P_m - P_c) \times Q_m$$

⁵ The term overcharge is little used in economic discourse. For example, the magisterial *New Palgrave* lists it nowhere (Eatwell *et al.* 1987). In contrast, a basic handbook on antitrust damages prepared by a committee of lawyers and economists has a long chapter devoted to entirely to overcharges (ABA 2010: Chapter 7). However, the overcharge rate has close correlate in the well known economic measure of market power, the Lerner Index. The Lerner Index is further discussed below.

⁶ Antitrust damages are legal remedies for persons (natural or business) that are injured by prohibited anti-competitive conduct of other persons (ABA 2010:3). While courts can order many remedies, the most common are monetary payments to compensate victims for their losses ("make them whole"). These are also known as objective or special damages. Injunctive relief in the form of constraints on future conduct by the defendants is sometimes seen. Authorities may also impose punitive costs on the perpetrators, but these are rare.

Overcharges incurred by buyers are only partial damages. *Potential buyers* who reduce or eliminate their purchases are also injured, but the latter effect is not an overcharge. Economists refer to this consumer loss as the dead-weight loss. Courts generally do not regard the harm inflicted on buyers priced out of the market compensable harm because it is difficult to identify these particular victims and because of the presumed difficulty of accurately calculating the dead-weight loss. (However, the State of Mississippi's antitrust law does allow for harm to the State's economy, which might reasonably be equated with the dead-weight loss). A solution to this conundrum would seem to be for courts to allocate additional *cy pres* awards of 10% to 20% of the value of recoveries. (See Connor and Lande (2012) for the derivation of these percentages).

⁷ The benchmark is referred to as the "but-for price" – the market equilibrium price that would have been observed were it not for the overtly collusive conduct of the sellers. The benchmark may be the purely competitive price, or it may be a somewhat higher price generated by legal tacit collusion by companies in an oligopolistic industry.

⁸ An overcharge can also be calculated for a single product sold by a single firm, i.e., a monopoly.

The price difference $P_m - P_c$ is conventionally converted to a *rate* (a ratio or percentage) by dividing the price wedge by the benchmark price. That is,

$$\text{Overcharge Rate} = (P_m - P_c)/P_c$$

The overcharge can in theory range from zero to infinity, though the latter is highly unlikely. If P_c is properly measured, an overcharge of 0% would imply that the cartel was ineffective in controlling market price and that buyers from the cartel had suffered no antitrust injuries.

Overcharge Rates Computed

There are a couple of reasons why overcharge ratios may be under-reported. First, commentators can err, even when the dollar overcharge and the affected sales are known precisely. Calculating an overcharge rate is straightforward when working with prices, but converting a *monetary* overcharge into a percentage overcharge can easily lead to an underestimate of the overcharge rate.⁹

Let us examine a specific overcharge calculation. In 1992-1995, the world's five producers of synthesized lysine (an amino acid that accelerates the growth of muscle tissue in animals) conspired to raise its global price. In the U.S. market, the cartel obtained a dollar overcharge of \$80 million on sales of \$460 million (Connor 2007b: 200, 220-235). Most observers would readily infer that the overcharge rate is $(80/460) \times 100 = 17.4\%$. This is the method commonly followed by counsel when reporting how well they have represented their clients.

However, the appropriate calculation is more complicated. It involves dividing the overcharge by the *competitive or but-for sales*, not the actual (affected) sales.¹⁰ The correct formula is:

$$\text{Overcharge Rate} = (P_m - P_c) \times Q_m / (P_m \times Q_m (1 - ((P_m - P_c) \times Q_m / P_m \times Q_m)))$$

So, in the lysine example the divisor ought to be *competitive* rather than overcharge-inflated affected sales. That is, the proper divisor is $\$460 - \$80 = \$380$ million, and the true overcharge rate is $(80/380) \times 100 = 21.1\%$. Note that when working with *prices*, underreporting overcharge rates is not an issue. The average monthly prices were about \$0.945 and the but-for price about \$0.78, which also yields an overcharge of 21%.

⁹ It is also easy to convert the (incorrect) ratio of overcharge to affected sales (OV/AS) to the correct one. Let OR be the overcharge rate. Then $OR = 1/(1 - OV/AS)$. For example, if the overcharge is \$5 and affected sales \$10, then the true OR is $1/(1 - 5/10) = 1/0.5 = 100\%$. This shows that if reported overcharge rates are computed using affected sales, the true overcharge rates are being under-reported.

¹⁰ The but-for sales might also be output under Cournot or some other reasonable non-cooperative oligopolistic conduct, which would also be considerably smaller than collusive sales. In the lysine case, the conspirators twice reverted to prices that were slightly below the long-run marginal cost of the industry leader.

A recent example of using the wrong denominator to calculate the overcharge rate can be seen in a widely read report commissioned by the European Commission from a respected consultancy: prices of an Austrian cartel fell from €1140 during collusion to €900 after a raid; the report computes the overcharge to be 22%, whereas the correct overcharge is 26.7% (Komninos *et al.* 2009: 52).

The Iowa Ready-Mix Concrete Antitrust Case

An order handed down by U.S. District Court Judge Mark W. Bennett in this case contains the following information:

“The combined settlement fund of \$18.5 million is sufficient to repay completely each class member’s actual overcharge damages even after fees and costs....[which is] ‘very unusual’ in an antitrust class action The \$18.5 million sum is especially remarkable, given that the United States Department of Justice estimated that the total volume of commerce affected by the price fixing conspiracies was only \$5,666,348.61” (Bennett 2011: 4).

Later in this decision we learn that the settlement fund includes \$7,638,113 in fees and costs, which implies that the overcharges were \$10,861,887. To compute the rate, the first impulse of counsel is to take the overcharges (\$10,861,887) and divide them by the sales during the collusive period (\$5,670,000). The result is 191.7%.

Hold on: This is an impossible number! The overcharges to direct buyers cannot exceed 100% of the value of their purchases. Overcharges can exceed *competitive* sales but not total affected sales. The solution to this conundrum is that the affected sales mentioned in the judicial order are far too small. The Judge was quoting from affected sales calculated by the U.S. DOJ for its criminal prosecution in which it counted only projects within 15 miles of each concrete plant. Private litigants used a more expansive approach to identifying geographic market boundaries, which resulted in more logical affected sales above \$18.5 billion.

A second cause of low reported overcharge rates is under-reporting of affected sales (see Box). Under-reporting of cartel sales is a common practice by antitrust authorities. One reason for this tendency is that authorities must defend their imposed fines when the alleged cartelists appeal their fines to a higher court. Because fines are directly, positively related to affected sales, the authorities customarily (1) cut down the list of *products* that probably were cartelized to list only products that were incontrovertibly subject to price fixing, (2) exclude *regions* within the jurisdictions that arguably were subject to price fixing, and (3) foreshorten the collusive *time period* either because early-period written documents are incomplete or because there is possibly contradictory testimony by cartel managers concerning start or ending dates. Lengthy appeals over imposed fines are common in the EU, Brazil, and many other legal systems. Appeals are also possible when defendants go to trial in criminal antitrust regimes.

In criminal jurisdictions like the United States, cartel fines are also linked to the size of affected sales, but the size of fines are the result of guilty-plea negotiations; the resulting agreements

cannot be appealed. However, prosecutors have incentives to carve down affected sales in order to avoid the risky outcomes of corporate antitrust litigation where the standard of proof is “beyond a reasonable doubt.” Concessions may be and are offered to defendants about which products, geographic regions, and time periods to include in affected sales (or the degree of harm caused). For example, a plea agreement may state that price fixing began “...as early as May 1, 2000,” when in fact collusion is later proven to have begun in January 1999.¹¹

Overcharges are Important in Economics and the Law

A price-fixing overcharge is a transfer of income or wealth from buyers to the members of the cartel that occurs as a result of an overt collusive agreement.¹² *Ceteris paribus* when a cartel achieves high levels of effectiveness (i.e., longevity, stability, and high overcharge rates), it tends to generate large customer losses in the form of decline in consumer surplus.¹³ Although there are other economic effects of price fixing, legal-economic scholarship on antitrust injuries tends to focus on the overcharge.¹⁴ Effective cartels are also viewed as destructive of the competitive process in the sense that they weaken the natural effects of demand and supply in price formation and cause deadweight social losses.¹⁵ The deadweight losses result from the costs incurred by customers when they are forced to substitute inferior substitutes, if any, the costs incurred by the members of the cartel in managing the collusive enterprise, and rent-

¹¹ The follow-on U.S. private damages litigation frequently adds time to the period of time mention in DOJ plea agreements. Also, in international cartel cases, the durations in decisions of other antitrust authorities tend to be longer than the durations for the same cartels negotiated in U.S. plea agreements.

¹² An overt collusive agreement is a contract that is the result of observable, explicit *communication* between the parties. The contract may be a written document, a verbal unwritten agreement, a “handshake” (or “gentlemen’s”) agreement, a cryptic or encoded message, or even simply body language (a “wink and a nod”). In some cultures, silence at the conclusion of a meeting at which consistent proposals were made may indicate a consensus agreement. In a jurisdiction with no antitrust laws or one that provides an industry exemption, the contracts may be publicized and may be enforceable in a court of law. In jurisdictions with anti-cartel laws, such contracts are usually hidden and are enforced only by the cartel members themselves. The need for self-enforcement of a secret agreement is the unique economic feature of contemporary cartels.

¹³ Customers are direct buyers and they are usually industrial buyers, but overcharge pass-on will transfer the losses in whole or in part to final consumers as indirect buyers. If cartels improve technical or dynamic efficiency, this may offset the buyers’ losses. The EU and some other jurisdictions permit innovation cartels in those rare occasions when the fruits of innovation passed on to consumers outweigh the static losses.

¹⁴ Technically, as a matter of economic and statistical principles, collusion can and does affect prices in ways other than a correctly measured overcharge. Keep in mind that P_m and P_c are ordinarily prices *averaged* over the collusive period for several hours or several years. However, there is a burgeoning literature that focuses on the *dispersion* of prices that result from collusive conduct (Connor 2005). In statistics, the mean average is but the first of four “moments” (or formulas) that describe a sample of numbers; the other higher-order moments are variance, skewness, and kurtosis. Theoretically, cartels can significantly affect price dispersion without creating an overcharge, but empirical works shows that changes in mean prices are usually accompanied by changes in dispersion (Connor 2004d, Connor *et al.* 2008, and von Blanckenburg 2010). Analyses of price-dispersion effects have promise in the detection of cartels and in proof of antitrust damages.

¹⁵ In large U.S. markets for manufactured products, the dead-weight loss is typically one-fifth to one-tenth as large as the overcharge, and the two losses are highly correlated (Peterson and Connor 1995). Lande and Connor (2012: 457-461) determined that from the few good studies available, the ratio was more in the 3% to 20% range.

seeking behavior by the cartel such as efforts directed at forestalling entry. “Umbrella pricing” or “free riding,” the tendency of suppliers outside the cartel to sell at the cartel’s elevated price, creates further harm for customers of fringe suppliers. In this paper I focus on cartel overcharge rates as the principal indicator of harm or damages created by price fixing.

Direct purchasers from an effective sellers’ cartel are the immediate losers. However, if the cartel is comprised of manufacturers (the most common story), then other buyers farther down the distribution channel are also harmed. These indirect purchasers typically will be other manufacturers, wholesale distributors, retail distributors, and the final consumers of the cartelized product.¹⁶ Indirect buyers pass on part or all of the overcharge contained in the direct purchase. Under simplifying assumptions, indirect purchasers in perfectly competitive industries pass on 100% of the initial overcharge, but if the indirect buyer is a monopolist then only 50% will be passed on at any one stage.¹⁷ If all the distributors use percentage mark-up rules, a fairly common situation, then the consumer pass-through rate is 100%. If the cartelized product is highly differentiated, then the pass-on rate will exceed 100%.

Until about 1990 scholarly literature surveys of the economics of cartels seldom addressed overcharges, but interest in this subject has blossomed in the past decade. For example, Levenstein and Suslow (2006: §6.1), while focusing their article on duration, examine eight cross-industry and 54 “selected” case studies of cartels in 19 industries for evidence about price or profit effects.¹⁸ They conclude that (1) almost half of the industry case studies do not address the issue, (2) when addressed, nearly all find at least short-run price changes due to cartelization, but (3) few of the latter are explicit about the counterfactual (i.e., the but-for price) (*ibid.* pp. 81-82). Today textbooks of economics conventionally devote considerable space to the market price effects of cartels.¹⁹ While empirical studies of cartels routinely survey selected antecedents as a prelude to the study being presented, to my knowledge no one has published a work aimed principally at comprehensively surveying and analyzing cartel overcharges.²⁰ This paper is aimed principally at filling this gap in the legal-economic literature.

¹⁶ This picture is simplified. Real-world distribution channels may lengthened if there are multiple sales from distributor to distributor, the cartel members may sell their products as components to other manufacturers for final assembly, or the channel may be foreshortened by manufacturer-distributor integration. Or, the chain may be much shorter than the example above, if, for example, consumers buy directly from cartelists via Internet sites.

¹⁷ Linear demand and supply curves, a homogeneous product, constant returns to scale, and fixed proportions in input use. See Harris and Sullivan (1979). In an extreme case of a monopolistic wholesaler and retailer, the pass-through rate from a manufacturing cartel to consumers is $0.5 \times 0.5 = 0.25$ or 25%. If the chain of sellers in the vertical distribution system is long, then a pass-through rate below one will shrink greatly before it reaches the consumer. If the distributors are competitive and the product is highly differentiated like cigarettes, then consumers could bear a 120% overcharge or higher.

¹⁸ An early (2004) version of the present study is cited (Levenstein and Suslow 2006: note 96).

¹⁹ The dominant U.S. textbook in the 1990s devoted 15 pages to cartels (Scherer and Ross 1990: 235-248, 258). Its market successor, about the same total length, spends 13 pages (Carlton and Perloff 2004: 128-131, 140-145, 148-150).

²⁰ I exclude, of course, antecedents of this article by the present author.

The actual size of cartel overcharges is an issue at the heart of a number of legal and economic controversies. First, knowing the size and distribution of cartel overcharges is necessary to justify the underpinnings of U.S. and foreign guidelines for sanctioning illegal cartel conduct. Many commentators on government fining practices have noted the absence of appropriate empirical data for the rational design of such policies. Second, because the typical harm from cartel operations was mainly anecdotal, there are widely varying opinions among experts on the critical issue of the size of sanctions needed for optimal deterrence of cartel formation.²¹ The following sections discuss these issues.

Overcharges and Cartel Fines

The United States

The Sentencing Reform Act of 1984 created the U.S. Sentencing Commission (USSC), a judicial-branch unit charged by the U.S. Congress with devising guidelines for criminal sentencing for the federal judiciary (USSG Advisory Group 2003). The first set of guidelines was promulgated in 1987, and after three years of study and public comment was made law in 1989. The guidelines included sanctions for organizations guilty of horizontal price fixing and bid rigging (Cohen and Scheffman 1989: 332). Although the Sherman Act of 1890 is a criminal statute that encompasses other types of restrictive business practices, by long tradition only horizontal price fixing and market-sharing agreements have triggered criminal indictments by the Department of Justice (DOJ).²² Passage of the USSGs was a major step in the evolving and complex criminal enforcement regime for antitrust offenses (Kovacic 2006).

The issue of how high cartels typically raise prices was crucial when the U.S. Sentencing Commission (USSC) established the fine levels for cartel violations. The USSC's formulas for calculating cartel fines follow from an embedded assumption: "It is estimated that the average gain from price-fixing is 10 percent of the selling price."²³ The Commission added: "The

²¹ In a personal communication to the author in 2006, Terry Calvani (former Commissioner of the U.S. FTC) commented on the release of first edition of this paper, saying: "[M]uch of what we thought we knew about cartel overcharges was largely 'urban legend.'"

²² Criminal filings are made in cases of *per se*, covert, intentional conspiracies by participants who are aware of the probable anticompetitive consequences (Hovenkamp 1999:585-586). While there are a few exceptions, potentially illegal anticompetitive conduct such as sharing among rivals of sensitive trade secrets, signaling, refusals to deal, resale minimum-price maintenance, tied sales, exclusive dealing, patent or trademark pooling, vertical price fixing (or resale price maintenance), mergers, monopolization, and attempts to monopolize are treated as civil matters. More than 95% of all naked cartel cases are brought as criminal actions, but a small number of such cases are, at the discretion of the DOJ, filed as civil matters.

²³ The USSC Guidelines start with a *base fine* double the 10% presumed overcharge and use it in conjunction with the assigned base Offense level (of 10) for antitrust offenses. They adjust this offense level by a number of factors, such as whether bid rigging and other aggravating factors were involved, and by mitigating factors as well. This adjustment results a pair of "*culpability multipliers*" that are between 0.75 and 4.0. The product of the base fine (20% of the affected commerce) and the culpability multipliers results in the fine range that is to be imposed on a cartel member. Thus, the fine range recommended for convicted cartelists is at its lowest 15% and at its highest 80% of affected sales. These fines usually are adjusted downwards for cooperation or as a part of the Division's leniency program. The USSC's Commentary also notes that "In cases in which the actual monopoly overcharge appears to be

purpose for specifying a percent of the volume of commerce is to avoid the time and expense that would be required for the court to determine actual gain or loss."²⁴ As the Sixth Circuit noted, the Sentencing Commission "opted for greater administrative convenience" instead of undertaking a specific inquiry into the actual loss in each case."²⁵

The USSC appears to have adopted the 10% presumption because its use was advocated by the then-head of the Antitrust Division, Douglas Ginsburg.²⁶ The origin of Ginsburg's 10% figure is not publicly known. However, a prominent analysis of the issue by Cohen & Scheffman (1989) published shortly after the antitrust sentencing Guidelines were promulgated, asserts that the economic evaluation of only three price-fixing conspiracies was particularly important in shaping Ginsburg's views. It says further that "...there is little credible statistical evidence that would justify the Commission's assumptions which underlie the Antitrust Guidelines (p. 333)." If this analysis is correct, a critical assumption in setting cartel penalties in the United States is supported by a surprisingly small amount of evidence.

The USSC's 10% presumption was attacked as unreliable and overstated almost as soon as it was issued. For example, Cohen and Scheffman (1989) conclude "...there is little credible statistical evidence that would justify the Commission's assumptions which underlie the Antitrust Guidelines ... At least in price fixing cases involving a substantial volume of commerce, ten percent is almost certainly too high (pp. 343-344)." Moreover, the specific data that the Commission uses was characterized as exaggerated: "later research has cast considerable doubt on ... these estimates, concluding that the markups, if they existed, were quite small" (ibid. p. 345).

Although the Antitrust Division of the DOJ has exclusive criminal powers in cartel enforcement in the United States, other federal agencies can be part of interagency task forces in especially large and complex prosecutions. In the investigations of the culpability of large banks in

either substantially more or substantially less than 10%" it might not employ the 20% base fine. But in practice the DOJ almost always uses the figure of 20% of affected commerce as their starting point in their criminal fine calculations.

²⁴ See *U.S. Sentencing Commission Guidelines For the United States Courts, 18 U.S.C. Section 2R1.1, Bid-Rigging, Price Fixing or Market-Allocation Agreements Among Competitors*, Application Note 3.

²⁵ See *United States v. Hayter Oil Co.*, 51 F.3d 1265, 1277 (1995). The court noted: "The offense levels are not based directly on the damage caused or profit made by the defendant because damages are difficult and time consuming to establish. The volume of commerce is an acceptable and more readily measurable substitute..."

²⁶ In a statement to the Commission, Assistant Attorney General Ginsburg stated that "the optimal fine for any given act of price-fixing is equal to the damage caused by the violation divided by the probability of conviction . . . such a fine would result in the socially optimal level of price-fixing, which in this case is zero"(USSG 1986:14). He stated his judgment that "price fixing typically results in price increases that has harmed the consumers in a range of 10 percent of the price..." and that these violations had no more than 10% chance of detection (*ibid.* p.15). Connor and Lande (2012) comment extensively on the appropriate detection probability for cartels and the other standard assumptions of the simple optimal deterrence model. For example, they consider the implications of risk-loving behavior of cartel managers or corporate cartelists in place of the usual assumption of risk neutrality (*ibid.*, pp. 432-455), and the implications of the present value of expected future monopoly profits and cartel penalties rather than nominal values (*ibid.*)

collusion or manipulation of interest-rate indexes (LIBOR and others), currency exchange, bid rigging of municipal derivatives, commodity price indexes, and many other markets, the SEC, CFTC, Federal Reserve Bank, and the DOJ's other divisions join together. Moreover, the DOJ can enlist the many Federal Attorneys and 55 State Attorneys General in common or parallel prosecutions of price fixing that can result in civil fines (Baer 2014: 1-5). Finally, the private damages suits that are launched against cartelists primarily provide compensation for victims, but also non-monetary injunctive relief and the possible punitive settlements that assist in cartel deterrence (*ibid.*, Connor 2012).

In the history of antitrust before 1990, the sum of all cartel penalties amounted to less than \$100 million (Gallo et al. 2004).²⁷ From 1990, a series of record corporate fines and other penalties were imposed for criminal price fixing by U.S. courts, most of which were prosecutions of international cartels (Connor 2011c).²⁸ By the end of 2011, additional U.S. criminal price-fixing fines had reached \$11 billion (Connor 2012). A similar upswing may be noted for fines imposed by the European Commission, the EU's Member States, and a few antitrust authorities in Asia, Africa, and Latin America. This figure does not include legal fees, corporate reputational effects, or penal sanctions.

The consensus of scholars is that current antitrust regimes are under-detering price fixing (Ginsberg and Wright 2010, Harrington 2012, Connor and Lande 2012). However, some attorneys engaged in defending alleged international price-fixing conspiracies have argued that the Guidelines have resulted in excessive penalties. For example, just as the DOJ's campaign against international cartels was gathering steam, Adler and Laing (1997) assert that "the fines being imposed against corporate members of international cartels are staggering (p.1)", placing the blame on the "uniquely punitive" requirements of the U.S. Sentencing Guidelines.²⁹ Denger (2003) too decries the prevalence of excessive price-fixing fines and private settlements. He places the blame for excessive fines on the Corporate Guidelines base fine calculation (p. 3). This approach, he notes, unlike all other white-collar federal crimes, means that the actual degree of direct harm caused does not have to be proven by prosecutors.³⁰ Denger blames this state of affairs on a gap in the economic-legal literature: "...we have little information on what level of criminal or civil exposure is needed to deter most cartels (p.4)."

²⁷ Although the Gallo et al. (1994) study covers only U.S. fines, cartel fines in other jurisdictions were negligible before 1990. This number is expressed in roughly 1982 dollars.

²⁸ For the definition of the term "international cartels" and related concepts, see the section "Evolution of Definition of 'Cartel'" below in the LITERATURE APPENDIX.

²⁹ Adler and Laing are correct that the fining standards of the DOJ do not compute fines simply as a function of damages, but rather as a function of the company's affected commerce, which is loosely related to damages. However, these authors do not document their claim that antitrust fines are harsher than other corporate crimes. In recent years, corporate fines for fraud and environmental crimes have greatly eclipsed antitrust fines.

³⁰ Denger appeals primarily to an increase in settlement rates in treble-damage direct-purchaser suits to establish the unfairness of the high fines imposed on corporate price fixers, an increase that, he believes, cannot be explained by increases in overcharge rates. He cites about 8 domestic U.S. law cases that settled for 2 to 4 % of sales in the 1970s and one international case in 2001 that settled for 18 to 20% (pp. 3-4). It is argued below that settlements are inappropriate evidence of overcharges.

Concern about the lack of empirical evidence on the size of overcharges caused by price fixing is not confined solely to those sympathetic to the increased exposure of corporate defendants. DOJ official Graubert (2003) notes that the controversy over whether antitrust payments are excessive is largely attributable to the "...difficulty of gathering useful data." In a law-review article noting the sharp increase in U.S. criminal fines on international cartels in the late 1990s, Klawiter (2001) believes that these fines and other related antitrust penalties "...have substantially increased the level of deterrence in antitrust criminal cases" (*ibid.* p. 756).³¹ Yet, he laments the paucity of information needed to make a more sweeping conclusion. "There are no known applicable empirical studies on the adequacy of the present mix of criminal and civil antitrust sanctions from the standpoint of deterrence" (*ibid.* note 79).

Other Jurisdictions

U.S. antitrust enforcement has been a model for many other countries that have more recently adopted such laws (Wells 2002). Germany and Japan had antitrust laws imposed on them by the U.S. occupation authorities in the late 1940s.³² After a vigorous debate, Germany revised its competition law in 1958; it, in turn, became one of the principal influences on the adoption of a similar statute by the original six members of the European Economic Community (Goyder 1998:18-33). After four years of confidential political discussions³³ within the EEC's Commission, Regulation 17 was passed in 1962; it lays out the powers of the Directorate General for Competition (DG-COMP) to fine companies for competition-law infringements (*ibid.* p. 45). That rule sets a maximum corporate fine of 10% of the company's total sales in the year prior to the Commission's decision and specifies that the specific fine will depend on the duration and seriousness of the offense.³⁴

Harding and Joshua (2003: 240) state that EC fines are supposed to incorporate both compensatory and punitive components, the latter meant to serve deterrence. Methods of calculating EC cartel fines are explained in 1998 and 2006 Notices (Connor 2010a). Under the earlier guidelines, EC cartel fines were loosely related to overcharges because cartels with large damages that are geographically widespread and relatively large companies were given larger

³¹ Klawiter contrasts enforcement powers in the late 1990s with the clearly suboptimal maximum fine of \$10 million available to the DOJ in the 1970s and 1980s.

³² Japan's Antimonopoly Law was seriously weakened after 1953 by a perceived need for centralized industrial planning. However, it has been reinvigorated since the 1980s by the growing influence of the country's consumer organizations and a new appreciation of the efficiency benefits of more intense market competition. Taiwan, Korea, and other East Asian countries have aspects of Japan's antitrust law.

³³ The practice at the time was for the Council of Ministers to appoint an Advisory Committee comprised of Commission civil servants to develop a report on proposed regulations of administrative practices. Although these regulations were essentially EEC laws, the Parliament had no role at the time. The Commissioner of Competition (a German) is often credited with drafting Regulation 17.

³⁴ Rule 17 was amended in 2004, but these provisions were unaffected.

finer. Since late 2006, EC fines have been computed using affected sales in the EU³⁵; total fines have risen (Veljanovski 2010 and 2011); and they have become more severe (Connor 2010b). After considering a number of culpability factors, the Commission ensures that the fine does not exceed 10% of a defendant's global sales in the year prior to the date of the decision.³⁶ By 2010, U.S. and EU government and private monetary penalties amounted to at least \$84 billion (Connor 2012). In early 2012, worldwide cartel penalties had surpassed \$100 billion.

Canada is another jurisdiction with relatively tough sentencing for cartels. Under a 1996 law, the Canadian Bureau Competition Bureau³⁷ uses a fairly simple standard for setting fines. Although not spelled out in any administrative guidelines, decisions of Canadian courts have, in the absence of aggravating and mitigating circumstances, imposed fines close to 20% of Canadian affected sales (Low 2004, Connor 2003).³⁸ A former Canadian prosecutor comments "there has not been any economic or judicial analysis of the assumptions behind this proxy for harm that this represents..." (Low 2004:19). Cooperating firms get leniency discounts, and recently recidivists have paid fines as high as 45% of affected sales, yet the large majority of convicted cartelists pay fines equal to 20% of Canadian affected sales. The Canadian 20% rule mimics the base fine of the USSGs. If Canada intends to punish cartels, then the presumed overcharge may also be 10%; if only compensation is the aim, then a 20% overcharge is assumed.

Overcharges and Cartel Deterrence

Concerns about the inadequacy or excessiveness of antitrust sanctions are part of the larger issue of the effectiveness of antitrust interventions. Most legal scholars accept that the fundamental objective of price-fixing laws is *deterrence*: that is, to minimize the future formation of new cartels or recidivism by previous cartel violators.

To make any headway in assessing empirically the adequacy of anticartel enforcement, analysts must have reliable information about the degree of harm generated by private cartels. Antitrust sanctions should be calibrated to cartels' overcharges. Total cartel injuries to purchasers are

³⁵ Veljanovski (2011) demonstrated for a small sample (11) of recent EC cartel decisions that once the cartel's share of the EU market and whether the offense was bid-rigging (both statistically positive), the gravity percentage is unaffected by the size of EU affected sales.

³⁶ As the great majority of offenders are large multiproduct, multinational corporations, in only 6% of all cases does the EC need to make reductions because of the 10% cap (Veljanovski 2011: Table 7). Also, while previously quite rare, under the 2006 Guidelines about 7% of cartelists are granted reductions in fines because of a financial inability to pay (ibid.).

³⁷ In April 2013 the Bureau was merged with another competition regulator and was renamed the Competition and Markets Authority (CMA).

³⁸ Under Section 45 of Canada's Competition Act, fines are limited to C\$10 million, but foreign price-fixing conspiracies can be prosecuted under Section 46, which has no fine limit (Low 2004:17). Canada's competition code was amended in late 2012 to impose much stiffer individual sentences for cartel offenses (Randles 2012). The maximum prison sentence was raised to 14 years, and judges will no longer be able to convert prison sentences to house arrest or community service (the universal practice prior to 2013). The burden of proof was lightened for prosecutors by removing a requirement that a perpetrator was "dishonest."

positively related to three economic factors: the size of the cartel's market, the duration of the conspiracy, and the percentage overcharge. Cartel deterrence can also be affected by other enforcement rules. Amnesty programs and general investigatory procedures can increase the probability of cartel detection or reduce the duration of cartels.

The sentencing guidelines developed in the United States, the EU, and elsewhere for fining hard-core cartels are consistent with the *optimal deterrence* standard first suggested in a seminal article by Becker (1968) and elaborated by William Landes (1983). Landes showed that to achieve optimal deterrence the damages from an antitrust violation should be equal to the violation's "net harm to others", divided by the probability of detection and proof³⁹ (Landes 1983:666-68).

Critics of the U.S. Sentencing Guidelines suggest that their assumed average overcharges are too high. For example, Cohen and Scheffman (1989) argue that fines based on the U.S. sentencing guidelines, when coupled with civil and marketplace sanctions will cause "a serious overdeterrence problem" (p. 334). That is, they and other critics of the Guidelines believe that there is a disparity between the size of the corporate fines mandated⁴⁰ for antitrust violations and the amount of the economic injuries caused by overt price fixing.⁴¹ Specifically, Cohen and Scheffman argue that actual overcharges are well below the 10% level assumed in the Guidelines (pp. 343-347).⁴²

During recent years, their criticism has been repeated with perhaps even more intensity. For example, in a provocative essay that quickly drew rebuttals,⁴³ Crandall and Winston (2003) argue that extant empirical evidence demonstrates that U.S. antitrust policy has been ineffective in deterring anticompetitive conduct. To support their view that the prosecution of overt price

³⁹ In 1986, the Assistant Attorney General for Antitrust, Douglas Ginsburg, estimated that the enforcers catch less than 10% of all cartels (USSG 1986: 15). If he is correct, optimal penalties for cartels should be more than tenfold damages. See also the illustration of detection probability in Landes (1983: 115 fn. 1). The percentage of cartels that are caught and proven guilty is probably higher since the mid 1990s (Miller 2009). There is, however, neither evidence nor speculation that it exceeds 33%, either historically or at present (Connor and Lande 2012: Table 3).

⁴⁰ Mandatory since their inception, the U.S. Sentencing Guidelines became advisory in January 2005.

⁴¹ Those critical of aggressive antitrust policy have often embraced the notion that cartels are fragile coalitions. However, empirical studies of discovered cartels from the 1920s to the early 2000s find that the average duration is between four and seven years (Zimmerman 2005; Levenstein and Suslow 2006). Modern international private discovered cartels continue to display the same average longevity (Connor 2009a). Legal U.S. export cartels – a sample unaffected by possible bias inherent in studies of prosecuted conspiracies – endured an average of 5.3 years (Dick 1996).

⁴² For larger price-fixed markets "...ten percent is almost certainly too high" (Cohen and Scheffman 1989: 343). This conclusion is contradicted by evidence cited in this article. In part, they rely on evidence of price-fixing *settlements* rather than awards made after trial; because settlements are the result of bargaining under uncertainty, reliance upon settlements biases overcharge estimates downward. My reading of their article turns up seven to ten overcharge observations. Despite the downward bias, the median is in the range of 8% to 14% (see Table 1 below). They also assert that there is "a sparse amount of economics literature" on cartel mark-ups, which is at variance with the scores of references in this paper published before 1989 (see Bibliography).

⁴³ See Baker (2003), Werden (2003), and Kwoka (2003). According to Kwoka (2003: note 2), Crandall and Winston's earlier drafts "... endorsed consideration of outright appeal of the antitrust laws."

fixing is misdirected, they cite five empirical studies of overt collusion that find no upward effects on prices of conspiracies convicted in U.S. courts.⁴⁴ In his comment on Crandall and Winston, Kwoka (2003) faults them for their “startlingly selective” body of evidence. He suggests that they should have included “... studies from any source with appropriate evaluation of their credibility” (p. 4).

There are few empirical studies of cartel deterrence. Even the most ambitious have focused on strictly national data (Connor and Lande 2012). Yet, since about 1995, a large majority of the overcharges generated by cartels have been international in membership and global in their geographic impact (Connor 2001a, 2003, 2008). To assess the likelihood of deterrence in the context of international schemes, *worldwide* monetary sanctions must be considered. Connor (2012: Figures 8 and 9) summarizes a large data set on the severity of penalties on global cartels during 1990-2010.⁴⁵ He finds that total monetary penalties worldwide average about 11% of affected sales (higher in North America and the EU, lower elsewhere). Penalties disgorge at most 40% of the worldwide overcharges generated.⁴⁶ Given that the odds of being caught are less than 100%, optimal deterrence requires cartel sanctions to be somewhat punitive. That is, disgorgement must exceed 100% of overcharges. Because it does not, punitive sanctions are the exception not the rule for illegal international price fixing. Clearly, information on both damages and penalties are needed on a worldwide basis.

In sum, there does indeed seem to be a broad consensus among legal and economic writers that the question of the optimality of price-fixing penalties turns mightily on the actual degree of harm caused by cartel conduct, and that not enough is known about this issue. Moreover, even if the creators of the USSC Guidelines were correct that in the 1980s cartels generally raised prices by 10%, the harsher cartel sanctions imposed more recently could mean that this presumption is no longer justified. The contents of this paper could provide a factual foundation for dialogs on optimal deterrence and rational anticartel policies.

LITERATURE SURVEY

This paper was prepared by examining approximately 1500 social science publications and legal documents.⁴⁷ Of these, 524 contained usable quantitative overcharge estimates.⁴⁸ The major

⁴⁴ Space constraints do not appear to be responsible for such a skimpy treatment of this topic, for they list 59 references. Somewhat inconsistently, Crandall and Winston do admit that the large DOJ fines meted out to cartels in the 1990s possibly deterred the most harmful cartels. They appear to refer to the lysine, citric acid, and vitamins cartels --international cartels with overcharges in the 15% to 40% range.

⁴⁵ Severity for non-global cartels with international membership is similar but lower than global cartels in every jurisdiction (Connor 2012).

⁴⁶ If adjusted for inflation and the time value of money, the 40% figure would be reduced by 20% to 40%.

⁴⁷ Almost half of the publications seemed promising, but ultimately contained no useful information.

⁴⁸ The References section below lists about 780 sources with useful information about private cartels. The 514 unique citations used for quantitative overcharge estimates are listed in Appendix Table 2.

portion of the overcharge estimates included in this paper is taken from books, book chapters, conference proceedings, or papers published in economic, historical, and legal journals whose readers and contributors are mainly academics. The great majority of these publications are peer reviewed. A minority of the estimates are taken indirectly from newspapers, magazines, and similar journalistic outlets; from reports issued by governments; from academic working papers; and from decisions rendered by courts or antitrust commissions. This section focuses on the evolution of social-science concepts about cartels and their price effects.

This section focuses on the evolution of social-science concepts about cartels and what I call “cartel studies.” In this report, the term *cartel studies* is reserved for empirical economic or legal analyses of real-world cartels and cartel enforcement. Cartel studies include historical examinations of the management and market impacts of a single cartel or groups of cartels, quantitative economic analyses of samples of cartels, or legal assessments of the effectiveness of actual anti-cartel cases or decisions. The present paper on cartel price effects falls within the definition of a cartel study.

Early Cartel Studies in Brief

Industrial-organization economics is the organizing theory of Adam Smith’s classic book *The Wealth of Nations* (1776), which signaled the emergence of economics (formerly called “political economy”) from other related fields of thought.⁴⁹ Smith explicitly examined business collusion, which he called “a conspiracy against the public.” From 1880 to 1920 there were numerous debates over public policies to address market power, market regulations, and the “trust problem” (Martin 2007). However, these discussions were hampered by the exclusive reliance of the economics profession on the models of pure competition and monopoly.⁵⁰ What changed in the 1930s was the development, slow at first, of conceptual models of oligopoly (*ibid.* pp. 6-11).⁵¹ At that point the sub-field of industrial economics was born and flourished.

Cartel studies spent 70 years being practiced before it had a name. The empirical economics literature on cartels up to the 1940s is characterized by a groping towards a conceptual

⁴⁹ The term political economy was coined in France (*économie politique*) in the early 17th century (ca. 1615), used in scholarly books, and adopted for the names of professorships, courses, and departments in the 18th and early 19th centuries in European universities (Groenewegen 1987). It is the antecedent field of thought for nearly all the modern social sciences, economics most particularly. In 1797 Glasgow University became the first to change the name of its department of Political Economy to Economics. It was not until the very late 19th century that economics became the preferred appellation in most academic institutions. The shift was signaled by the by the publication of *The Economics of Industry* by Alfred and Mary Marshall in 1879 in the UK and solidified in the United States by the founding of the American Economic Association and its journal, the *American Economic Review*, in 1890.

⁵⁰ The exclusive attention to the theories of perfect competition, perhaps monopolistic competition, and monopoly (and the absence of oligopoly) prior to the 1920s is illustrated by the dominance of the English-language microeconomics textbook of Alfred Marshall (1890). However, a few oligopolistic topics are treated in Marshall’s largely empirical *Industry and Trade* (1919).

⁵¹ Although Cournot’s oligopoly model was published in 1838, it was more than 100 years before it was rediscovered (Martin 2007).

understanding of the nature of private cartels and the first tentative steps toward quantitative evaluation of the market effects of overt collusion (for more details see the LITERATURE APPENDIX).

Economic studies of cartels began in Germany in 1870s; books and articles written in German continued to dominate the literature through the 1920s. Among German scholars, the ideas of Smith, Ricardo, and the other classical economists spread only slowly during the early 19th century (Gerber 1998: 81-88). While the core concepts of classical economics continued to be accepted, during the late 19th century the “historical school” came to dominate the scholarship of German academic economists. The historical school emphasized the importance of unique temporal and institutional factors in explaining empirical phenomena; it consciously rejected abstract theories as a guide to empirical studies. Cartels were usually seen as an inevitable response to historical overproduction. Despite their understanding of the monopolistic tendencies of cartels, evaluation of cartels was almost solely from the producers’ perspective rather than consumers’ interests. Especially influential was the German economist Liefmann (1897, 1932). His concept of a cartel as a voluntary, contractual association of independent firms intent on profit maximization⁵² and monopolistic control of a market later became the accepted definition.

An unfortunate legacy of the German historical school of cartel studies was its view that gauging price effects was either fruitless or impossible, a presumption that discouraged Continental European economists from attempting to estimate overcharges until the late 20th century.⁵³ However, U.S. social scientists inherited a more pragmatic tradition driven by an awareness of the country’s new antitrust law, which was passed in 1890 after a long debate that highlighted the negative effects of cartels on small businesses. Court decisions interpreting the Sherman Act in the early 1900s stimulated further scholarship on cartels. As a result, most quantitative estimates of overcharges made prior to 1945 were produced largely by American social scientists.⁵⁴

Some highlights include Jenks’ (1888) path-breaking analysis of the Midwest salt cartel; Jones’ (1914) book on the anthracite coal industry; Edgerton’s (1897) superb analysis of price effects of a short-lived but highly effective international cartel, the U.S. Wire Nail Association; Andrews (1889) sketch of what is quite possibly the world’s first *global* cartel, the Secrétan copper

⁵² An issue among economists up to the 1940s was whether cartels raised average prices in a manner consistent with monopolies or whether cartels simply stabilize price movements with no net increase in prices. Liefmann was in the minority that accepted profit maximization as the goal of a cartel.

⁵³ Unlike most of his colleagues, who believed that price or output stabilization were the objectives, Liefmann accepted that raw-materials cartels typically did raise prices. However, Liefmann considered the price effects of industrial cartels an open question. While most of his contemporaries considered such calculations impossible, Liefmann took the position that precision was difficult because of simultaneous changes in demand and supply. The lack of attention to estimates of price effects may also have resulted from an absence of cartel suits in German courts.

⁵⁴ An interesting exception is the book on Australian trusts by Wilkinson (1914), which grew out of that colony’s 1906 federal competition law modeled on the U.S. Sherman Act (Shanahan and Round 2008). However, the law’s requirement that collusive conduct had to be proven to have been to the “detriment of the public” lead to confusion in the courts.

syndicate of 1887-1889; and Stevens' (1912b, 1912c) study of the convicted Gunpowder Trust, notable for focusing on what was believed to be the longest-running discovered cartel in the Nation's history (it lasted 35 years, of which 17 were illegal).⁵⁵ Jenks and Jones were innovators in measuring cartel overcharges (see Box).

MILESTONES IN MEASURING OVERCHARGES

It is quite likely that the before-and-after method of computing a cartel overcharge is the most ancient. As will be documented below, it is by far the most popular. The author first in print with it was Jenks (1888) when writing about the second 1881-1882 episode of the *U.S. Salt* cartel centered in Michigan; he employed both before and after prices. However, the first to employ the relatively unusual intra-episodic price war is McCrosty (1907) when describing the 1898-1906 episode of the *UK White Salt Union*.

I credit Jones (1900) with being the innovator of the constant-cost (or constant-margin) method, which he first applied to the 1882-1886 *U.S. Whiskey Alcohol* cartel and to many others thereafter. As for the yardstick method, a good case can be made for Judge William Taft as the innovator in his famous Federal Court decision in *Addyston Pipe* (a cast iron pipe cartel in 1895-1896), though Jones (1900) book about the *Eastern U.S. Sugar* cartel was written at about the same year.

Two publications mark the start of econometrics as a method for estimating overcharges. Sultan's (1975) book on the Great Electrical Conspiracy in the U.S. apparently originated from testimony for defendants in damages trials in the early 1960s. Parker's (1972) article on the *U.S. concrete pipe cartel* is the first peer-reviewed statistical study of cartel overcharges. An article on the *U.S. milk cartel* by Kwoka (1977) marked the beginning of a flood of econometric measurements of cartel price effects.

In the decade after World War I, hundreds of cartels were established (or re-established) in a wide range of commodities and industrial products, gaining control of nearly half of world trade in the 1930s. Nearly all of them operated in the open. Contemporary scholars now regard the Inter-War era as something of a Golden Age of Cartels. Yet, exceedingly few cartel studies by professional economists date from this era.

Post-World War II Cartel Studies

During and immediately after World War II, a surge in publications examined the roles of cartels in international trade and in war production. Ervin Hexner (1946), a Czech refugee turned

⁵⁵ The current world champion for endurance is the *Indo-Ceylon-Pakistan Shipping Conference*, which was established in 1875 and dissolved by the Competition Commission of India in October 2008 – a life of 134 years (Connor 2009b).

scholar at a U.S. university, produced the most comprehensive economic study of international cartels yet published.⁵⁶ Hexner had an insider's knowledge of cartels (Barjot 1994: 65). Louis Marlio (1947), a French economist who wrote a detailed account of the international aluminum cartel, had a similar background (*ibid.* p. 66). Both of these authors found much to admire in the effects of international cartels, whereas post-World-War-II works by American authors tend to be distinctly more skeptical, if not hostile concerning the economic and political effects of the interwar cartels (e.g., Berge 1944, Edwards 1946).

Although they may overstate the issue, Harding and Joshua (2003) draw sharp a distinction between the views held toward cartels of North American lawyers and lawmakers and those in Europe in the immediate decades following the War:

“...the North American approach has been, since the end of the nineteenth century, one of categorical censure [and] recourse to criminalization of antitrust violations as a central plan of legal control... On the other hand, the general European approach ...has been altogether more tentative, more agnostic...and only in recent years moving towards an uncompromising condemnation of cartel activity...” (p. 40).

One finds these disparate but changing views reflected in the social-science literature on cartels.

Perhaps the first publications to attempt to quantify systematically the price effects of cartels were a pair of books produced by a team of economists that had access to information handed over to investigators of Congressional committees and to criminal court proceedings (Stocking and Watkins 1946, 1948).⁵⁷ These books were the culmination of eight years of study by a team of economists.⁵⁸ They set a new intellectual standard for the economics literature on cartels, because they were the first to apply rigorous modern concepts of the emerging field of industrial economics; because of access to normally secret quantitative and organizational information spawned by numerous Congressional investigations, the Federal Trade Commission, and law suits; and because they were among the first to focus on the market effects of international

⁵⁶ Hexner's (1946) book spends dozens of pages toying with alternative definitions of “cartel,” ultimately adopting one quite close to Liefmann's.

⁵⁷ Stocking and Watkins had access to the results of a number of major investigations. The Temporary National Economic (or “Kilgore”) Committee published its hearings a few years before their books were published (U.S. Congress 1938-1940). Other Congressional committees investigated the munitions industry and patent pools. The authors also had information on U.S. criminal prosecutions by the Justice Department of more than 40 international cartels.

⁵⁸ Stocking appears to have had overall leadership of the team. George W. Stocking was a professor at the University of Texas during 1926-47. He was appointed as the economic advisor to the new U.S. Attorney General Thurman Arnold in 1938, just as a revival of antitrust began after repeal of the National Industrial Recovery Act of 1933-1937. Stocking served as the co-chair of the Consent Decree Section of the DOJ through at least 1943 (Mueller 2007: 187-188). It was in the early 1940s that the DOJ investigated the many international cartels that would be formally indicted by the DOJ in 1944-48. As there were few if any economists employed by the DOJ, Stocking played a role something like the first Chief Economist of the DOJ. Both at the University of Texas and at Vanderbilt University (1947-1963), Stocking mentored many students who became leaders in the fields of industrial organization economics and antitrust law, including my mentor Willard F. Mueller (Anon. 1976, Marion 2007).

cartels.⁵⁹ Numerous and continuing citations to their books by leading contemporary scholars attest to their status as seminal works and classics in the field (Mueller 2007: 188).

The increasing evidence of negative impacts of cartels during 1920-1945 began to bring about a reappraisal of the welfare impacts of cartels among Europeans just after World War II. In Germany, there was a healthy parliamentary debate over its cartel laws in 1951-57 (Wells 2002:165-74). Through the early 1950s, a majority of the UK's manufacturing output was affected by cartels (Symeonidis 2002, Swann et al. 1974). The reconsideration of the benefits of cartels by Europeans began around 1950 with a series of empirical studies by the Monopolies Commission, which investigated the structure and performance of British industries and made recommendations to the government about restrictive practices, dominant firms and mergers.⁶⁰ By the late 1950s, anticartel legislation had been adopted that placed the burden of proof on cartels to prove the economic benefits of their price fixing and related conduct. Germany was the prime mover behind the adoption of tough anticartel provisions in the Treaty of Rome, which solidified the antitrust tradition in the EU and its Member States.

In the second half of the 20th century, relatively few books were written about the empirical economics of cartels, but there have been three brief periods of interest.⁶¹ First, there was intense but short-lived U.S. interest in domestic cartels when the "Great Electrical Equipment Conspiracy" burst onto the Nation's consciousness in 1960-1961.⁶² The great electrical equipment conspiracy resulted in the release of more publications in a few years than any other single historical event since the beginning of cartel literature. The scope of the conspiracy, the fame of the leading companies involved, and the U.S. Government's aggressive prosecution of the violators – all these factors lead to a degree of public fascination and publicity about an antitrust action not seen since the Supreme Court decisions against the Standard Oil and American Tobacco trusts in 1911.⁶³ Several trials provided unusually detailed pictures of the cartel's organization. The books written about the heavy-electrical-equipment conspiracy include at least six monographs documenting the complex organizational details of these long-lasting and widespread bid-rigging conspiracies (Herling 1962, Smith 1963, U.S. Congress 1965, Sultan 1975, Epstein and Newfarmer 1980, and Bane 1973). Sultan's books are by far the most

⁵⁹ Technically, because one of the defendants was British American Tobacco, the 1911 conviction of American Tobacco *et al.* was the first U.S. prosecution of an international cartel, but the international character of the collusion was a minor aspect of the case.

⁶⁰ I found 22 of these reports had useful overcharges estimates.

⁶¹ Overcharges were taken from about 50 books and chapters in edited books, of which 30 were published after 1950. Compared to the total number of economics books printed after 1950, the share of them devoted to cartel studies is smaller than before.

⁶² When the guilty pleas were received in the Philadelphia U.S. District Court in early 1961, nearly every daily newspaper in the United States placed the events on their front page.

⁶³ The conspiracies are notable for their duration (up to 40 years), the huge size of the sales involved (\$7 billion per year in the late 1950s), the large number of well known companies involved (General Electric, Westinghouse, etc.), the record size of the fines imposed (over \$2 million), the size of the damage awards granted from three trials and hundreds of private settlements (totaling \$400 to \$500 million) from more than 1900 suits, and the imposition for the first time of significant prison sentences for several top executives.

quantitative. In addition, three journal articles were devoted to the cartels (Kuhlman 1972, Finkelstein and Levanbach 1983, and Lean *et al.* 1985). These studies have become staple references in textbooks in industrial organization (e.g., Carlton and Perloff 1990, 2005).

Second, there was a brief revival of focus on international cartels after 1973 when the Organization of Petroleum Exporting Countries (OPEC) first used its power to raise crude petroleum prices.⁶⁴ Many books and articles were written about the cartel. Two economic studies tried to predict OPEC's staying power by studying previous international cartels.⁶⁵ A chapter in a book by Eckbo (1976) is notable for its effort in classifying cartels according to a large number of potentially significant economic dimensions. One dimension is a binary variable that separates cartels with significant price effects from those that were ineffective in this respect. Another book chapter may be the most comprehensive quantitative study of cartel price effects (Griffin 1989).⁶⁶ Griffin, who has several cartel studies to his credit, specifies a formal cartel model, which allows for a fringe of competitive, non-cooperating producers outside the cartel. From this theoretical model, Griffin derives a simple empirical model that explains variation in the Lerner Index⁶⁷ of market power.

Third, scholarship seems to have been stimulated by the large number of well publicized, U.S. and EU prosecutions of global cartels that commenced in the mid 1990s. Many of these cartels were organized by some of the world's most recognizable multinational companies. The first global case in decades in both jurisdictions was *Lysine*, which was capped in the United States by a notorious 1998 criminal trial of three executives of the Archer Daniel Midlands Co. The trial record provided a degree of testimonial evidence that is unique for international cartels discovered after World War II (Lieber 2000, Eichenwald 2000, and Connor 2007b). EC

⁶⁴ I do not include OPEC's price effects in this survey because it was created and enforced by what amounts to a multilateral treaty organization.

⁶⁵ George W. Stocking wrote a non-technical study in 1970 of the oil industry, *Middle East Oil*, that his biographer calls "prophetic" (Anon. 1976: 454).

⁶⁶ Eckbo (1976) comes close. Eckbo studies 51 episodes in 18 markets, but does not really calculate overcharges so much as place them somehow in high/low categories; Griffin terms Eckbo's approach subjective.

⁶⁷ The Lerner Index is also computed by starting with the *dollar overcharge* in the numerator, just as one calculates the overcharge rate, except that the Lerner Index is measured by dividing the overcharge by the monopoly price instead of the competitive benchmark price. That is, the Lerner Index is a *margin* on the collusive selling price, while the overcharge is a *mark-up* on the competitive benchmark price. Thus, for the same cartel the Lerner Index is a smaller number than the overcharge ratio, though the differences are small for small overcharges.

The Lerner Index is $L = (P-C)/P$, where P is the observed market price and C is the but-for or competitive price. Because C is equal to marginal cost in competitive equilibrium, L is also a profit *margin* on sales. L is zero in perfectly competitive markets and has a maximum value of one. The monopoly overcharge is a *mark-up*: $MO = (P-C)/C$. MO is also zero in perfectly competitive markets, but can approach positive infinity when C is very small. Because P is always greater than or equal to C , MO is greater than L whenever L is positive. If the but-for scenario is perfect competition, the simple algebraic substitution allows one to express MO as a function of L , viz., $MO = L/(1-L)$. Alternatively, $L=MO/(MO+1)$. If, however, the but-for state of competition is effective noncooperative oligopoly, then the overcharge conversion will overstate the Lerner Index (Boyer and Kotchoni 2012). For that reason, we include Lerner Indexes in the sample of overcharges *without conversion*. This will cause averages of overcharges to be understated.

decisions have become major sources of information about contemporary cartel conduct (Harrington 2007).

After about 1973, many empirical analyses of cartel effects began to appear in professional academic journals. The shift away from monographs to journal papers is remarkable. Of the 125 journal papers with useful overcharge information, 88% were published after 1973.⁶⁸ While a few are historical narratives⁶⁹, the later articles tend to focus on statistical tests of theoretical hypotheses or demonstrations of the superiority of a novel estimation technique. In general, these journal papers supplied only about one-fifth of the estimates in the vast literature in economics that measures the price effects of cartels. It is small because external information is needed to identify markets in which sellers overtly colluded from the much larger number of markets characterized by presumptively tacit collusion. These papers for the most part depend heavily on statistical methods of analysis. Around the early 1970s, statistical methods started to become standard for proving cartel damages (Finkelstein and Levanbach 1983). Other important sources of scores of overcharge estimates are the decisions of courts and competition-law commissions, most published since 1990.

Quantitative Estimates of Cartel Overcharges

Statistical methods and regression analysis in particular have been employed in nonexperimental empirical economic analyses since at least 1928.⁷⁰ By the 1960s, regression analysis was a required subject for economics Ph.D. graduates. While regression analysis and other market simulation methods are not new *methods* of computing overcharges, they are more precise and objective. Most cartel studies published in academic journals since about 1974 use econometric methods to estimate overcharges.

The first published work that uses econometrics to estimate a cartel overcharge is Sultan's (1974) analysis of the U.S. electrical equipment conspiracy of the 1950s. Fisher (1980) and Finkelstein and Levanbach (1983) show that experts in U.S. civil trials as early as 1970 were presenting econometric evidence of price fixing. Econometric evidence on monopoly overcharges was also published to critique government-enforced compulsory cartels; Kwoka (1977) is the first of many analyses of the price effects of agricultural marketing orders. However, quantitative analyses of the size of *buyers'* cartels' undercharges are rare; Daggett and Freedman (1985) seem to be the first to publish such a study. Sophisticated econometric

⁶⁸ In addition to journal articles, this study draws upon numerous working papers of economists, many of which became journal papers.

⁶⁹ Elzinga penned an influential survey (1984). Elzinga's paper was intended to mark the 10th anniversary of the DOJ's antitrust Economic Policy Office, but was in fact at the time a rare survey of the state of the economics profession's views of cartels. It focuses almost entirely on the huge impact of Stigler's formal model of collusion and pays little attention to empirical developments, which were few either in economic publications or in enforcement. Joshua (2006) quotes Elzinga's non-technical paper at length and cites it as an inspiration to him when he became a new EC cartel hunter.

⁷⁰ I believe that the Columbia University Ph.D. dissertation of the great agricultural economist Frederick Waugh (1928) was the first to employ the technique. He measured the hedonic value of characteristics of fresh vegetables.

modeling has spread into historical studies of cartels: a notable pair of studies by Hausman (1980, 1984) examines two UK coal markets from 1699 to 1845. Levenstein (1997) analyses the century-old bromine cartel. Genesove and Mullin (2001) is a rare example of a widely cited historical cartel study that does not employ statistics.

A new development in the cartel literature was the statistical analysis of auctions and bid rigging, much of it inspired by the urge to test game-theoretic notions (Porter 2001 surveys this literature). Howard and Kaserman (1989) study collusion in public tenders for sewer construction; Froeb *et al* (1993) federal-government procurement of frozen fish; Brannman and Klein (1992) state road-building contracts; and Lee (1999), Porter and Zona (1999), and Pesendorfer (2000) school-milk procurement. These studies were made possible by U.S. “freedom-of-information” laws that mandate public access to bids for public project tenders. Although such laws exist outside the United States, few have been used to obtain data on bid rigging of public tenders.

Novel methods continue to be applied to estimating cartel mark-ups. There is substantial work focused on understanding cartel stability from which price effects can be derived. Grossman (1996) looked at the 1851-1913 railroad express delivery market, and several have studied the 19th century Joint Economic Committee railroad cartel (Porter 1983, Briggs 1992, and Ellison 1994). Bajari and Ye (2003) applied the Bayesian statistical method to a U.S. seal-coating conspiracy. Clarke and Evenett (2003) apply a trade model to importing countries to estimate price increases during the 1990’s bulk vitamins cartel. Dynamic estimation methods have begun to yield insights into cartel conduct (e.g., de Roos 2006). Zona (2011) has invented a structural method for estimation.

Surveys of Cartel Price Effects

Given the importance of the topic for legal-economic discourse, there have been surprisingly few compilations of the empirical findings of cartel overcharges. Economics textbooks devote limited space to the subject.⁷¹ I have been unable to find any research publication that has as its *principal* aim collecting or analyzing information on the price effects of overt collusion.⁷² However, I have found seven works that mention a significant number of studies of mark-ups due to overt collusion. The overcharges are assembled as a prelude to scholarly research or policy analysis, not as an end in itself; none claims to be a comprehensive survey. The seven surveys are summarized in Table 1.

⁷¹ Of the leading textbooks in industrial organization, Carlton and Perloff (1990) devote more space to cartels than most – almost 50 pages out of 852 total pages. This work mentions by name 60 cartels, most of them interwar, international cartels. Other textbooks have far fewer numbers of cartels cited.

⁷² Hay and Kelley (1974) authored a classic review of 65 U.S. price fixing conspiracies, which Fraas and Greer (1977) extended to 606 cases from 1910 to 1972. Both studies contain a wealth of information about the number of conspirators, duration, industry, and specific collusive methods employed. A comprehensive book by economists on competition-law decisions of the European Commission has extensive discussions of punished cartels (Russo 2010). However, none of these works covered the topic of price effects.

First, the most comprehensive previously published quantitative study of cartel price effects appears in a chapter by Griffin (1989).⁷³ He estimates a simple behavioral empirical model that predicts the Lerner Index of market power econometrically using three factors. The model was fitted to data on 54 cartel episodes of 22 cartels.⁷⁴ The episodes span 1888 to 1984, but most were active during the interwar period, and all operated unconcerned about legal punishments.⁷⁵ All but four of the cartel episodes (7%) were effective at raising price.⁷⁶ Griffin (1989: Table 1) concludes that the mean Lerner Index for the 54 cartel episodes is 0.31, which is equivalent to a 45% cartel overcharge if the but-for scenario is perfect competition. Focusing on the 38 private cartel episodes, the mean overcharge is 54.4% (Table 1).

There is a close, but not perfect relationship between measuring cartels price effects with the overcharge or the Lerner Index.⁷⁷ If the but-for price is the purely competitive price or marginal costs, then the Lerner Index can be easily converted to an overcharge. The formulas for the two are the same, except that the Lerner Index uses the monopoly price as the *numeraire*, whereas the overcharge uses the competitive or benchmark price. That is, the Lerner Index is a *margin* on the collusive selling price, while the overcharge is a *mark-up* on the competitive price. Thus, for the same cartel the Lerner Index is a smaller number than the overcharge.⁷⁸ If, on the other hand, the but-for price is supra-competitive (because the non-collusive regime was tacit collusion), then converting the Lerner index to an overcharge will overstate the correct overcharge. In practice, the two indexes are closely positively correlated.

⁷³ Eckbo (1974) comes close. Eckbo studies 51 episodes in 18 markets, but does not really calculate overcharges so much as place them somehow in high/low categories; Griffin (1989) politely characterizes Eckbo's approach as "subjective."

⁷⁴ An episode is a period during which a cartel's agreement remains by and large unaltered. If an existing cartel renegotiates a previous contract so as to change participant composition, geographic area of influence, or significant new terms (e.g., market shares where none were previously allocated), then a new episode commences. Often, the demarcation between episodes is signaled by a return to more competitive pricing conduct, but in some instances expert judgment is required (see Levenstein and Suslow 2004a).

⁷⁵ The sample in this paper excludes 16 of Griffin's episodes that were government-sponsored cartels: Sugar I, Sugar IV - VII, Coffee I - I II, Tea I and II, Cocoa, Wheat I and II, Rubber I, Bauxite I, Tin III, and Nitrogen fertilizer I. That leaves 38 *private* cartel episodes in this paper's sample.

⁷⁶ That figure is consistent with present survey.

⁷⁷ In my experience, the Lerner Index is strongly preferred by economists because it appears as an equilibrium condition in a large number of oligopoly models. Lawyers and legal scholars habitually write about overcharges because they are closely tied to cartel damages.

⁷⁸ For example, if the competitive benchmark price is \$1.00 and the cartel mark-up (or overcharge) is 5%. Then the Lerner Index L is $(1.05 - 1.00)/1.05 = 0.0476 = 4.76\%$. However, if an overcharge is 25%, $L = (1.25 - 1.00)/1.25 = 0.20 = 20\%$. If the but-for price is the perfectly competitive price, one can derive algebraically a one-to-one linear functional relationship between the overcharge (MO) and L ; $MO = L/(1-L)$.

Reference	Number of Cartels	Episodic overcharge	
		Mean (%)	Median (%)
1. Cohen and Scheffman (1989)	5-7	7.7-10.8	14.0
2. Werden (2003)	13	21	18
3. Posner (2001)	12	49	38
4. Levenstein and Suslow (2002)	22	43	44.5
5. Griffin (1989)	39	28.0 ^c	28.7 ^c
6. OECD (2003), excluding peaks ^a	13	21.6	14.0
7. Davies and Majumdar (2002) ^b	23	24.9-33.9	20-25
Total, simple average of seven above	127-129	32.4	27.1
Total, weighted average of seven	127-129	38.1	31.0
<p>a) One overcharge in the OECD survey with missing affected sales (U.S. lysine) was converted to percentages using affected sales data in a published U.S. Court decision. One overcharge reported to be "more than 13%" was recorded as 14%. If a range, the midpoint is used for averaging. Three percentages cited to be "as high as" were omitted because they are not likely to be representative of the overcharge rate for the whole episode. The OECD report states that its sample median is "between 15 and 20%."</p> <p>b) The present author did not discover this estimable survey until 2011, perhaps because of its title.</p> <p>c) Because one does not know what the benchmark prices are for these observations, I show average Lerner Indexes. If the benchmark is perfect competition, the mean and median overcharges would be higher, 53.2% and 38.9%, respectively.</p>			

Second, Cohen and Scheffman (1989) recognize that the average size of price-fixing overcharges generated by overt collusion is a critical issue in evaluating cartel fines. Their paper cites five to seven estimates for price-fixing cases from the 1970s.⁷⁹ Third, a working paper by Werden (2003) cites 14 studies of cartel overcharges. All of his sampled studies examine conspiracies that operated after 1974, the first year in which cartels could be prosecuted as felonies in the United States; three studies examined international cartels prosecuted by the DOJ in 1996-97. Fourth, Posner's (1975, 2001) treatises on antitrust law illustrate the social costs of cartelization, Posner assembles data on 12 "cartel price increases...[in] industries having well-organized (mainly international) private cartels" (Posner 2001:303), which he admits are "crude and probably exaggerated" (*ibid.* p.304).⁸⁰ Given that Posner is an avatar of the Chicago School of economics, it is noteworthy that his estimates are among the highest of the seven studies.⁸¹

⁷⁹ One of them (Block *et al.* 1981) is irrelevant because it quotes the ratio of out-of-court settlements to *annual* sales for several U.S. bread price-fixing cases. As Cohen and Scheffman recognize in footnote 66, both the numerator and denominator of this ratio are inappropriate indicators of an overcharge; nevertheless, in the text of their article, they persist in citing this ratio.

⁸⁰ Moreover, I regard his inclusion of several studies in his sample as highly dubious examples of cartels; rather, they are well-executed, perhaps classic studies of market power from tacit collusion. These dubious studies are: Applebaum (1979), Morrison (1990, 1993), Barnett (1995), and Bhuyan and Lopez (1997). I have excluded these studies' overcharges from all tables and figures in this paper, except Table 1.

⁸¹ The Chicago School of industrial economics is well recognized in textbooks (e.g., Martin 1994:8-11) and by members of the school itself (Posner 1979). The Chicago School generally maintains that sustained collusion by

Fifth, Levenstein and Suslow (2006) focus on the determinants of success for both interwar and more contemporary cartels. Although the authors are modest about their accomplishment, this paper contains 21 estimates of price effects for international cartel episodes. The Levenstein-Suslow paper lists monetary or percentage overcharges generated by 17 cartels (*ibid.* Annex A). While not all of the survey responses can be converted to overcharge percentages, the usable responses represent an unusually authoritative compilation of data on mark-ups by contemporary cartels that have been prosecuted by courts or commissions.⁸² Sixth, an influential OECD (2003) report on private “hard-core” cartels reports on a 2001-2002 survey of its government-members on the economic harm caused by cartels recently prosecuted by the European Commission and several national antitrust authorities.⁸³ Finally, Davies and Majumdar (2002: 52-67) critically survey 16 mostly econometric studies of price effects of hard-core cartels that they judge to be representative; in addition, they cite price effects from the decisions of one EC and six DOJ prosecutions.⁸⁴

The overcharge estimates of the 126 to 128 estimates cited in the seven surveys are summarized in Table 1. The simple mean average overcharge across the seven surveys is 32.4% of cartel affected sales, and the median is 27.1%. If the seven surveys are given weights, equal to the number of studies they summarized, then the weighted mean overcharge is 38.1%, and the weighted median is 31.0%.

GENERAL DESCRIPTION OF THE SAMPLE

Technically, the *observed* cartel overcharges collected for this paper are a sample of a larger population of cartel overcharges, both seen and unseen. The *unobserved* overcharges are the vast majority of the total for two reasons. First, since about the middle of the 20th century (and earlier

private firms alone is empirically rare. Posner’s (2001) insistence on widespread cartel success is a departure from the School’s normal themes.

⁸² In a few cases, the harm was reported as a monetary value and the size of affected commerce was missing, but I was able to find a reasonable estimate of the affected commerce from an alternative source. For example, the U.S. DOJ provided a monetary estimate of the U.S. harm caused by the international lysine cartel of 1992-1995, and I found the value of affected commerce in a sentencing opinion written by a federal judge in a criminal jury trial that convicted three of the cartel’s managers. I was able to derive 16 overcharge percentages, of which 12 were long run and 4 were peak.

⁸³ A few non-members that participated in an OECD-sponsored “Global Forum on Competition” also submitted responses to the survey. “Hard-core” is a European term that refers to conspiracies that fix prices and/or quantities. Other cartels (soft core?) cooperate on information, technology, marketing, and the like. The distinction seems roughly to correspond to criminal versus civil violations under U.S. law.

⁸⁴ These authors provide ranges of overcharge estimates in six instances, and for five other studies they mention the minimum effect. Two studies (Sproul 1993, Newmark 1988) find zero price effects. I use the ranges and the minima as given to summarize in Table 1. There is no bibliography provided, but the text citations make the sources fairly straightforward to pinpoint.

in the United States) most cartels are clandestine. The great body of expert opinion is that in the past few decades fewer than one-third of all cartels are discovered by antitrust authorities (Connor and Lande 2012: Table 1). Second, among those cartels that never hid themselves or that were discovered by antitrust authorities, sufficient price data were unavailable (or of no interest to the writer) for roughly half or more.⁸⁵ Thus, the sample of overcharges in this paper, while quite large, is no more than one-fourth of the total of all cartel overcharges.

Because the sample of observed cartels may be different in some respects from the total population of all cartels, the features of the sample about to be described may be subject to “selection bias.” Only samples that are selected randomly from a list of the whole population are fully representative of that population, but that process is not possible in the case of cartels. Fortunately, a recent study from Germany suggests that selection bias may be minor. Haucap et al. (2010) compared all illegal cartels with state- or federal-authorized German cartels during 1958-2004, hundreds of the latter being permitted for a wide range of reasons.⁸⁶ In terms of industry distribution, the legal cartels had a greater share in mining, textiles, machinery, and metals manufacturing than did illegal cartels. Surprisingly, there was virtually no difference in the average number of firms per cartel between the two types. The major difference was that the median duration of legal cartels, having state support, was 2.75 times the illegal cartels, and legal cartel with few members or in the food industry tended to be the most durable (ibid. p. 18). What Haucap et al. (2010) suggest is that the cartels sampled for this study may well be representative of all cartels, except for their endurance.

The data are organized according to *three levels of analysis*: markets, episodes, and overcharge estimates. By “market” is meant the industry or product that was subject to price fixing.

- (1) *Markets* are precisely self-identified by the participants in the conspiracy, though occasionally there are alternative names for the same market.⁸⁷ The name of the market is eponymous for the cartel. The range of cartelized markets is impressive.⁸⁸
- (2) *Episodes*, discussed more fully in the Data Appendix, are distinct periods of collusion separated by price wars, temporary lapses in agreements, or changes in cartel membership or internal organization. Episodes may be adjacent in time or may be

⁸⁵ Of the published cartel studies that I found from the periods when cartels operated openly (and for some export cartels up to the present time), about half were discarded because they contained no usable price data. In the *Private International Cartels* data set, which is comprised entirely of discovered cartels since 1990, for only about one-third can overcharges be obtained or computed.

⁸⁶ Of the 360 cartels operating in 2004, 17% were permitted to set conditions of sale, 66% could set domestic quantities or prices, and 15% were export cartels.

⁸⁷ For example, the “nitrogen” cartel is in fact dry salts of nitrogen used as fertilizer, not the gaseous form. The hugely successful “vitamins” cartel is best regarded as a series of overlapping ventures, each of which focused on one of 15 products.

⁸⁸ There is no limit on the types of goods and service cartelized. Even spiritual services can become cartels (Axaroglou et al. 2012).

separated by significant gaps of time.⁸⁹ The markets marked by adjacent multiple episodes will typically be regarded by antitrust law as one infraction, but as economic phenomena as multiple cartels. Because there are sometimes multiple publications about the same episode and because a single analyst will sometimes apply alternative methods of estimation, this paper often records several estimates for a single episode.

- (3) *Overcharge estimates* are the most numerous and detailed level of observation in this study. Each episode will in principle have one true “average” (episode-long) overcharge and one “peak” overcharge.⁹⁰ After examining the distribution of the three levels in this “General Description” section, I find that the three result in similar information. Thus, most of the analyses in this paper will use overcharge estimates as the units of observation.

Number of Cartelized Markets

My search yielded useful overcharge or undercharge information on cartels that operated in **532** markets (Table 2).⁹¹ If one group of sellers decided to fix prices of a product in one geographical region and a different group colluded on the same product in a separate geographical region, these may be counted as two markets. Of the 532 markets, 55% were cartelized by international agreements, where “international” describes the membership composition of the cartel and not necessarily the geographic spread of the cartel’s effects. Some international cartels affected directly the commerce of only one nation, though the vast majority was international in a geographic sense as well. National-membership cartels account for the remaining 45% of the cartelized markets.⁹² In this category I count some purely national price-fixing cartels that were formed for the sole purpose of controlling a nation’s export sales of a

particular product; in the United States, these export cartels⁹³ are called Webb-Pomerene Associations. In addition, some domestic cartels had side agreements with international cartels that protected their domestic market from exports from the international cartel’s members.

⁸⁹ Episodes are in principle different from phases of cartels that give rise cartels instability. Episodes mark changes in cartel *organization*, whereas stability is measured by changes in the degree of cartel *discipline or cohesiveness*.

⁹⁰ In the rare instances where a cartel kept the market price constant for the whole episode, the two overcharge concepts collapse to the same number.

⁹¹ A complete alphabetical list of these cartels may be viewed in Appendix Table 1 (see DATA APPENDIX)

⁹² A few markets were cartelized by both types; typically, a domestic cartel was expanded to respond to foreign competition. The potash cartel is one example; originally German, it became international shortly after World War I because after World War I potash mines in Lorraine became part of France. A joint Franco-German scheme was established to regulate world exports. Thus, after 1918 the two jointly administered national potash cartels became counted as international; however, the earlier pre-1918 domestic German episodes are classified as national.

⁹³ Of course, if an export cartel is composed of companies drawn from two or more countries, then this cartel is categorized in this study as international. Some contemporary export cartels registered in Germany contain companies from several European nations. Price-fixing export cartels maintain the fiction that their activities do not affect prices in the “home country.” Most export cartels cooperate on merchandising or other non-price matters. For a survey of export cartels, see Levenstein and Suslow (2004b).

Table 2. Number of Cartelized Markets and Episodes, by Characteristics				
Characteristic of Cartel	Number of Cartels	Percent of Sample	Number of Episodes	Percent of Sample
Membership:				
International membership	294	55	515	59
Members from one nation	238	45	359	41
Conduct:				
Bid-rigging schemes	179	34	212	24
Classic price-fixing cartels	353	66	612	76
Buyers' Cartels	34	6.4	36	4.1
Legal Status:				
Cartel found guilty or liable for damages	399	75	629	72
Known to have been operating legally	97	18	245	38
No record of sanctions (presumed "legal")	36	6.8		
Membership Location:				
North America	166	31	246	28
EU-Wide	57	11	77	8.8
Nations of Europe	131	25	179	20
Asia and Oceania	88	17	103	12
Africa, Lat. Am. & E. Europe	20	3.8	30	3.4
Global (members from 2 or more continents)	70	13	240	27
Market Location:				
North America	178	34	288	33
EU-Wide	44	8.3	67	7.7
Nations of Europe	143	27	205	23
Asia and Oceania	84	16	106	12
Africa, Lat. Am. & E. Europe	20	3.8	46	5.3
Global (operations in 2 or more continents)	63	12	168	19
Geographic Reach:				
Single Nation, of which:	425	80	608	70
Local/Sub-National	114	21	186	21
Cross-National, of which:	109	20	267	31
Global	64	12	162	19
Total Sample	532	100	874	100
Sources: Appendix Tables 1 and 2, summarized in J. Connor, <i>Price Fixing Overcharges Master Data Set</i> , spreadsheet dated October 2013.				

One-third (34%) of the sample consists of markets affected by bid-rigging cartels.⁹⁴ Although many cartels have some sales to government entities or industrial customers that purchase by tenders, these cartels are explicitly described to have been principally or exclusively engaged in bid rigging. The proportion of bid-rigging schemes in the sample is probably underestimated because some sources did not always provide enough detail on the cartels to be certain of the degree of bid rigging. Recall that the U.S. sentencing guidelines assume that bid rigging leads to higher overcharges than otherwise identical conspiracies. The remaining 66% of the cartelized markets may be called “classic” price-fixing cartels, those that set market prices and/or market quotas for each or its members.⁹⁵

Cartels may profit by attempting to either raise selling prices of their outputs or suppress the prices of their purchased inputs. Buyers’ cartels are often overlooked in the literature. I find that 6.4% of the cartels buyers’ cartels; that is, one out of ten of the price-fixing cartels fixed the prices of their inputs, not their outputs. This ratio is likely to be higher than many experts would have expected.

Three-fourths of the cartels (75%) were found to be in violation of antitrust laws by at least one legal body.⁹⁶ Sometimes these are called “discovered” or detected cartels. The determination of guilt or liability may take the form of guilty pleas (or *nolo contendere* in U.S. courts up until the early 1960s); of a decision at trial by judge or jury; of a commission decision to impose fines, consent decrees, or other sanctions; of the payments of civil penalties; or of negotiated settlements by defendants in a suit. Eighteen percent of the remaining cartelized markets are known or believed to be “legal,” because they operated prior to the enactment of antitrust laws in the jurisdictions in which they functioned or because they were organized and registered under antitrust exemptions, such as export cartels or ocean shipping conferences. About 7% of the cartels may be described as “extra-legal” because there was nothing in the case material indicating that an antitrust authority punished them.

Who ran these cartels and where did they function? Regarding membership composition, the largest number (187 or 35%) hail from Western or Central Europe, of which about 40% were comprised of companies from a single European nation. The next highest number is North American cartels (165 or 31%), followed by Asian (16.5%), and rest of the world (ROW = 3.8%). The final category is one that will loom large in the discussion below – global cartels. These are the 70 cartels (13%) with at least two members from different continents, though typically North America, Western Europe, and East Asia are represented.

⁹⁴ In Europe, bid rigging is generally referred to as collusion involving “tenders.”

⁹⁵ Only a small number of cartels were oligopsonies.

⁹⁶ Counted in this category are criminal convictions; adverse decisions of the UK Monopolies Commission, which made recommendations to the government similar to consent decrees; adverse decisions of the European Commission and similar civil authorities; and those cartels that paid court-approved damages. A few unfinished probes by antitrust authorities are placed in this category because 96% of these investigations yield convictions. Since 1990, virtually all the cartels in the sample are guilty; prior to 1990, the ratio is below 60%.

The loci of operations are somewhat different (Table 2). The large majority of price fixing by cartels (80%) is directed within the boundaries of a single national jurisdiction (and one-fourth of that is more localized. The rest involves cross-national operations (and more than half of that is global). The largest single geographic category (34%) is North American cartels – those operating in the United States, Canada, or both markets. The second largest geographic group (27%) is cartels that functioned in only one nation in Western Europe; if these are combined with trans-EU cartels, then Western Europe is the largest continent with 35.1% of the sample. Global cartels (trans-continental cartels) comprise merely 12% of the sample; these tended to fix prices in North America, Western Europe, and Asia. Asian and ROW cartels (20%) tend to be domestic schemes populated by local companies.

The apparently heavy location of cartels in only two continents is somewhat misleading. It is an artifact of the relatively early enforcement of anti-cartel laws in North America and Western Europe, giving rise to numerous well documented cartel cases that could be studied by academics in those regions. The numbers likely understate cartel activity in Asia and the ROW. Going forward, cartel numbers are more likely to reflect the geographical distribution of antitrust convictions and the local capacities to analyze the cases.

Number of Episodes

A more precise way of accounting for the distribution of cartel activity is by counting cartel episodes rather than whole cartels. This term *episode* is commonly used in modern cartel studies. If a cartel had more than one episode, then each episode is marked by a change in membership composition, the terms of the collusive agreement, method of management, geographic focus, or other major organizational innovation.⁹⁷ In other words, when a cartel is re-formed, it adopts a new organizational configuration. The end of an episode is often instigated by expansion of fringe sales, by an intolerable level of cheating by cartel members, or by the appearance of a new process or product technology that redefines the market boundary. Between episodes, pricing discipline often breaks down; for some of the cartels the interregnum is a period of contract renegotiation. The inter-war global aluminum cartel, for example, went through six distinct phases from 1901 to 1939 that sometimes were adjacent in time and sometimes were several years apart. This heavily researched cartel has 28 overcharge observations (Appendix Table 2).

The total number of episodes is undercounted. Some single episodes reported are in fact averages of groups of episodes. For example, one episode summarized the results of 109 bid-rigging convictions in numerous distinct fluid milk markets of the Southeastern United States that occurred within a few years of each other (Lanzillotti 1996). Each of the 109 convictions should be counted as separate episodes because each conviction represented a distinct buyer. Similarly, the long-running *Dutch Construction* cartels involved tens of thousands of rigged bids,

⁹⁷ Because of the multiple dimensions that must be assessed, it is not unusual for experts to differ on the dates of cartel episodes.

and the contemporary *Auto Parts* super-cartel⁹⁸ encompasses more than one hundred parts and separate schemes for each part directed at several major auto manufacturers (Connor 2013a).

For 49% of the cartels found, only one episode was reported. The *Bulk Vitamins* cartels had 78 episodes, or about five for each vitamin product. The most impressive single-product cartel was the *Newcastle Coal* cartel, for which 22 distinct episodes were recorded during its impressively long life from 1699 to 1845. An additional 17 cartels have had five or more episodes, most of them global commodity cartels.

Table 2 shows several key characteristics of cartel episodes. They are generally distributed in a similar fashion to the cartels themselves (cf., Table 1). International cartels tend to have more episodes than non-international cartels, and this is especially true of geographically global cartels. So, while global cartels comprise only 13% of the sample, their episodes are 27% of the sample. On the other hand, bid-rigging cartels (34% of the sample) tend to have single episodes written up (24%).

Number of Episodic Overcharges

While many cartels have only one overcharge estimate, there are multiple overcharge estimates for a large minority of the markets. Consequently, for three reasons there are many more overcharge estimates than the number of cartelized markets (Table 2).

First, about half of the markets experienced multiple phases or “episodes” for which the price effects differed. This term is commonly used in cartels studies. If a cartel had more than one episode, then each episode is marked by a change in membership composition, the terms of the collusive agreement, method of management, geographic focus, or other major organizational innovation. In other words, when a cartel is re-formed, it adopts a new organizational configuration. The end of an episode is often instigated by expansion of fringe sales, by an intolerable level of cheating by cartel members, or by the appearance of a new process or product technology. Between episodes, pricing discipline often breaks down; for some of the cartels the interregnum is a period of contract renegotiation. The inter-war global aluminum cartel, for example, went through six distinct phases from 1901 to 1939 that sometimes were adjacent in time and sometimes were several years apart. This heavily researched cartel has 28 overcharge observations (Appendix Table 2).

The present study’s sample consists of **1530** cartel episodic overcharges. In the simplest and most common situation, a cartel has only one episode. However, about half of the markets experienced multiple phases or episodes; they had an average of about six episodes.

⁹⁸ Connor (2013a: 2) defines a super-cartel as: (1) global in scope and (2) have a large number of distinct products (i.e., separate cartels) with partially overlapping corporate membership, and (3) direct their price fixing at customers in one vertical production-distribution channel. In short, supercartels have wheels within wheels. Super-cartels are rare.

Researchers usually report the *average* price increases over a whole episode or a representative portion of it. Episodic averages are the measure most relevant for forensic⁹⁹ purposes and are the measures that will be the focus of most analyses in this paper. Many, probably most episodic overcharges are conservative numbers.¹⁰⁰ In some cases, the episodic prices are carefully weighted by the sales in each year or month of the episode, but in most cases the authors give equal weights to the price changes in each sub period during the total affected period. Sometimes it is not clear from the source whether the averages are weighted or unweighted; if the conspiracy period is marked by steady slow market growth, it matters little which is reported. Less commonly, some authors report *minimum* overcharge estimates. To be conservative, all minimum estimates are counted as episodic averages.¹⁰¹ If analysts give minimum and maximum estimates, I employ the center of the range for calculation purposes.

The distribution of episodic overcharges across types of cartels is shown in Table 3. In general, that distribution is similar to the distribution of cartelized markets across cartel characteristics (cf., Table 2). International cartels tended to have above-average number of multiple overcharges than did domestic ones and bid-rigging cartels lower. However, *global* international cartels really stand out with 7.7 overcharges per cartel on average. The number of overcharges per market does not vary significantly across other type categories. Therefore, international cartels seem to be uniquely able to fall apart and reform, often with better internal organization than before. This ability to reform, renew, and regenerate new episodes is a major factor that accounts for the longevity of international – and especially global -- cartels.

Two kinds of cartel mark-up data are available: *episodic* and *peak*. Peak overcharges are interesting because they indicate the effectiveness of cartels when internal and external conditions are briefly optimal. Comparisons of the two measures will be made in the “Peak Overcharges“ section below.

⁹⁹ On the meaning of forensic economics in an antitrust setting, see Connor (2007c). For a survey of a broader meaning of the term – covering all hidden unethical behavior by economic agents – see Zitzewitz (2012).

¹⁰⁰ Sometimes authors report monetary overcharges along with affected sales, in which case a true calculation of the percentage overcharge can be made (i.e., one that calculates the denominator by subtracting the dollar overcharge from affected sales). More commonly, authors provide a percentage overcharge that is *understated* because they divide the overcharge by total affected sales during the episode. Readers often are in the dark as to which method of calculation is used.

¹⁰¹ I have preserved these ranges in the appendix tables of Connor (2004b), but have used the midpoints of the ranges for the tables in this paper. The median ranges, if any, are quite narrow.

Table 3. Number of Episodic Overcharge Observations, by Type of Cartel			
Characteristic of Cartel	<i>Number</i>	<i>Percent of Sample</i>	<i>Episodes per Cartel</i>
International membership	1042	65.5	4.3
National members only	548	34.5	1.0
Bid-rigging schemes	341	21	1.9 ^a
Classic price-fixing cartels	1249	79	3.3
Buyers' cartels	72	4.5	
Cartels found guilty or liable	1137	71.5	2.7
No record of sanctions ("legal")	453	28.5	3.2
Membership Composition:			
North America	414	26.0	2.3
EU-Wide	195	12.3	4.4
Nations of Europe	289	18.2	2.0
Asia and Oceania	142	8.9	1.7
Africa, Latin America & Eastern Europe	51	3.2	2.6
Global (2 or more continents)	500	31.4	7.9
Market/Pricing Location:			
North America	512	32.2	2.3
EU-Wide	141	8.9	4.0
Nations of Europe	292	18.4	2.2
Asia and Oceania	146	9.2	1.6
Africa, Latin America & Eastern Europe	61	3.9	3.0
Global (2 or more continents)	383	24.1	7.7
Total (episodes with either episodic or peak estimates)	1590	100.0	2.9
Sources: Appendix Tables 1 and 2, summarized in J. Connor, <i>Price Fixing Overcharges Master Data Set</i> , spreadsheet dated December 2013.			
a) An episode is very likely to encompass a large number of bids, perhaps hundreds.			

Defining Cartel Eras

One of the features of this sample is the broad time span of the data collected – two and one-half centuries. To simplify exposition, tabulations are organized into seven Eras. The seven periods distinguished in this and subsequent tables were selected to represent different antitrust regimes

in the United States and abroad.¹⁰² In addition, the Eras correspond roughly to the major changes in the relationship of antitrust jurisprudence to economics (Kovacic and Shapiro 2000).

- (1) *Before 1890*. The era up to 1890 is an obvious first period because of the enactment of the Sherman Act in the United States and the 1889 Anti-Combines Act in Canada. Prior to 1890, no effective antitrust statute had been passed, mainly because of weak sanctions.¹⁰³ Except for a few export-trade cartels, international cartels were rare.
- (2) *1891-1919*. During the early decades of the 20th century, numerous U.S. court decisions made the scope and power of the U.S. anticartel law apparent to lawyers, enforcement officials, and businesspersons in the United States (Wells 2002).¹⁰⁴ This period marks the emergence of significant numbers of international cartels. I choose the year 1919 as a break point because it represents the end of a period of intense interest by economists and U.S. antitrust activism. Because of World War I during 1914-1919 nearly all international cartels, a few of them with U.S. corporate members, ceased operating. Many of the prewar cartels were re-established after 1919, but in the majority of instances without the active participation of U.S. firms.
- (3) *1920-1945*. This period witnessed the appearance of hundreds of truly international private cartels – often dubbed the Golden Era of Cartels. During the Inter-War period U.S. antitrust enforcement retrenched, as did the empirical writings of economists. The year 1945 is another logical break point.¹⁰⁵ During 1939-1945, nearly all of the interwar international cartels became infeasible and were disbanded; moreover, wartime price controls and cost-plus government contracts made cartels superfluous. Scores of U.S. criminal prosecutions of international cartels during 1944-1947 clarified for U.S. firms the illegality of many more subtle forms of cartel participation, such as patent pools, cross-licensing of technologies, and the creation of overseas subsidiaries as loci for cartel participation.
- (4) *1946-1973*. The post-World War II era is characterized by the emergence of industrial-organization as a separate discipline within economics, of rapid advances in empirical methods of analysis, and of the adoption of effective anticartel laws outside of North America. Kovacic and Shapiro (2000) note that in the United States by the 1940s “...there was considerable consistency between judicial decisions and economic thinking...” (pp. 51-52). Moreover, the vast expansion of higher education in North America and Europe brought about a parallel expansion of the economics profession as a whole and, consequently, an acceleration in the total resources devoted to theoretical

¹⁰² They are also convenient to chart changes in the historical views toward cartels or in methods of analysis.

¹⁰³ There were written laws against price-fixing in ancient times (Assyria, for example), in 15th century England, and in revolutionary France. None is known to have been effective against private hard-core cartels. The Canadian Statute was largely ineffective until a 1986 revision (Low and Halladay 2011).

¹⁰⁴ But few economists. The first time the Supreme Court took notice of the work of economists was in the 1925 *Maple Flooring* decision (Kovacic and Shapiro 2000:47).

¹⁰⁵ While the world war interrupted international cartel cooperation, Berge (1944: 186-187) mentions that the 1901-1944 *Match* cartel had plans already drawn up plans to resume full collusion immediately after the War ended.

modeling (particularly after 1980) and related empirical testing on collusion.¹⁰⁶ While econometric methods began to be offered as evidence in U.S. courts around 1970, 1974 was the year the first econometric analysis of an overcharge appeared in a published work.

The transition years 1945-1973 correspond with four relevant changes in anticartel enforcement. First, the antitrust idea became firmly implanted in the laws of countries outside North America for the first time: Germany and Japan in 1947, the United Kingdom in 1956, and the European Economic Communities (EEC) in 1958.¹⁰⁷ Second, the European Commission (EC), the administrative arm of the EEC, after a decade of registering cartels, successfully prosecuted its first cartel in 1969. Third, U.S. price-fixing enforcement penalties became significantly more severe in 1974. A change in U.S. anticartel legislation was the 1974 law that made price fixing a felony, thereby lengthening maximum individual prison sentences and strengthening the bargaining power of the DOJ.¹⁰⁸ Class action suits became far more common by the mid 1970s because of changes in federal court rules, a change that permitted plaintiffs to attract better lawyers and economic expertise (White 1988: Table 1.1). Fourth, Beginning in the 1960s, economists in North America began to work more closely with prosecutors and the private bar in antitrust cases, and many of them began to analyze and write about those activities. This is a major factor responsible for the fact that nearly 80% of the estimates of “national” cartels (most of them prosecuted in North America) are drawn from the post-1945 time period.

- (5) *1974-1989*. Kovacic and Shapiro (2000) identify 1973-1991 as the years during which the Chicago School of economics had its greatest influence on antitrust law and enforcement. The Chicago School was as hostile to cartels as the mainstream economists, but tended to be skeptical that cartels were widespread or durable market phenomena. In the 1980s, U.S. federal antitrust
- (6) *1990-1999*. By 1990, nearly all the present criminal sanctions available to the U.S. government were in place. In 1990, penalties for corporations rose from \$1 million to \$10 million.¹⁰⁹ Moreover, in the early 1990s, the DOJ had in place three devices that improved detection and prosecution of cartels: the U.S. Sentencing Guidelines for corporations (1989), the automatic amnesty policy for corporate whistle-blowers meeting

¹⁰⁶ Up until the mid 1990s, however, there is a notable absence of empirical publications by European economists working out of European research institutions. Obviously, there are many European analysts, most lawyers by training, located in EU and national antitrust authorities’ bureaucracies and performing cartel studies, but few of them publish outside of their governments’ official organs.

¹⁰⁷ However, these were early, uncertain years for cartel enforcement: the EEC did not fine its first cartels until 1969. Moreover, elements of the EC’s bureaucracy outside of the Competition Directorate encouraged cartels in some industries. Jensen-Eriksen (2011) details how national paper-export cartels in the Nordic countries maneuvered successfully in the 1960s to form global paper cartels that affected most of Western Europe and North America.

¹⁰⁸ Although the prosecution of price-fixing of relatively inconsequential domestic conspiracies was at a high level in 1974-1990, the DOJ did not give a high priority to investigating international cartels, nor did it have any success in the courtroom in the few international cases it did pursue (Connor 2001a).

¹⁰⁹ Raised to \$100 million in April 2004; maximum prison sentences rose from 3 to 10 years.

- certain criteria (1993), and a demonstrated ability since 1994 to impose fines above the \$10-million statutory cap by means of an alternative sentencing provision. These devices were in some cases adopted by the EU and other antitrust authorities, which significantly improved the investigation and prosecution of international cartels. Both U.S. and EU prosecutions of international cartels increased markedly; both convicted *global* cartels for the first time.
- (7) *2000-2013*. The U.S. DOJ refined its ability to imprison non-U.S. cartel managers, and began an anti-cartel campaign that substituted prison sentences for corporate fines. The decade of the 1990s was when leniency programs were new and experimental; in the 2000s, leniency programs became standard features of antitrust enforcement worldwide. In particular, a flawed EU leniency program was revised and a new, more effective one put into place by the EC in 2001. EC Commissioners Monti and Kroes negotiated and implemented fining guidelines (2001 and 2006) that vastly enhanced EC cartel fines. Additionally, around 2000 the EU's National Competition Authorities began to coordinate their activities and ramped up enforcement against international cartels. Some NCAs criminalized their price-fixing laws. Finally, around 2000 a dozen antitrust authorities in middle-income countries began attacking international cartels. Because of these shifts in antitrust enforcement, this paper distinguishes data of the decades of the 1990s from the 2000s.

To summarize, there are seven Cartel Eras distinguished in the present analysis: the years prior to 1890, 1890-1919, 1920-1945, 1946-1973, 1974-1989, 1990-1999, and 2000-2013. Connor and Bolotova (2006) demonstrated in formal econometric testing that these periods were significantly different with respect to the level of overcharges.

Numbers of Episodic Overcharge Estimates Collected Over Time

London Coal Cartels

Identifying cartel episodes is sometimes a challenging proposition, even for the most experienced experts. Consider the several episodes of what is historically the longest-running *documented* cartel (or is it cartels?): the market for coal brought by coastal ships from northern England up the Thames River to London. This is an old market. Records of taxes paid on “sea coal” in London go back to 1213 – more than 800 years ago (Levy 1927:9).

The London coal-buyers' cartel that began as early as 1595 and persisted on and off for about 200 years.¹¹⁰ The buyers were lightermen, wholesale coal merchants who were able to manipulate the prices paid to the owners of coal-laden ships in London's harbor. The government took many ineffectual actions against this cartel. Acts of Parliament against bid rigging were passed in 1642 and 1665. Later, in 1729 a Parliamentary investigation found that ten lightermen controlled 67% of purchases in London, and the investigation report specifically

¹¹⁰ Coal was mined in many parts of Britain, but high land transportation costs conferred a monopoly on the Vend over a wide range of delivered London prices. UK coal-cartel studies with overcharge estimates include Ashton and Sykes (1964), Levy (1927), Sweezy (1938), Hausman (1980), and Tan (2003).

blamed them for 1722-29 price increases. Moreover, price controls for London coal were legalized in 1744, to be administered by three judges. In 1788, a law made any agreements among or partnerships of more than five coal buyers illegal “combinations in restraint of trade.” Whether these laws had more than fitful, short-term effects on this buyers’ cartel is doubtful.¹¹¹ A 1700-1702 coal bid-rigging episode in London is the second-oldest overcharge estimate in the present study.¹¹²

Sometime between 1700 and 1750, the locus of power in the London sea-coal market moved north. London consumers of coal were later exploited by a *sellers’* cartel of coalmine owners.¹¹³ It is the Coal Guild of northeastern England (later known as the “Newcastle Vend”), which made its first recorded collusive agreement on London coal prices in 1699. In the early 19th century when the Vend was best organized, Tan (2003: 22) estimates that various episodes resulted in coal overcharges of from 12% to 16%. Although highly unstable, the Vend did not finally collapse until 146 years later in 1845. The two coal cartels operated for 250 years, making them the most durable in this study’s data set.¹¹⁴

Total Episodes over Time: International Cartels

The total number of episodic estimates in this study is summarized in Figure 1. Because of the long period covered by the sample, the mix of overcharge numbers changes quite a bit. Except for a bump in the two decades following the 1890 Sherman Act and a drop in the Inter-War period, the total number of *domestic* cartel estimates is surprisingly constant across the seven Cartel Eras (Table 4). However, the number of *international*-membership cartel estimates tends to increase and peak twice: first in the interwar years (1920-1945) and then in the last 24 years (1990-2013). Although not shown, dual peaks for *global* cartels are even more pronounced than other international cartels in those years.

¹¹¹ Reliable time-series price data (from the records paid for coal by London hospitals) begin around 1700.

¹¹² I could not resist including one cartel from classical Greece (2300 years ago), for which I made a rough yardstick-approach overcharge estimate. For a lighthearted rendition of this cartel and the fatal consequences of the public trial by an Athens jury, see Connor (2007c: 31-34).

¹¹³ Mine owners who sent coal by coastal ships from Newcastle to London controlled this cartel. The number of mines was quite large at times. Output was reduced through closing smaller mines and paying the owners compensation (“side-payments”). The lightermen’s buyers’ cartel may have operated simultaneously with the Newcastle mine-owners’ sellers’ cartel during 1700-1750

¹¹⁴ When railroads from the Midlands reached London in the early 1840s, the Newcastle owners’ transportation-cost advantage disappeared and so did the Vend.

Fig. 1. Number of Episodic Overcharge Estimates Collected over Time

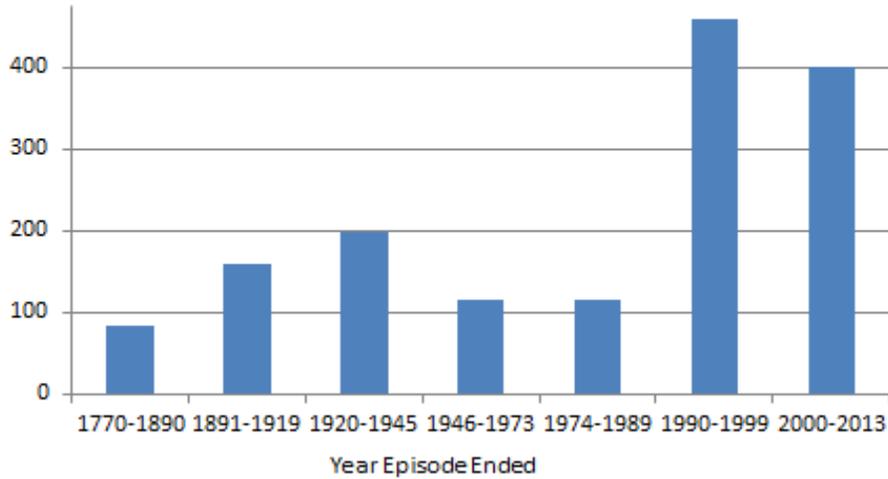


Table 4. Number of Episodic Overcharge Estimates, by Year and Type

Cartel Episode End Date	Membership		Legal Status		Bid Rigging	Classic Price Fixing	Buyers' Cartels	ALL TYPES
	National	Inter-national	Found Guilty	Legal				
	Number							
Before 1890	78	5	47	36	8	75	1	83
1891-1919	109	51	42	118	43	117	1	160
1920-1945	30	169	60	139	1	198	5	199
1946-1973	84	32	73	43	42	74	5	116
1974-1989	79	36	96	19	53	62	9	115
1990-1999	74	386	436	24	74	386	15	460
2000-2013	76	326	360	42	144	258	34	402
ALL YEARS	530	1005	1103	432	330	1205	70	1535

Sources: Appendix Tables 1 and 2, summarized in J. Connor, Price Fixing Overcharges Master Data Set, spreadsheet dated December 2013.

The increasing awareness of the illegality of price fixing in the United States likely accounts for the absence internal records of domestic cartels in the United States after 1890. Moreover, because the penalties were so low (a maximum of \$5000 per count), relatively few court decisions bothered to give details about sales or prices during the conspiracy.

During 1920 to 1945, for the first time, the majority of observations are drawn from studies of international cartels.¹¹⁵ The Inter-War period witnessed an explosion in global cartels, many of them Europe-based export cartels. During 1920-1945, 169 episodic overcharges of international price fixing were recorded; these cartels account for an impressive 85% of all episodes in the interwar period, a record-high proportion that still stands.

During 1946-1989, discovered international cartels remained relatively scarce. Moreover, the 86 episodes of international cartel overcharges comprise only 29% of all of the episodes in that period. One can only speculate as to why global collusion apparently first became feasible in the 1920s and then later – during 1980-2000 – revived in popularity. The availability of improved international and trans-oceanic communication and transportation very likely played a role. International trade and foreign investment surged in the 1920s and 1980s. These conditions may account for intensified price competition or the formation of strategic conjectures about all the world's major suppliers in an industry.

The post-World War II decline in total numbers of overcharges is also very likely due to an absence of convictions of international cartels by the U.S. DOJ in the 1950s to 1970s, aided by small numbers of private damages cases in North America.¹¹⁶ During these years, large U.S. businesses were rapidly expanding into overseas markets by means of largely unregulated horizontal acquisitions where they faced weak local rivals. Profits on these overseas ventures were higher than parallel domestic lines of business (Connor 1977). To American multinationals, illegal price fixing may have appeared less profitable than in prior or subsequent eras. A Harvard professor of international business who wrote several popular books went so far as to proclaim that “... global cartels have passed into history“ (Vernon 1977: 75). Shortly thereafter, an experienced DOJ prosecutor averred that “... the old-fashioned private international cartel... is now rarely found“ (Rosenthal 1979). The inability of the DOJ particularly to discover international cartels persisted until the early 1990s, partly because of a federal-government policy decision enforced in the 1980s to focus on bid rigging in localized markets.¹¹⁷

¹¹⁵ Exceptions include USDA-overseen fruit and vegetable Marketing Orders. These USDA Marketing Orders were formed voluntarily in the 1930s by votes of their farmer-members, but once approved all producers must conform to the quality and timing restrictions imposed by the Order's administrators. Few farmers are opposed to their continuing operation. Four overcharge estimates of marketing orders are in the data set.

¹¹⁶ The modern era in private litigation began around 1977 when the U.S. Rules of Civil Procedure were amended in ways that facilitated the formation of class actions; in Canada similar rules' changes occurred in 1992. Economists are often spurred to write about cartels after serving as class-action experts.

¹¹⁷ The alleged blindness of the DOJ to international cartels is a frequent theme of Joshua (2006: 1-5), who credits the EC with moving aggressively against them as early as a decade earlier. However, it must be conceded that the EC, once it began employing unannounced visits (“dawn raids“) in 1979, held a considerable advantage over the DOJ in collecting inculpatory written evidence of international *intra-EU* collusion (Harding and Joshua 2003: 164-166). Both authorities faced similar challenges in obtaining *extra-jurisdictional* evidence of collusion until effective

Finally, it is important to note the special role of *global* international cartels. There are 277 episodes of global-cartel overcharges, and these global estimates account for 18.3% of the total number of overcharge estimates in the sample. There are very few global-cartel overcharges prior to 1920. The first recorded global cartel¹¹⁸ is the Secrétan copper syndicate of 1887-1889. Although organized by four French and British firms, the syndicate cornered the supply of copper by signing long-term supply contracts with mine owners all over the world. The syndicate made profits when the contraction of supply forced up the price of copper contracts traded on European commodity exchanges (Andrews 1889). The cartel managers did not anticipate that supplies of Asian recycled copper that brought this pioneering global cartel to its end. It is noteworthy that nearly all the global-cartels episodes in the sample that ended before 1890 were metals or metallic ores, industries with very high fixed, sunk costs.

Rates of Discovery

Looking at *total* numbers of overcharges may distort the picture because the number of years per Cartel Era varies considerably. The annualized *rate* of overcharges observed may be more instructive.

The number of observations *per year* has grown over time (Figure 2). The growth in the rate of episodes ending in 1990-1999 was extraordinary. The primary factor that explains the upward trend in the number of overcharges is the growth in the number international cartels with usable data (Figure 3).¹¹⁹ Up until 1890 when price-fixing was legal everywhere in the world, only one estimate is available about every six months on average. During this early period, the vast majority of price effects are reported for domestic cartels operating in the United States, the United Kingdom, and Germany. Although there were large numbers of domestic cartels extant in the late 19th century; the small size of the fledgling economics profession, a literary approach to writing in economics, and inevitable destruction of most business records over time contributed to the fewness of quantitative overcharge observations for 19th century cartels.

From 1891 to 1989, five to seven overcharge estimates are available per year. The proportion of international schemes is especially high during the interwar period and especially low during 1946-1990 when most overcharges are from domestic cartels. It is likely that there were more domestic cartels operating legally in Europe in the early 20th century than there were international cartels, but the latter were given more publicity because they appeared to be novel forms of business organization.¹²⁰

corporate leniency programs were instituted. After 1993 and up to the late 2000s, the DOJ seems to have held an investigatory and lead over the EC in pursuing international and especially global cartels.

¹¹⁸ The French-Belgian zinc national cartels that began in 1847 later morphed into a global cartel of four episodes during 1910 to 1963.

¹¹⁹ Although there is a dip in 1946-1990, the correlation between the number of episodic observations per year and a linear time trend highly positive.

¹²⁰ When the UK, Germany, and the EEC began requiring registration of cartels in the 1950s, hundreds came forth in each jurisdiction.

Fig. 2. Number of Episodic Overcharge Estimates per Year

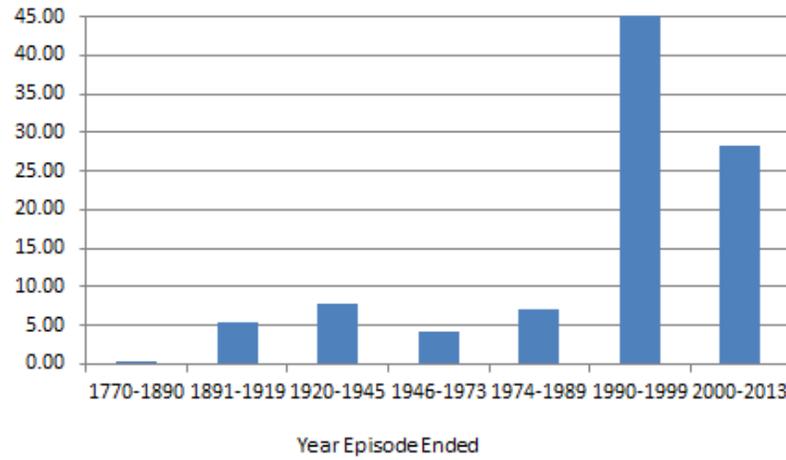
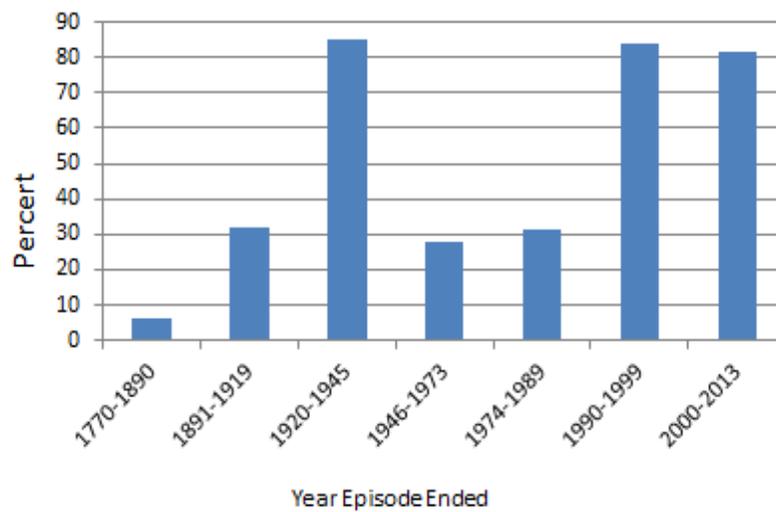


Fig. 3. Proportion of Episodic Overcharges International



During 1891-1919, there are 3.8 price observations per year; the rate rises to 5.6 per year in the interwar period. More data are available for international cartels during 1891-1945 than for cartels composed of companies from a single nation. About two-thirds of the observations are drawn from international cartels. One reason is that international cartels mostly were based in Europe, where they operated with legal impunity. That is, they had freedom to set monopolistic prices. Only in Weimar Germany for a few years after 1923 were cartels regulated. In a few European countries, cartels were required to register with the government. In others, cartel contracts were enforceable in the courts.

Many of the interwar international cartels were organized as federations of national cartels and were aimed primarily at creating national monopolies and assigning shares for export sales.¹²¹ As nearly all of them were believed by their members to be legal at the time, the business press often openly reported their activities.¹²² Members of these cartels did not attempt to hide their activities; indeed they often publicized their operations, particularly if they achieved putatively efficiency-enhancing industry rationalization, protected national markets, increased national employment during stressful economic times, or promoted price stability. During this period, many countries passed legislation specifically authorizing cartels that controlled national exports, even if that meant agreements on prices in various overseas markets. In a few cases, including the United States, these cartels were used as cover organizations for domestic price-fixing.

In the early and mid 1940s, many of the interwar cartels were investigated by the U.S. Congress, indicted by the DOJ, and sued by private parties. Combined with the expanding size of the economics profession and the growing interest among economists in imperfect competition, the transparency of non-U.S. cartels led to a large number of empirical cartel studies. For 50 years after the end of World War II, the number of known international cartels declined markedly. Perhaps because of the aggressive prosecution of cartels by the DOJ in the early 1940s, it appears that international cartels were by and large driven underground for decades after 1945. From 1946 to 1989 an average of five or six overcharge estimates could be found, nearly all of them domestic conspiracies. Few international cartels were discovered or prosecuted until the early 1990s -- less than one international cartel episode every two years.

¹²¹ I do not include national cartels that were fostered by governments (some governments even compelled all the companies in an industry to join) in this data set; likewise, I exclude many international commodity-stabilization schemes that were regulated by government ministries under parliamentary laws or came about because of a multilateral treaty. The second tea cartel in the 1930s, which was authorized by several parliaments of the British Empire and regulated by the Colonial Office, is one example of a "public" cartel. However, I do include a few international cartels with one or more members consisting in part of government-appointed committee members, government-owned corporations, or government-sanctioned national cartels, if they were formed by an agreement among the members. An example is the sugar cartel in the late 1930s. Many of the European export cartels also created national monopolies for their members.

¹²² U.S. companies apparently believed that patent pooling with foreign firms was legal; others joined cartels indirectly through controlled overseas subsidiaries. U.S. courts judged these and other subterfuges illegal.

Several explanations have been offered for the hiatus in international cartel formation in the two decades following 1945. The destructiveness of World War II left the United States with as much as 65% of world industrial capacity in the late 1940s. As a result, manufacturers in Europe and Japan were oriented mainly toward rebuilding their domestic markets; not only were few industrial partners available for international agreements, it seems that U.S. firms were less prone to form cartels than firms from countries with no or weaker antitrust cultures. In the 1950s and accelerating in subsequent decades, U.S. firms embarked on a period of rapid foreign direct investment as the preferred means of entering overseas markets; leading European and Asian firms adopted this strategy increasingly after the late 1960s. Until the early 1980s, most United States markets were subjected to little import competition, but by the 1990s imports were exerting a powerful influence on price competition across a wide spectrum of commodity markets. Most international cartels have arisen only in industries with internationally traded merchandise and populated by multinational corporations with strong leading positions. For all these reasons and probably several others as yet unknown, international-cartel formation was seemingly at an historically low level until the 1980s.

Since 1989, the number of overcharges available has exceeded 35 per annum on average – more than double the previous period. In part, this may be ascribed to the launching of an historically high number of international cartels in the early and mid 1980s. Many of these cartels could not have been contemplated without the direct participation or passive cooperation of leading U.S. companies in the cartelized markets. Other factors that may be responsible for the surge in overcharge estimates may include greater interest in collusive phenomena by economists, shifts in antitrust enforcement priorities, expansion in the sheer number of antitrust authorities worldwide, and improved cartel-detection programs.

Guilty or Guilt Not Proven?

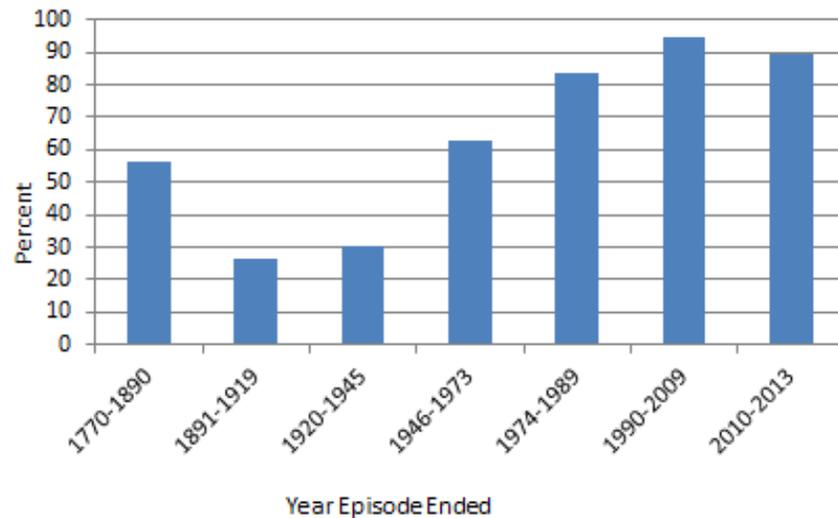
A second important trend is that most cartel data now arise from prosecuted cartels (Figure 4). Prior to 1946, about one-third of the observations refer to cartels known to have been sanctioned.¹²³ Prior to the 1940s, U.S. anticartel sanctions were weak by today's standards, but increasingly after 1911 or so U.S. businesspersons became aware of the legal dangers of overt collusion in the domestic market. However, until the early 1970s national and international cartels comprised of European companies could form cartels subject only to registration requirements in most European countries (and in the EEC after 1960).¹²⁴

¹²³ This ratio may be deceptively high. Many durable cartels straddled eras that bridged shifts in public attitudes or antitrust enforcement. Almost all the sanctioned-cartel observations prior to 1890 derive from the Newcastle Vend, which was not “punished” until the 1830s when a British Parliamentary committee issued an unfavorable report but no further consequences. Later in the 19th century, Parliament again passed laws making coal price fixing illegal, but no monetary sanctions were levied. Similarly, the U.S. anthracite coal cartel operated for four decades before it was indicted.

¹²⁴ Export cartels that in theory did not affect the jurisdiction's commerce were permitted in the United States from 1918 and in most other nations throughout the 20th century. Today less than one-third of all countries permit export cartels, and many that have an antitrust exemption appear ready to repeal the loophole (Levenstein and Suslow 2004b).

The European Commission began imposing fines on unregistered cartels that affected EEC trade beginning in 1969 (Harding and Joshua 2003:121). During 1974-1990, U.S. corporate sanctions on cartels became significantly more severe, and the European Union's prosecutions moved in the same direction (Connor 2003). Both jurisdictions imposed historically unprecedented penalties on international cartels beginning in the late 1990s. After 1990, virtually all the observed cartels in the sample were prosecuted or fined by one or more antitrust authority. This pattern suggests a marginal improvement in cartel deterrence (albeit still sub-optimal), but it does not necessarily mean that the probability of discovery by prosecuting bodies has gone up.

Fig. 4. Proportion of Overcharges from Sanctioned Episodes



However, it probably does represent a heightened aggressiveness in anticartel enforcement by a much larger number of authorities as well as more productive research methods by social scientists.¹²⁵

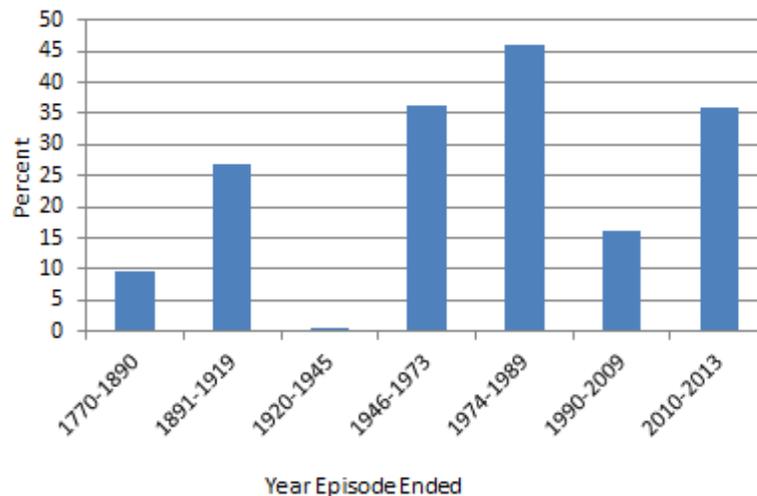
¹²⁵ In the last decade, announcements of probes, guilty pleas, and fines on cartelists are more and more to be found in convenient Internet sites and through Internet search engines than formerly.

The proportion of estimates from cartels that were judged guilty by a competent antitrust authority rose very slowly until 1989, but reversed positions thereafter (Table 4). The large majority of the guilty-cartel overcharges occur in episodes ending after 1989. Before 1990, 47% of the episodic estimates were from guilty cartels, whereas after 1990, 92% were. It is likely that these estimates patterns reflect objective market conditions, i.e., the globalization of many markets in the early 20th century, recessions in the Inter-War period, and the surge in anti-cartel detection after 1990.

Bid Rigging

One other change in the mix of cartel pricing conduct may reflect the availability of data and the changing preferences of economists rather than objective market conditions. In particular, the number and proportion of episodes involving *bid rigging* increased markedly. Prior to the 1950s, overcharges could be located for only six cartels that primarily engaged in bid-rigging conduct.¹²⁶ Before 1945, bid-rigging episodes accounted for only 12% of all sample overcharges; during 1946-1989, it rose to 41%; but after 1989 it fell to 25% (Table 4 and Figure 5). Rather than a doubling or trebling of the proportion of bid rigging in natural markets, a more likely explanation may lie in a reorienting of the research interest of economists.

Fig. 5. Proportion of Overcharges from Bid-Rigging Episodes



¹²⁶ They are four early episodes of UK copper smelting (1787-1867), coal lightermen in London ((1700-1729), a UK books auction (1919), military gunpowder (1851-1862), power equipment in Japan (1931-39), and cast-iron pipes in the United States (1895-1896).

The well-publicized U.S. electrical equipment conspiracies discovered around 1957 and publicized in the early 1960s might have triggered awareness of the importance of bid rigging among economists. In addition, there were advances in economic theories of auctions that spurred interest in empirical testing the theories. Post-War studies of bid-rigging cartels focused on national cartels in the United States, most of them local milk or construction conspiracies. The immediate victims of most of these bid-rigging conspiracies were governments. Relatively few international cartels rely primarily on rigging auctions or tenders for public projects. What may seem like a refocus in research effort may also be a consequence of changes in data availability.¹²⁷ Most of the articles on bid rigging have drawn on public records of state or federal agencies that have been the objects of these conspiracies. It is possible that the increase in bid-rigging cases seen in the data is simply due to the advent of open-records laws in the 1960 and 1970s at the state and municipal levels similar to the federal Freedom of Information Act.

ANALYSIS OF OVERCHARGES

This section covers several topics. First, the number and pattern of overcharge estimates are explained. Second, a series of illustrations show the average heights of episodic overcharges according to analytically meaningful types. Third, the size distribution of overcharges is shown to be quite asymmetric, so special attention is focused on the highest overcharges responsible for skewing the sample. Fourth, I examine the relationship of peak to episodic estimates. Fifth, overcharges are related to geographic location, cartel size, and duration. Finally, I explore the size of overcharges from controlled market experiments.

Number of Overcharge Observations

There is a total of 2044 quantitative estimates of overcharges and undercharges drawn from about 350 publications.¹²⁸ The sample consists of 1535 episodic (long-term) and 470 peak estimates (highest price achieved for one year or less). Every estimate is assigned to one episode. Of the 1589 price-fixing episodes in the sample, 1536 (96.7%) have only an episodic estimate¹²⁹

¹²⁷ In the 1970s many U.S. state passed laws releasing bids on requests for proposals under open record laws. The U.S. Freedom of Information Act and similar national laws elsewhere opened up valuable, large data sets on government tenders. See Hansen (1985) and Athey et al. (2011).

¹²⁸ The same estimates sometimes appear in multiple publications (see Bibliography). Here I count only the total number of books, articles, and reports that contain one or more original estimates. The undercharges are entered as positive numbers.

¹²⁹ By “an estimate,” I mean to include a point estimate, single range, or the midpoint of a range.

and 53 (3.3%) have only a peak estimate, but 455 episodes (28.6%) have both types of overcharge estimates.¹³⁰

A large majority (65%) of the *episodic* overcharge estimates are drawn from international-membership cartel episodes (Table 4). More than two-thirds of the estimates (71%) come from episodes that were legally sanctioned and almost four-fifths (78%) from “classic” price-fixing schemes. The smallest cartel type by far is buyers’ cartels (4.6%).

The episodes may be classified according to their geographic extent or geographic region of operation. Of the episodic overcharges, 17% are local/subnational, 47% cover entire nations, 36% involved multiple nations within one continent, and 25% are global. In regional terms, the great majority of episodic overcharge estimates are drawn from Western European (30%) or North American (25%) conspiracies (Table 9). However, the share of episodic estimates drawn from episodes of *global* price fixing is also quite large (31%). Information on African, Asian, or Latin American cartels is relatively sparse. International-membership and global-international collusion tends to be more durable and to spawn far higher numbers of episodes per cartel than any other types of collusion.

Twenty-three percent of the 2005 overcharge figures that were assembled are *peak* price effects. In some cases, the peak price was reached for only one day during a cartel episode; in other cases, the peak may be the highest one of several years; most often peaks were portions of a year. Peak price changes indicate the potential for maximum harm when a cartel is at its most disciplined or when market conditions were most congenial. Classifying a particular estimate as an average or peak figure in a minority of cases required judgment. If the original source is unclear about which type of estimate is being presented, in order to be conservative I have assumed it is a peak estimate. Peak estimates are separately analyzed below.

Height of Episodic Overcharges by Type and over Time

Table 5 and Figure 6 display the medians of all episodic overcharges, distinguished by membership type, legal type, mode of pricing conduct, and time period. Some readers may prefer median averages, because nearly all the cells contain negatively skewed figures. That is, a few very high overcharges in any particular category tend to overwhelm the larger number of low-to-medium percentages when calculating the more common type of average, the mean. Moreover, while there is no upper limit on overcharge estimates, they cannot fall below zero. In such situations, the means are larger than the medians, and the median may be a better representation of central tendency. The median cartel overcharge for all types and Cartel Eras is 23.0% and for effective (“successful”) cartels 26.0%.¹³¹

¹³⁰ Note that $1536+455+53 = 2044$. Tabulations of episodic overcharges have only 1535 observations because one overcharge is infinity.

¹³¹ “Successful” cartels are those with nonzero overcharges. In the earliest report of this research (Connor 2005a), the median average was 25.0%, but as more observations were added, mostly from cartels ending in 1990-2013, the overall median has declined.

Table 5. Median Average Episodic Overcharges, by Year and Type

Cartel Episode End Date	Membership		Legal Status		Bid Rigging	Classic Price Fixing	Buyers' Cartels	ALL TYPES
	National	Inter-national	Found Guilty	Legal				
	<i>Median percent^a</i>							
Before 1890	8.4	18.2	26.1 ^b	16.0	85.0	19.3	32.5	19.3
1890-1919	19.5	35.0	15.0	31.3	12.5	31.6	25.0	34.5
1920-1945	20.0	35.0	27.0	29.0	20.0	29.0	12.5	29.0
1946-1973	24.0	28.5	16.7	24.0	18.7	21.2	57.0	19.5
1974-1989	13.5	15.9	21.5	18.5	15.0	22.3	12.5	18.1
1990-1999	27.5	45.5	23.9	21.0	17.8	22.1	20.0	24.0
2000-2013	20.0	15.0	20.5	57.0	21.0	25.1	36.7	20.0
ALL YEARS	18.2	26.0	22.0	27.7	20.0	24.0	26.3	23.0

Sources: Appendix Tables 1 and 2, summarized in J. Connor, *Price Fixing Overcharges Master Data Set*, spreadsheet dated December 2013.

- a) Medians of the point estimates or, where appropriate, of the midpoint of range estimates. Includes many zero estimates. See Table 4 for the numbers of observations in each cell.
- b) Only three cartels (but with 47 episodes) were deemed guilty prior to 1890: *Wholesale Grain Merchants in Greece* (guilty by public trial), *Anthracite Coal* (by U.S. court), and *Newcastle Coal* (by the UK Parliament).

Fig. 6. Median Episodic Overcharges by Cartel Type

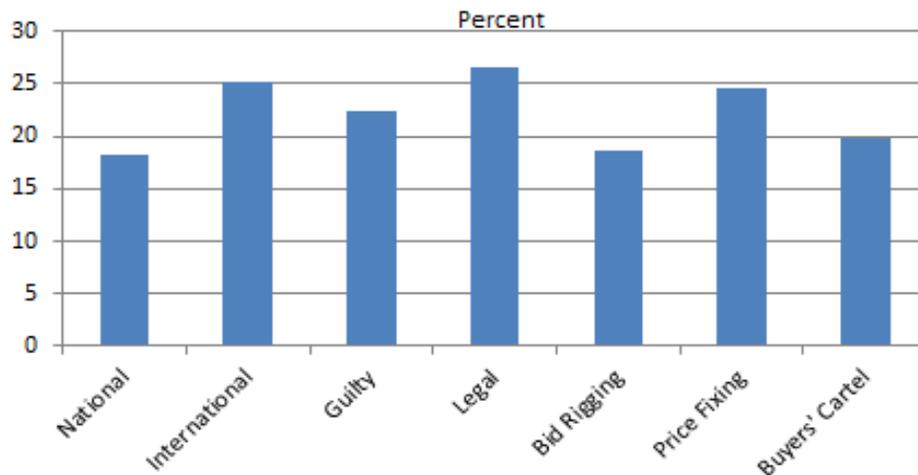
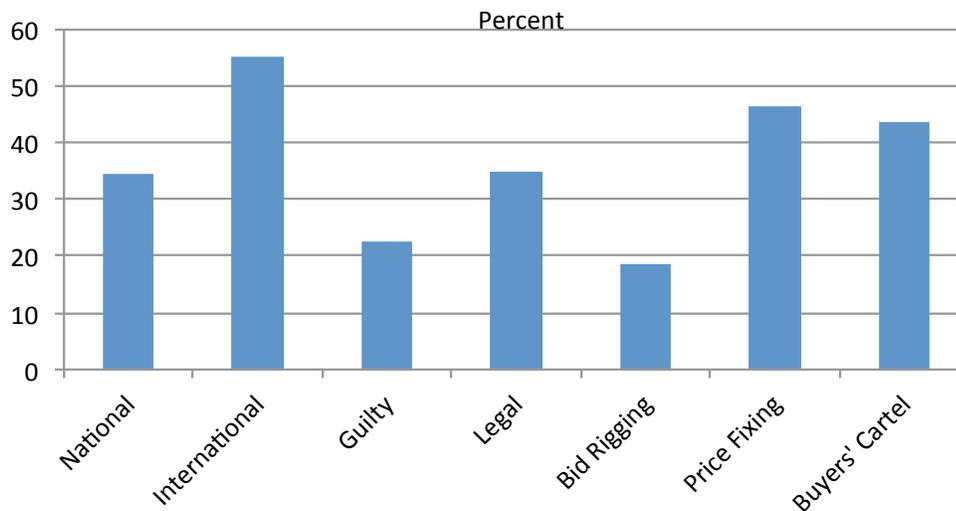


Fig. 7. Mean Episodic Overcharges by Cartel Type



I will demonstrate later below that the highest overcharge estimates are in no sense aberrations. They are generally taken well-conducted studies of cartel episodes that arose from monopolistically structured markets. These high estimates ought not to be rejected. Hence, the *mean* average, which is considerably higher than the median, also has a strong claim to represent the central tendency of the sample.

International-Membership Cartels

The median overcharge for national cartels is 18.2%, whereas for international cartels it is 25.1% (38% higher). Measured by the mean averages, international overcharges are 56% and national are 35% (Table 5B). Regression analyses verify that international cartels have overcharges about 45% higher than domestic schemes (Bolotova 2009: Table 4). The strongest categorical pattern is that until the 2000s in every historical period international cartels have had higher overcharge rates than domestic cartels (Table 5).

Up to the 1990s, international cartels were on average 133% more effective in raising prices than “national” (or domestic) cartels: those that fixed prices in one nation and were comprised of firms from that same nation. This is not so surprising in the pre-World War II era because most of the prewar sample of national cartels operated in the United States and achieved quite low

overcharges.¹³² But the fact that the differences persisted in the postwar period is somewhat unexpected. Besides antitrust-enforcement considerations, the greater pricing power demonstrated by international agreements may reflect a greater degree of freedom from threat of entry than for geographically more localized cartels. International cartels in all eras tended to attract members that controlled the lion's share of production in all the regions of the world with modern production facilities. Also, international cartels by their very nature deal with internationally tradable commodities, mostly homogeneous producer intermediates with relatively low long-distance transportation costs. Finally, international cartels can more easily engage in third-degree price discrimination among national markets than cartels organized within a single geographic market.

In the 1990-2005 period, the superior pricing power of international schemes ebbed. The median overcharge fell to an historical low of 24.4%. In a sharp break from the first five periods, overcharges of international cartels averaged only 16% higher than national ones. The reasons for the convergence of national and international cartel mark-ups are difficult to divine.¹³³

Bid Rigging Schemes

A somewhat similar difference may be seen in the higher median overcharges for classic price fixing over bid rigging. In the sampled cartels classic price-fixing conduct led to 32% higher median overcharges than observed for bid-rigging methods. Bid rigging cartels often are organized to exploit tenders for government public-works projects. Some economists have hypothesized that government buyers are less competent in detecting rigged bids than are professional industrial buyers.¹³⁴ Relatively few international cartels engage primarily in bid rigging, so this conduct category may be confounded with geographic extent or industry type (most are found in construction).

The apparently lower overcharges arising from bid rigging may be an illusion. Regression analyses suggest that overcharges from bid rigging are no different from classic price fixing (Connor and Bolotova 2006, Bolotova 2009). This finding has policy significance, because it undermines an assumption of the U.S. Sentencing Guidelines, which impose higher penalties for bid rigging. Most other governments have no stated guidelines imposing extra fines for bid rigging, but there is evidence that bid rigging of government tenders is treated more harshly (Connor 2009c).

¹³² Few international cartels in 1900-1945 had U.S. corporate members. Those U.S. companies that did join international conspiracies may have believed that they had structured their participation in international cartels in ways that would not run afoul the Sherman Act.

¹³³ One possibility is the rise in exports of manufactures from China. Prior to 2005, there is no example of a Chinese company forming or joining an international cartel. One reason is that on average China's large and fast-growing manufacturing sector is remarkably more competitively structured: The average CR4 in China in 2002-2006 was one-half as high as that in the United States, which is itself one of the most competitive in the world (Wang and Whalley 2014).

¹³⁴ Cohen and Scheffman (1989:345) also cite low normal profits and declining demand.

Sanctioned versus Unsanctioned Cartels

The difference in median overcharges for “legal” versus guilty cartels is rather small; punished cartels achieve lower median overcharges overall, though not in most Cartel Eras (Table 5). Regression analysis verifies that there is no significant difference in overcharges by legal status (Bolotova 2009: Table 4).

Contrasting cartels according to their legal status may shed light on “sample selection bias,” an important methodological issue in cartel studies. Many cartel studies depend on samples of *convicted* cartels, and critics of these studies have asserted that cartels discovered through government investigations or sued by private plaintiffs are as a group inept compared to cartels that either had no fear of sanctions or remained clandestine. “. . . [I]t is not known whether cartels that find themselves in court are unsuccessful or merely unlucky” (Carlton and Perloff 1990:216-217). In particular, an influential study by Asch and Seneca (1976) finds that price fixers that were caught in 1958-1967 were significantly less profitable during collusion than a control group of unprosecuted firms.¹³⁵ Lower profitability ought to go hand in hand with relatively low overcharges.

The data in Table 5 suggest a resolution of this paradoxical finding. Cartels punished in the time period covered by the Asch and Seneca study (1946-1974) were indeed relatively inept: their median overcharges of 14.3% are the lowest of the “guilty” cartels in any of the seven Cartel Eras. Moreover, their sample appears to have been drawn disproportionately from domestic bid-rigging conspiracies, the categories that throughout history have generated the lowest overcharges. While a more precise analysis is needed, it appears that the Asch and Seneca study may itself be flawed by sample selection bias.

Buyers’ Cartels

Blair and Harrison (2010) argue that monopsony and oligopsony are topics often given short shrift by economics and rarely addressed by the courts, in part because of the mistaken belief that if buyer power forces down prices below competitive level then consumers must benefit. In fact, if buyers explicitly collude on the price of a procured input, then an *undercharge*¹³⁶ is likely to be imposed on suppliers that is symmetric to the antitrust damages created by overcharges on buyers from sellers’ cartels (ibid. pp. 157-163). In both cases, industry output contracts from the level that would be seen in purely competitive or noncooperative oligopsonistic procurement markets and allocative inefficiency is created.

¹³⁵ The authors interpret their results in two ways. Firms are more likely to collude when industry conditions cause profits to decline, or cartels that are relatively ineffective at raising prices are also inept at hiding their illegal conduct and, consequently, the most likely to be detected and indicted by the antitrust authorities.

¹³⁶ Oddly, this term does not appear in Blair and Harrison’s book. They stick to the more rigidly formal economic jargon of a “Buyer Power Index.” They do not present more than one or two examples of empirical power estimates.

Blair and Harrison (2010) valiantly attempt to readers that buyers' cartels are "...far more prevalent than many have recognized" (ibid. pp. 1-14). Restricting their purview to cases brought in U.S. courts¹³⁷ or documented in publications by American economists, by my count they assemble a sample of 24 documented buyers' cartels.

Drawing upon a slightly older version of this work's price-fixing overcharges data, Jing Liu (2011) statistically analyzed the prevalence and unique economic characteristics of buyers' cartels. She finds four notable differences. Throughout history, only 5.5% of all cartel price effects were undercharges by buyer groups, but that ratio had risen from practically zero to above 8% after 1990 (ibid. Table 1). While sellers' cartels are mainly in manufacturing, buyers' cartels are preponderantly discovered in the food, tobacco, raw materials, and services industries (ibid. Table 4). Buyers' cartels are much more likely to be domestic bid-rigging schemes than other cartels (ibid. Figures 8 to 10). Finally, the average price effects of buyers' cartels are 33% weaker than those of sellers' cartels (ibid. Table 11). Enlarging upon her work, I find that scholars have published studies on 70 cartel undercharges; that these comprise 4.6% of the sample; and that median undercharges are 19.8%, the lowest type-of-cartel overcharges (4A and 4B).

Overcharges over Time

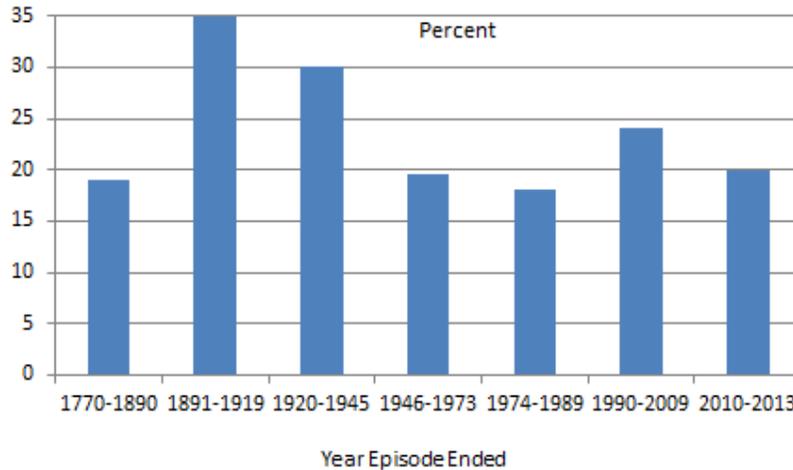
Cartel mark-ups vary according to time period, but it is hard to tell from the raw data whether the 300-year trend is rising or falling (Table 5 and Figure 8). They are above average for two periods (1891 to 1945), below average during two periods (1946-1989, and closer to the all-periods average for the other three Cartel Eras (before 1890 and 1989-2013). Variation over time appears to be related primarily to changes in the mix of cartels types. For example, overcharges are relatively high when the time-period mix is rich in unpunished and/or international cartels but poor in bid-rigging cartels (cf., Table 4).

Looking more deeply into the micro data (1531 episodes), a strong upward linear time trend in international-membership cartel episodes is apparent.¹³⁸ Episodic overcharges are slightly positively correlated with international membership ($r = 0.06$), but there is no evidence of a simple correlation of overcharges with any of the other cartel characteristics.

¹³⁷ In some cases, plaintiffs were denied standing or lost their cases.

¹³⁸ International membership is also bi-modal, rising sharply after 1880 and falling from a plateau after 1940 and repeating this pattern after 1989.

Fig. 8. Median Episodic Overcharges over Time



A finding emphasized in this study is the superior price effectiveness of international cartels relative to domestic ones (and correspondingly the higher mark-ups of geographically expansive collusion over small-scale schemes). However, this disparity is disappearing over time. A steep secular decline in episodic overcharges is evident among international cartels.¹³⁹ Median international-cartel overcharges were an unequalled 53.0% prior to 1920. During the Inter-War period these cartels attained only average levels of price effectiveness; median overcharges fell by 31% compared to before 1920. Given the poor economic conditions of the 1930s, the profits generated by these cartels may have been satisfactory. But overcharges continued to decline by 43% in 1947-1989 and finally by 60% in 2000-2013 relative to pre-1920 levels. In fact, prior to 2000-2013 international cartel episodes had exceeded domestic ones in every period by large margins, whereas in the most recent 14 years their positions had reversed!¹⁴⁰

Regression analysis confirms that, after changes in mix of types of cartels is taken into account, cartel overcharges were significantly lower after 1919 than before 1920 (Connor and Bolotova

¹³⁹ It is rather odd that the notable surge in discovered international cartels after 1990 came at a time when the profit incentives for cartel formation were at an historic low (Connor 2003). Of course, if profits declined in the 1980s and 1990s, it is possible that the *percentage increase* in expected cartel profits was at an historic high point. Uctum (1998) presents evidence of just such a decline in the USA, Canada, Germany, and Japan from the 1950s or 1960s to the 1990s.

¹⁴⁰ I do not often use explanation marks in professional writing. This is a most curious phenomenon that demands an explanation. Several experienced plaintiffs' antitrust attorneys have conveyed to me privately their surprise at the historically low overcharges being estimated by economist-experts in high-profile global damages cases.

2006: 1133). During the interwar period, overcharges were six to seven percentage points (about 20%) below the 1770-1919 reference period. During 1946-1989, overcharges were eight to 11 percentage points lower than the reference years. Finally, after 1989 – the era of strongest antitrust enforcement – overcharges declined about 40% below the pre-1920 reference period. While the temporal decline in cartel overcharges is undeniable, the historical forces responsible have not been pinned down. The rigor and geographic spread of antitrust enforcement seems to me the most natural candidate as the principal factor responsible, but other forces may be contributing.¹⁴¹

It is a challenge to explain the downward trends for some types of cartels. Besides the possible influence of the spread of effective anticartel enforcement, several alternative hypotheses may be put forward. Perhaps the application of more sophisticated quantitative methods by researchers in recent decades systematically yield lower estimates of price effects than the earlier studies that relied on simpler before-and-after comparisons. Perhaps expected profit rates in cartelized industries declined as the impacts of globalization were felt in formerly protected markets, and those companies that join cartels are satisfied with smaller percentage increases from collusion. Industry mix could provide an explanation. The sample drawn from the earlier periods tends to contain more minerals and metals conspiracies, whereas the later estimates have a higher proportion of chemical, construction, and services firms represented. Construction and services have historically returned very low profit margins. Because the most recent periods contain a higher proportion of cartels that were caught by antitrust authorities, the more recent estimates may be drawn from a population of cartels that is relatively incompetent in hiding their activities; similarly, the greater antitrust scrutiny in the United States from 1940 and from Europe since the 1960s could prompt cartelists to refrain from full monopoly pricing increases so as to reduce the chances of detection. Some of these hypotheses will be investigated below.

There are significant differences in the height of overcharges when the sample is split according to three cartel characteristics: national or international in membership, bid-rigging or classic price-fixing conduct, and sanctioned or unsanctioned cartels history. In the aggregate and for all Cartel Eras, highest mark-ups are associated with international membership, classic price-fixing methods, and no history of official sanctions (Figure 6). The patterns evident from these tabulated overcharges have been verified by a more formal statistical analysis (Connor and Bolotova 2006).

Unsuccessful Cartel Episodes

It is worth noting that there are relatively few unsuccessful cartels in the data set. Only about 6% of the overcharges indicate that an analyst judged an episode to have produced no significant effect on market prices, even though the members had established an agreement in principle to fix prices. I do not wish to make too much of this percentage. It may be understated because of

¹⁴¹ Globalization (through freer international trade and foreign direct investment) does not seem to be a strong alternative explanation. Most cartels appear in manufacturing. The rise of Asia as the world's new center of gravity for manufacturing may have played a subtle role in international cartels. Most of these cartels discovered after the mid 1990s (but organized typically from the early 1980s or later) contained non-Chinese Asian companies. It is possible that these firms were more likely to cheat or, more likely in my view, were more likely to have lower long-term profit goals (before and during collusion). Chinese firms have been the biggest spoilers of international cartels since about 1990; if they should become joiners rather than remaining on the fringe, cartel formations will rise.

selection bias in the studies relied upon. Injurious cartels may be inherently more interesting to analysts, because they are more policy relevant or the results more publishable than those about incompetent cartels. Not counting failures to discover a feasible contract, my intuition is that the true proportion of unsuccessful cartels (discovered and undiscovered) is likely to be higher than 6%.

Commodity Cartels

Recent research has discovered that so-called commodity (or primary-product) cartels are different from cartels at later stages of production. Commodity cartels are tied to the earth: they comprise the raw materials of mines, farms, or forests and the first-stage or primary processing of these raw materials (food processing, tobacco processing, basic metals, cotton and wool textiles, fertilizers, and wood). There are often tight geographic and vertical business relationships between these two stages of production.

The major findings are that primary-product cartels as a group have declined radically as a share of the total, yet have achieved 31% higher overcharges than did secondary-product cartels (Connor 2012a). The reasons for the latter result are unclear, but suggest that a greater effort should be extended to monitoring primary-product industries for signs of collusion.

Size Distribution of Overcharges

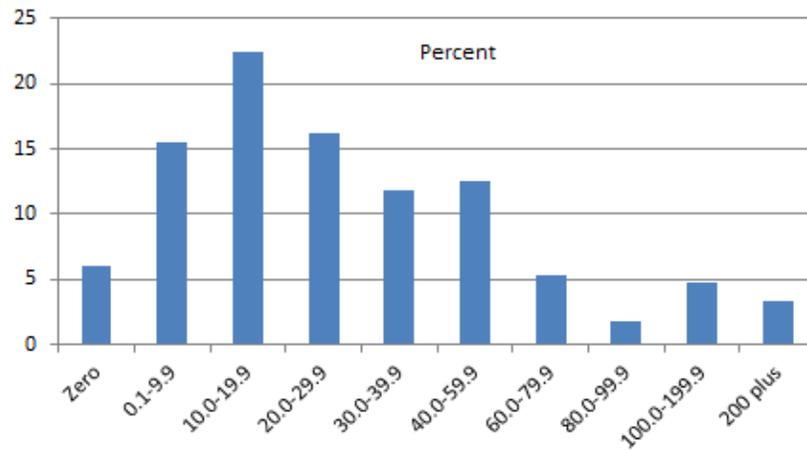
The cartel fining guidelines of several nations are based on formulas that are multiples of assumed overcharges (or proxies thereof), notably the EU and United States. Given the interest in the factual foundations of the U.S. Sentencing Guidelines applied to cartel sanctions, an examination of the size distribution of the overcharge estimates ought to be of interest. Figure 9 classifies the average estimates into eight size categories. Because the U.S. Guidelines are predicated on the assumption that the average cartel has a 10% overcharge, that break point is of special interest.

The discussion of Table 6 focuses on the effective cartels (non-zero overcharges). Perhaps the most striking result is that **60%** of the cartel episodes have overcharges above 20%.¹⁴² The remaining episodes have overcharges less than 20%. The mean overcharge of these episodes is 12%. *These are the episodes imagined to be typical by the creators of the U.S. Sentencing Guidelines.* By contrast, the 60% of the cartel episodes with overcharges of 20% or higher have a mean overcharge of 79.7%, which is eight times the level assumed by the authors of the U.S. Guidelines.

¹⁴² Note that from a legal perspective, each episode is an actionable offense. For the highest overcharges the implied own-price elasticities of demand are very large. One of the highest overcharges (800%) is for tungsten carbide, for which General Electric had a monopoly in the United States in 1927-1937. This newly developed material was sold at \$453/lb. to most customers and at \$360/lb. to a few favored buyers; up to 1927, Krupp sold it at \$50/lb. in the United States and during 1927-1937 at \$45 to \$50/lb. in Europe (Stocking and Watkins 1948: 132). These numbers imply that the U.S. elasticity of demand was 81.5 to 64.8.

The Guidelines were designed to deter recidivism, but even if one makes the wildly optimistic assumption that the probability of detection is 100%, five-eighths of the cartel episodes in the sample would have been under-deterred.

Fig. 9. Size Distribution of Episodic Overcharges



Percentage Range ^a	Number of Observations	Mean Average	Distribution of Observations	
			Total	Non-Zero
	<i>Number</i>		<i>Percent</i>	
Zero or less ^b	92	0	6.0	0
0.1-9.9 ^c	239	5.4	15.5	16.5
10.0-19.9	345	14.5	22.4	23.8
20.0-29.9	250	24.4	16.2	17.3
30.0-39.9	181	34.2	11.8	12.5
40.0-59.9	192	48.4	12.5	13.3
60.0-79.9	81	67.9	5.3	5.6
80.0-99.9	27	88.8	1.8	1.9
100.0-199.9	72	136.6	4.7	5.0
200 plus	50	563.9	3.3	3.5
Total	1540	48.7^d	100	100

Source: Appendix Tables 1 and 2, summarized in J. Connor, *Price Fixing Overcharges*

Master Data Set, spreadsheet dated October 2013.

^a Point estimates or midpoints of ranges.

^b Undercharges are converted to positive numbers.

^c Four estimates of “weak cartels” are assumed to be 1% overcharges.

^d For effective cartels (those with positive overcharges) the mean average is 58.9%.

Looking in Detail at Extreme Observations

As noted in the previous section, about 3% of the sample of episodic overcharges is 200% or higher. An anonymous reviewer and previous readers have expressed incredulity about these rates. Because they strongly affect the mean sample value¹⁴³, I will examine them in detail. Are the high-overcharge cartels from unique historical periods? Were the data or analyses of poor quality? Do their other traits differ significantly from the rest of the sample?

To answer these questions, Table A.1 isolates the 50 largest episodic overcharge observations and lists their essential characteristics.¹⁴⁴ It also includes in the last column my subjective qualitative evaluative of the reliability of the estimates – something I have refrained from doing elsewhere in this report.¹⁴⁵

The high-overcharge cartels tend to be drawn from older cases; their average beginning year is 1949 versus 1962 for the remaining effective observations. Another difference is that the high-overcharge cartels were on average two years more durable than the remaining cartels: 10.0 years as compared to 8.1 years. I would not ascribe the high estimated price effects to poorly executed analyses. Fully 75% of the grouped observations in Table 12 were rated from very good to excellent analyses.

In terms of overall industrial mix, the high-overcharge cartels look very much the same as their lower-overcharge counterparts: a few raw materials, some services, but mostly manufactured intermediate inputs. However, closer look reveals that a large proportion of the cartelized products were new products in great demand as essential industrial inputs with few or no practical substitutes and that near-monopoly supply conditions obtained (Appendix Table A2). Ship owners relied almost exclusively on hemp cordage for their rigging in the late 19th century. With the use of natural manures, farmers worldwide have become dependent on phosphate and potash for fertilization of crops. Radium was highly prized as a novel illuminant for instruments in 1912-18 when world production was dominated by a duopoly. Incandescent light bulbs were

¹⁴³ The reviewer suggested the 200% break point as worthy of special attention. The mean average of all 1,447 episodic non-zero overcharges is 51.02%. When the 49 overcharges of 200% or higher are excluded, the mean average drops to 32.57%, or by 36%. (The *median* average is very little affected: it falls from 24.8% to 24.0%).

¹⁴⁴ See the APPENDIX: SOURCES AND COLLECTION METHODS below.

¹⁴⁵ My assessment is based upon a combination of what I know about the quality of the price data available, craftsmanship in applying the method of overcharge analysis, professional reputation of the authors or organization responsible (if known), and evidence of balance in presentation of results (including peer or editorial review).

also quite new consumer products in 1922-1941 in many parts of the world, and a global cartel effectively created territorial monopolies almost everywhere except Japan. The tungsten carbide cartel was a U.S.-German territorial duopoly for what was then patented and the hardest machine coating material available for four decades.¹⁴⁶ (Note also the large number of mutually supporting independent studies of high overcharges).

I conclude that that is no reason to exclude the very high overcharges from the sample. They are high for reasons consistent with economic reasoning: very inelastic demand combined with duopoly or very tightly organized, monopolistic cartels and no threat of entry.

Peak Overcharges

So far, only the episodic overcharges have been examined – those that refer to the mean price change over all or most of a price-fixing episode. Figure 10 and Table 7 display over 500 peak price effects attained by cartels – the maximum, usually brief mark-ups observed for one week, one month, one quarter, or one year of an episode, depending on the price series available. It is not always clear from a source whether a price effect being reported is episodic or peak; if it is vague, the effect is classified as peak.

It is well known that collusive arrangements typically generate price changes that fall short of what a pure monopolist in a blockaded market would set in order to obtain maximum profits. Tacit collusion generally results in prices that are above, but closer to competitive levels than to monopoly levels. While overt collusion should be somewhat more effective than tacit collusion at raising prices *ceteris paribus*, information failures, potential competition, and cheating also typically result in sub-monopoly price effects. Because the peak periods are generally too brief for significant changes in the structure of the industry to change, the observed peak overcharges are measures of the short-run market power exercised by cartels when the market-structure conditions are closest to optimal and the discipline of the members is at its most cohesive.¹⁴⁷ Thus, the peak price effects are instructive about the potential harm that cartels can cause when they are unfettered by coordination problems.

From Figure 10 it is apparent that on average the peak overcharges are 60% to 80% above the episodic overcharges for all types of cartels except buyers' cartels. Table 7 shows the median peak overcharges in detail over time and across types of effective cartels. The highest median peak cartel mark-ups are from the interwar period.¹⁴⁸ For all types of collusion, there is no trend

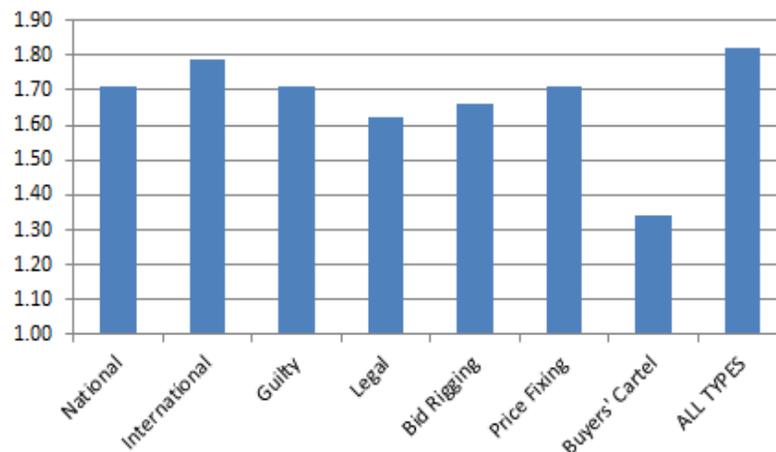
¹⁴⁶ Tungsten carbide was simultaneously invented by General Electric and Krupp Steel in the early 1920s. Only industrial diamonds are harder, but natural diamonds were prohibitively expensive for most industrial applications until artificial diamonds were first marketed in the 1950s.

¹⁴⁷ Peak price changes may well be affected by short-run shifts in demand. Exogenous, unanticipated shifts in demand may exaggerate the peak price changes. However, in some cases these shifts are endogenous. Especially when a well financed cartel felt free to announce a new agreement that buyers perceived as likely to be effective, "panic buying" often ensued, which amplified the purely collusive effect on prices.

¹⁴⁸ Approximately one-fifth of the 413 observations available for Table 7 refer to interwar cartels, which have been well studied by economic historians who often had available public commodity-exchange prices. Forty-two percent of the observations on peak prices are for episodes ending after 1989.

in peak effectiveness over time.¹⁴⁹ There is a slight decline over time in peak overcharges of international cartels and a weak positive trend for bid rigging.¹⁵⁰ The absence of significant time trends for peak overcharges reinforces the idea that these are proxies for monopoly overcharges.

Fig. 10. Median Ratio of Peak to Episodic Overcharges



The pattern of peak overcharges across cartel types is similar to that for the effective episodic overcharges (Table 7): (1) In all Cartel Eras, international cartels were able to reach higher levels of peak price effectiveness than the “national” cartels – on average 86% higher; (2) Peak mark-ups are also higher (68% higher) for legal cartels than for sanctioned ones; and (3) Cartels that fixed prices or production levels are 85% more harmful as bid-rigging agreements, both overall and in each of the seven Cartel Eras.

Table 8 provides calculations of *how much higher* median peak overcharges are compared the median episodic overcharges. Generally speaking, the peaks are about 50% to 70% of the episodic mark-ups. There are no noteworthy trends in these ratios over time. However, the ratios for international cartels are far lower than domestic schemes, and lower for bid rigging than for classic price fixing. These ratios have a couple of interesting interpretations. First, a high ratio may be regarded as inverse indicators of *pricing efficiency*. An efficient cartel is one that has

¹⁴⁹ The correlation of episode end year with peak overcharge for all 413 observations is not significantly different from zero.

¹⁵⁰ The correlation over time (the end year of each episode) for international cartels is $r = -0.102$ and for national cartels $r = +0.070$; for bid-rigging schemes, there is a weak positive time trend ($r = +0.085$); but for guilty cartels, legal cartels, and classic price-fixing cartels, there is no time trend.

achieved episodic prices that are close to the profit-maximizing (monopoly) price. That is, low ratios may be interpreted as cartels that achieved few operational problems or external challenges from customers or fringe producers. If this latter interpretation is correct, then peak/average ratio is a rough indicator of price instability during a conspiracy.¹⁵¹ Second, the international cartels and bid-rigging arrangements are relatively efficient. These hypotheses await formal tests.

Table 7. Median Average Peak Overcharge Estimates, by Year and Type, Effective Cartel Episodes

Cartel Episode End Date	Membership		Legal Status		Bid Rigging ^b	Classic Price Fixing	Buyers' Cartels	ALL TYPES
	National	Inter-national	Found Guilty	Legal				
	<i>Median percent^a</i>							
Before 1890	55.5	114.5	46.8	64.0	21 ^b	65	--	59.5
1890-1919	33.6	85.0	33.3	71.7	--	51.3	430.0	51.3
1920-1945	48.0	72.0	52.5	72.0	50 ^b	69.0	7.6	67.0
1946-1973	45.9	53.0	49.0	45.6	42.6	59.0	42.8	49.0
1974-1989	27.4	74.0	29.4	315 ^c	27.5	70.0	11.3	31.0
1990-1999	23.7	50.0	49.0	16.7	44.0	48.9	21.9	48.9
2000-2013	30.1	45.0	50.0	30.5	40.0	18.2	7.6	38.8
ALL YEARS	33.3	60.5	45.0	67.0	28.2	52.9	10.2	50.0

Sources: Appendix Tables 1 and 2, summarized in J. Connor, *Price Fixing Overcharges Master Data Set*, spreadsheet dated December 2013.

a) Medians of the point estimates or, where appropriate, of the midpoint of range estimates.

b) Only four peak observations before 1946, so comparisons with classic price fixing are problematic.

c) Three of the four estimates from the global *Mercury* cartel only; hazardous to compare with the guilty cartels.

¹⁵¹ These ratios could be relevant for assessing whether cartels intend to maximize profits through price increases (as most economists assume) or whether the goal is to control *variation* in their output or prices. Apologists for cartels, particularly those writing about international cartels during the Great Depression, tended to assert that cartels did not aim to raise prices so much as stabilize prices (Marlio 1947, Pyndyck 1979). There is little evidence in table 8 that the interwar, international cartels achieved greater price stability than those ending before or after the interwar period.

Table 7A. Number of All Peak Overcharge Estimates, by Year and Type								
Cartel Episode End Date	Membership		Legal Status		Bid Rigging	Classic Price Fixing	Buyers' Cartels	ALL TYPES
	National	Inter-national	Found Guilty	Legal				
	<i>Number</i>							
Before 1890	17	2	4	15	3	14	0	17
1890-1919	54	30	25	59	0	84	0	84
1920-1945	16	72	31	57	1	87	1	88
1946-1973	24	19	23	20	14	29	3	43
1974-1989	26	25	44	7	22	29	3	51
1990-1999	16	119	130	5	18	117	7	135
2000-2013	29	58	79	8	32	55	13	87
ALL YEARS	182	325	336	171	90	417	27	507

Sources: Appendix Tables 1 and 2, summarized in J. Connor, *Price Fixing Overcharges Master Data Set*, spreadsheet dated December 2013.

Table 7B. Median Average of Positive Episodic Overcharges, by Year and Type								
Cartel Episode End Date	Membership		Legal Status		Bid Rigging	Classic Price Fixing	Buyers' Cartels	ALL TYPES
	National	Inter-national	Found Guilty	Legal				
	<i>Median percent^a</i>							
Before 1890	20.6	74.0	24.4 ^b	17.6	16.2	22.6	36.5 ^c	22.0
1890-1919	24.8	59.8	24.4	44.0	24.5	44.0	430 ^c	36.8
1920-1945	20.0	39.5	44.9	36.7	34.0	37.0	6.4 ^c	36.9
1946-1973	18.8	42.0	28.2	17.9	14.2	23.9	47 ^c	22.5
1974-1989	16.9	43.5	20.0	9.7	20.0	21.5	23.0	20.0
1990-1999	18.9	25.1	24.6	21.5	18.9	25.0	16.9	24.0
2000-2013	23.3	20.2	20.3	18.4	18.0	21.0	17.6	20.0
ALL YEARS	20.0	27.0	23.3	30.0	19.8	26.6	21.6	25.0

Sources: Appendix Tables 1 and 2, summarized in J. Connor, *Price Fixing Overcharges Master Data Set*, spreadsheet dated December 2013.

a) Medians of the point estimates or, where appropriate, of the midpoint of range estimates. This table excludes zero estimates. On average, 94% of all episodic overcharges are above zero, and that percentage increases over time. Very few peak overcharges are zero.

b) Only three cartels (but with 47 episodes) were deemed guilty prior to 1890: *Wholesale Grain Merchants in Greece* (guilty by public trial), *Anthracite Coal* (by U.S. court), and *Newcastle Coal* (by the UK Parliament).

c) Only five peak observations before 1974, so comparisons with totals are problematic.

Table 8. Ratio of Peak/Episodic Effective Overcharges, by Year and Type								
Cartel Episode End Date	Membership		Legal Status		Bid Rigging ^b	Classic Price Fixing	Buyers' Cartels	ALL TYPES
	National	Inter-national	Found Guilty	Legal				
	<i>Ratio of Medians^a</i>							
Before 1890	2.69	1.55	1.92	3.64	1.30	2.88	--	2.70
1890-1919	1.35	1.42	1.36	1.63	--	1.17	1.00	1.39
1920-1945	2.40	1.82	1.17	1.96	1.47	1.86	1.19	1.82
1946-1973	2.44	1.26	1.74	2.55	3.00	2.47	0.91	2.18
1974-1989	1.62	1.70	1.47	--	1.38	3.26	0.49	1.55
1990-1999	1.25	1.99	1.99	0.78	2.33	1.96	1.30	2.04
2000-2013	1.29	2.23	2.46	1.66	2.22	0.87	0.43	1.94
ALL YEARS	1.67	2.24	1.93	2.23	1.42	1.99	0.47	2.00
Sources: Tables 5A and 7 above.								
a) Medians of the point estimates or, where appropriate, of the midpoint of range estimates. Excludes zero estimates.								
b) Only four peak observations before 1946.								
-- = Not available								

Overcharges by Location of Cartel

Lawmakers and antitrust enforcement officials may be interested in the locus of decision-making by the cartels in the sample. Figure 10 and Table 9 classify episodes according to the location of the cartel's headquarters or the place of residence of the great majority of the cartel's corporate members. In many cases, corporate membership mix corresponds to a cartel's geographic field of operations, which is examined next.¹⁵²

Cartels may be composed of member companies with headquarters in only one country or one continent; many contemporary cartels are "virtual" joint ventures with no permanent addresses. On the other hand, many early 20th century cartels established secretariats with professional staffs in London, Zurich, or similar locations. In more recent decades trade associations or management consulting firms have assisted with cartel operation. In these cases, the geographic locus is easy to identify. Cartels with corporate members from multiple regions are more difficult to classify, but if a supra-majority of the companies were headquartered entirely in North America, Western Europe, or Asia, the cartel is categorized in one continent. Global

¹⁵² The major exception is export cartels, which are categorized in their country or region of origin but set prices in the "rest of the world."

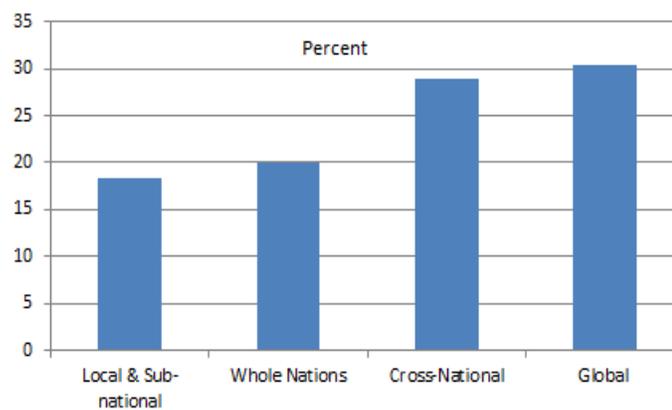
cartels are international cartels that fixed prices on two or more continents; nearly all global cartels aimed at controlling prices in at least Western Europe, North America, and East Asia.

Table 9. Average Episodic Overcharge Estimates, by Geographic Concepts				
Location of Cartel Members' Headquarters or Region of Operation	Number of Estimates	Median Overcharge	Mean Overcharge	Mean Positive Overcharge
		<i>Percent</i>		
Membership Composition ^a				
USA and Canada	405	21.0	40.8	43.9
Multiple Nations in W. Europe (EU) ^b	184	29.2	49.9	52.8
Single Nations in W. Europe	275	16.1	62.3	67.4
Asia and Oceania	140	20.0	41.9	44.5
Africa, Latin America, & E. Europe	50	19.4	21.3	22.6
Global (Companies from Two or More Continents)	480	27.5	51.9	54.2
Where Collusion Took Place ^a				
USA and Canada	512	22.0	38.3	40.2
Multiple Nations in W. Europe (EU) ^a	141	25.0	38.1	39.8
Single Nations in W. Europe	292	16.1	60.5	65.4
Asia and Oceania	146	20.4	37.9	40.1
Africa, So. America, & E. Europe	61	20.0	23.4	23.4
Global (Two or More Continents)	383	30.4	65.6	71.6
Geographic Extent of Collusion				
Global (Two or More Continents)	383	30.4	65.6	71.6
Non-Global:	1152	20.1	43.1	44.0
Cross-National ^c	559	29.0	56.8	60.8
Single National:	976	20.0	44.1	46.7
of which local/regional	286	18.3	36.8	39.5
Total	1535	23.0	48.7	51.8
Sources: Appendix Tables 1 and 2, summarized in J. Connor, <i>Price Fixing Overcharges Master Data Set</i> , spreadsheet dated December 2013.				
a) Export cartels that drew their membership from one nation or region are counted in that geographic area. However, many national-membership cartels affected world trade; hence, their "market location" is Global.				
b) Cartels that operated across several nations of the 27-Member European Union, most of them discovered and convicted by the European Commission.				
c) A high proportion of these cartels are either global (69%) or EU-wide (23%).				

Geographic Spread and Price Effects

The section above looked at examined differences in overcharges according to cartel membership composition. Here I analyze whether cartel overcharges vary due to the geographic scope of their pricing conduct. Four categories of geographic scope are employed. From most extensive to least, they are: (1) *Global* (pricing schemes designed to affect two or more continents), (2) *Cross-National* (price effects in multiple countries in one continent or in world trade), (3) *National* (price effects intended for only one national market or a portion of it), and (4) *Local/Sub-National* (a small geographic area, such as one or a few municipalities, counties, or regions of a single state). All local cartels are also national cartels, but not the reverse. Otherwise, the categories are non-overlapping.

Fig. 11. Median Average Overcharges by Geographic Extent of Pricing

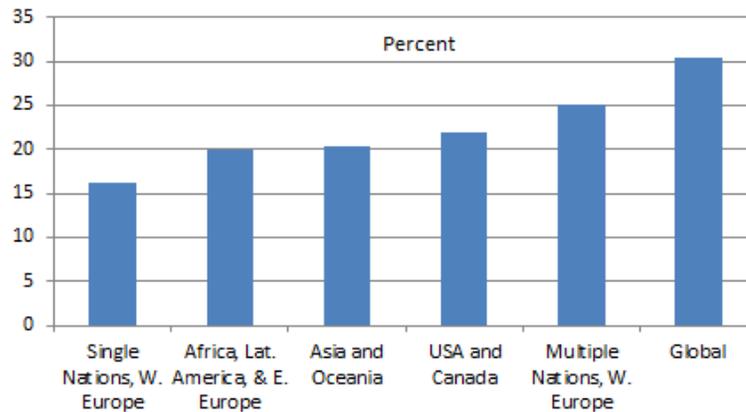


Geographic spread of collusion makes a difference in episodic price performance (Figure 11). Using the Global cartels as the *numeraire*, the data show that Cross-National cartels achieve 5% lower median and 13% to 15% lower mean overcharge rates. Single-Nation cartels fare substantially worse, with rates 33% to 35% below their Global counterparts. Finally, Local/Sub-National cartels face the greatest challenges in raising prices; relative to Global types, small-area cartels generate margins that are 40% to 45% lower than Global.

The lesson is clear: Cartelists that are fortunate enough to co-opt all the world's suppliers into a price agreement are far more likely to profit handsomely than are firms trying to rig bids on a municipal tender. There may be many explanations for this disparity, but the superior ability to global cartelists to deal with entry by fringe suppliers and to exploit geographic price

discrimination must rank high on the list. Because the Cross-National cartels suffer little in price-raising ability on average, operating across customs unions like NAFTA and the EU seems to keep many fringe producers at bay because of distance or trade barriers.

Fig. 12. Median Average Overcharges by Geographic Location of Pricing



Grouping cartels by geographic regions produces parallel results (Figure 12). Those that operated in only one Western European country have on average the lowest overcharges; cartels in single nations in the ROW were slightly more profitable – with median overcharges around 20%. Cross-national cartels -- those managed across North America,¹⁵³ the EU, or other adjacent nations -- have significantly higher overcharges than the single-nation cartels. But those organized across continents were as a group the most successful. In general, cartels able to organize themselves over broader geographical areas were able to achieve higher price effects than those in smaller zones.

There are some significant differences in average cartel overcharges across geographic regions. Those that operated in one Western European country have the lowest overcharges, but those organized across national boundaries in Western Europe were as a group the most effective in raising prices.¹⁵⁴ North American conspiracies were also quite low.¹⁵⁵ Median overcharges for

¹⁵³ Defined here as the USA and Canada, but could include Mexico in many cases because of the absence of formal tariff barriers. Unfortunately, until recently the Mexican federal antitrust commission did not often prosecute international cartels. Connor and Bolotova (2006) confirm that North American cartels and single nations of Western Europe as a whole have significantly lower overcharges.

¹⁵⁴ In the past few decades, these correspond to intra-EU international cartels.

global conspiracies were relatively high.¹⁵⁶ In general, cartels able to organize themselves over broader geographical areas were able to achieve higher price effects than those in smaller zones.

Market Structure

Overcharges are a measure of group (multilateral) market power exercised. A long tradition of empirical research in industrial economics has demonstrated a strong association between market power and several dimensions of market structure. For example, high seller market concentration raises sellers' power, while buyer concentration lowers it. While information on market structure is difficult to obtain (particularly for older cartels), Bolotova (2009) constructed a sample of 156 international cartels discovered between 1990 and 2005 that includes five measures of market structure (Table 2). These variables have as a group strong power to explain variation in overcharges.¹⁵⁷ Bolotova's regression results demonstrate that the cartel supply share (close to seller market concentration) is positively related to overcharges and buyer concentration negatively related, as expected (Table 5). Furthermore, inequality of size among the cartel members (the leading firm's market share) lowers overcharges. Two other structural variables were not statistically significant.

There are historical examples of cartels that ended because of the growth of fringe production; in such cases, one would expect supplier concentration to decline after collusion ends. The vitamin C cartel of the 1990s is one well-documented case (Connor 2007b). However, that may not apply to cartels that were broken up through enforcement actions. A recent study by Levenstein *et al.* (2011:12) examines the levels and changes in an importer-based proxy for supplier concentration.¹⁵⁸ While their sample is limited to seven global organic chemicals cartels in the 1990s that ended because of antitrust actions, they find that supply is very highly concentrated in all cases. A key regression analysis shows that three to four years after the break-up year, in six out of seven cases there was no significant decline in concentration (*ibid.* Table 8).

Overcharges and Duration

The price-fixing overcharges data set includes information on duration for each cartel episode. It is very likely the largest data set on cartel duration in existence. An earlier, smaller version of these data was analyzed by Zimmerman (2005) and by Abrantes-Metz and Connor (2009). Connor and Bolotova (2006) found evidence of a positive relationship between the two.

¹⁵⁵ Connor and Bolotova (2006) confirm that North American cartels and single nations of Western Europe as a whole have significantly lower overcharges.

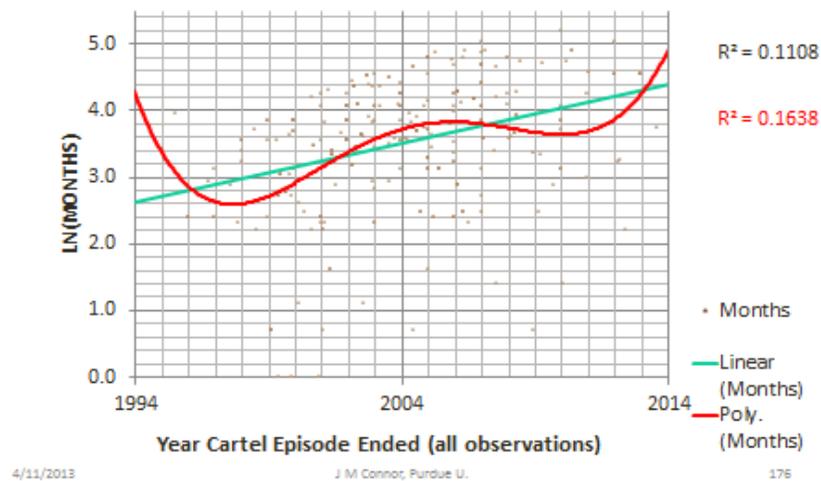
¹⁵⁶ When this analysis is repeated using post-1989 data, the ranking remains the same but differences are smaller.

¹⁵⁷ Market structure variables are far stronger explanatory variables than industry type or geographic location (Bolotova 2009: Table 5). In a broader sample of cartel episodes, industry was the strongest explanatory group. This is evidence that industry variables capture variation in the structure of supply.

¹⁵⁸ The Herfindahl index is computed from national import values for several years before and after the cartel broke up. It may be understated because in some cases (probably uncommon) two cartel members may each have plants in the same exporting country and because domestic production in the importing country is ignored.

The relationship of overcharge rates to episodic duration seems tenuous. I examined many plots of the two variables for various Cartel Eras and for various types of cartel conduct. Generally, overcharge rates were found to be impervious to variation in either time or collusive duration. However, for a sub-sample of 352 contemporary global price-fixing episodes, duration is rising over time (see chart below), while overcharge rates were holding firm. This implies a need for greater antitrust priority for this class of cartels.

Logarithm of Duration of Contemporary Global Cartels (1990-2013): **Trend Is Rising**



Overcharges and Market Size

The affected sales of discovered cartels since 1990 have become progressively larger.¹⁵⁹ A commentary in the U.S. Sentencing Guidelines asserts that there is an inverse relationship between the size of affected sales and the height of the overcharges achieved by cartels (USSG 1987). This commentary implies that judges are authorized to approve fines for criminal price fixing by cartels with large affected sales that are smaller per dollar of affected sales than for members of cartels with small affected sales. No conceptual or empirical justification is provided for this assertion in the Guidelines themselves.¹⁶⁰ Moreover, subsequent empirical evidence

¹⁵⁹ It is difficult to know whether this statement applies to cartels throughout the 20th Century.

¹⁶⁰ The original testimonies about the USSGs are unpublished (U.S. Sentencing Commission (1987)). However, the few empirical studies of cartels with information on price effects available to the Sentencing Commission in 1986 (e.g., Hay and Kelley 1974, Asch and Seneca 1975, Fraas and Greer 1977, Posner 1976). Eckbo (1976) and Griffin (1989)) do not link the prices to cartel size.

does not support a positive market size-overcharge connection.¹⁶¹ Bolotova's (2009) regression analysis of a large sample of modern international cartels finds that a cartel's affected sales is unrelated to cartel overcharges (Table 5).

Laboratory Market Experiments

The overcharges reported in this paper are derived from studies that use a wide variety of analytical methods (see Connor 2007c). Most of these methods are not controlled scientific experiments in the strictest sense. Some come from econometric studies, which are quasi-experimental results derived from observations taken from natural markets.¹⁶² Controlled market experiments now provide supplementary results about overt collusion that reinforce outcomes about cartel price effects using older methods.¹⁶³

Since at least 1948, economists have been reporting on prices generated by controlled, small-scale laboratory market experiments.¹⁶⁴ The supply sides of these games are oligopolies, and the treatments consist of changes in the number of players, supply conditions, available information, trading rules, and seller communication protocols. Goods are almost always homogeneous and bought by anonymous buyers. All laboratory experiments allow the players to "communicate" tacitly through observed transaction prices or quantities, but a smaller number permits sellers or buyers to talk. Only the latter type opens up the possibility of cartel behavior.

A classic survey of laboratory experiments with homogeneous-product monopoly and oligopoly can be found in Plott (1989: 1142-1159). The predictions of pure monopoly theory are verified by these controlled experiments. One laboratory experiment finds that "[W]hen the monopolists post prices, market behavior is ... accurately captured by monopoly theory" (*ibid.* p. 1144). That is, buyers end up paying the monopoly price.¹⁶⁵

¹⁶¹ Appropriate data to test this proposition are contained in Connor (2003: Tables A.1 - A.12). This working paper develops affected sales and overcharge data for a modest sample of modern international cartels: approximately 92 pairs of such data are available. Sales are in current U.S. dollars and generally fall into the decade of the 1990s. Correlation statistics were calculated for a number of sub samples. The first sample of 50 cartels examined the largest geographic market for each cartel; the coefficient correlating sales and overcharge rates was not significantly different from zero ($r = -0.105$).

To see whether extreme observations might unduly affect the result, I repeated the experiment but dropped first all cartels with \$5 billion in sales or more and second all cartels with overcharges of 65% or higher; in both cases r became closer to zero (-0.065 and $+0.019$, respectively), which indicates that extreme observations do not account for the low correlations found. Finally, I examined geographic sub groups of the cartels: global, U.S., EU and other single national markets. The correlations for these four samples varied from -0.17 to $+0.24$, none statistically significant.

¹⁶² List (2006, 2011) argues for the continuing importance of field experiments in economics.

¹⁶³ Levitt and List (2007) argue that laboratory market experiments too have their limitations.

¹⁶⁴ Industrial-organization pioneer Edward Chamberlin (1948) was the first to publish the results of a laboratory market experiment. The Nobel Prize in Economics was granted to Prof. Vernon Smith for his innovative research in laboratory markets.

¹⁶⁵ When the exchange mechanism is the double oral auction, buyers pay prices slightly below the full monopoly price (Plott 1989: 1143).

Cartel Experiments

More apropos this survey are oligopoly experiments that simulate cartels. A central conclusion of oligopoly experiments is that “market participants almost always recognize a harmony of interests” and that where direct communication is not permitted, observation of bids, offers, or transaction prices is one way that tacit agreements are realized (*ibid.* p. 1149). In other oligopoly experiments that allowed traders to talk among themselves (but prohibited profit-sharing or side payments), traders “discussed conspiracy almost immediately and they had no difficulty in articulating an agreement” (*ibid.* p. 1150). When the few sellers post prices and have full information about each other (i.e., perfect monitoring within the collusive group), prices are supra-competitive (*ibid.* p. 1154). Long periods of interaction also facilitate collusion. Similarly, bid riggers who post their offers are able to reach infra-competitive prices (*ibid.* p. 1157).¹⁶⁶ Perhaps because profit-sharing, side payments, and punishment for cheaters are not allowed (all common features of cartels), collusion experiments result in prices below the full monopoly (above the monopsony) price.

More recent experiments reinforce the importance of information and transparency among sellers in a cartel in achieving pricing effectiveness (Haan *et al.* 2009). Under tacit collusion, information about other sellers cannot be shared and sellers cannot talk to each other before or during trading. Experimental markets with tacit collusion generally result in competitive prices, except for homogeneous-product duopolies, which usually achieve Cournot-level prices. First, access to rival sellers’ information can be collusive. If private information about current sellers’ costs or market shares is made available voluntarily, through a trade association for example, experiments with repeated games produce collusive effects. Revealing information about all past outputs and profits of rival sellers usually increases collusion. Second, with posted pricing, explicit collusion among sellers who can easily detect cheating typically results in near-monopoly prices. Third, if sellers explicitly collude on *list* prices but buyers can also communicate and ask for secret discounts, *transaction* prices are still well above competitive levels; collusion ends only if sellers compete on both list and transaction prices.

The Cartel Monopoly Index (CMI)

A meta-analysis of 154 oligopoly publications reporting on 512 controlled experiments focuses on the collusive price effects of sellers’ oligopolies under various treatments (Engel 2007). These oligopoly price effects are reported using a measure of pricing *efficiency or effectiveness* that I will call the *Cartel Monopoly Index (CMI)*.¹⁶⁷ The monopoly index divides the observed equilibrium overcharge by the maximum possible (monopoly) overcharge, expressed as a

¹⁶⁶ However, like monopoly, both buyers’ and sellers’ cartels showed weaker price effects when the trading system was a double auction.

¹⁶⁷ I have coined this term because I can find no previous writer seems to have done so. Engel also presents two other pricing efficiency indexes, but little is lost by focusing on only the CMI.

percentage.¹⁶⁸ Because the monopoly price is the highest that would be observed in long-run equilibrium, the CMI is a useful indicator of how close a particular cartels came to extracting the maximum monopoly profits in a given market setting, whether in an artefactual laboratory on a natural market.¹⁶⁹ When cheating is tolerated or punishment mechanisms are not credible, the CMI will drop below 100%.

Without specifying the type of collusion, the efficiency of collusion increases with the fewness of sellers; CMI is highest for duopoly experiments (CMI=62%), lower for triopolies (CMI=43%), and lower still for quadropolies (CMI=14.6%)¹⁷⁰ (Engel 2007: 504-506); similarly, the use of posted prices intensifies collusion relative to other pricing systems (*ibid.* pp. 537-538).

There are three experimental designs that shed light on collusion with overt communication. First, some experiments permit communication among sellers *before* trading begins (the classic Prisoners' dilemma with "cheap talk"), and this may permit either misleading posturing or a degree of trust to develop among sellers. Collusion *with* prior communication seems to instill trust, because it generally results in more efficient collusion than when communication is prevented (*ibid.* pp.521-525). The efficiency of price collusion when communication occurs depends strongly on certain interactive factors. When the choice variable is quantity (i.e., a Cournot game in which price is an outcome, not a choice variable), cartels achieve higher pricing power (CMI=74%) than do tacitly colluding sellers (CMI=47%); experienced sellers that are allowed to talk (possibly a proxy for trust) achieve much higher pricing efficiency (CMI=73%) than inexperienced participants (CMI=24%); and price effects are stronger when sellers have good *ex ante* information (CMI=61% to 64%).

Second, a necessary feature of cartels is that sellers can conclude an enforceable agreement. In laboratory experiments, the availability of an enforceable agreement significantly increases price effects under certain conditions: when concentration is high (with duopoly CMI=87%), when buyers are anonymous (CMI=84%)¹⁷¹, when the game is Cournot (CMI=79%), when sellers are symmetric (CMI=93%), and when their capacity is unconstrained (*ibid.* pp. 523-528). Thus, when an enforceable agreement is concluded, high seller concentration, seller symmetry, low

¹⁶⁸ $CMI = (P - P_c) / (P_m - P_c)$, where P is the observed average outcome price, P_m the monopoly price, and P_c competitive benchmark price. The same indexes can be computed for quantity experiments. CMI cannot be converted into Lerner or overcharge indexes.

¹⁶⁹ There are five cartel studies using data from natural markets that reveal the necessary overcharges to compute a CMI (i.e., an episodic cartel overcharge and a predicted monopoly price). Ellison (1994) found that CMI=80% for the five-member Joint Executive Committee railroad cartel. Genosove and Mullin (2001) computed a lifelong CMI of 11% for the 14-firm U.S. sugar cane refining cartel; during three 1890-1914 episodes CMI=70% to 83%; however, *the peak price reached CMI=95%* in one year. Yu (2003) finds a CMI of 79% for imports of "oil-country tubes" from a European export cartel into selected developing countries in 1990-1995. Clay and Troesken (2003) find a CMI of 83% to 94% for four episodes of the U.S. Whiskey Trust 1882-1895. Crespi and Chacon-Cascante (2004) predict CMIs of 63% and 66% for the U.S. domestic price and the world export price, respectively, of California almonds in 1962-1997.

¹⁷⁰ However, CMI does not decline from N=4 to N=5, and the pattern for more than five sellers is irregular.

¹⁷¹ By "anonymous" is meant that sellers face a computerized demand curve, which seems to me equivalent to a large number of buyers. With face-to-face human buyers (i.e., small numbers of buyers), CMI is below 14%.

buyer concentration, homogeneous products, or excess capacity resulted in Monopoly Indexes above 70%.

Third, one experiment shows the profound price effects that result when sellers can communicate after bidding begins (Fonseca and Normann 2011). The CMI of a duopoly averages 94%, and it declines when the number of sellers increases from 2 to 4 (CMI=81%), to 6 (CMI=65%), or to 8 (CMI=55%). However, compared to tacit collusion, explicit agreements result in smaller price gains under duopoly and when N=8 than when N is 4 or 6 (*ibid.* p. 11). Similarly, when sellers expect a fine that is high (half of the monopoly gains), the sellers choose to cartelize more than half of the time when N= 2 to 8, whereas in a duopoly tacit collusion is chosen two-thirds of the time (*ibid.* p. 12). This study is unique in studying the content and purposes of messages sent between sellers; the authors conclude that explicit communications help raise prices by implement more sophisticated pricing strategies, assist in dispute mediation (e.g., after a defection is observed), and if permitted before trading begins (but not after) seems to instill trust that improves pricing effectiveness (*ibid.* pp. 29-30).

In summary, laboratory market experiments are a promising way to study cartel price effects using the utmost scientific rigor. Unfortunately, none yet incorporates most or all of the salient characteristics of real-world cartels. In particular, only a small minority of market laboratory experiments permits overt communication among suppliers. Nevertheless, when limited pre-play communication or during-play discussion is permitted, monopolistic pricing conduct is observed. Collusive prices on homogeneous goods approach monopoly levels when buyers are many and sellers are few, symmetric, experienced, have excess capacity, post their prices, and chose output as the strategic variable. While it is tempting to include the price results of market experiments, they are excluded from the sample reported herein.

DECISIONS OF ANTITRUST AUTHORITIES

Economists versus Courts or Commissions

Are there systematic differences between overcharge estimates made by economists and those resulting from a judicial process? The answer to this question is important for the policy relevance of the present study. If the estimates taken from social-science publications significantly differ from the conclusions of juries, judges, or commissions, then the overcharge estimates in this study are of limited value in confirming the wisdom of present anti-cartel enforcement or proposing changes in such enforcement.

A survey of final verdicts of U.S. courts in collusion cases finds that 25 collusive episodes had a median average episodic overcharge of 21.6% and a mean overcharge of 30.0% (Connor and Lande 2005).¹⁷² The 9 cases that reported peak overcharges produce a median peak overcharge

¹⁷² Robert Lande and research assistants under his direction in 2004 calculated these figures. Less than 1% of all U.S. published court opinions on price-fixing damages contain both the dollar damages and the affected sales of a cartel. For a discussion of the merits of examining only final verdicts, see Connor and Lande (2005).

of 71.4% and a mean peak overcharge of 130%. All but 5 found that the cartel had raised prices by more than 10%. Due to the small number of final verdicts, it would not be meaningful to analyze these verdicts in even smaller groups. By comparison, the 327 estimates for North American cartels had a median episodic overcharge of 21.0% and mean overcharge of 38.8%. Thus, the median averages from both sources are extremely close, but the mean is slightly higher from the economic studies.

Figure 13 and Table 10 combine the U.S. court survey above with other episodic overcharge estimates derived from cartel decisions by other antitrust authorities.¹⁷³ There are 485 such observations from 38 antitrust authorities – 32% from analyses of guilty findings of U.S. and Canadian courts, 24% from decisions of the European Commission that imposed fines on EU-wide cartels, 20% from commissions ruling on cartels that operated in single European nations, 20% from Asian and Oceanic antitrust authorities, and 3.5% from the rest of the world. Besides U.S., Canadian, and EC decisions, there are relatively large numbers of observations from decisions by the UK Monopolies Commission in the 1950s and 1960s and the Fair Trade Commissions of Korea, Japan, and Taiwan. Most of the decisions are from decisions that fined international cartels discovered since 1990. Texts of most of these decisions can be found on the web sites of the authorities or in various searchable law archives (Lexis Nexis, WestLaw, the *Official Journal of the European Communities*, EUR-Lex, and the like). In some cases press releases or press summaries contained sufficient information to calculate an overcharge, but more commonly an analyst used the product definition, affected sales, and conspiracy dates in the opinion and applied this information to prices from a third party to calculate an estimate. As in the case of U.S. final verdicts, only a small minority of available decisions contains the appropriate quantitative data.¹⁷⁴

The median episodic overcharge from the 320 authority-decision-related estimates is 20.0%, and the mean is 40.8% (Table 10). The *median* and *mean* overcharges in Table 10 are close to the full sample median of 23.0% (Table 5) and mean of 48.7% (Table 6), respectively. Overcharges from all jurisdictions are negatively skewed.¹⁷⁵ Moreover, the relative geographic pattern in Table 10 is parallel to that of Table 9; that is, median overcharge rates are highest for multiple-

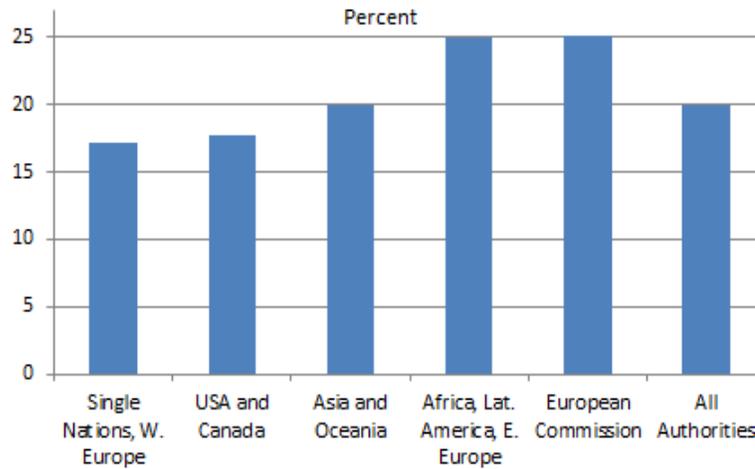
¹⁷³ Sometimes a published decision will mention explicitly an overcharge figure, but more commonly court and commission decisions need to be interpreted. For example, a decision may mention in passing the price series upon which it relied to determine the severity of a sentence, and that series is then interpreted by an economist. The DOJ, U.S. FTC, and federal courts and counted as one authority. However, the EC and the EU NCAs are counted as separate authorities.

¹⁷⁴ Guilty pleas and sentencing memoranda of the DOJ and Canadian Competition Bureau almost never mention damages. The EC has fined more than 100 cartels since 1969, but the full decisions are not always published, publication can be delayed for up to five years, and only a small proportion include price data. EC decisions yielded usable information on product definition, affected sales, geographic area, dates of the conspiracy, or other helpful information for 75 episodes. Similar comments apply to the other authorities' press releases, newsletters, or formal decisions.

¹⁷⁵ With three or more observations, the mean is higher than the median.

nation EU cartels, lowest for single-nation European cartels, and about 20% for all the other continents.¹⁷⁶

Fig. 13. Median Average Overcharges from Antitrust Authorities' Decisions



Location: Antitrust Authority	Number of Observations (episodes)	Median	Mean
		Percent	
North America:	156	17.7	48.4
US, 1898-1911	9	22.5	31.2
US, 1948-1973	8	16.8	135.5
US, 1980-1999	13	18.0	155.3
US, 2000-2013	120	16.9	31.1
US, 1898-2013	150	17.7	47.5
Canada, 1945-2013	6	37.3	71.1

¹⁷⁶ Although not shown, decisions regarding *global* cartels resulted in higher overcharge estimates than other types or locations of cartels.

European Union: ^b	117	25.1	32.2
European Commission, 1974-1990	11	25.0	31.7
European Commission, 1991-1999	19	22.5	22.9
European Commission, 2000-2013	86	26.7	34.5
Nations of Western Europe:	96	17.2	33.0
Belgium	1	21.0	21.0
Denmark	3	12.0	16.0
France	16	19.5	22.1
Germany	10	11.5	20.5
Hungary	2	13.8	13.8
Iceland	2	50.1	50.1
Italy ^c	14	75.0	83.8
Netherlands	3	8.8	38.9
Norway	5	9.0	17.1
Poland	1	28.0	28.0
Portugal	4	62.5	53.1
Slovakia	1	24.9	24.0
Spain	6	15.0	13.3
Sweden	3	8.3	12.2
Switzerland	2	78.6	78.6
United Kingdom:	31	16.9	63.1
UK Monopolies Commission, 1951-57	24	13.4	74.3
OFT & Other UK, 1990-2013	7	20.6	24.7
Asia and Oceania:	95	20.0	36.8
Australia	4	10.5	10.1
China	2	21.1	21.1
India	2	42.3	42.3
Indonesia	6	46.1	72.9
Israel	1	120.0	120.0
Japan	15	28.0	25.2
Korea	44	17.9	31.5
Pakistan	5	24.2	29.9
Taiwan	13	25.0	46.7
Turkey	2	115.0	115.0
Vietnam	1	20.0	20.0
Africa, Latin America, E. Europe:	17	25.0	32.7
Brazil	1	11.3	11.3
Egypt	3	20.9	25.6
Latvia	1	2.7	2.7
Lithuania	2	27.8	27.8
Mexico	2	32.6	32.6
South Africa	4	18.7	20.1
Total	485	20.0	40.8

Sources: Appendix Tables 1 and 2, summarized in J. Connor, <i>Price Fixing Overcharges Master Data Set</i> , spreadsheet dated October 2013.	
a) Most decisions have a single estimate reported by or interpreted by one person, but several decisions have alternative estimates (or models) by single authors, and some have single estimates by multiple authors.	
b) This is shorthand for collusion across two or more of the 27 nations that form the EU today.	
c) Nine observations are from the two <i>Infant Formula</i> cases. I am informed by an economist familiar with the evidence in these cases that, while the Authority strongly suspected overt collusion, it could not find documentary proof. Nevertheless, the participants were fined.	

In three jurisdictions, there are enough observations to examine changes over time. In North America, median overcharges from before 1990 are slightly higher than from subsequent periods. Similarly, the UK Monopolies Commission's reports produced very cautious estimates compared to more recent UK cases. The EC's recent decisions suggest higher overcharges than earlier ones.

I conclude that, on the whole, estimates of the height of overcharges developed from decisions of antitrust authorities around the world differ little from estimates derived from other economic studies. The overall median overcharge of the 485 legal decisions (20.0%) is about 15% lower than the remaining sample estimates.

Cartels Targeted by Class Actions

In American and other common-law regimes, counsel for private plaintiffs are commonly regarded as complementary to the anti-cartel efforts of the federal and state attorneys general (Lande 2010: 9, Baer 2014). This follows from the increasingly outdated view that private suits "follow-on" after criminal convictions have made the private suits relatively easy to prosecute. In fact, almost half of U.S. private damages suits do not follow DOJ convictions (Connor 2012; Lande and 2006, 2008 and 2010). So, what kind of cartels do plaintiffs sue these days?

I informally analyzed the overcharges of the cartels that resulted in the 50 largest price-fixing settlements from class actions in North America during 1990-2012 (Connor 2012: Table1). The actions are ranked according to the amount of cash settlements that they received by direct or indirect purchasers in all jurisdictions (expressed in \$2012). Of these 50 largest, 258 overcharge estimates are available for 41 cartels. The median overcharges of these 41 cartels were 29.4%, or 30% higher than all guilty cartels during the same period (Table 5). Except for being slightly less durable (7.2 years) than the average cartel (8.2), there were no other obvious differences between cartels that settled and other contemporary cartels. Hence, on balance, plaintiffs are targeting cartels generating larger dollar injuries.

Price Effects of Antitrust Intervention

There is a body of opinion that competition-law enforcement is ineffective in improving the competitiveness of formerly cartelized markets. For example, a provocative paper by Crandall and Winston (2003) opined that U.S. antitrust laws should be abandoned. In support of their position they assembled five studies that they interpreted to show either that cartels do not raise prices or that prices do not decline after cartel convictions. This opinion piece immediately evoked an onslaught of rebuttals by Baker (2003), Werden (2004), and Connor (2004c), among others.

Rather than revisit that particular debate, it may be useful to examine what a larger body of studies shows about the effects of antitrust enforcement on cartel effectiveness. First, there is evidence of its effects on collusive price effects. Connor and Bolotova (2006) showed that price-fixing overcharges have declined secularly as anticartel laws and enforcement have strengthened since the late 19th century.

Second, there is an analysis of cartel duration following the break-ups of contemporary cartels by antitrust authorities. Levenstein and Suslow (2010: 13-18) identified six "causes of death" for 79 international cartels that colluded since 1990; they found that 62% of the cartels expired because of antitrust legal actions and the remaining 38% because of unilateral reactions to economic incentives they term "natural causes" (including 22% convicted following defections by amnesty applicants) (*ibid.* Table 2). In their analysis of the antitrust determinants of duration, they find that duration shortens after 1995¹⁷⁷ and when cartel organization includes share quotas but excludes third-party support and punishment mechanisms (*ibid.* Table 4).

Third, one of the most convincing responses is the study of the long-lasting German high-voltage power-cable manufacturing cartel of 1901-1997 (Normann and Tan 2013). This cartel was legal from 1901 to 1957, illegal from 1958 to 1974 (and convicted three times), exempted from prosecution from 1975 to 1984, and once again made illegal after 1984 whereupon it was heavily fined in 1997. Profits rose 16% to 19% each year the cartel was exempted with no compensating efficiency gains (*ibid.* pp. 11-12).

RELIABILITY ISSUES

Many readers may have prior beliefs about the most appropriate data and methods to be used to derive estimates of the price effects of cartels. Some might regard a lengthy historical investigation with access to the internal communications of a cartel's managers as the surest path

¹⁷⁷ They choose 1995, the year the *Lysine* cartel was punished in the U.S., as a "defining moment" – a watershed or regime shift -- for international cartel enforcement (note 29). It is also close to the years in which leniency programs were introduced in the U.S. and EU. Besides being a rather Americocentric choice, so many other changes occurred before and after 1995 that I am skeptical that any qualitative variable is adequate to the task. A continuous variable along the lines of Zimmerman's (2005) amnesty awareness index seems preferable.

to the truth. Others might give greater credence to such communications only where the cartelists had reason to believe that their activities were legal or where the managers are writing about an illegal cartel years after the statute of limitations had passed. Some might assume that disinterested social scientists are likely to be closer to the mark than prosecutors, plaintiffs' counsel, defendants' counsel, or other interested parties. Indeed, the cross checks of a more global retrospective analysis might contradict delusions, if they are delusions, of cartel managers about their power over markets. Among economists, ever cognizant of the march of progress in quantitative research methods, there may be a tendency to find peer-reviewed studies applying methods of the most recent vintage to highly disaggregated, detailed data the most reliable.¹⁷⁸ Among legal scholars, many will view criminal trials or other procedures with criminal protections as the gold standard of fact-finding, whereas civil-law administrative hearings likely to contain more errors.

By design, this research project did not filter out some groups of cartel studies because other groups in quality purportedly surpass them.¹⁷⁹ Rather, three approaches are taken to learn whether the various overcharge estimates are sensitive to the methods utilized, data sources, time period, or disciplines of the authors. In my view, statistical meta-analysis applied after data collection is a more appropriate tool to handle such issues, and that is the approach taken in Connor and Bolotova (2006). Their model uses a large sub set of the data shown in this paper and controls for a large number of cartel-estimation factors and predicts quite satisfactorily. I summarize their findings in this section.

Data Sources

Confidence in the estimates may be judged in part by the high quality of the publication sources from which the overcharge estimates were derived (see Bibliography). The large majority of the estimates are drawn from the traditional end-product outlets of academic research: academic books, book chapters, and peer-reviewed journals account for 65% of the total (Connor 2004b: Table 11). In addition, 15% of the estimates were taken from economist' working papers, most of which examine modern international cartels and are intermediate versions of subsequently published book chapters and journal papers. The majority of the government reports (4% of the estimates) is authored by civil servants with specialized training in economics, and some were written by academics commissioned by the agency; typically, a panel of experts vets these reports. For example, the legal decisions of the UK Monopolies Commission were reviewed and approved by panels that contained a couple of leading professors of industrial economics working alongside senior civil servants attached to the Commission. Much the same process was used for United Nations, OECD, and Congressional Committee reports on cartels. Court and competition-law commissions accounted for 12% of the estimates. In sum, four-fifths of the estimates are drawn from the formal or informal writings of academic social scientists, and most

¹⁷⁸ One highly critical response to the sampling methods employed in this paper falls into this category. Ehmer and Rosati (2009) state: "Many of [Connor's] estimates are taken from the works of historians, political scientists, and journalists ... rather than from economic studies published in refereed economics journals" (p. 2). They then state that because I have not rejected such publications of "lesser quality" [sic], the sample is fundamentally unreliable, biased, and inflated. They sampled about 10% of the larger overcharge estimates and found one episodic overcharge that was incorrectly computed. It has been removed from this edition.

¹⁷⁹ A very small number of omitted studies and the reasons for rejection are given in Appendix Table 3.

of the remainder was the product of professionally trained individuals subject to the checks and balances of internal reviews.

Method	Number of Estimates	Median Overcharge	Mean Overcharge	Mean Positive Overcharge
		<i>Percent</i>		
Unavailable/None given	74	18.3	33.2	40.3
Historical Examination of Cartel Archives	20	0	10.8	30.7
But-for Price from Before Collusion	411	26.0	40.3	41.9
But-for Price from Price War During Collusion	28	28.2	39.7	41.2
But-for Price from After Collusion	200	25.0	46.3	48.0
Cost-Based or Constant-Margin	69	21.5	50.3	52.6
Yardstick from Comparable Unaffected Market	192	28.8	78.7	81.7
Econometric Model prediction	289	19.5	31.3	33.6
Legal Decision ^a	245	17.5	35.0	35.5
Other Quantitative (Simulation, etc.) ^b	7	670	1277	1277
Total	1535	23.0	48.7	51.8

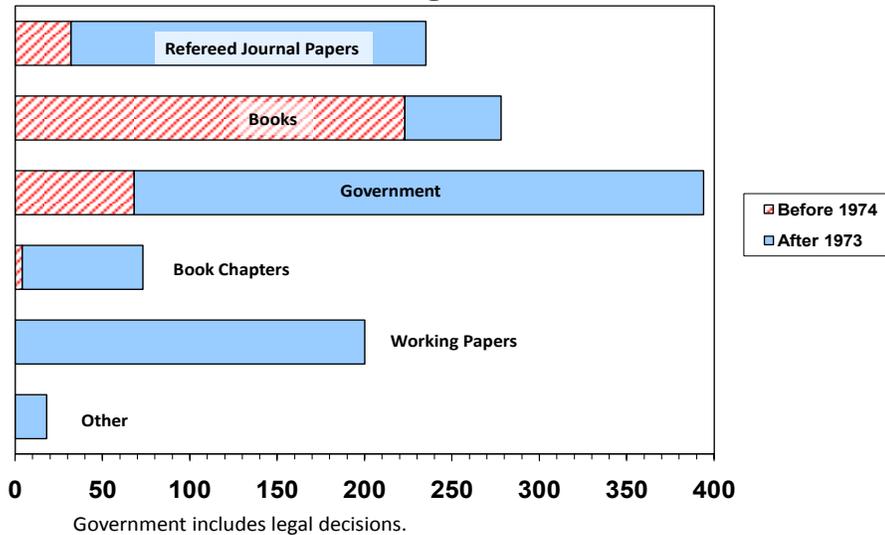
Sources: Appendix Tables 1 and 2, summarized in J. Connor, *Price Fixing Overcharges Master Data Set*, spreadsheet dated December 2013.

a) No specific method mentioned by court, jury, or commission issuing decision. May be a monetary amount or a percentage. Also includes judgments about what amounts constitute adequate compensation or restitution for victims. See Table 10 for details.

b) Four of the seven observations (and the highest) are from Normann and Tan (2011).

The types of publication outlets have also changed over time (Figure 12). Before 1974 books and chapters in edited collections accounted for 58% of the publications that contained usable overcharge data. Most of these works show evidence of meticulous scholarship, but the share of them subject to blind reviews is small. After 1973, books became a minor component (11%) of this survey's source materials. Instead, the greatest sources of overcharge estimates shifted to the published decisions of courts and commissions (44%) and to academic journal papers (34%). That is, in recent decades most estimates are drawn from papers that have been peer-reviewed, from an adversarial forum, or from decisions likely to be reviewed by courts of appeal. It is reasonable to regard review processes as likely to induce calculations that are more reliable.

Figure 12. Publication Sources of Episodic Overcharge Estimates



Controlling for other factors, Connor and Bolotova (2006: Table 6) find that government reports tended to have systematically lower overcharges than the reference group, books, and monographs. Estimates published in all other publication forms were not statistically different from books.

Sensitivity to Advances in Methods of Analysis

A singular characteristic of science is its tendency to improve on the past. I examined whether there are systematic differences between the episodic overcharges across time, using the date of publication of the study as a proxy for analytical advances. The intuition here is that the authors of more recent empirical studies of cartels have learned to avoid the methodological pitfalls of their predecessors.¹⁸⁰ Among the economic studies that dominate the sample, there is an undeniable trend away from mere narrative historical case studies sometimes embellished with simple graphical illustrations towards more formal statistical modeling. Correspondingly, in industrial economics generally there is a trend away from evaluating cartels from the point of view of the theory of pure monopoly toward a more sophisticated and nuanced view informed by game theory and other conceptual advances.

¹⁸⁰ Alternatively, one might infer that analysts may have increasingly employed techniques that have won court approval as forensically reliable (see Connor 2004a).

Controlling for other factors, Connor and Bolotova (2006: Table 6) find that overcharge estimates decline over time, but the effect is not completely monotonic. Of course, other things are changing over time as well, including generally tougher anti-cartel enforcement with respect to cartel discovery and severity of penalties. A more direct test involves qualitative variables for the author's method. In this case, the yardstick method tends to result in significantly higher estimates than the reference group, which is the "after" method. The rest of the analytical methods are not significantly different from each other or the reference group. Thus with one minor exception, methods do not cause bias in estimating overcharges.

For this paper, except for about 5% of the episodes where no method was given, I classified the remaining 1461 episodes according to one of eight estimation methods used to derive the overcharge rates (Table 11). One of the most unusual methods (accounting for 2% of the episodic overcharges) is an historical examination of original cartel archives. This method of analysis resulted in *by far the lowest* mean overcharge of 10.8%; in fact, more than half of such estimates were zero. Echoing the findings of Connor and Bolotova (2006), estimates derived from a yardstick approach were the *highest* on average. Cost-based estimation (69 episodes) produced the second-highest mean overcharges. Interestingly, the most popular method (639 episodes) – the three "straight-line" before-and-after methods -- had lower-than-average mean values. But even lower were episodes derived from econometrics (289) and from legal decisions (245).

The fact that some methods result in above- or below-average overcharges does have implications for accuracy, as each type of method may be associated with different mixes of cartel types, locations, or Cartel Eras. Econometric methods and legal decisions, for example, tend to be of a more recent vintage.

Intra-Episode Comparisons

An additional check on reliability of estimates across various analytical methods controls for changes in the composition of the sample by focusing on pairs of estimates applied to identical cartel episodes. Recall that a cartel episode refers to a single market, time period, and form of cartel organization. There are 291 pairs of observations available for this analysis of reliability, which examines six general methods of estimation. The most widely used is the so-called before-and-after method in which the price during the episode is compared to one of three "but-for" or base prices. The second most popular method is statistical modeling, which accounts for 20% of the estimates. The yardstick methods accounts for about 10% of the sample. Overcharges derived from costs of production or profits are the least frequently employed method (about 3%). U.S. courts have sanctioned the five methods for determining damages in price-fixing trials (Connor 2004a). Sixth, approximately 10% of this study's estimates are quotes from or interpretations of decisions made by antitrust authorities.¹⁸¹

By and large, different authors and different methods applied to identical cartel episodes do not result in markedly different estimates. The correspondence among the three before-and-after

¹⁸¹ Seventh, "method unspecified" estimates are on average quite close to the before-and-after price method.

methods is quite close. Nevertheless, there are two differences worth commenting on. One somewhat surprising result is that the before-and-after method produces cartel-overcharge estimates that are *higher* than econometric modeling applied to the same episodes. Econometric techniques offer the opportunity to the analyst to make precise allowances for several sources of shifts in demand and supply, for seasonality, for trends in technology, and for feedback effects. If in fact econometric techniques are the most accurate, what this result seems to suggest is that authors of traditional before-and-after analyses are failing to adjust for all the competitive factors that might drive up the competitive benchmark price. However, this result could be explained by other factors, such as the time available to perform a calculation or to differences in access to confidential price data.¹⁸²

Second, compared with the before-and-after method, the cost-based and yardstick techniques yield relatively high overcharge estimates.¹⁸³ This suggests that the methods that use costs or profits fail to fully account for all competitive industry costs, perhaps those related to product marketing or overhead. Similarly, as yardsticks are frequently chosen to be prices in proximate *regions* in which the cartel did not attempt to fix prices, this result suggests that analysts may be identifying prices in regions with lower cost structures than the conspiracy-affected markets. Possibly the full costs of transportation and transfer from geographic yardsticks to the affected geographic market are underestimated. If the yardsticks are *product* substitutes, analysts may have underestimated quality differences between the cartelized product and the analogous product.¹⁸⁴

In sum, apart from minor exceptions, neither sources nor methods suggest unreliability.

SUMMARY AND IMPLICATIONS

Summary

This paper's major goal is to collect and analyze the largest possible body of serious, quantitative estimates of price-fixing and bid-rigging overcharge rates. From several hundred publications dating to 1888, I assembled 2044 such estimates that belong to 532 cartels functioning during the past three centuries.

¹⁸² See Connor (2004a, 2008) for just such an example. Connor and Bolotova (2006) find no differences between before-and-after estimates and econometric estimates.

¹⁸³ These two methods seem to be conservative relative to statistical modeling, but the number of pair-wise observations is quite limited. Historical case studies, many by historians with access to original documents, tend to produce lower estimates (Connor and Bolotova 2006).

¹⁸⁴ Yardstick prices are more likely to be available at geographic points close to large centers of supply (concentrations of production or major ports of importation). Public price reporting of products with multiple grades normally is restricted to the most common, least differentiated grade.

The primary finding is that the median¹⁸⁵ episodic cartel overcharge for all types of cartels over all Cartel Eras is 23.0%. It is lower for cartels with solely domestic membership (18.2%), higher for international cartels (25.1%), and highest of all for global cartels (30.4%). Overcharges from courts and commissions are slightly lower than from social science analyses. Cartel overcharges are skewed to the high side, pushing the mean overcharge for all successful cartels to 52%. The “peak” cartel overcharges in the sample are typically almost double those of the long-run averages.¹⁸⁶

This paper’s findings are generally consistent with the few, more limited works that comment on cartel overcharges.¹⁸⁷ Seven previously published economic studies with samples ranging from five to 38 overcharges report a simple average median overcharge of 28% of affected sales. A comparison of social-science and legal sources also yields generally similar average estimates. Finally, more recent results from controlled market experiments with representative cartel structures also support the social-science-based conclusions.

The authors’ professions, types of publications, years of publication, intensity of peer review, and analytical estimation methods incorporated in the sample vary greatly. There is some indication that estimates prepared from the yardstick method are higher than other approaches and that estimates appear in government publications are lower than others.¹⁸⁸ Otherwise, however, extensive examinations of variation in overcharge rates across such categories give no reason to regard any sub set of the sample as inherently biased or unreliable.

Implications for Economics

The great majority of economists, whether swayed by collusion theory or by empirical evidence, roundly condemn cartels. Yet, there is a small minority view among industrial-organization economists that there is little evidence that cartels injure the markets in which they operate. Cartels, they believe, rarely raise prices significantly above non-collusive levels. Moreover, even if cartel price effects are significant, cartels are such fragile coalitions that the harm to the allocative functions of markets is negligible. Finally, they believe that the negative static allocative effects of cartels are counterbalanced by two forces: improved static productive and increases in the dynamic performance of cartelized industries through increased productivity growth.¹⁸⁹ In sum, these critics dismiss the importance of the cartel phenomenon and, by

¹⁸⁵ All medians presented in this section incorporate all relevant zero estimates and omit peak results unless otherwise mentioned.

¹⁸⁶ If one assumes that the peak mark-ups are the result of a cartel having achieved something close to monopoly price levels, then the lower episodic overcharges imply that historical cartels are constrained by substitutes, fear of entry, internal discord, or other factors that frustrate optimization. This is a common finding from studies that measure the degree of monopoly power.

¹⁸⁷ All of the relevant estimates in the seven works are incorporated in the sample assembled for this paper.

¹⁸⁸ Two other types (historical case studies and government reports) tended to be low.

¹⁸⁹ Such beliefs seem to arise from theoretical modes of collusion that typically do not allow for communication or contain unrealistically strict assumptions. For example, Telser (1985) has a proof that joint sales agencies improve

implication, the relevance of economic cartel studies. In this sub-section, I briefly respond to the empirical validity of these criticisms.¹⁹⁰

In defending the value of empirical studies of cartels, I must once again mention a great limitation of the behavioral social sciences: one cannot observe the unobservable. Increasingly, since the middle of the 20th century, most cartel managers have gone to great lengths to hide their illegal joint ventures from public view. Consequently, in the past several decades, empirical studies of cartels have been limited to analyzing samples of discovered, punished cartels. "...[W]e know a great deal about cartels that get caught, but very little about those that escape detection" (Carlton and Perloff 2005:127). These samples may not be representative of the population of all cartels. Successful, clandestine cartels may well have better managers, greater endurance, and superior financial returns than the putatively inept discovered cartels. Or not.

Several responses can be made to concerns about "sample selection bias" (nonrepresentative cartel samples). First, this survey's sample is unparalleled in its extraordinarily large amount of data spanning centuries. The historical depth of the sample suggests that time is not a source of potential bias. Large numbers of the cartels in the present study operated in legal environments with little or no fear of prosecution or severe monetary penalties: they *predate* the current era of high penalties.¹⁹¹ Second, the present study distinguished between overcharges of "guilty" cartels versus unsanctioned cartels. These categories mimic, however imperfectly, discovered versus undiscovered cartels. There is no great difference in overcharge rates between the two categories. Third, there are still legal cartels to be studied today. Samples of legally registered export cartels and government-sponsored cartels also tend to find evidence of positive price effects. Fourth, controlled laboratory market experiments find ample evidence of strong price effects when the conditions are correctly specified. Fifth, even if undiscovered cartels are indeed different from detected cartels, international discovered cartels are the most appropriate sample for studying the influence of competition laws. In short, the absence of sample selection bias seems just as likely as its presence.

Beliefs about the fragility of collusive conduct are driven by cartel theories that focus on the profit incentive that individual cartel members have to cheat on price agreements. While this incentive is undeniable, so is the creativity of cartels that create credible punishment mechanisms.¹⁹² The empirical reality is that durable cartels are observed in the great preponderance of quantitative studies. Duration is bimodal, with a large number lasting less than a year and the remainder much longer lasting (Levenstein and Suslow 2006: 44-45). Median

efficiency, but in fact few contemporary cartels forward vertically integrate. Those in the past that did create sales agencies tend to have longer duration (Levenstein and Suslow 2006: 69).

¹⁹⁰ There are theoretical models that prove the possibility of efficiency improvements under overt collusion.

¹⁹¹ In the United States, corporate penalties for cartel conduct were light until the early 1990s, and prison sentences for individuals likewise (Connor 2004b, 2009b). The EU only began imposing serious cartel fines in the late 1980s and still has no managerial penalties. Outside these jurisdictions, significant penalties appeared in only the past ten years. There is a good case to be made that even today global cartels function with impunity.

¹⁹² The development of infinitely repeated games demonstrates the wide range of conditions over which collusion can persist indefinitely.

duration of cartels is typically five to seven years, but the median life of international and global cartels is higher, probably because of smaller fringe competition and higher profits from geographic price discrimination. Moreover, the mean cartel duration is higher than the median because some cartels last for many decades.¹⁹³

Finally, although data constraints are especially severe, most recent economic analyses of investment, or productivity change do not support a sanguine view of cartels on this score.¹⁹⁴ One intensely studied phenomenon is legal German commodity cartels. Regression analyses of output of a large sample of German coal-mining firms determined that productive efficiency did not change when they joined the Ruhr cartel during 1883-1913 (Burhop and Luebbers 2008). Audretsch (1989) collected information on a large number of post-1945 German cartels; he showed that cartel formation resulted in lower output, not lower costs.¹⁹⁵ Blankenberg and Geist (2011) analyzed data from the German cement cartel of 1981-2002; during collusion this cartel experienced significant price increases, changes in price dispersion, and declines in cost efficiency. Another heavily researched natural market experiment is the temporary introduction of government-supervised cartels in the United States under the National Industrial Recovery Act (NIRA) in 1933. Although Bittlingmayer (1995) found no output changes due to cartelization, this finding is not supported by several other studies.¹⁹⁶ After mid 1934 when federal compulsion flagged, many of the cartels fell apart; however, those that were able to implement open-price filing (Krepps 1997), those industries where firms had symmetric costs (Alexander 1994), and those cartels with viable self-enforcement mechanisms (Alexander 1997) did experience output contraction.¹⁹⁷

One might think that higher profits from collusion might result in increased industry investment. Peters (1989) and Steen and Sorgard (1989) do observe this in two cartels. However, Connor (2008: 205) displays internal capacity data for the lysine cartel that shows more plant investment before and after collusion than during collusion. Levenstein and Suslow (2006: 85) conclude that the effects of national cartel policies have no clear effects on national economic productivity and development. However, rigorous empirical research on the dynamic effects of cartelization is just beginning.

¹⁹³ Four cartels endured from 96 to 134 years. Two were ended by antitrust agencies and two by entry.

¹⁹⁴ An oft-cited study that the author suggests shows that cartels can be efficient is Dick's (1992a) study of 16 legal U.S. export cartels. Of the 16, he finds that six either lowered prices, raised output exported, or both; of these, only three were "efficiency-seeking." Three cartels raised prices, and seven had insignificant or conflicting effects either way. This seems to be an almost random outcome. See also Günster et al. (2011).

¹⁹⁵ For studies that purport to find that late 19th century government-controlled German coal, iron and steel cartels were efficiency-enhancing, see Troeksen (1989), Kinghorn (1996), and Kinghorn and Nielsen (2004).

¹⁹⁶ Bittlingmayer's study was rejected for inclusion herein for other quality problems (Appendix Table A4)

¹⁹⁷ The aggregate impact of the NIRA codes on U.S. durable-goods manufacturing output was at least negative 10% (Taylor 2002: 8). In a later paper using more disaggregated data, Taylor (2010) finds that about one-fourth of the industries with the most variable production displayed output increases associated with efficiency enhancement (many were dairy products); the remaining three-fourths experienced the expected output reductions.

Implications for Public Policy

The results of the survey have significant policy implications. First, there is a minority view among antitrust writers that there is little evidence that cartels raise prices significantly for a period long enough to justify anticartel laws and, especially, contemporary cartel penalties.¹⁹⁸ Consequently, they argue for the repeal or scaling back of the fines or damages that result from collusion. This survey's results, which are based upon an extraordinarily large amount of data spanning a broad swath of history of all types of private cartels, sharply contradict these views. In fact, the data suggest the opposite. Mean overcharges are several times as high as the average level presumed by the U.S. Sentencing Commission (i.e., 10% of sales) and similar guidelines of other antitrust authorities.

Generally speaking, sanction guidelines aim at optimal deterrence of cartel formation (Connor and Lande 2012). More specifically, antitrust enforcement generally seeks general deterrence rather than specific deterrence. Hence, rules for imposing cartel fines ideally combine a proxy for a cartel's antitrust damages (typically its affected commerce) with some average multiplier of cartel harm.¹⁹⁹ It is not clear which of the many concepts of "average" are the most appropriate for an antitrust authority to employ in designing effective and transparent sanction guidelines. What is clear is that the median averages discussed in this paper are *inappropriately conservative guides* to cartel fines.

Alternative and perhaps superior *mean* averages are shown in Table 12. Mean episodic overcharges are more than double the respective median averages. Moreover, if authors failed to compute overcharges with competitive sales instead of actual sales²⁰⁰, then the mean overcharges attained by cartels were around 100% -- much higher than the medians of 23% to 25%.

Second, the relative injuriousness of bid rigging is sensitive to the measure of central tendency employed. Compared to other forms of collusion, *median* bid rigging overcharges were generally 25% lower; but *mean* episodic bid-rigging overcharges were 11% to 24% higher than classical price fixing. These results suggest that antitrust sanctions' guidelines should not necessarily treat bid rigging *per se* more harshly than other forms of collusion.

¹⁹⁸ A paper by Crandall and Winston (2003) disparages the effectiveness of antitrust laws and enforcement. It is answered well by Baker (2003) and Werden (2003). Connor (2004c) also criticizes Crandall and Winston's reliance on a slim sample of facts concerning cartels.

¹⁹⁹ While most jurisdictions adopt a single percentage multiplier (within a stipulated range) as a starting point, others have categorical multipliers. The United States uses 10% and 20% to calculate a range. The EC chooses a single number between 15 and 30, depending on gravity. The JFTC has a much higher percentage for manufacturers than for retailers. Connor and Lande (2008) proposed a single percentage that was double for international cartelists compared to domestic cartels.

²⁰⁰ I do not know what share of estimates this correction ought to be to. In most cases when working with dollar overcharges, authors did not reduce affected commerce by the amount inflated by collusion. However, authors computing overcharges with prices need no such correction. So, these figures are to be regarded as upper limits.

Third, international cartels are typically more destructive of competitive market forces than domestic conspiracies. Connor and Lande (2005) propose raising the overcharge presumption for U.S. fines to 15% for domestic cartels and 25% for international cartels.²⁰¹ This is a conservative and modest proposal in light of this article's demonstration that cartels typically generate at least two or three times the antitrust damages presumed by the current U.S. Sentencing Guidelines. Global cartels have historically generated greater overcharges than other international conspiracies. Despite the evident increases in cartel detection rates and the size of monetary fines and penalties in the past decade, a good case can be made that current global anticartel regimes are under-detering (Bush *et al.* 2004, Connor 2005). Global cartels are more difficult to detect, have less fear from entry of rivals, achieve higher levels of sales and profitability, and systematically receive weaker corporate antitrust sanctions than comparable domestic cartels. Base fines of 20% of cartelists' affected commerce, even when adjusted by significant culpability multipliers,²⁰² will do little to deter most of these cartels.

Fourth, hundreds of overcharge estimates based on the after-price method conclude that when cartels collapse because of the direct intervention of antitrust authorities, prices both in the short run and long run typically *do decline*. Nor does antitrust enforcement that suppresses collusion seem to have adverse effects on either static or dynamic industrial efficiency. See, for example, the research in Buccirosi *et al.* (2012) showing that competition-law enforcement directly spurs total factor productivity growth.

When the effects of private suits are factored in, it is clear that the U.S. court system is already shouldering the bulk of the world's burden of punishing international cartels and their managers; moreover, more severe prison sentences for executives have little additional deterrence power (Connor and Lande 2012). This survey suggests that overcharges generated by cartels discovered in most jurisdictions are higher than North America-centered cartels. Consequently, barring multilateral antitrust treaties, anticartel laws and fine-setting practices abroad are in even greater need of strengthening. The surge in EU cartel fines (by both the EC and the EU's National Competition Authorities) and the rising intensity of enforcement in 50 more jurisdictions since 2000 will marginally improve cartel deterrence. But with virtually no private rights of action outside North America, total penalties are likely to remain sub-optimal for quite some time (Connor 2010).

²⁰¹ As an anonymous reviewer of an article derived from material in this paper suggested that such *changes* need to be considered alongside appropriate levels for private settlements. These recommendations are particularly complicated by corporate leniency programs and by the joint fining policies of overseas antitrust authorities for international conspiracies.

²⁰² For a variety of factors, however, very few firms actually pay a fine amounting to 20% or more of the amount of commerce affected. Most violators have their fines reduced by 60% to 80% of the maximums.

Table 12. Mean Average Overcharges, by Type								
Average Measure	Membership		Legal Status		Bid Rigging	Classic Price Fixing	Buyers' Cartels	ALL TYPES
	Nat- ional	Interna- tional	Found Guilty	Legal				
	<i>Percent</i>							
Mean Episodic, as Reported ^a	34.6	56.1	48.7	48.6	54.5	47.2	43.6	48.7
Mean Episodic, Corrected for Competitive Affected Sales ^c	52.9	127.8	91.6	91.1	109.7	89.4	77.3	94.9
Mean Effective (Non-Zero) Episodes	37.8	58.7	50.5	51.6	56.0	50.6	45.5	51.8
Mean Effective Episodes, Corrected for Competitive Affected Sales ^c	63.1	142.1	102.0	106.6	127.3	102.4	83.5	107.5
Mean Peak Positive Overcharges	69.0	121.7	108.5	75.9	53.9	114.1	33.1	103.5
Sources: Appendix Tables 1 and 2, summarized in J. Connor, <i>Price Fixing Overcharges Master Data Set</i> , spreadsheet dated December 2013.								
<p>a) The arithmetic mean. If they report their method at all, the large majority authors appear to divide the dollar overcharge by the cartel's dollar sales during the collusive period ("affected sales"), which leads to under-reporting of the overcharge rate. Other authors do not have access to the affected sales of the cartel and instead use total market sales, which in general causes even a greater under-reporting of the overcharge rate.</p> <p>b) The divisor is corrected for the inclusion of collusion-inflated sales. No adjustment is made for possible inclusion of fringe firms' sales.</p> <p>c) Suppose OV% is the conventional computation of the overcharge rate (see note a) above). The True Overcharge Rate TOV% = $OV\% / (100 - OV\%)$. Note that authors that employ prices directly to derive the overcharge rate do not require this correction.</p>								

One sanguine development is that for most types of cartels there are secular reductions seen in cartel mark-ups observed. Because the post-1990 era has been the period with by far the highest level of fines imposed, this decrease is consistent with the theory of optimal deterrence. It also suggests that the recent worldwide trend towards the intensification of cartel penalties has ameliorated cartel injuries. If procedures for calculating criminal fines correspond more closely to the actual levels of cartel overcharges, monetary sanctions against price fixing will more closely provide optimal deterrence.

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APPENDIX: SOURCES AND COLLECTION METHODS

Selection Criteria

I have made every attempt to locate and extract all useful information on *private, hard-core* cartel overcharges available from *serious*²⁰⁴ published sources. A private, hard-core cartel is one that by contemporary U.S. standards could be criminally indicted under the Sherman Act.²⁰⁵ *Private* cartels are those not protected by treaties or national sovereignty. *Hard-core* or “naked” cartels are those that made explicit agreements on horizontal restraints to control prices or limit quantities to be produced or sold. Price agreements may cover list prices or transaction prices; the transactions prices may be floor prices, target prices, or, if a common sales agency is employed, actual transactions prices. Prices may refer to sales of goods or services, procurement of inputs, or bids in auctions or tenders. Quantity restrictions most commonly involve fixed market shares for each participant, but may also include territorial exclusivity, customer allocations, production-capacity, or fringe-boycott agreements. Cartels that focused *exclusively* on collective action regarding vertical restraints, advertising, patent pooling, technical standards, R & D, and the like are not considered hard-core.

²⁰⁴ Some readers have overlooked this selection criterion. For example, Bergman (2008) has said the following:

"Connor's results are based on all estimates of price effects that he has been able to find, irrespective of the quality of the underlying analysis...[M]any of the studies are unsubstantiated claims by competition authorities."

“Serious” studies are identified primarily by form of publication. Books, monographs, academic journals, and government publications that are written by professionals and show attention to detail nearly always make the cut. Working papers by scholars that seem to have publication potential are included. Newspaper articles, editorials, and opinion pieces; essays in popular magazines; and blogs are rarely included, unless they happen to be cited approvingly by academic experts. Statements by antitrust officials about overcharges are included only if their methods are explained and are methods normally accepted by U.S. courts. To my knowledge, other than a well regarded OECD (2003) survey, there are no unfiltered assertions by antitrust officials – or any other parties to cartel legal suits -- in this survey. I have, however, omitted a very small number of egregiously methodologically flawed studies (See Appendix Table 3 for the brief list of excluded studies and the reasons for their exclusion).

Admittedly, and by design, seriousness and professionalism is not a high bar, but when authors attempt to pick a sample of studies according to some subjective criterion of “quality,” excluding data points opens them to reasonable suspicion of tilting results to fit their inevitable prior beliefs (and lose friends). Indeed, Bergman's analysis itself may be criticized for basing his paper on a sample of 13 overcharges when so many others available; he displays a strict preference for econometric studies that I have argued may be the counsel of perfection in practical competition enforcement (Connor 2007c). Meta-analysis is one appropriate method for dealing *ex post* with heterogeneous quality; minimal, harmless heterogeneity has been detected in this paper’s (see Connor and Bolotova 2006).

²⁰⁵ In the United States, bringing criminal indictments for *only* hard-core cartels is a matter of custom, not law. Some hard-core cartels are brought as civil matters because prosecutors judge that the criminal burden of proof cannot be met. Since the 1980s, the EU and most other other civil-law jurisdictions have abandoned requiring an effects test and now follow more or less the same conspiracy approach used in common-law countries (Joshua and Jordan 2003).

Classifying the sampled cartels at times requires judgment. Some cartels operated prior to 1890, after which passage of the Sherman Act made participation by U.S. companies illegal, but many 20th-Century cartels headquartered in Europe predate the beginnings of effective European anticartel laws. If these cartels were not formed by means of a legally enforced government monopoly, they are generally considered *private* schemes.²⁰⁶ However, if a government simply required registration or chartering of a cartel but left its management in corporate hands, they are included in the data set. Beginning in 1918 in the United States and in most European countries in the interwar period, domestic producers were permitted to register and operate export cartels with no or minimal supervision; I consider these private cartels, unless they were compulsory by law. Similarly, if a government-owned national monopoly or commodity association voluntarily joins an international cartel, the latter may qualify as a private cartel. Thus, the mere fact that governments tolerated or turned a blind eye to cartels does not disqualify them from inclusion in the data set. However, commodity agreements known to have been initiated, actively sponsored, or intentionally protected by national sovereignty are not included in this paper.²⁰⁷ In these “public” cartels the active involvement of governments are signaled by the signing of a treaty, government ownership of stocks or commodities, or the appointment of civil servants to cartel-management positions. There are many fine studies of such agreements, but the inclusion of government-sponsored or -enforced cartels would tend to bias upward the overcharges in the sample (Suslow 2001). Moreover, public cartels are beyond the reach of antitrust law.

With very few exceptions, this paper reports on every scholarly or serious study that contained quantitative information on the price effects of hard-core private cartels. Writings by economists, political scientists, economic historians, and legal scholars are included. Written decisions or detailed reports of decisions of antitrust authorities everywhere in the world were examined. While no time limit was placed on the literature search, the large majority of the sources consulted were written after 1945.²⁰⁸

I have examined more than 1000 English-language books, journal articles, working papers, reports, and other shorter analyses looking for evidence of cartel price effects. Many were written primarily as historical case studies or are focused on demonstrating a new method. Some mention price effects only in passing. Economists write the great majority of cartel studies,

²⁰⁶ Wallace and Edminster (1930: Appendix A) provide a convenient chronology of most government-sponsored export-control monopolies through the late 1920s. The Japanese camphor monopoly of 1899, the Italian citric acid monopoly of 1910, the Greek currant monopoly of 1895, and the New Zealand kauri-gum monopoly of 1927 are examples of clearly public, government-managed cartels.

²⁰⁷ In some cases particularly in the early 1930s, the earlier phases of an international cartel were controlled by national producers’ organizations of private firms that negotiated voluntary quota reductions; when cheating threatened the effectiveness of the cartel, colonial or metropolitan governments stepped in to pass mandatory supply-control legislation. The early phase of the cartel I deem private, but not the latter.

²⁰⁸ Unless available in translation, I have mostly confined this survey to English language sources. Many antitrust authorities now translate their press releases, decisions, and annual reports into English; moreover, members and some nonmembers submit summaries of their annual reports in English to the OECD. The preponderance of sources published after 1945 is explained by the growth of the field of industrial-organization economics and the passage of effective anti-cartel legislation worldwide.

typically by North American academics using cartel episodes that affected commerce in the United States or Canada. The small number of empirical studies by European or Asian academics is striking.²⁰⁹ In addition, countless hours were spent reading press releases, decisions, etc. at the Web sites of antitrust authorities.²¹⁰

In general, I aimed at collecting the largest possible body of reasonably professional, quantitative estimates of cartel overcharges, and avoided applying possibly subjective quality screening. In the vast majority of cases, the writers themselves provided the overcharge calculations. In a small minority of cases, I made inferences from price data contained in the works, following the judgment of and the facts supplied by the author, such as dates of collusion. The bases for my inferences are briefly outlined in Connor (2007c).²¹¹ Overcharge claims appearing in newspapers, magazines, and newsletters are avoided because such assertions are usually from anonymous sources who may not be disinterested parties in an ongoing law suit or in some public policy debate, roles that may color their assertions. In some cases, overcharge estimates may originate from information in industry trade journals, but if they were cited by economists, historians, or legal scholars with some background in cartel studies, such estimates are reported in the present survey (e.g., Demaree 1969). Estimates found in a small number of book-length, years-long investigations by journalists, public servants, or other professional nonfiction writers are included (e.g., Berge 1944, Taylor and Yokell 1979).

Clearly, this catholic approach to data-gathering will create concerns in the minds of many readers about the reliability and precision of the overcharges. There may be substantial variation in the quality of the price data, the methods used, degrees of judicial scrutiny, and the professional orientation of the sources that could affect reliability as perceived by any individual. I noted above the lack of clarity among professional writers about the essential characteristics of

²⁰⁹ One might speculate as to why this is so. The supply of well-trained industrial economists in Europe is unlikely to be an explanation. The principal European organization for industrial economists (EARIE) equally active in sponsoring meetings the past decade than its U.S. counterpart (IOS), and the EARIE meetings had a good proportion of empirical and legal-economic papers. The structure of academic departments at European and Asian universities may be one explanation of the paucity of useful studies. Compared to U.S. departments of economics, European departments tend to be smaller (perhaps falling below the threshold necessary for collaborative teamwork on large-scale data sets), more focused on IO theory, and have different expectations for Ph.D. dissertations. Perhaps a more important factor is the inability of academics to obtain access to the price data needed to calculate overcharges. Civil antitrust damages cases are unusual in Europe, so the little work being done on cartel overcharges is done in-house by antitrust authorities. Unlike North America, there is little mobility between the staffs of European antitrust authorities and universities or think tanks. Finally, a survey of European and North American industrial-organization economists reveals that there are very few attitudinal differences between the two groups on economic theory, but the former were less inclined to expect economists to influence competition policies (Aiginger *et al.* 2001).

²¹⁰ The term “antitrust authority” has gained currency in recent years to cover any national or supra-national government agency empowered to enforce criminal or civil antitrust laws or competition-law rules. Thus, it encompasses, the U.S. DOJ Antitrust Division, the Fair Trade Commissions of many nations, the EC, and the many administrative authorities modeled on the aforementioned. Courts supervising antitrust trials or damages litigation are acting as antitrust authorities.

²¹¹ If a credible study of a cartel concludes that it was “ineffective,” I have coded this comment as a zero price effect and included this observation in the averages. Likewise, conclusions that the impact of collusion was “overwhelmed” by natural market forces are interpreted as a zero overcharge. However, vague conclusions that a cartel episode was “effective” in controlling prices are not tabulated in the quantitative summaries.

the cartels until at least the 1920s. Consequently, some readers may wish to dismiss scholarship before that decade, while others will be untroubled by semantic differences. Economists may well give greater weight to writings by professionals in their own field than to opinions reached by judges, commissions, or juries, whereas legal scholars will often give greater credence to the latter. Legal professionals may have strong preferences for high court decisions over state or district courts, or they may have strong opinions about European versus American antitrust jurisprudence. Similarly, many economists might trust results published in refereed scientific journals more than other publication outlets that receive less peer scrutiny, prefer modern quantitative methods to deep historical case studies, or express skepticism about the analyses of economists writing before the Age of Game Theory.

To contend with the disparate preferences of readers, I have chosen to cast my net widely, but look across the sources for evidence of systematic bias. In addition, the data are displayed across several Cartel Eras, data sources, and methods of computation so as to permit readers to choose the combinations they prefer. Indeed, the analysis of these data by source, time period, or method may provide useful insights in itself. I hope to provide the interested reader with enough information to make up his or her own mind about reliability.²¹²

Social Science Studies

The first block of sources consists of archived materials: books, monographs, reports, and refereed journal articles written by specialists in many fields: economists, historians, political scientists, lawyers, and in a few instances journalists.²¹³ Newer publications were located by using various bibliographic search engines, by noting the references cited by authors in the works themselves, and by searching on-line library catalogs. These studies vary substantially in terms of depth and the degree of professional commitment to the study of cartels. Some economists and historians have spent substantial portions of their careers specialized in cartel analysis, but most of the publications quoted herein are by social scientists for whom cartels were just a passing interest.

There are several methods used by social scientists to derive the effects of cartels on prices. Older economic studies tended to use a rather informal method of price analysis that now comes under the rubric of the “before-and-after method” (Connor 2007c). That is, armed with knowledge of when overt collusion occurred, the author would compare prices during the affected period with prices before the cartel began or after it ended; in some cases, the basis of

²¹² The influences of types of publications and methods of computation are formally analyzed in Connor and Bolotova (2006).

²¹³ I have confined journalists’ accounts of cartels primarily to book-length treatments of cartels, in the belief that such monographs are in-depth accounts of a cartel collected from many sources, some of them anonymous, over a period of time sufficient for the author to provide a balanced account of conflicting claims. Books by journalists typically do not focus on the quantitative economic aspects of the case at hand, so in practice there are relatively few overcharges drawn from these sources in the present study. I rarely include overcharge estimates embedded in newspaper or magazine articles, though some specialists may judge such assertions to be sufficiently reliable to include in their published studies. For example, Elzinga (1984) cites Demaree (1969), and Carlton and Perloff (1990) cite Smith (1963).

comparison would be a price war that erupted during the affected period. The base price was typically assumed to be the long-run competitive equilibrium benchmark price (now rather succinctly, if inelegantly, termed the “but-for price”). Although some were careful to take such factors into account, in many cases the possibility that shifts in demand or supply conditions could have caused the benchmark price during the affected period to depart systematically from the before or after price was ignored; moreover, the idea that price wars could generate unsustainably low prices was not often recognized. Some economists of the time realized the importance of averaging before or after prices for periods long enough to eliminate the influence of transitory disturbances in markets, but others were satisfied to identify one month’s prior price as the but-for price.

A second way of calculating a benchmark price is the yardstick method. In this type of analysis, an economist would collect prices for analogous markets that were believed to be free from cartelization. For a localized conspiracy, the competitive yardstick could be prices in a nearby city or an adjacent state with similar demand or cost conditions. If prices before or after collusion are highly correlated, then the trend in cartel prices could then be compared to the trend in the yardstick-market prices during the collusive period. Yardstick price movements can also be constructed for a noncartelized product made in the same region that is made with the same inputs, utilizes a similar technology, and is consumed by the same customers.²¹⁴ If a cartel colludes against only some of its customers, then the discounts offered to other similarly situated customers could yield a yardstick.

Third, sometimes the costs of production and the margins earned by firms in the relevant lines of business may provide collateral indicators of variations in the degree of competitiveness of a firm or market. Absent significant changes in production technology, constant long run marginal costs or constant operating margins may be assumed before, during and after alleged collusion; if they are not constant, collusion may be the cause. Cost-based estimates are relatively uncommon because detailed internal business records are needed. The before-and-after, yardstick, and constant-margin methods require expert judgment about the market or industry in question, but all are acceptable methods used in courts of law or commission hearings to determine the fact of injury or the amount of damages.

Fourth, since the 1970s the rigor and precision displayed in deriving estimates of cartel overcharges have made several advances (Baker and Rubinfeld 1999). Driven by developments in oligopoly theory, statistical methods, and the increasing availability of detailed company and market data, increasingly econometric models are specified and fitted to the data from the alleged collusive market.²¹⁵ Game theory has influenced contemporary concepts of collusion, the design of competition policies, and empirical modeling of oligopolies (Werden 2004). One type of econometric modeling is an elaboration of the before-and-after method. A structural model of the market before or after the conspiracy can be estimated and used to predict the

²¹⁴ The danger with this method is that the product yardstick may be a substitute for the cartelized product, and, hence, price-responsive to a cartel overcharge.

²¹⁵ These data are often proprietary facts revealed during the discovery phase of litigation or submitted to an antitrust authority under compulsory legal processes. In addition to transaction prices of the defendants, production and marketing costs of details of business contracts may be handed over on a confidential basis.

competitive benchmark price during the conspiracy (Brander and Ross: 17-20). A second type of econometric model can specify demand, supply, and an oligopoly model (usually Cournot or Bertrand) and fit the model to data from the collusive period (*ibid.* pp. 21-23). An early example of this approach is Dick's (1992a) study of 16 U.S. Webb-Pomerene cartels.²¹⁶ The most common approach is a reduced-form model. These models usually specify the demand and supply conditions in the relevant market as a function of the observed market price before, during, and after a conspiracy; the analyst then investigates through statistical tests whether and to what extent changes in prices or output fail to respond to normal, competitive market forces (*ibid.* pp. 23-29).²¹⁷ Because these models can simultaneously incorporate multitudinous factors that explain prices, economists tend to regard overcharge estimates from such models as more accurate than analyses that depend on more informal ways of accounting for such factors.²¹⁸

Defining Episodes

Like most natural phenomena, most cartels are born and die only once, and the dates of those events are known with precision. A cartel's birth and death describe one episode and one cartel.

The birth of a cartel ("formation") is marked by the day a collusive agreement is adopted.²¹⁹ Cartel deaths are more varied and sometimes more difficult for observers to pinpoint. Cartels can die "natural" deaths if changes in market conditions make collusion unsustainable. Natural deaths may be quiet events marked by a consensus among the cartelists to close shop (e.g., if fringe entry becomes large, a new superior substitute product appears, or warfare among nations makes business as normal impossible), or they may end in convulsion (e.g., if cheating or defections become excessive or if major players engage in open warfare) (Levenstein and Suslow 2010). Cartels may also die "unnatural" deaths if the cheating or defections are caused by the presence of effective anti-cartel laws. That is, antitrust authorities can decide to investigate suspicious prices being charged to buyers, examine unusual signals from a screening program that shows market prices to be incredibly steady or significantly less variable, or follow up on a leniency application by a participant in a cartel.

However, some cartels have led charmed lives, dying and being reborn. Indeed, some cartels are formed, disband, reform, and disband several times. Each collusive cycle is an episode.

²¹⁶ Dick (1992a) interprets his results as identifying only two cartels that either significantly raised prices (*Crude Sulphur*) or caused quantity to contract (*Carbon black*). However, I add *Pebble Phosphate* to this list because I believe a one-tail test of significance is warranted.

²¹⁷ Either a dummy variable is included for the assumed collusive period, or the model can forecast or backcast benchmark prices from a noncollusive period.

²¹⁸ On the other hand, if a cartel operated during a span in which cost conditions (input prices, expansion of capacity, inventories, and technology) were steady and demand conditions (consumer preferences, disposable income, available substitutes, and the like) did not shift, then elaborate econometric models and the more traditional methods will yield the same overcharges. For durable cartels, constancy of all these factors is unlikely.

²¹⁹ This event may be marked by the signatures of the cartelists on a written contract, by the adoption of a verbal agreement and handshakes all around, or by some similar less formal method of communication.

Overcharges are computed for episodes rather than cartels, so the dates of those episodes are critical parameters for analysts.

Consistent with contemporary empirical studies of cartels, in this study each cartel episode is treated as a unique observation.²²⁰ The reasons for analyzing episodes rather than one cartelized market over time are straightforward. When a new episode appears, the cartel may have new members, a different territory, or simply a revised agreement. Pauses between episodes are often quite lengthy. Because the agreement or the players are different, in effect a new cartel is launched. Changes in these contractual factors will generally affect price outcomes.

The period between the termination of one episode and the rebirth of the next episode is known in economic game theory as a “reversion to competition.” During this interim, the cartelists cease to observe and enforce the contract, cease to have harmonious multilateral contacts, may engage in open warfare, and typically suffer lower prices and profits than previously. During reversion prices may fall from near-monopoly levels to levels associated with noncooperative oligopoly (Cournot equilibrium, for example), purely competitive prices, or even sub-competitive prices. Price wars are not necessarily signs of failure, rather, they may be opportunities for a cartel to reorganize and adopt better rules for price-setting, profit-sharing, compensation and the like (Levenstein and Suslow 2006).

Sometimes there are practical impediments to measuring episodic dates. In a forensic setting, the dates marking an episode may be obvious or uncontroversial; both sides stipulate the dates, and fines or damages can be computed with the stipulated dates. However, particularly for more durable cartels, the beginning date of an episode may be debatable, because written records have been lost or destroyed, cartel managers have retired or moved on, or memories faded.²²¹

Ending dates should be better documented because in modern times most cartels end with publicly reported raids. However, cartel deaths are quite varied and some are difficult for observers to pinpoint. Cartels can die “natural” deaths if fringe supply grows too large, if cheating becomes excessive, or if defections (including leniency applications) occur; or cartels can die sudden “antitrust” deaths from raids resulting from tips²²² to an antitrust authority (Levenstein and Suslow 2010: Table 2). Of these causes of death, only the dates of raids can be objectively recorded. Moreover, in the case of global cartels, various antitrust authorities often cite different dates.

²²⁰ Some early writers were fuzzy about this notion, but Sweezy (1938) and his successors like Eckbo (1976) and Griffin (1989) were meticulous in identifying temporal episodes carefully.

²²¹ Beginning dates may be reported by government antitrust authorities as later than the true dates because the standard of proof is high or because they are only interested in dates after their laws take effect. In the United States, the DOJ can make plea bargaining more expeditious by moving forward a provable starting date as a concession to a defendant. Frequently, follow-on private plaintiffs are able to secure damages from a longer episode than that written in a plea agreement.

²²² The main source of tips is disaffected directors or employees of cartel participants, the secondary source is outgrowths of other investigations (including Amnesty-Plus applications), and the tertiary source is customer complaints.

To assist forensic economists in objectively identifying the existence and dates of collusion, a quantitative technique called a *variance screen* has been developed and implemented. Statistical analysis of price distributions begins with determining when the mean average price deviates from the but-for price. The mean is the first moment of the distribution, and there are three higher moments: variance, skewness, and kurtosis. Connor (1985) was probably the first to suggest the rationale for the notion that higher moments could be used to identify cartel price effects. Abrantes-Metz et al. (2006) found that price variance declined during collusion by frozen fish sellers. Connor *et al.* (2008) also successfully tested the variance as a screen for cartel behavior. Blanckenburg *et al.* (2012) test for the effects of cartelization on all four moments of price distribution. Abrantes-Metz *et al.* (2011) applied Benford's Law to demonstrate how LIBOR rates differed from the expected non-collusive distribution of digits, suggesting that bid rigging could have been detected.

Decisions of Antitrust Authorities

The second big block of information includes the printed reports and Web pages of scores of antitrust agencies, lists of court and commission decisions, and multilateral organizations concerned with competition issues. Data collection began by trying to collect verdicts in collusion cases, namely, final decisions antitrust cases involving horizontal collusion, broadly defined to include bid rigging and related practices, where a judge, jury, or commission calculated the damages.

Starting with the United States, in theory researchers should be easily able to determine how high cartels raise prices by a straightforward examination of a statistically significant sample of the thousands of U.S. antitrust cases that involved cartels. However, for many decades in U.S. government cases, resolution of these numerous cases has involved fewer than ten trials per year, most of them of individuals, not corporations. Moreover, the amount that prices changed, or even whether prices were affected at all, is not relevant to the issue of whether a defendant violated U.S. criminal antitrust law.²²³ In U.S. criminal antitrust cases, it is unnecessary for prosecutors to present evidence of the extent of any overcharges or undercharges. Even at the sentencing phase of criminal price-fixing trials, prosecutors rarely offer information on damages. Guilty-plea statements and sentencing memoranda often mention affected sales and culpability factors that were used to calculate the sentencing guidelines ranges. Only a few contain stipulated damages as percentages of affected sales, and these percentages are probably minimal overcharge rates.²²⁴

²²³ See the discussion in Sullivan and Grimes (2000:165-233), which shows that in *per se* cases the plaintiff does not have to prove whether prices rose (or even whether defendants had market power). The issue of whether prices rose can be an element of a rule of reason case, but rule of reason cases do not give rise to criminal fines, so are not the subject of this paper.

²²⁴ What the documents say is that the percentage of what the defendant and the Government both agree is the amount of damages that prosecutors could prove beyond a reasonable doubt had a criminal trial been held. This is a higher standard of certainty than economic statistical reasoning can usually provide.

In civil damages cases, however, the damages awarded to a successful plaintiff are equal to three times the overcharges, so in these cases plaintiffs must demonstrate how much prices increased or decreased due to the actions of the cartel. Finding overcharge rates in judicial decisions in civil actions also proved to be extremely difficult, because almost every private antitrust suit for damages settles or is dismissed before an overcharge can be calculated by a neutral observer and made part of the public record of the case. As a consequence, final verdicts involving cartels where a judge or jury calculated an overcharge are surprisingly rare. This approach yielded less than 30 episodic overcharges (Connor and Lande 2005).

Besides U.S. court decisions, the Web sites of many foreign antitrust authorities were examined.²²⁵ In the jurisdictions employing Common Law, most cartels are sanctioned after government negotiations that result in guilty pleas or by monetary settlements with private parties out of court. When this is the method of resolution, the press releases practically never mention the degree of harm caused by the cartel. Very few cartels defend themselves in court, and very few of the trials result in published decisions that reveal the overcharges.

Although judicial decisions themselves may not mention an overcharge rate, there are other ways to obtain overcharges from some of the decisions. Three sources were explored: computer assisted searches of data bases, reading through a large number of articles and treatises on cartels and on antitrust damages, and messages to groups of knowledgeable antitrust professionals. For example, inquiries were made on the antitrust list serves of the ABA Antitrust Section, the National Association of Attorneys' General, and of the American Antitrust Institute. Every qualifying final collusion verdict is included.²²⁶ The small sample size of overcharges from U.S. decisions is disappointing.

In other legal systems, antitrust commissions hold confidential hearings to determine guilt and impose sanctions. These decisions are announced in press releases that seldom mention the extent of cartel damages. Italy, the Netherlands, and Korea are exceptions to this rule; these overcharges are collected in Connor (2003). Moreover, these antitrust authorities and some others have reported a few of their decisions and overcharge estimates to the OECD (2003). However, in some jurisdictions a detailed report is released a year or two after the decision, and

²²⁵ The most useful sites were: The European Commission (EC); the Australian Competition and Consumer Commission (ACCC); the Canadian Competition Bureau (CCB); the German Bundeskartellamt (BKA); the Fair Trade Commissions of Japan, Korea, and Taiwan; and the competition authorities of Finland, Sweden, Norway, Denmark, the Netherlands, France, Italy, Portugal, and Israel. Many of these authorities seem committed to reminding taxpayers of precisely how harmful the cartels they ensnared have been.

In past decade, the large majority of the authorities' Web sites translate summaries of their decisions and their annual reports into English. However, I also read some earlier, untranslated documents in French, German, Spanish, and Italian. In recent years, (using browsers with the names of punished cartelists, for example) I have found short press releases from antitrust authorities or news bureaus written other languages and obtained sensible on-line translations.

²²⁶ Many of the verdicts found were only expressed in monetary amounts, which could only be translated into percentages if trade sources could be found for the often narrowly defined cartelized products. Other decisions gave good or at least minimally acceptable price change data for the affected markets.

some of these reports have prices that can yield useful overcharge information, though that is not often the case.²²⁷ Additionally, commission decisions can be appealed to a court that renders a decision with a recitation of the facts of the case.²²⁸

The 50 Highest-Overcharge Observations

The following table provides support for the text section “Looking in Detail at Extreme Observations”.

Table A.1. Summary of the Characteristics of the 50 Highest-Overcharge Observations, by Year Cartel Began				
Cartel Market [Number estimates above one]	Years	Over-charge ^a	Source of Estimate (s) ^b	Quality Assessment ^c
		%		
Cordage, sisal or hemp, Eastern U.S.	1878-81	350.0	Dewing (1913) book	Very good
Borax, European-based	1890-94	223.5	Pierce (1913), Holt (1907) books	Very good
Steel Tubes, US	1899-14	227.0	Jones (1921) popular book, academic author	Very good
Steel, barbed wire, US	1900-08	233.0	Jenks and Clark (1929) popular book, academic authors	Very good
Telephone service, home and office, NY City [2]	1908	433-620	Demarest (1910), an opinionated book on evils of monopoly by an author considered one of the pioneering „muckrakers“	Perhaps poor yardstick if Bell Co. had no competition
Radium, global	1912-18	243.0	Government of Canada (1945) research report	Excellent
Raisins, US	1913-22	257.0	Jenks and Clark (1929) popular book, academic authors	Very good
Phosphate Rock, US, World Exports	1919-49	254.0	Dick (1992a) refereed article	Excellent
Rare books auction, bidding ring, country estate in Surrey, UK	1919	430.0	Porter (1992) refereed article	Excellent
Sulfur, global [2]	1922-40	201.8 – 203.0	MacKie-Mason and Pindyck (1987) academic book chapter	Excellent
Electric Light Bulbs, world price	1924-39	222.0	Stocking and Watkins (1946) classic book	Excellent
Electric Light Bulbs, world price [4]	1924-39	214-322	UK Monopolies	Very good

²²⁷ I read almost 100 EC decisions that imposed fines on cartels (listed in Burnside (2003: Annex 1) and others published since 2003). The UK Monopolies Commission also released detailed reports, and I read about 40 of the ones that declared the cartel was “not in the public interest.”

²²⁸ Occasionally, the commission reported an absolute overcharge, and the size of affected sales needed to be estimated.

			Commission (1951)	
Tungsten Carbide [2]	1928-36	800.0-836.5	Berge (1944) DOJ prosecutor's book	Very good
Tungsten Carbide [3]	1928-36	243.0-1329.0	Government of Canada (1945) research report	Excellent
Tungsten Carbide [2]	1928-36	886.0	U.S. Court Decision	Very good
Tungsten Carbide	1928-41	429.0	Suslow (2005) refereed academic journal	Excellent
Tungsten Carbide [2]	1936-41	302.0-310.0	Government of Canada (1945) research report	Excellent
Tungsten Carbide [2]	1936-41	200.5-612.0	Stocking and Watkins (1946) classic book	Excellent
Mercury	1951-70	239.9	MacKie-Mason and Pindyck (1987) academic book chapter	Excellent
Cable, high voltage power, Germany, experimental laboratory market [3]	1902-90 ^d	1255.0-4918.0	Fonseca and Normann (2012) refereed academic paper	Excellent
Coconut Oil, Philippines	1959-59	739.0	Buschena and Perloff (1991) refereed academic paper	Excellent
Antiques Auction, UK (One Week)	1964-64	480.0	Cassaday (1967) academic book	Very good
Uranium Metal, US Market	1974-74	200.0	Davis and Garcés (2009) advanced textbook on damages methods	Very good
Uranium Metal, US Market	1974-74	244.0	U.S. Congress (1977) report	May not incorporate the highest scientific standards
Banks, credit-card interchange fees, Spain	1990-05	200.0	Carbó-Valverde et al. (2011) Working paper	Very good
Banks, debit-card interchange fees, Canada	1990-95	Infinity	Carbó-Valverde et al. (2011) Working paper	Very good
Tobacco, leaf, procurement, Italy	1995-2002	211.0	EC Decision 10/20/2005	Very good
Currency conversion fees, charge cards, US	1996-2005	200.0	Complaint 1/22/2002	Suit has not been successful, so estimate in doubt
Natural gas pipeline bid to Calif. "El Paso"	1996-2003	378.0	Lande and Davis (2007)	Excellent
Anti-anxiety drugs, US	1998	1800.0	FTC (1998) widely cited, well documented report	Excellent
Euro-Zone Fees, Banks in DE & NL	1999-2001	800.0	Guersent (2004) report by EC expert	Good but method a bit vague
Mobile Telephone Fees, UK & Germany	2000-02	450.0	Connor (2003) working paper	Possibly questionable yardstick
Distribution, Liquefied Petroleum Gas (LPG), So. Taiwan	2000-01	200.0	Taiwan FTC (2001) report to OECD (2001)	Good
Air passengers, Transatlantic routes, US-UK	2004-06	470.0	Antitrust Division DOJ (2008) report on increase in fuel surcharge increase compared to spot jet fuel	Very good

			prices	
Potash exports from Canada, Russia & Belarus	2005-12	348.5	Jenny (2010) newspaper opinion piece by well informed economist	Good
River boats, Phnom Penh to Siem Reap, Cambodia	2005-05	400.0	Bhatia (2006) from government report	Good
Glass, flat, Korea	2006-09	270.0	Yoon (2009) reporting on KFTC analysis	Very good
Avg. 50 High-Overcharge Cases	1949-1958	577.3^e	Duration 10.0 years	39% excellent, 36% very good
1398 Other Effective Cases	1962-1969	32.6	Duration 8.1 years	Not rated

Sources: Appendix Tables 1 and 2, summarized in J. Connor, *Price Fixing Overcharges Master Data Set*, spreadsheet dated December 2013.

- a) Similar estimates from similar sources are sometimes combined in one row.
- b) Single source may provide alternative models or methods, hence multiple estimates.
- c) The author's subjective assessment weighed according to the quality of the data employed, care used in applying the method of analysis, reputation of the authors (if known), and evidence of care in presentation of results (including peer or editorial review)
- d) This cartel, when discovered by the German Federal Cartel Office, had archives extending back to 1902, but as Germany's current version of its competition law was enacted only in 1958, the overcharge analysis covers only this latter period.
- e) Using the mid-ranges, the average for the 28 very good- and excellent-rated cases is 522%.

LITERATURE APPENDIX: Pre-Modern Cartel Studies

It took roughly 75 years of groping in the dark before economics had a clear-eyed vision of the essential nature of the price-fixing cartel and had the necessary theoretical framework to organize empirical studies in a logical manner.

As the example of Adam Smith shows, interest in collusive business organizations began well before industrial-organization economics was first taught as a distinct discipline in a few universities in the 1930s. Yet, cartels were initially conceptually conflated with monopolies, horizontal corporate mergers, and short-run commodity-market manipulation schemes involving pooling or hoarding. The German-speaking profession debated the details of the definition of *kartell* from the 1870s for 50 years, but was held back by its long adherence to a historical-institutional method of analysis hostile to classical economics. Cartels were primarily of interest from business or esoteric legal perspectives. English-language economists, who would come to dominate the profession, forged growing disciplines by wedding classical economics to empirical testing, but they totally lacked a precise, consensus definition until the 1940s. Most importantly, serious economic studies of cartels was inhibited by the absence of models of *oligopoly*. Private cartels are not only forms of business enterprise “in between” competition and monopoly, they are essentially distinct from either.

Moreover, cartel studies were discouraged by the absence of a public policy debate. Cartels were promoted (or tolerated by registration laws) by Continental European governments and were subject to only mild censure in the United States. Consequently, prior to World War II, only a few dozen archival academic publications treated the economics of cartels.

Only a few pioneers seemed to have intuited that cartels were unique and pervasive business organizations with potentially large welfare effects inevitably injurious to efficient markets. Because theories of oligopoly were slow to be developed and accepted by the economics profession and because public-policy debates were infrequent or inconsequential, economists largely disregarded cartels as an economic phenomenon worthy of formal analysis or empirical testing.

The three-volume set of books by Stocking and Watkins (1946, 1948, and 1951) was a watershed event. These authors who were well versed in the primitive field of industrial economics of the time, demonstrated that cartels were pervasive in the U.S. and world economies, had strong negative effects on their markets, and were dangerously incompatible with democratic institutions. Stigler’s (1964) oligopoly model of cartels gave legitimacy to cartel studies, and the exposure of Great Electrical Conspiracy in 1959-60 added policy urgency to the burgeoning field.

Evolution of the Definition of “Cartel”

A comprehensive bibliography about “trusts” compiled by the **U.S. Industrial Commission** in 1901 lists about 600 items in English, French, and German (*ibid.* 947-977). These early publications tended to use the terms “pools,” “corners,” “trusts,” “combinations,” “monopolies,” and “syndicates” interchangeably to identify various monopolistic business arrangements.²²⁹ Bullock’s (1901) seminal survey paper of late 19th century U.S. publications tends to regard all of these words as roughly equivalent terms for what

²²⁹ Other terms include monopolies, trade associations, conventions, *comptoirs*, *ententes*, and intergovernmental commodity agreements.

would be more precisely called today *monopolistic business entities with market power over price* (p. 183).²³⁰ Consistent use of these terms to represent analytically different phenomena was not well established in economics written in English until the mid 20th century.²³¹

Robert Liefmann coined one of the most cited and pithy definitions of cartels: “free [voluntary] associations of producers for the monopolistic control of the market” (Liefmann 1932: ix). By this definition he meant to include only arrangements by independent companies linked by formal or informal contractual agreements; compulsory commodity schemes enforced by government decrees or parliamentary statutes are not true cartels by his definition, though international agreements negotiated between compulsory national cartels would qualify if the negotiated agreement did not require statutory enforcement.²³² He dismisses the widely accepted view of the time that cartelists are merely aiming to achieve a “reasonable profit,” insisting that cartels are instruments for maximizing profits. Liefmann assembles a great deal of information on German cartels and limited information on cartels outside Germany, but with one exception, he includes no useful price series that could be used to compute price effects.²³³

Liefmann’s positions continued to influence German economists for decades to come. However, other German economists like **Beckerath** (1930) opined that cartels were motivated primarily by a desire to reduce fluctuations in output or prices. To do so, durable cartels typically used their power to raise prices during slumps and restrain prices during booms. While he admits that raw-materials cartels and patent pools were successful in raising prices above competitive levels in the long run, he believed that for other

²³⁰ In a footnote on p. 184, Bullock quotes with approval Jenks observation that trusts and cartels also aim “to check competition,” that is, prevent market entry.

²³¹ Until World War I or later, the word “cartel” or *Kartell* was not in general use among Anglophone economists; **Sayous** (1902), a French economic historian, discusses 16th and 17th century cartels. Sayous (1902:381) appears to be the first academic writer in a U.S. journal to use the word cartel in its present economic sense. He is one of the first writers to clearly distinguish private cartels from government-run schemes, trusts, holding companies, and the like. The famous Dutch East India Company, he argues, was a government-supported monopoly, not a cartel. Sayous believes that a cattle-procurement monopoly by butchers of Anvers, France in the 16th century qualifies as an early private European cartel. Notz (1920, 1929), a U.S. Government economic analyst whose work is discussed below, helped popularize the term in the United States.

In Germany, the word *kartell* came into popular usage in 1887 when two formerly antagonistic political parties formed a ruling government coalition under Chancellor Bismarck. In the UK, cartel first appeared in the press in the May 24, 1902 edition of the *Daily Chronicle*. The business press regularly reported on cartel developments, including price effects. For example, on p. 68 of *The Economist* (January 12, 1935) an unsigned article on Austria says in part: “The cartel movement is spreading....The Vienna coal trade has arranged for a cartel for house coal, and a 4 per cent price rise has occurred.” This is an example of an overcharge that does not meet this study’s minimum requirement for seriousness.

²³² That is, if a government-to-government treaty joins two or more national cartels, the result is not a cartel proper. It is the voluntary nature of the agreement that is the defining characteristic of true cartels, according to Liefmann. This distinction is a useful one for the present survey, because I wish to focus “private” cartels that are indictable under U.S. antitrust law. Private cartels may contain state-owned companies or legal export cartels as members, but if the arrangement is sanctioned by national laws, protected by national sovereignty, or the result of international treaties, I deem them “public.” Compulsory cartels, a type popular in Europe and Japan in the 1930s, are a special type of public cartel.

²³³ Liefmann (1932) has no doubts that cartels frequently raise prices (or prevent them from falling during recessions), but he is a bit of a perfectionist, insisting that “...it is impossible to say what the prices would have been if there had been no cartel (p. 104).”

types the evidence was lacking (p. 262). "...[I]t can only rarely be proved that a cartel is the only reason behind a price rise" (p. 263).²³⁴ Indeed, the book contains no price data.

In 1916, **Ripley** led the way in differentiating between cartels, mergers, and dominant firms, using terms that became commonly accepted economic and legal jargon by the 1940s. Pools or corners were contractual joint-profit-increasing agreements by independent sellers over prices or quantities; in most cases, speculators (or sometimes suppliers themselves) secretly purchased or contracted for a large inventory of a commodity²³⁵ in order to profitably control its price. Today, these are regarded as one variety of cartel (Ripley 1916: xiv).²³⁶ Ripley cites the U.S. cordage cartel, formed in 1860, as the first documented U.S. pool. Other 19th century pool-cartels include cotton bags, distilling, iron pipes, steel, salt (Jenks 1888), wire nails (Edgerton 1897), and a patent pool for porcelain bathtubs.²³⁷

"Trusts" proper were legal instruments used in the United States from about 1879 to 1902 for combining independent companies under a single board of directors (Ripley 1916). Hence the U.S. legal term "antitrust" to refer to laws governing price fixing, monopolies, and merger control; "antitrust" is now the world-wide term adopted in many foreign languages to refer to price fixing and other restraints on trade (but excluding merger control, dominant firms, and anticompetitive state support of national firms). Beginning in the late 1890s trusts were supplanted as a means of industrial merger by the holding company. Thus, trusts, combines, and holding companies can and often do refer to the outcomes of mergers and acquisitions rather than to cartels. However, when a trust was created as a cover for previously independent companies to collude, they closely resemble modern cartels (see Genosove and Mullin (1998) for a remarkable study of the U.S. Sugar Trust).

Yet, the word "trust" continued to be used loosely and popularly throughout the early 20th century to cover both cartels and mergers intended to increase market power. As late as the 1930s, several terms were often used interchangeably for cartels (Plummer 1936, Curtis 1931). Curtis considered cartel to be a term used mainly in Europe. His preferred terminology was pools for more informal and unstable cartels and trusts for cartels with strong central direction and control.

Industrial organization economics pioneer **Edward Mason**, professor at Harvard University, writing to a broad audience in 1944, dwelled on the ubiquity of the term "cartel" and "international cartel" among U.S. writers.

²³⁴ However, Beckerath undercuts his agnostic position by noting that most cartels have members with varying costs and set their common price so as to allow its highest-cost member to make a profit (p. 265); it follows that at such a price all the others are making economic profits.

²³⁵ A variant of the pool was one that spread false rumors exaggerating the size of its supply control.

²³⁶ However, pools often were organized to obtain only short run profits, whereas cartel connotes a more enduring scheme. "Cartel," from the German cognate *Kartell*, came into general use in British writing in 1902 (Connor 2001:20). Although more common in the 19th century, modern cartels do not usually endow a joint venture with capital contributions, though they may set up a sales office or secretariat. The first work in the United States that I have seen referring to German cartels is to "combinations" that "regulate" industries (Bullock 1901:207). Ripley (1916: xiv) cites German *kartells*. On the continent of Europe, "syndicate" or *comptoir* was often used to describe a cartel, with a joint sales agency often implied.

²³⁷ Other early examples (1908-1915) of convicted cartels based upon patent pooling are paper (1908), electrical equipment (1911), umbrella frames (1907), bicycle coasters (1912-13), shoe machinery (1914), cash registers (1915), harvesters (1914), and watch cases (1915) (Ripley 1916: 604-605).

“The word ‘cartel’ is enjoying an extraordinary and somewhat curious vogue in the United States. Its meaning, like that of many more or less technical words adopted for popular use, has become more vague while at the same time becoming more portentous. And the overtones are definitely sinister [in the United States]....Those opposed have relied on such words as conspiracy, monopoly, Fascism...[T]he United States is rather enthusiastically to an anti-trust policy...[but] our antipathy to monopoly ... is not shared by other countries.” (Mason 1944: 604-607).

After noting the precise definition²³⁸ developed by economists and consistent with contemporary discourse in economics, Mason (1944) then went on to discuss the various ways the appearance of international cartels have necessarily broadened the term cartel. He would include under the rubric international patent-pooling agreements, the establishment of joint marketing ventures by dominant firms,²³⁹ voluntary export associations (like the U.S. Webb-Pomerene export cartels), and voluntary export associations with government-owned companies as participants. These are all “private international cartels” in the strict sense, he proposed.

However, if an international cartel was formed by inter-governmental agreements, these are best called international commodity agreements (or perhaps public international cartels). Mason notes that international commodity agreements typically arise from pre-existing *national* (and often mandatory) cartels that were formed in response to falling prices and perceived “excess supply.” Sometimes the formation of international cartel agreements places pressure on certain governments to cartelize previously competitive industries, because as long as the industries remain competitive they can undercut the agreement.²⁴⁰

European Scholarship on Cartels

Perhaps the earliest careful writer on (public) cartels was the Dutch statistical economist **H. W. Tydeman** (de Jong 2009a: 56-58), who analyzed the market effects of municipally licensed craft guilds in towns in the 15th to 19th century. The first of them appeared in Amsterdam around 1400, had increased to 45 in 1688, and rose to 51 in 1818. After 20 years of public debate, guilds were abolished in the Netherlands by a royal decree in 1818. In a 124-page “essay” published a few years after they were abolished, Tydeman examines the economics of the Amsterdam guilds. Guilds set minimum quality standards and prices for its member’s goods and services. Tydeman found that by limiting the number of suppliers, the extra profits flowing from membership were low but measurable. The costs of joining a guild (i.e., becoming a fully qualified “Master”) equaled 1 to 5 years of apprenticeship at low wages, plus a purchase fee of 4% to 15% of the initial year's income of a new Master. Public policy of the Dutch rulers had consistently been to restrain abuses of the guilds. But the greatest restraints on the power of guilds were substitutes --

²³⁸ “Cartels... are agreements between firms in the same branch of trade limiting the freedom of these firms to in the productions and marketing of their products...that aim at the restriction of output or sales by the member firms...” (Mason 1944: 604). “...[C]artel, in the strict sense of the word, means a marketing agreement between *private* firms...” (ibid. p.605).

²³⁹ An example is the several Duperial companies in Latin America jointly owned by DuPont and Imperial Chemical Industries to sell products for which both companies had dominant positions in their respective home markets (Berge 1944: 183). Kreps (1950: 166) says that the Duperial agreement signed in 1929 was to have lasted for 50 years and involved territorial noncompetition for 400 chemical and drug products.

²⁴⁰ Mason (1944: 607) gives the inter-War European steel cartel as an example. This cartel initially included most of the important steel-producing nations of Continental Europe. After UK steel producers joined this export cartel, the UK government insisted that its steel companies form a domestic cartel.

such as public markets and craftsmen located outside the city's boundary (and, hence, the guild's jurisdiction) -- and the purchasing power of ship owners or other powerful buyer groups.

Private cartels first came to the attention of Low Country economists from **Kleinwächter's** (1883) book (de Jong 2009a: 62-63). European cartels began to release some information to the public on their operations in the 1880s, and this was used for the first Dutch academic publication on cartels by **Willem van der Schalk** (1891). Van der Schalk developed a sensible typology of five types of cartel organizations that he thought went from least effective to most effective, where the latter is equivalent to a monopoly: (1) P-fix, (2) Q-fix, (3) P- and Q-fix, (4) common sales office, and (5) a Central Bureau for sales-and-output direction. These degrees of performance assume that a cartel has tariff protection; if not, then he contended that the formation of an international (cross-border) cartel is necessary. Van der Schalk judged that only 2 of 11 international cartels in existence in 1888 (including *UK-German dynamite*) were minimally successful. Lack of success generally could be traced to long contract negotiations, a high degree of cheating, and no punishment mechanism. A factor that assisted effectiveness was state intervention in making transparent cartel members' market shares (e.g., monthly inspections of German coal mines, publication of brewery excise taxes, the use of public auctions for procurement).²⁴¹

Robert Liefmann (1897) published one of the first economic monographs that contained the word *Kartell* in its title.²⁴² The book appeared in five editions in German from 1897 to 1929. He was a widely read writer on cartels (de Jong 2009: 38-39). The last edition was updated, translated into English, and published in London in 1932; the Oxford University economist who wrote the book's Introduction hailed it as the best known study of cartels and trusts "from a German perspective."²⁴³ In many ways Liefmann was leagues ahead of his contemporaries in the analysis of the cartel phenomenon.²⁴⁴

Herman Levy was a contemporary of Liefmann. Levy was a prolific writer of books on economic history. Not counting revised editions, he authored ten books between 1900 and 1927, eight in German and two in English.²⁴⁵ De Jong (2009) calls Levy a "very perceptive" economist on the topic of cartels and trusts, including dynamic aspects (pp. 36-38). In disagreement with Schumpeter, Levy suggested that there were market conditions that would facilitate concentrated markets through cartels or mergers to monopoly: tariff protection, large economies of plant scale, input supply inelasticity, cost-reducing vertical integration, and seller reputation. Levy opposed state planning of an economy because it resulted

²⁴¹ Schalk's modern views on cartels would come to be replaced by Dutch economists (Wibaut, de Vries) writing in 1903-1940 who attempted to distinguish between good and bad cartels, the latter to be handled by nationalization or other forms of regulation (de Jong 2009a). In fact few nationalizations took place for 60 years in the Netherlands. Public opinion was mostly pro-cartel, tolerant of price fixing, and unreceptive to competition policy. Laws passed in the 1950s to correct abuses were ineffective. Only in 1998 did the Netherlands join in with the EC in properly enforcing anti-cartel legislation.

²⁴² The first appears to be Kleinwächter (1883), but this author was not as influential as Liefmann. Hirst (1905) seems to be the first book in English to have *Kartell* or *Cartel* in its title.

²⁴³ I interpret this phrase to imply that the British economics profession did not share German economists' fascination with the topic.

²⁴⁴ De Jong (2009: 38-39) credits Liefmann with other important contributions to Industrial economics. He may have been one of the first economists to write about potential competition (he called it "latent" competition) that would likely arise from the increase in prices due to cartelization of a market.

²⁴⁵ Levy wrote the first book on an English agricultural economics in 1904 (*Large and Small Holdings: A Study of English Agricultural Economics*. Cambridge Univ. Press, translated 1911).

in compulsory cartelization. While indebted to Liefmann's concepts and definitions, Levy covers different ground than Liefmann. Unlike Liefmann, Levy is eager to quantify the economic impacts of cartels and trusts. Levy (1968) is a reprint of the second (1927) English-language edition of his book on British cartels, monopolies, and oligopolies. This work is concerned about why the British cartel movement was weaker and slower to develop than on the Continent of Europe. It contains unique information on 18th and 19th century British cartels.

An issue among European writers is when and why *kartells* first appeared. **Piotrowski** (1933) delves into pre-Christian, Roman, and medieval history to find many examples of organizations that appear to resemble private cartels, but in most cases pre-modern historians fail to provide details about cartel conduct, organization, or the degree of government support. However, **Sayous** (1902) makes a well-documented case for the existence of private cartels in the strict sense of the term in 17th century Holland.²⁴⁶ The Dutch Company of the North was chartered in 1614 to exploit the Greenland whale-oil industry; by 1618 the Company had adopted a supply-restraint objective to keep domestic prices above competitive levels. However, the private nature of the Company of the North ceased in 1622 when the States-General of Holland granted it a long-lasting monopoly for whale-fishing.²⁴⁷

Nevertheless, it is Germany that has the best claim as the birthplace of industrial cartels that were organized and managed along contemporary lines.²⁴⁸ **Liefmann** (1932) believes that the first domestic German cartel was the Neckar Salt Union, an 1829 combination of salt mines in three German states. Five more were formed prior to 1870. However, Liefmann and other writers point to the German depression of the mid 1870s as a peak period for the formation of many of Germany's earliest industrial cartels. From 1903 to 1944 a German monthly magazine (*Kartell-rundschau*) was published that contained numerous articles on legal and business developments concerning cartels.²⁴⁹ A 1905 German government survey found 385 industrial cartels operating; the number rose to 3000 by 1925.²⁵⁰ As for *international* cartels, Liefmann identifies the 1867 merger of the Neckar Salt Union in Germany with the Eastern French Salt Works Syndicate as the first of its kind. By 1897 there were at least 40 international cartels with German companies as members, most of them in chemical or nonmetallic minerals product markets. Notz (1920) quotes a German book that found 114 international cartels in 1912; in 1920 he could identify 11 of those international cartels with participation by U.S. companies.

²⁴⁶ **Sayous** (1902:381), a French economic historian, appears to be the first academic writer in a U.S. journal to use the word cartel in its economic sense. He clearly distinguishes private cartels from government-run schemes, trusts, holding companies, and the like. The more famous Dutch East India Company, he argues, was a government-supported monopoly. Sayous believes that a cattle-procurement monopsony by butchers of Anvers, France in the 16th century also qualifies as an early European private cartel.

²⁴⁷ However, the government refused repeated appeals by the Company of the North to impose import barriers on whale oil or bone. The principal advantage of the Company of the North was secrecy about the location of its fishing grounds; it became weakened by the entry of three other Dutch companies that required a reallocation of its market share and by leakage of the secret to the Danish whale-fishing fleet in the 1630s.

²⁴⁸ Cartels evolved in a parallel fashion in the more industrialized parts of the Austrian Empire.

²⁴⁹ It may reasonably be inferred that in the early 20th century there was a large readership of professional cartel administrators (*Verbandsmanager*) and legal advisors in German-speaking nations and surrounding areas.

²⁵⁰ Liefmann (1932) notes that these numbers do not count hundreds of local German price-fixing agreements among hairdressers, hotels, and other local service providers.

Another early European writer who was concerned about the lack of concrete measures of the market effects of cartels is a then-young lawyer and economics lecturer, **Hirst** (1905). His book grew out of an 1899 Oxford student essay that attempted to develop price-based indicators of the price effects of cartels. Noting that German cartels frequently exported significant shares of domestic output to other countries at lower prices than their fixed domestic prices, he proposes using the export prices as a yardstick. Although there is some danger of overstating the domestic overcharge if the cartel is dumping product at predatory prices or if the marginal costs of exporting are lower than comparable domestic sales, he applies this method to six German cartels using 1900-1902 prices.²⁵¹ Hirst may be the first author, in the English language at any rate, formally to apply the yardstick method.

There were two important interwar conferences that focused on international cartels. Cartels, mergers, trade, and foreign direct investment were major concerns of the **League of Nations**, which sponsored a major conference in Geneva organized by its Economic Committee on cartels in 1927. Papers prepared by some of the leading European cartel writers of the day were published as part of the conference proceedings (de Rousiers 1927, MacGregor 1927, Wiedenfeld 1927, and Economic and Financial Section 1927).²⁵² These papers dwell on conceptual and organizational issues surrounding cartels and contain little of interest on price or welfare impacts. Indeed the near absence of empirical detail in these reports and other studies by European scholars active in the interwar period provide a striking contrast with the industrial analyses emerging in the United States. The final report of the 1927 conference reveals a deep split between those participants who believed that cartels harmed consumers (or laborers), national economies, and international trade and those who believed that cartels stabilized prices, investment, and employment. Representatives of social-democratic parties favored significant government action to control cartels, but the economists and civil servants who dominated the conference rejected the need for such laws (Gerber 1998: 159-161). Perhaps to rectify these ambiguities, the League later sponsored cartel studies with more empirical content (Benni *et al.* 1930, Oualid 1938).

From the 1920s, advances in European economic scholarship in cartel studies languished for decades. It is true that researchers at European universities and economic research institutes made important contributions to game theory and other theoretical developments in industrial organization economics, but that occurred in the late 1970s and 1980s. Similarly, novel research on legal-economic topics like optimal deterrence or „antitrust economics“ were largely North American preserves until the late 1980s or 1990s. Major empirical economic studies of cartel price effects were rare or fitful in Europe until the mid 1990s,²⁵³ and empirical analyses of large samples of cartel prosecutions did not begin to appear until after about 2004.²⁵⁴

²⁵¹ This method also may result in an inaccurate benchmark price if the elasticity of demand in the export market differs from that in the domestic market and this difference is not taken into account. In Hirst's study, however, I judge this factor to be a minor source of inaccuracy, because the export markets (mostly the Benelux countries) were geographically proximate to Germany and were at similar levels of industrial development.

²⁵² The United States was not a member of the League of Nations and sent only observers to the 1927 conference. Similarly, there were members of the U.S. Congress at the Interparliamentary Union conference of 1930, but the U.S. delegation abstained from endorsing the conference report.

²⁵³ Exceptions are Swann *et al.* (1974), Schroeter (1993), and Barbezat (1989). Probably the first empirical studies of cartel overcharges out of Europe are Schroeter (1996), Albaek *et al.* (1997), Fölster and Peltzman (1997), and Scott-Morton (1997).

²⁵⁴ The Netherlands (especially the Amsterdam Center for Law and Economics (from 2003) and the University of East Anglia's Centre for Competition Policy (from 2004) led the way. Among the first such studies are Schinkel (2006) and Stephan (2005). See also Russo *et al.* (2010)

Early European Anti-Cartel Legislation

Most writers about the establishment of competition law in Europe emphasize the key role played by the adoption of strong anti-cartel legislation by the German parliament in January 1958 after years of debate on the subject. German negotiators almost singlehandedly pushed for the inclusion of provisions for the control of cartels and monopolization in the Treaty of Rome that established the predecessors of the European Union, and it was the EU's antitrust laws that have served as the model or inspiration of competition laws in European and other jurisdictions. However, less appreciated are earlier attempts to fashion such laws in Europe.

Gerber (1998: 51-62) traces the origin of struggles over competition laws in Europe to the Austrian Empire of the 1890s.²⁵⁵ Like Germany, cartels were initially viewed as inevitable and benign creatures, but unlike Germany Austrian law invalidated cartel agreements. In the 1890s, growing reports of aggressive, harmful conduct by cartels turned public opinion against them. In the 1895 election, two major political parties attacked cartels as exploiters of the people. In 1897 and 1898 the parties in power introduced legislation that required cartel registration and information-sharing; an office of civil servants would then distinguish beneficial from harmful cartels and if necessary invalidate or punish the offending conduct. The justification for this law was that cartels interfered with the process of competition, transferred wealth from consumers to cartel owners, concentrated power in the hands of a few, and reduced government excise taxes. Because of political turmoil this competition law was never voted upon in Austria, but it was an influential model for academic and parliamentary debates in Germany in the 1950s (*ibid.* p. 67).

Public disenchantment with cartels also grew in Germany after 1900 (Gerber 1998: Chapter V). In 1908 and for several years thereafter the Reichstag requested a cartel office to be established, but delays by the bureaucracy and World War I intervened. The first European legislation to protect the competitive process from cartels was enacted in Germany in 1923. It was emergency legislation intended to address the nation's hyperinflation, modeled after pre-World-War-I ideas. A small cartel court in the Ministry of Economics registered cartels, heard cases, and ordered corrections for abusive conduct until 1933, thereby creating a body of judicial decisions that had some influence outside Germany, most notably in laws passed in 1925 in Sweden and 1926 Norway. The Norwegian competition law was by all accounts highly effective, but had modest influence on further developments in Europe. Competition laws adopted in Czechoslovakia (1933), Poland (1933), Yugoslavia (1934), and the Netherlands (1935) were variations on the German model (Harding and Joshua 2003: 79).

A meeting on antitrust issues was sponsored by the Interparliamentary Union at its 27th Conference in London in 1930.²⁵⁶ The Union regularly sponsored international conferences for members of various

²⁵⁵ The first European antitrust statute in modern times was France's *Loi Chapelier* of 1891, which aimed to protect economic freedom by prohibiting members of the same industry from regulating conduct that served their "common interest" (Gerber 1998: 183-186). An 1810 criminal law, designed to combat hoarding during wartime, further made manipulating prices a serious violation. These laws were applied infrequently in the early 19th century and after that not at all. These laws were a legal dead end in France and had no influence outside France.

²⁵⁶ The Union was created in 1889, originally as a venue for individual parliamentarians to engage in conflict resolution. In 2009 it had 143 parliaments as members and observer status at the United Nations.

national parliaments. This conference issued an unopposed resolution endorsing the enactment of strong national antitrust laws to protect the “public interest” and a set of ideas “... that was to be the core of the European competition law tradition for decades” (Gerber 1998: 161). Specifically, it recommended the establishment of an independent government entity to supervise cartels and have powers to prevent “harmful effects” and “abuses” arising from cartel conduct.²⁵⁷ This conference articulated a distinctly European model of competition law based upon the notion of abuse of market power that would continue to guide “...competition law thought and decisions more than half a century later” (*ibid.* p. 162).

Following decisions made by the Allies at the Potsdam Conference of 1945, tough anticartel laws were adopted in the U.S. and British zones of occupation of Germany (Edwards 1966). In 1947 alone more than 1000 cartel agreements were voided, and the process accelerated in 1950 with criminal proceedings, cease-and-desist orders, and private suits in German courts seeking damages. As the Allied High Commission intended, these actions had considerable effects in industrial and legal circles in Germany, including the voluntary abandonment of many cartels (Wells 2002: 146-174). This program had the support of Economics Minister Ludwig Erhard, his Christian Democratic Party, and the Ordo-liberal school of law and economics that were to dominate German political and intellectual life in post-War Germany through at least the late 1960s (Gerber 1998: 270-277). In 1951, the responsibility for enforcing the 1947 decrees was transferred to the nascent German government, on condition that soon after sovereignty was restored in 1955 a new statute would be debated and enacted. There was a vigorous debate over more than 20 draft laws from 1952 to 1957 in the Bundestag, with the Ordo-liberals embattled by national industrial interests and their allied political parties. Germany’s competition law of 1957 is a hybrid of Ordo-Liberal ideas, U.S. antitrust law, and the earlier administrative-law concepts of European competition law (*ibid.* p. 276-277). The Federal Cartel Office is an independent administrative body whose decisions are appealable to regular German courts; the criminal law prohibits hard-core horizontal cartels, but allows exemptions for many other horizontal and vertical restraints.

A second important development was also required by the Occupation Authority as a condition for the cessation of their direct control over the German steel industry, viz., the European Coal and Steel Community (ECSC) (Harding and Joshua 2003: 93-99). The 1951 ECSC Treaty prohibited cartel conduct and authorized the High Authority to impose fines for such conduct; the Authority’s decisions were not appealable to a court. The Treaty’s anticartel provisions were strongly influenced by American law advisors.²⁵⁸ The ECSC and Germany’s competition law are the two most important direct precedents for current EU antitrust rules.

Early Cartel Research in North America

Bullock (1901,1905), a professional economist and author of an early American economics textbook, wrote the first English-language survey of cartels and trusts in the social-science literature. After noting that there was a near absence of publications on the topic during 1890-1896, he finds an astonishing

²⁵⁷ Gerber (1998) speculates that the proposed commission structure was influenced by the 1923 German and 1920 and 1926 Norwegian competition laws. Norway’s law was probably the most effective in interwar Europe (*ibid.* pp. 156-158). Harding and Joshua (2003: 82) judge that the Norwegian law was major model for the Union resolution.

²⁵⁸ Edwards (1967: 246) claims that they were written in Washington, DC. Gerber (1998: 336-340) emphasizes that U.S. influence was hidden as much as possible; notes that drafts made by an American law professor were redrafted into a “European idiom” by a French civil servant; and speculates that the prohibition of cartels was accepted because of the Ordo-liberal orientation of the chief German negotiator.

outpouring of 34 books and 48 serious articles in 1897-1900.²⁵⁹ Interest in the subject continued in the early 20th century, with most of the cartel literature from 1900 to 1940 appearing in books.²⁶⁰ Some of these works were written by historians and others by some of the earliest practitioners of the emerging field of industrial economics. Most of these studies contain little or no quantitative data. Bullock opines that the quantitative measurement of the market-price effects of cartels and trusts is not possible.

Jeremiah W. Jenks was a political science professor at Cornell University in 1900 when the first of his five editions of *The Trust Problem* was published, though he had already been researching pools, trusts, and monopolies for 20 years by that time.²⁶¹ Jenk's 1888 study of the Michigan salt cartel seems to be the first economic study of cartels to appear in a peer-reviewed professional journal.²⁶² His publications display a strong empirical bent and show a deep interest in gauging the economic effects of cartels. Unusual among academics of the time, his commitment to the study of trusts seems to have been cemented by his extensive work as an advisor for the **U.S. Industrial Commission**, which held a series of public hearings in 1898-1899 on conditions in several oligopolistic industries. Jenks' books (1900, 1901, 1903, 1917, 1929) contain carefully constructed series of wholesale prices for refined sugar, whiskey, wire nails, barbed wire, steel, and other products controlled by cartels or dominant firms. Among his analytical advances was the creation of coterminous price series for the principal inputs for the final products (corn for whiskey, steel for nails, etc.). By correcting for changes in product prices due to input prices, he was able to determine more precisely when and how strongly prices were affected by a cartel.²⁶³

Harvard University seems to have been the leading campus for economic and legal studies of cartels in the early 20th century.²⁶⁴ One indication of its preeminence is the publication of what is probably the first textbook on cartels, mergers, and monopolies in 1905.²⁶⁵ The revised edition is a huge (872 pages of

²⁵⁹ The books include a couple of government reports of investigations and proceedings of major conferences. Moreover, there was no sharp distinction between academic journals and serious pieces in intellectual magazines like *The Atlantic Monthly* at the time. Bullock includes one book written in French, but none of the large German literature. He seems unaware of the extensive bibliography in the report of the U.S. Industrial Commission (1901).

²⁶⁰ Among the earlier post-Bullock monographs in English with significant economic content are books by Liefmann (1897, 1932), Jenks (1900, 1907, 1911), Jenks and Clark (1917, 1929), Hirst (1905), Jones (1914, 1921), Levy (1927, 1968), Michels (1928), Seagar and Gulick (1929), Domeratsky (1928), Notz (1929), von Beckerath (1930), Piotrowski (1933), and Plummer (1934, 1951). Levy (1968), a careful historian, cites about 30 books on cartels and closely related subjects published before 1927, the great majority in German.

²⁶¹ Jenks seems to be the originator of the cost-based method of calculating overcharges. The 1921 edition of Jenk's book received a glowing review by a well known cartel economist (Dana 1922). The most complete biography of Jenks appears in Brown (2004).

²⁶² The Salt Association was still operating successfully in 1888. Jenks judges that the Association had only four limited and brief upward effects on prices; as an exclusive marketing organization, it may have lowered the costs of transportation and selling in the upper Midwest. He does not calculate the cost benefits of this cartel relative to its damagingly higher prices.

²⁶³ McCrosty (1907) also wrote a book on the "trust problem" in the UK. While lively and impassioned on the subject, it is from an analytical perspective but a poor imitation of Jenk's works.

²⁶⁴ Other economists with occasional interests in cartels worked at California, Columbia, Cornell, and Stanford universities.

²⁶⁵ Perhaps the most important U.S. study of cartels to appear in the 1930s was a long monograph on seven international cartels or dominant firms in markets for nonferrous metals: nickel, platinum, aluminum, tin, copper,

small print) compilation of reprints from professional journals of law and economics, excerpts from briefs and court decisions, and legal commentary (Ripley 1916).²⁶⁶ Ripley aimed at applying the case-study method pioneered by Harvard Law School into advanced economics courses. The history of perhaps the first U.S. cartel, the marine cordage industry, was written at Harvard (Dewing 1913).

Eliot Jones wrote a Ph.D. dissertation at Harvard University on several episodes from 1871 to 1914 of cartelization of the U.S. anthracite coal industry, the largest U.S. mineral industry of the early 20th century. His dissertation won a University prize and was published by Harvard University Press in 1914. Jones' first book is for its time one of the best analyses of the economic history, market structure, collusive conduct, and price effects in any industry. It may be one of the first books to combine an empirical interest in industrial concentration with attention to the antitrust laws. In addition to detailed ownership and price data from industry trade sources, Jones had available testimony and exhibits from one of the early U.S. antitrust trials. This industry case study illustrated how a concentrated, technologically dynamic industry with extensive network economies, the railroads, could leverage its market power in transportation through backward vertical integration and collusion in the coal-mining industry; after the Sherman Act was passed, the railroads adopted new strategies (mergers, cross-ownership, and interlocking directorships) to maintain their market power in coal. Along with papers in the *Quarterly Journal of Economics*, his writings received extensive peer review that was unusual for the period. Jones' interest in competition and antitrust laws was extended in his 1921 book. Jones was a contemporary of Jenks, but better versed in the still-emerging concepts of industrial-organization economics. Despite his evident interest in the price effects of cartels, in his second book quantitative data were presented on price effects for only three cartels.

The 1870s were also a formative period for U.S. cartels. **Seagar and Gulick** (1929) trace the earliest documented U.S. pools to the East Coast cordage industry, which began making agreements on prices at least as early as 1861, but cordage manufacturers did not begin a formal association until 1878. The Michigan Salt Association, formed in January 1876, may be the first recorded formal U.S. cartel. Because of the high costs of transporting salt, an elaborate organizational structure, and the highly inelastic demand for salt, this cartel was successful in dominating the Midwest market for 25 years.

Two lengthy reports from analysts in the **U.S. Department of Commerce** presage the triumph of the more precise German usage of the term cartel (Domeratsky 1928, Notz 1929) Notz (1929) accepts Liefmann's classic definition of a private cartel: a voluntary association of two or more independent business organizations in the same line of business with the aim of increasing joint profits by controlling markets or reducing competition.²⁶⁷ Essential is an overt agreement to divide market territories, set or stabilize prices, limit or allocate industry supply, establish a common sales agency, pool intellectual property, or some combination of these five strategies. If the organizations are registered in at least two countries, then it is an international cartel. While the Department of Commerce reports are strong in detailing cartel membership and industry supply conditions, they have little to offer by way of price effects.

lead, and zinc (Elliott *et al.* 1937). This book was the result of a multiyear project by several economists working at Harvard University and Radcliff College. A different member of the project team authored each cartel study.

²⁶⁶ A similar book was edited by Curtis (1931).

²⁶⁷ Notz dwells on private cartels because compulsory cartels were mostly a phenomenon of the 1930s. However, he does briefly mention a phase of the German potash cartel that was nationalized during the Weimar Republic.

Relatively few books were written about cartels in the 1930s, a period during which antitrust was in temporary eclipse in the United States. In this decade, cartels were often embraced because they were perceived as antidotes to the worldwide depression and, in some industries, deflation. Cartels took on distinctly political roles as tools of economic planning in Europe and Japan. Indeed, the Brookings Institution sponsored a series of books during this time to assist U.S. policy makers in implementing the National Recovery Act of 1933 (e.g., Pribram 1935). U.S. Supreme Court decisions quickly restored the antitrust laws by 1938 (Wells 2002). Around that time President Roosevelt and his advisors became apprised of the intimate connections between the principles of National Socialism and compulsory cartels in Germany in the 1930s. The Roosevelt administration henceforth rejected using cartels to foster economic recovery.

Early Cartel Research in the Rest of the World

Outside Europe and North America, publications about cartels are scarce. One very early book on Australian combinations and cartels is by Wilkinson (1914). This work was preceded by more than a decade of decisions by Royal Commissions and a 1906 federal antitrust law. It contains extensive case studies of Australian trusts in the sugar, tobacco, shipping, coal, food manufacturing, wire, nails, fertilizer, wood, brick, and printing industries. Price effects, profits, cost inflation, and entry conditions -- both horizontal and vertical -- are documented. Some of these trusts were true monopolies, others cartels. Wilkinson (1914: Chapter 4) shows how American Tobacco and British-American Tobacco formed a manufacturing cartel around 1903-1905 that extended control to distribution and importation; manufacturers' accounting profits rose, and local Australian tobacco farmers saw prices decline and were told that the cartel would stop buying locally. Prices and wages rose as much as 129% after an interstate shipping cartel was formed (ibid. Chapter 5). While all these effects are consistent with effective cartelization, showing that they were causally related was beyond the ability of the author.

Cartel Price Effects

Although most books written prior to 1945 lacked empirical analyses of the market effects of cartels, a small number of U.S. economists²⁶⁸ published a few well documented case studies of price effects. Many were written during the heady times (1885-1920) during which state and federal antitrust laws were being debated and first enforced, though none of the authors of these works suggested that their approaches had forensic value.²⁶⁹ Among the most useful papers containing overcharges are Jenks (1888), Andrews (1889), Edgerton (1897), Hudson (1890), Walker (1906), Stevens (1912), and Tosdal (1916).

Jenks's study of the Michigan Salt Association of the 1880s is a classic example of a well researched history of the methods used by a mining cartel to control a market that incorporates substantial information on costs and prices.²⁷⁰ Edgerton's (1897) paper on the U.S. Wire Nail Association is a superb analysis of the evolution, operation, and price effects of a short-lived but tightly structured, highly

²⁶⁸ Hirst (1905) and Allen (1923) were among the very few European writers to write about cartel price effects.

²⁶⁹ These years bracket what is generally called the Progressive Era in American history. Some historians limit the period to the beginning of the first T. Roosevelt administration in 1901 to the late Wilson administration ca. 1919.

²⁷⁰ Until World War I or later, the word "cartel" or *Kartell* was not in general use among Anglophone economists; Sayous (1902), a French economic historian, discusses 16th and 17th century cartels. Notz (1920, 1929) helped popularize the term in the United States.

effective manufacturers' cartel; his paper was written with the help of insider interviews just a year after the cartel dissolved. This study is notable because the conspiracy is the first U.S. work on a U.S.-based *international* conspiracy.²⁷¹ Andrews (1889) drew upon contemporary business publications to recount what is quite possibly the world's first *global* cartel, the infamously scandalous Secrétan copper syndicate of 1887-1889. Stevens' 1912 study of the gunpowder trust is notable for focusing on what was believed to be the longest-running discovered cartel in the Nation's history; Stevens carefully delineated three distinct phases of the cartel, and he drew upon the records of a 1911 antitrust trial to document the final episode. Tosdal (1916) and Walker (1906) provide competent analyses of the earlier episodes of two highly durable domestic German cartels, potash and steel, respectively; subsequent scholars have repeatedly returned to these cases. Ripley (1916) reprints a fascinating court decision of the U.S. enameled bathtub cartel, which used patent licenses on a new machine to achieve effective collusion. Allen's (1923) account of the 18th century English copper-smelting cartel is the first quantitative assessment of cartel effectiveness by a European economist to appear in a peer-reviewed academic journal. The absence of cartel studies in professional journals in the 1920s and 1930s is striking.

²⁷¹ The paper contains an intriguing hypothesis about the optimality of price fixing. The cartel's organizers were well aware that most U.S. pools at the time were ephemeral because most manufacturing processes permitted quick entry, about six months in this industry. To discourage entry, the perpetrators consciously decided to raise prices *higher than the monopoly level* within a few months. They reasoned that potential entrants would view such unsustainable prices as evidence that the members were irrational and that the pool would quickly crash before the outsiders could start production. This information-obfuscation tactic worked because large-scale entry was thwarted for a year, which allowed the cartel to operate successfully for 19 months, about 12 months longer than if a more moderate pricing policy had been adopted.

DATA APPENDIX TABLES*

* Professor Robert H. Lande was initially responsible for preparing the material on overcharges from antitrust verdicts in U.S. courts up to about 2004. Jeff Zimmerman, David Ubilava, and Yuliya Bolotova were of great assistance in doing data crosschecks and in rechecking the tables summarizing the social-science overcharges.

Appendix Table 1. Alphabetic List of Cartelized Markets					
Cartel Market Name	Code No.	Characteristics			
		International	Location ^a	Bid Rigging	Found Guilty and Penalized or Liable for Civil Penalties (Blank cell means “legal”) ^b
Acrylic Glass/MMA and PMMA	343	X	GLOBAL		EU fines, US civil suit
Aggregate (crushed stone), Sao Paulo, BR	424	X	BR	X	Fined by Brazil
Air cargo	345	X	GLOBAL		US, EU, AU, KR, UK fines
Air passengers, US-Korea	348	X	GLOBAL		US fines
Air passengers, US-UK	347	X	GLOBAL		US fines
Air route, Latvia (LV)	425	X	Latvia		Fined by Latvia
Air Routes, Brazil	325		BR		Fined by CADE
Air Routes, Danish	235	X	EUR		EC fines
Air Routes, Hawaii	294		US		Legal
Airline ticket commissions, US	354		US		US civil suit settlement
Airlines, passenger, Indonesia	426	X	ID		Fined by Indonesia
Airlines, US passenger	172		US		
Almonds, US and export	205		US		Legal cartel
Aluminum foil, JP	276	X	JP		JFTC probe
Aluminum phosphide, US	82		US		U.S. guilty pleas
Aluminum, metal (1990s)	199	X	GLOBAL		
Aluminum, metal (interwar & earlier)	18	X	EUR		U.S. consent decree
Anti-anxiety drugs, US	370		US		US FTC fines
Asphalt paving, Alabama, US	204		US	X	US settlement
Asphalt paving, Finland	419	X	FI	X	Fined by Finland
Asphalt paving, Oklahoma, US	7		US	X	Jury trial decision
Asphalt paving, Seine-Maritime, FR	305		FR	X	FR fines
Asphalt paving, Suffolk County, New York	328		US	X	Guilty pleas
Asphalt paving, Sweden	331	X	SE	X	SE fines
Auction houses, fine art	42	X	US+UK		U.S. pleas, EU fines
Auction, UK Antique	416		UK	X	Legal
Auctions, houses in DC, US	53		US	X	U.S. trial
Auctions, used police cars, NY City	52		US	X	Civil settlement
Auto repair, Ft. Erie, Canada	420		CA		Fined by Canada
Automobile manufacture, US	25		US		Listed below, but not a cartel
Automobile testing equipment, JP	308	X	JP	X	JFTC sanctions
Automobiles, Canadian imports, US	427	X	US&CA		Damages paid in US
Automotive refinishing paint, US	403	X	US		US Private settlement

Baby Equipment, US	428	X	US		Damages paid in US
Ball & roller bearings, France	115	X	FR		France, fines
Bank credit-card interchange fees	409	X	GLOBAL		Fines, consent decrees
Bank debit-card interchange fees	410	X	GLOBAL		Fines, consent decrees
Bank loans, Hong Kong	357		HK		
Banks, debit-card interchange fees, ES	534	X	ES		Spain consent decree
Banks, Euro Zone fees, DE & NL	216	X	DE		EU fines
Banks, interbank check fee, FR	429	X	FR		Fined by France
Banks, multilateral interchange fees agreement, Latvia	430	X	Latvia		Fined by Latvia
BAR/BRI bar review courses, US	263	X	US		Settlement in US
Basmati rice auctions, Panipat, India	340		IN	X	
Bath tubs, enameled, US	239		US		US trial
Bath tubs, iron, UK	63		UK		Legal cartel
Batteries, auto, Korea	251		KR		KFTC fines
Battery recycling, Italy	374	X	IT		IT fines
Bedsteads, metal, UK	167		UK		Legal cartel
Beef purchases in California, US	45		US		US trial
Beer brewing, Korea	252		KR		KFTC fines
Beer, Belgian, HORECA channel	431	X	EC		Fined by EC
Beer, Belgian, Retail Private Label	432	X	EC		Fined by EC
Beer, France, HORECA ^f	433	X	EC		Fined by EC
Beer, Korea	535	X	KR		Fined by Korea
Bicycles, NL	434	X	NL		Fined by Netherlands
Bitumen, NL	386	X	NL		UC fines
Bleaching powder, UK	383		UK		
Bleaching powder, US	384	X	US		
Blueberries, wild, purchases, ME	264		US		US trial
Boats, Phnom Penh, Cambodia	369		CB		
Bond underwriting, US	153		US	X	
Bookstores, college, IUPUI, US	326		US		US criminal conviction
Borax Trust	379	X	GLOBAL		Congressional Investigation
Bread and flour 1, ZA	435	X	ZA		Fined by South Africa
Bread, white pan, US	37		US		U.S. Appeals Court
Bricks, China	244		China		China AMB fines
British Sugar, UK	536	X	UK		Fined by EC
Broadband internet service, Korea	281	X	KR		KFTC fines
Bromine	246	X	GLOBAL		US guilty pleas
Bromine, US	6	X	US		U.S. guilty pleas
Buspironone drug, US	317	X	US		US civil suit
Cable TV operators, Taiwan	243		Taiwan		TWFTC fines
Cable, rubber & plastic, UK	59		UK		Legal cartel
Cables, electric power, Germany	124		DE	X	Germany, fines
Calcium carbide	388	X	FR		Legal, acquitted at trial
Carbon and Graphite Electrical and Mechanical Products, world	436	X	GLOBAL		Fined by EC, CA & US
Carbon black, US exports	152		US		Legal export cartel
Carbon Cathode Block, world	437	X	GLOBAL		Fined by EC
Carbon dioxide, US	202		US		US civil settlement

Carbon fiber, US	198		US		US investigation
Carbon, arc lighting, US	188		US		Legal cartel
Cardboard boxes, AU + NZ	438	X	AU&NZ	X	Fined by AU & NZ
Cardizem CD hypertension medicine, US	203	X	US		US FTC and civil trial
Carpets, polypropylene US	319		US		US fine
Carpets, polypropylene, US	224		US		US trial
Carpets, woven, UK	62		UK		Legal cartel
Carton board, EU	39	X	EUR		EU fines
Cartons, corrugated, US	142		US		US trials
Cathode ray tubes (see electronic radio & TV tubes)					
Cattle procurement, fed, US	271		US	X	Jury trial
Cell phones (see telephone)					
Cement 1, Pakistan	439	X	PK	X	Fined by Pakistan
Cement, Aegean region, Turkey	314		TR		Turkey fines
Cement, Brazil	353	X	BR		
Cement, Corsica, France	339		FR		France fines
Cement, Egypt	327		EG		
Cement, Germany	106	X	DE	X	Germany, fines
Cement, importation, Taiwan	441	X	TW	X	Fined by Taiwan
Cement, India	415	X	IN	X	India, CCI fines
Cement, Jalalpur, India	363	X	IN	X	India, consent decree
Cement, Norway	212		NO		Legal cartel
Cement, Pakistan	358		PK		Restitution requested by Govt
Cement, Poland	440	X	PO	X	Fined by Poland
Cement, Romania	277	X	RO	X	Romania fines
Cement, South Africa	70		ZA	X	
Cement, Turkey	329		TU		Turkey fines
Chicken, Peru	393		PE		Fined by Peru authorities
Chicken, US	144		US		US trial & decree
Chocolate candy	372	X	GLOBAL		U.S. damages suit
Choline chloride (Vitamin B4)	81	X	GLOBAL		US jury trial
Cigarettes, U.S.	26		US		
Cipro, Pay-for-Delay, US	537	X	US		Private Calif. suit still undecided
Circuit plates, copper-plated phenolic paper laminate, JP	538	X	JP		Fined by JFTC
Citric acid	76	X	GLOBAL		U.S. pleas, EU fines
Coal, anthracite, eastern US	160		US		US trial
Coal, black, Australia	179		AU		
Coal, interwar, UK	324		UK		Legal cartel
Coal, Newcastle, England	166		UK		Parliamentary inquiries
Coal, Nord-Pas-de-Calais, FR	323		FR		Legal cartel
Coal, Ruhr, Germany	155		DE		Legal cartel
Coconut oil, Philippines	206		PL		Legal cartel
Coffee, Hungary	248	X	HU		Hungary, fines
Coffee, roasted, Germany	394	X	DE		German fines
Coke, Europe	147	X	EUR		Legal export cartel
Compact discs, prerecorded, US	444	X	US		Fined by US FTC
Compressors, refrigeration, BR	445	X	GLOBAL	X	Fined by US & EC

Concrete poles, electric power, PK	446	X	PK	X	Fined by Pakistan
Concrete, Denmark	51		DK	X	
Concrete, precast pipes, culverts, manholes, & sleepers, ZA	447	X	ZA	X	Fined by South Africa
Concrete, ready mix, Germany	114	X	DE	X	Germany, fines
Concrete, ready mix, Northwest Iowa, US	448	X	US	X	Fined by US
Concrete, ready-mix, central Indiana, US	449	X	US	X	Fined by US
Construction & other industries, US	196		US	X	US convictions
Construction & procurement, JP	213		JP	X	JFTC actions
Construction machinery mfg., Korea	278	X	KO		Korea FTC fines
Construction of athletic tracks, NL	450	X	NL	X	Fined by Netherlands
Construction projects, Korea	32		KO	X	Korea, fines
Construction, agric. engineering projects, JP	305	X	JP		JFTC sanctions
Construction, buildings, Germany	174		DE	X	Germany fines
Construction, buildings, NL	539	X	NL		Fined by Netherlands
Construction, buildings, UK	540	X	NL		Fined by UK
Construction, civil engineering projects, NL	108	X	NL	X	Netherlands, fines
Construction, concrete, NY, US	261		US	X	US trial
Construction, D-1 Highway, Slovakia (SK)	453	X	SK	X	Fined by Slovakia
Construction, electric wiring contractors, DK	122		DK	X	Denmark, fines
Construction, electrical, France	175		FR	X	France consent decree
Construction, heavy-lift marine, global	541	X	GLOBAL		Fined by US
Construction, Hibernia oil platform, CA	454	X	CA	X	Fined by Canada
Construction, installation engineering, NL	455	X	NL	X	Fined by Netherlands
Construction, kitchen, Japan	163		JP	X	Japan trial
Construction, landscaping, NL	456	X	NL	X	Fined by Netherlands
Construction, Natl. Library façade, CH	312		CH	X	Swiss fines
Construction, Normandy Bridge, France	247		FR	X	French fines
Construction, Norway	107	X	NO	X	Norway, probe
Construction, pipes & cables, NL	458	X	NL	X	Fined by Netherlands
Construction, public bridge project, Norway	542	X	NO		Fined by Norway
Construction, public bridges, JP	322		JP	X	JFTC and High Court fines
Construction, public works 4, France	459	X	FR	X	Fined by France
Construction, public works 8, Meuse, France	460	X	FR	X	Fined by France
Construction, public works 9, asphalt, Seine-Maritime, FR	461	X	FR	X	Fined by France
Construction, public, Japan	161		JP	X	A few civil actions
Construction, roads, Colorado, US	222		US	X	US trial
Construction, roads, Florida, US	1		US	X	Trials, settlements
Construction, roads, France	177		FR	X	France consent decree
Construction, roads, Germany	123		DE	X	Germany, fines
Construction, roads, Korea	193		KO	X	Korea FTC fines
Construction, roads, NY, US	260		US	X	US trial
Construction, roads, SD & NC, US	34		US	X	Trials, settlements
Construction, roads, seal coating, US	211		US	X	
Construction, roads, Spain	407		ES	X	Spanish fines
Construction, roads, US	195		US	X	Trials, settlements
Construction, school bldg., China	245		China	X	China AMB fine
Construction, schools, 4 towns, France	342		FR	X	Fines, France

Construction, sewers, Lithuania	368		LT	X	Commission decision
Construction, sewers, US	33		US	X	Trial
Construction, SRO, Netherlands	463	X	EU	X	Fined by EC
Construction, tendered, SRO, NL	290		NL	X	EC fines
Construction, university, France	176		FR	X	France consent decree
Construction, US Navy shipyard, Japan	162		JP	X	JFTC fines
Construction, wastewater, USAID in Egypt	101	X	Egypt	X	U.S. trial, conviction
Construction: see also asphalt					
Copper concentrate	88	X	GLOBAL		US, EU Probes
Copper metal 1	22	X	US/GLOBAL		
Copper, London Metal Exchange	418	X	GLOBAL		US, UK, JP penalties
Copper smelters, UK	225		UK	X	
Copper tubes & fittings, EU	395	X	EU		EU fines
Copper, London Metal Exchange	418	X	GLOBAL		
Corn Glucose Syrup, US	466	X	US	X	Damages paid to direct buyer
Corn Syrup, high fructose, US	414		US		Private US settlement
Currency conversion fees, charge cards, US	467	X	US		Damages paid to US cardholders
Dairy processing, US	54		US		US consent decree
Defense Department procurement, US	367		US	X	
Detergent manufacturing, KR	469	X	KR		Fined by So. Korea
Detergent, laundry, FR	470	X	FR		Fined by France
Diabetes testing strips, PT	330	X	PT	X	PT fines
Diamonds, gem, So. Africa	71	X	ZA		Legal cartel
Diamonds, Industrial	543	X	GLOBAL		Settlement in US
Distribution, bananas, 8 northern EU states	472	X	EU		Fined by EC
Distribution, drugs, ZA	364	X	ZA	X	ZA authority report
Distribution, food, New York City	366		US	X	US convictions
Distributors, natural gas, TW	229		TW		TFTC fines
DRAMs (memory chips)	292	X	GLOBAL		US guilty pleas
Dredging, river, Japan	164		JP	X	Japan trial
Driver training, Graz, Austria	552		AT		Austria fines and appeal
Drug-gang cartel, local US	373		US		Never penalized
Drugs (also see pharmaceuticals)					
Drugs, generic, UK	105	X	UK	X	UK probe, civil restitution
DVD, "3C" technology Patent Pool, world	473	X	GLOBAL		Fined by Taiwan FTC
Dyestuffs, synthetic	159	X	EUR		Legal cartel
E-Rate federal Internet program, 8 states	485	X	US	X	Fined by US
Education, bar review prep., GA	263		US		US trial
Electric hydro-power equipment, NO	116	X	NO	X	Norway, fines
Electric light bulbs	21	X	EUR		
Electric light bulbs, UK	184		UK		UK Commission
Electric light bulbs, US	189		US		
Electric meters, UK	61		UK	X	Legal cartel
Electric motors, UK	60		UK		Legal cartel
Electric pipes, Israel	249		IL		Israel court fines, prison
Electric power equipment, global	129	X	GLOBAL	X	US conviction
Electric power equipment, Japan	273		JP	X	
Electric power equipment, U.S.	48		US	X	US pleas, settlements
Electric power equipment, UK	183		UK	X	UK Commission

Electrical subcontracting, GA, US	267		US	X	US trial
Electricity and gas utilities, US	474	X	US		US obtained mandatory Restitution from a federal court
Electricity, green certificates, BE	475	X	BE		Case undecided
Electronic books, US	550	X	US		U.S. trial
Electronic radio & TV tubes, UK	192	X	UK		UK Commission
Elevators & escalators in Belgium	476	X	BE	X	Fined by EC
Elevators & escalators in Canada	530	X	GLOBAL	X	No fine in Canada, but by EC
Elevators & escalators in US	531	X	GLOBAL	X	No US fine, but by EC
Elevators & escalators, world	532	X	GLOBAL	X	Fined by EC and EU NCAs
Elevators and escalators in Austria	477	X	AT	X	Fined by Austria
Elevators and escalators in Germany	479	X	DE	X	Fined by EC
Elevators and escalators in Korea	482	X	KR	X	Fined by So. Korea
Elevators and escalators in Luxembourg	480	X	LU	X	Fined by EC
Elevators and escalators in Netherlands	481	X	NL	X	Fined by EC
EPDM synthetic rubber, world	483	X	GLOBAL		US buyers got damages
Eurocheque commissions, EU	289	X	EU		EC fines
Explosives, US	98	X	US	X	U.S. guilty pleas
Ferrosilicon, US	100	X	US		U.S. pleas
Ferry services, English Channel	41	X	EUR		EU, fines
Fertilizer (see nitrogen, phosphate, potash)					
Fire protection installation, AU	121		AU		Australia, fines
Flour imports, Taiwan	220		TW		TW FTC fines
Flour milling, KR	332		KR		KFTC fines
Football replica kits, UK	311		UK		UK OFT fines
Forklift trucks mfg., Korea	279	X	KR		Korea FTC fines
Frozen fish procurement, US	36		US	X	US guilty pleas
Frozen foods, Australia	120		AU		Australia, fines
Fuels, military, Korea	112	X	KR	X	Korea, fines
Futures contract, ME potatoes, US	266		US		US trial
Garbage collection, NY & NJ	233		US	X	NYC convictions
Gas, liquid propane, Israel	349		IL		Israel guilty pleas
Gas, liquid propane, Mexico	253		MX		Mexican FCC fine
Gas, liquid propane, Taiwan	242		Taiwan		TWFTC fines
Gas, natural, distribution, Taiwan	221		Taiwan		Taiwan FTC fines
Gasoline, diesel, & kerosene, Korea	337	X	GLOBAL		Korea, fines
Gasoline, retail, Florianopolis, Brazil	360		BR		Fined, Brazil
Gasoline, retail, France	110	X	FR		France, fines
Gasoline, retail, Italy	109	X	IT		Italy, fines
Gasoline, retail, Sherbrooke, Canada	391		Canada		Canada federal fines
Gasoline, retail, Sweden	111	X	SE		Swedish court, fines
Gasses, compressed, Canada	102	X	CA	X	Canada, fines
Gasses, compressed, NL	274	X	NL		EU fines
Gasses, industrial, JP	477	X	JP		Fined by JFTC
Glass, flat, Benelux	237	X	EUR		EU fines
Glass, flat, Korea	381		KR		KFTC fines
Glass, flat, US	113	X	US		US settlement
Glass, window, US	380		US		Legal
Grain, wholesale merchants, Athens	414		GR	X	Convicted at trial 326BC

Graphite electrodes	84	X	GLOBAL		US, CA, EU, KR fines
Graphite, isostatic	351	X	GLOBAL		EU fines
Gunpowder, US	158		US		First episode legal
Gymnasium seats, folding, US	2		US	X	US settlements
Gypsum wallboard, US	269		US		US trial
Harbor loading services, Taiwan	240		TW		TWFTC fines
Hardwood, US	284		US		US trial
High fructose corn syrup, US	197		US		US settlements
Hotel association, Spain	125		ES		Spain, fines
Hotels, luxury, Paris, FR	305		FR		France fines
Hydro-Electric power equipment, NO	478	X	NO	X	Fined by Norway
Hydrogen peroxide, EU	397	X	GLOBAL		UC fines
Ice cream manufacture, Korea	338		KR		KFTC fines
Infant & baby formulas, Italy	286	X	IT		IT fines (twice)
Insecticide, forest, Canada	83	X	CA	X	Canada pleas
Insurance brokers' fees, US & UK	336	X	GLOBAL	X	US settlements
Insurance, auto, Italy	551	X	IT		IT fines
Insurance, auto, Korea	250		KR		KFTC fine
Insurance, Auto, Vietnam	478	X	VN		Fined by Vietnam
Insurance, industrial property, Germany	479	X	DE		Fined by Germany
Iodine	40	X	EUR		Legal export cartel
Iron & steel rolls, cast, EU	227	X	EUR	X	EU fines
Jute textile, U.S.	344		US		Legal
Jute yarn and bags, India	359		IN		Legal
Lamp oil (Kerosene), U.S.	375		US		Legal
Land surveys, Edmonton, Canada	421		CA		Fined by Canada
LCDs, TFT Type, sold to Apple	489	X	GLOBAL	X	Apple received damages
LCDs, TFT Type, sold to Dell	490	X	GLOBAL	X	Dell received damages
LCDs, TFT Type, sold to Motorola	491	X	GLOBAL	X	Motorola received damages
Lead	69	X	GLOBAL		Legal export cartel
Lease oil fees for landowners, US	355		US		US civil settlement
Legal aid fees, DC, US	256		US		US trial
Lemons, California	210		US		Legal cartel
Linerboard, US	201		US		US civil settlement
Linoleum exports	137	X	EUR		Legal export cartel
Linoleum, UK	180		UK		UK Commission
Lipitor, "Pay-for-delay," US	493	X	US		Civil suit undecided
Liquid Crystal Display panels (LCDs)	411	X	GLOBAL	X	US jury trial
Liquor, retail, TX, US	258		US		US trial
Lysine	75	X	GLOBAL		US pleas, EU fines
Magnesite	94	X	EUR		US prosecution
Magnesium metal	28	X	US		US pleas, fines
Manufacturing basic materials, JP	214		JP		JFTC actions
Manufacturing, Sweden	303		SE		Legal cartels
Manufacturing, U.S.	38		US		US pleas, fines
Manufacturing, UK	55		UK		Legal cartels
Manufacturing, W. Germany	304		DE		Legal "rationalization" cartels
Marine hose, global	398	X	GLOBAL	X	EC fines
Market makers, NASDAQ, US	31		US		U.S. settlements

MCAA (monochloroacetic acid)	385		GLOBAL		US, EU fines
Mercury	72	X	EUR		Legal cartel
Methionine	78	X	GLOBAL		EU fines, US settlements
Methyl glucamine	85	X	GLOBAL		EC, Canada fines
Methyl methacrylate (see Acrylic)					
Microcrystalline cellulose (MCC)	356	X	GLOBAL		US FTC consent decree
Milk, mfg., 2 counties, Florida	10		US	X	U.S. state convictions
Milk, mfg., 3 counties, Florida	11		US	X	U.S. state convictions
Milk, mfg., 3 counties, Kentucky	9		US	X	U.S. state convictions
Milk, mfg., AMPI cooperative	226		US		U.S. trial
Milk, mfg., Cincinnati, Ohio	30		US	X	U.S. trial
Milk, mfg., core area, Kentucky	14		US	X	U.S. state convictions
Milk, mfg., Dallas, Texas	19		US	X	U.S. settlement
Milk, mfg., Danville, Kentucky	12		US	X	U.S. state convictions
Milk, mfg., North Texas	262		US		US trial
Milk, mfg., Owensboro, KY	13		US	X	U.S. state convictions
Milk, mfg., Southeastern U.S.	15		US	X	U.S. state convictions
Milk, U.S. marketing orders	207		US		Legal cartel
Mobile phone fees 1, Netherlands	533	X	NL		Fined by Netherlands
Mobile phone operators in FR	494	X	FR		Fined by France
Mobile phone service, IT	495	X	IT		Investigation in progress
Mobile phone service, PK	496	X	PK		Investigation in progress
Mobile/cell phones (see telephone)					
Motors, large-medium industrial, KR	497	X	KR		Fined by Korea
Movie distributors, ES	544	X	ES		Fined by Spain
Movie rentals, first run, MN, US	259		US		US trial
Movie tickets, KR	499	X	KR		Fined by Korea
Moving and storage services, (intl. freight forwarding), DE-US	500	X	GLOBAL	X	Fined by DE and US
MSG and Nucleotides (IMP, GMP), world	501	X	GLOBAL		Fined by CA, EC & US
Municipal Bond Derivatives, US	545	X	US	X	Fined by US
Mushrooms, canned, Germany	230	X	GLOBAL		EC fines
Nails, Germany	186		DE		Legal cartel
NASDAQ (see Securities, NASDAQ)					
Natural gas pipeline bid to Calif.	316		US	X	Civil US settlement
Nitrogen (sodium nitrate) fertilizer	16	X	GLOBAL		Legal cartel
Nitrogen, nitrate, ammonium sulfate for fertilizer, Chile	217		Chile		Legal cartel
Nonferrous metals, UK	181		UK		UK Commission
Oil (see petroleum)					
Oranges, California navel	209		US		Legal cartel
Paints, export, Japan	157		JP		Legal cartel
Paper pulp, bleached sulphate	228	X	GLOBAL		EC fines
Paper pulp, mechanical sulfite	138	X	EUR		
Paper, Adhesive label Stock, US & CA	503	X	US		US settlement approved
Paper, carbonless, EEC/EU	89	X	EUR		EC fines
Paper, copy paper imports, KR	465	X	KR		Fined by South Korea
Paper, newsprint, CA	302		CA		Legal cartel
Paper, thermal fax, US	99	X	US		U.S. pleas & trial

Paper, toilet, KO	315		KR		KFTC fines
Parcel Tankers, Chemical Shipping	504	X	GLOBAL	X	Fined by US
Pasta, Italy	553	X	IT		Fined by Italy
Personal care products, ES	390	X	ES		Fined
Petroleum distribution, Iceland	285	X	IS		Convicted
Petroleum refining, Midwest	35		US		U.S. trial
Petroleum, lamp oil, Ontario	134		CA		Legal cartel
Petroleum, offshore leases, US	154		US	X	
Petroleum, TX & Okla.	190		US		Legal cartel
Petroleum, US	24	X	US		Listed below, but not a cartel
Pharmaceutical wholesale distribution, ZA	505	X	ZA		Fined by So. Korea
Pharmaceuticals, antihypertensive, ID	389		ID		KPPU decision
Pharmaceuticals, cholesterol, Italy	119	X	IT	X	Italy, fines
Pharmaceuticals, respiratory, Italy	118	X	IT	X	Italy, fines
Pharmaceuticals, US	141		US		US trial
Phosphate rock exports, US	135	X	US		U.S. indictment
Phosphorus, red	132	X	EUR		
Pipes, cast iron, SE US	23		US		U.S. trial
Pipes, concrete, US	143		US	X	US trials
Plasterboard, EU	399	X	EU		EC fines
Plastic Additives, epoxidized soybean esters	506	X	GLOBAL		Fined by EC
Plastic bags, industrial, EU	400	X	EU		EC fines
Platinum	47	X	EUR		
Plumbing fixtures, US	156		US		US trial
Plywood, Japan	178		JP	X	JFTC fines
Plywood, US	145		US		US trial
Polyester staple, US & CA	507	X	EC & EU		Fined by CA & US
Polyethylene, low density plastic	405	X	EU		EC fines
Polyols, polyester aliphatic, US+CA	508	X	US & CA		Fined by US & CA
Polypropylene carpet (see Carpet)					
Polypropylene, EU	272	X	EUR		EC fines
Polypropylene, high density polyethylene, KR	509	X	KR		Fined by Korea
Polystyrol plastic, HU	510	X	HU		Fined by Hungary
Polyurethane foam, AU	511	X	AU		Fined by Australia
Polyvinyl chloride plastic	232	X	EUR		EC fines
Porcelain, sanitary, UK	57		UK		Legal cartel
Potash, Canada exports	352	X	GLOBAL		U.S. class action voided
Potash, International	73	X	EUR		Last episode 1935-39 US conviction
Potassium chloride, slow release US	301		US		FTC sanctions
Potatoes, fresh Idaho	392		US		Legal farmers' cooperative
Poultry, ZA	512	X	ZA		Fined by So. Korea
Power transmission equipment, PK	513	X	PK	X	Investigation in progress
Printing check pads, UK	514	X	UK	X	Fined by UK
Private equity buyouts, US	515	X	US		Suit for damages filed by buyers
Professional associations fees, KO	310		KR		KO govt. made cartels illegal
PVC (polyvinyl-chloride) plastic, EU	516	X	EU		Fined by EC
Quebracho tanning agent	50	X	AR		U.S. conviction
Quinine	131	X	EUR		U.S. pleas, fines

Radium	300	X	GLOBAL		Legal cartel
Railroad, Chicago to East, US	49		US		Legal U.S. cartel
Railroad, U.S. South	133		US		Legal U.S. cartel
Raisins, US	208		US		Legal US cartel
Rare books auction, bidding ring, UK	291		UK	X	
Raw materials, Germany	350		DE		Legal
Rayon (Artificial Silk)	136	X	EUR		
Real estate auction, Wash. DC, US	334		US	X	Guilty at trial
Realtors' listing service, CA, US	257		US		US trial
Realtors' sales commissions, MD	268		US		US trial
Rock Salt, northern Ohio	417	X	US	X	State damages suit
Rock salt, northern US	3		US	X	U.S. convictions
Roof tiles (clay), DE	518	X	DE		Fined by Germany
Roofing felt, Belgium	219		BE		EU fines
Roundwood (logs) buying, Sweden	236		SE	X	
Rubber, crude	20	X	EUR		Legal export cartel
Rubber, nitrile synthetic	401	X	GLOBAL		U.S. guilty pleas, EC fines
Rubber, polychloroprene synthetic	293	X	GLOBAL		U.S. guilty pleas, EC fines
Rubbers, two synthetic, EU (293+401)	402	X	EU		EC fines
Salt, Michigan	194		US		
Salt, PT	519	X	PT		Fined by Portugal
Salt, white, duopoly, UK	215		UK		Commission decision
Salt, white, Salt Union, UK	168		UK		Legal cartel
Scholarships, graduate, US	173		US		DOJ consent decree
School books in Indonesia, IBRD	520	X	ID	X	Bidders Banned by World Bank
School uniforms, KO	309		KR		KFTC fines
Securities, NASDAQ exchange, US	318	X	US		US civil suit
Shipping (marine freight lines) US-Puerto Rico	521	X	US		Fined by US
Shipping TACA (Trans-Atlantic Conference Agreement)	522	X	GLOBAL		Fined by EC
Shipping-agent services, PT	333		PT		PCA fine
Shipping, chemical parcel tankers	86	X	GLOBAL	X	U.S. convictions
Shipping, Europe-Australia wheat	404	X	GLOBAL		Legal
Shipping, express packages, US	127		US		Legal U.S. cartel
Shipping, Maritime, 3 UK conferences	171	X	EUR		Legal cartels
Shipping, Maritime, EATA Conference	287	X	GLOBAL		EC consent decree
Shipping, Maritime, France-Africa	43	X	EUR		EU fines
Shipping, Maritime, US Imports	412	X	US		Legal cartels
Sodium chlorate	79	X	EUR		
Soft drink bottling, KR	523	X	KR		Fined by Korea
Soft drinks, US	27		US		
Soil & gravel, Japan	165		JP	X	JFTC warning?
Sorbates	77	X	GLOBAL		US and EU fines
Stamp auctions, bidding ring	371	X	GLOBAL	X	US fines1
Steel and iron, Germany	238		DE		Legal cartel
Steel beams (structural steel), EU	524	X	EU		Fined by EC
Steel drums, UK	64		UK		Legal UK cartel

Steel girders, Germany	187		DE		Legal cartel
Steel pipes, insulated, EU	93	X	EUR		EU fines
Steel pipes, sewage, UK	58		UK		Legal UK cartel
Steel rails, Europe	169	X	EUR		Legal cartel
Steel rails, US	150		US		First episode legal
Steel tubes, US	151		US		Legal cartel
Steel, bulk metal, European	74	X	EUR		Legal cartel
Steel, flat rolled	218	X	GLOBAL		
Steel, flat rolled, Brazil	361		BR		Brazil (CADE) fines
Steel, flat stainless, EU	92	X	EUR		EU fines
Steel, flat, ZA	525	X	KR		Fined by EC
Steel, integrated, Japan	270		JP		Government-tolerated
Steel, merchant bars, France	297		FR		Legal cartel
Steel, pipes, specialty, US	320	X	US	X	US fines
Steel, road culverts, US	254		US	X	US trial
Steel, seamless tubes, EU	91	X	EUR		EU fines
Steel, semi-finished, France	295		FR		Legal cartel
Steel, structural, bridges, US	5		US	X	U.S. convictions
Steel, structural, buildings, US	4		US	X	U.S. convictions
Steel, structural, EU	95	X	EUR		EU fines
Steel, structural, France	296		FR		Legal cartel
Steel, thick plates, France	298		FR		Legal cartel
Steel, thin sheets, France	299		FR		Legal cartel
Sugar beets procurement, US	44		US		U.S. trial
Sugar refining, Korea	365		KR		KFTC fines
Sugar refining, UK	96		UK		EU, fines
Sugar refining, US	67		US		U.S. trial
Sugar, cane	17	X	GLOBAL		Legal export cartel
Sugar, Spain	126		ES		Spain, fines
Sulfur	87	X	GLOBAL		
Sulfur, crude, US exports	191		US		Legal export cartel
Sulfuric acid, US & Canada	103	X	US+CA		DOJ probe
Switchgear, gas-insulated, EU	396	X	GLOBAL		EU fines
Taxi service, Lithuania	313		LI		Lithuania fines
Tea	128	X	EUR		Legal cartel
Telephone fees, Indonesia	382	X	ID		KPPU fines
Telephone fees, international, Korea	283	X	KR		KFTC fines
Telephone fees, Italy	117	X	IT		Italy, fines
Telephone fees, local service, Korea	280	X	KR		KFTC fines
Telephone fees, long distance, Korea	282	X	KR		KFTC fines
Telephone fees, long distance, Philippines-US	546	X	PL		Abandoned because of comity
Telephone fees, UK & Germany	97	X	IT		EC probe
Telephone service, home, NY City ca. 1908	423		US		Legal
Terazosin hydrochloride drug, US	322	X	US		US civil suit
Tetracycline, US	223		US		Civil settlement
Text message service (SMS), ID	526	X	ID		Fined by Indonesia
Thorium nitrate, Germany	170		DE		Legal cartel
Thread, surgical, Taiwan	241	X	Taiwan	X	TWFTC fines

Timber, buyers at US Govt. auctions	29		US	X	
Tin	146	X	GLOBAL		Legal export cartel
Tin plated steel	376		US		Legal
Titanium metal, US	139		US	X	US trial
Tobacco leaf, Spain	288	X	ES		EU fines
Tobacco leaf, US	200		US	X	US settlement
Tobacco, leaf, procurement, Italy	527	X	IT	X	Fined by EC
Toiletries manufacturing, DE	362	X	DE		DE fines
Tomatoes, processed, US	547	X	US		Fined by US
Toys and games, UK	104	X	UK		UK OFT decision
Transformers, large, UK	65		UK	X	Legal UK cartel
Transformers, power & distn, E. AU	528	X	AU	X	Fined by Australia
Transformers, system, UK	66		UK	X	Legal UK cartel
Travel brokers' fees, Utah, US	234		US		US trial
Tungsten carbide	8	X	GLOBAL		U.S. trial
Uranium metal	130	X	GLOBAL		U.S. pleas, settlements
Urethane plastic, US	422	X	GLOBAL		US civil trial
Vanadium ore, US	46		US		U.S. jury trial
Vegetable oils, ES	529	X	ES		Fined by Spain
Vegetable parchment mfg., US	265		US		US trial
Visa & MasterCard fees, US	387	X	GLOBAL		Private settlement in US
Vitamin B4 (see choline chloride)					
Vitamin C, China exports to US	275	X	China		US civil case
Vitamin D, US	140		US		Patent abuse trial
Vitamins and Carotenoids, 16 bulk markets ^c	80	X	GLOBAL		U.S. & EU fines
Wallpaper manufacturing, Belgium	231		BE		EC fines
Waste collection, Germany	548	X	DE	X	Fined by Germany
Wheat auctions, Nerala, India	341		IN	X	
Whiskey alcohol, US	148		US		First episode legal
Window coverings, PVC, US + CA	549	X	US & CA		Fined by US
Wire and cable, UK	182		UK		UK Commission
Wire nails, US	149	X	US		Legal cartel
Wire rope, non-marine, UK	56		UK		Legal UK cartel
Wire, barbed, US	377	X	US		Legal cartel
Wire, Germany	185		DE		Legal cartel
Wire, smooth steel, US	378	X	US		Legal cartel
Zinc metal	68	X	GLOBAL		Legal export cartel
Zinc phosphate	90	X	EUR		Fined by EC

- a) X = the cartel was international in membership, that is, two or more of the companies colluding were from different nations; or the nationality of the cartelists differed from the location of a conviction authority; also includes export cartels. National abbreviations follow the two-letter codes used for Internet addresses.
- b) Cartels with participants that were fined, that paid civil penalties, or were subject to “consent decrees” (mandatory restrictions imposed by antitrust authorities on future market conduct) are considered to be *guilty* of cartel behavior. Cartels known to have operated during times or in jurisdictions that had no anti-cartel laws are considered to be *legal* cartels. If the cell is empty, the cartel is presumed to be legal.
- c) This observation includes 16 non-substitutable vitamins and provitamins, each of which is a separate market and cartel. Source: John M. Connor. *Price-Fixing Overcharges Master Data Set* (December 2013).

Appendix Table 2. Summary of Price-Fixing Overcharges				
Cartel Type, Location, and Dates ^a	Method of Analysis	Overcharge or Undercharge		Source ^c
		Epis- odic ^b	Peak	
		<i>Percent</i>		
1. Florida State road-building construction contract auctions, 1738 projects, 1981-1986; no mention of convictions by Gupta, but by June 1983 the Florida Attorney General had collected \$15 million in fines and settlements from road construction companies the state.	Econometric model explains variation in price-cost margins; compares the minimum of 2 bidders with average number (5) of bidders. Maximum observed number of bidders in the sample (19) is the competitive benchmark.	28-37	34-45	Gupta (2001b: 464), <i>Christian Science Monitor</i> (6/15/1983:4)
2A. Bid rigging against US schools by the members of the Folding Gymnasium Seating Council, U.S., April 1954-early 1960; DOJ consent decree in early 1960; study controls for changes in costs	Benchmark pre-cartel price is for Jan.-Mar. 1954 (\$6.43) vs. avg. 1955-58 price of \$9.06 per foot	40.9	--	Erickson (1976: 192-193)
2B. Same as 2A above	Benchmark price is for brief breakdown period April-June 1959 (\$6.68)	35.6	--	Erickson (1976: 192-193)
2C. Same as 2A above	Benchmark price is post-cartel: Sept. 1960- March 1961 (\$6.95)	30.4	--	Erickson (1976: 192-193)
3. Bid rigging, rock salt sold to state and local governments, northern U.S. ; began in early 1930s and renewed in 1948-49, but court testimony covers only 1954-1960; umbrella pricing by two largest U.S. companies; guilty at trial	But-for price is average of 1961-63 prices; study controls for changes in costs	60	66	Erickson (1976: 197)
4A. Bid rigging and market divisions, structural steel sold to construction contractors for public buildings , upper Midwest of U.S., March 1950-August 1962; probably convicted	Pre-conspiracy prices (1948-March 1950) compared to conspiracy period except for one brief breakdown in collusion; peak is 1961-62	9.0	27.9	Erickson (1976: 199)
4B. Same as 4A above	Conspiracy prices compared to post-conspiracy prices (Sept. 1962-Dec. 1963); peak prices from 1961-62	0	17.3	Erickson (1976: 199)
5. Bid rigging and market divisions, structural steel sold to construction contractors for bridges , upper Midwest of U.S., March 1950-Aug. 1962; meetings were "interrupted" from July 1960 to March 1961				
5A. Conspiracy period March 1950 – August 1962, excluding "interruption"	Benchmark price is for 1948-March 1950	9.0	--	Erickson (1976:199)
5B. Same as 5A.	Benchmark price is for 1948-March 1950	27.9	--	Erickson (1976:199)
5C. Late phase of conspiracy, April 1961 – August 1962	Benchmark price is for Sept. 1962 – Dec. 1963	0.0	--	Erickson (1976:199)
5D. Same as 5C.	Benchmark price is for Sept. 1962 – Dec. 1963	17.3	--	Erickson (1976:199)
5E. Same as 5A	Compares profit on equity	50	--	Erickson (1976:199)

	1950-1961 of a typical conspirator with the U.S. national industry average			
6. Price fixing of bromine sold to pharmaceutical manufacturers to make potassium bromide, U.S., three episodes:				
6A. National Bromine Co., pool 1885-1891	Base is 1880-1884 prices	9.7	19	Levenstein (1997)
6B. Shields pool, 1892-1902	Base is March 1891-October 1892 prices	65.2	126	Levenstein (1997)
6C. Shields pool, 1892-1902	Base is 1880-1884 prices	31.6	81	Levenstein (1997)
6D. Dow Chemical pool, 1902-1914	Base is several non-cooperative periods during 1905-1908	74.4	257	Levenstein (1997)
7. Bid rigging by 8 members of the Asphalt refiners Assn. of liquid asphalt contracts for the Oklahoma Highway Dept., 1954-1968, found guilty by jury trial.	Comparison of constant OK winning bid price with yardstick: average delivered prices in 6 surrounding states supplied from OK	71	71	Funderburk (1974:69-70)
8A. Cemented tungsten carbide , invented by Krupp Steel and General Electric in early 1920s; two firms formed a cartel in 1928, protected by patents later invalidated, that divided the U.S. and European markets between them; GE had a U.S. production monopoly, but Krupp sold to two US importers, which colluded with GE and were bought by GE in 1936 and 1937 to preserve its U.S. monopoly; GE was indicted for price fixing by DOJ in 1941, found guilty at trial in 1947.	U.S. price in 1927 when Krupp still exported to U.S. compared to GE's U.S. 1928-Oct. 1936 price when 3 US firms were colluding	800+	800+	Stocking and Watkins (1948:132-134), Berge (1944:43)
8B. Same as 8A	U.S. price 1928-36 compared to yardstick of (Krupp's) monopoly European price	787-886	--	Stocking and Watkins (1948:132-134), Berge (1944:43)
8C. Same as 8A above, except in second episode price lowered during Oct. 1936-1941	U.S. price October 1936 to 1941 compared to yardstick of (Krupp's) monopoly European price	99-302	--	Stocking and Watkins (1948:132-134)
8D. Same as 8C	U.S. monopoly price October 1936 to 1941 compared to highly profitable Government wartime price	395-829	395-829	Stocking and Watkins (1948:132-134)
8E. Same as 8A	U.S. price in 1928-1936 compared to Krupp's U.S. import price to two US exclusive importers and GE co-conspirators	886	886	<i>U.S. v. General Electric Co. et al (10/8/1948)</i>
8 F. Same as 8A.	Price 1928-35 compared to (inflated) price in Germany same years.	806	806	Canada (1945: 14)
8 G. Same as 8C.	Price 1936-39 compared to (inflated) price in Germany.	310	310	Canada (1945: 14)
8 H. Same as 8A.	Price 1928-1935 compared to (inflated) price in Germany.	243	243	Canada (1945: 14)
8 I. Same as 8C.	Price 1939 compared to (inflated) price in Germany.	50-321	50-321	Canada (1945: 14)
8 J. Same as 8A.	Price 1928-1935 compared to	1329	1329	Canada (1945: 14)

	price in October 1941 after antitrust indictment by DOJ			
8 K. Same as 8C.	Price 1939 compared to price in October 1941 after antitrust indictment by DOJ	61-543	61-543	Canada (1945: 14)
8L. Same as 8A+8C (no distinction between two episodes)	Mean annual deflated wholesale prices during 1929-1941, relative to 1926-28 average; peak is 1941	429	700	Suslow (2005:734)
9A. Bid rigging by three processors (Turner, Flav-O-Rich, and Prairie Farms) of school milk contracts, ½ pints of lowfat white milk, in Boone, Kenton, and Campbell Counties, Kentucky, 1984-1988; bid riggers won 20 of 22 contracts in 1987.	Benchmark is 1983 pre-collusion price of three riggers (\$0.12 per ½ pint); May- Sept. 1987 is representative cartel period, avg. of 20 winning bid prices (\$0.141); peak is 1 st bid (\$0.153)	18.3	27.5	Lanzillotti (1996:Figure 7, p.442)
9B. Same as 9A.	Geographic yardstick is price (\$0.1156) in surrounding more competitive counties; May-Sept. 1987 is representative cartel period, avg. of 20 winning bid prices (\$0.141); peak is "LIVP" bid (\$0.145)	22.0	26.1	Lanzillotti (1996:Figure 7, p.442)
9C. Bid rigging by three processors (Holland, U.C., and Ideal American) of school milk contracts, ½ pints of lowfat white milk, school districts in Boone, Kenton, and Campbell Counties, Kentucky, 1984-1988; bid riggers won 20 of 22 contracts in 1987.	Benchmark is 1980 pre-collusion price of 3 riggers (\$0.12); May- Sept. 1987 is representative cartel period, avg. of 20 winning bid prices (\$0.1417); peak is 1 st bid (\$0.153)	18.1	27.5	Lanzillotti (1996:Figure 7, p.441)
9D. Same as 9C	Benchmark is 1987 yardstick prices of non-colluding processors in adjacent counties (\$0.1095); May- Sept. 1987 is representative cartel period, avg. of 20 winning bid prices (\$0.1417); peak is 1 st bid (\$0.153)	29.4	39.7	Lanzillotti (1996:Figure 7, p.441)
9E. Bid rigging by two processors (Meyer and Trauth) of school milk contracts, ½ pints of lowfat white milk, school districts in Boone, Kenton, and Campbell Counties, Kentucky, 1984-1988; author shows that for 3 years after conspiracy, duopoly and yardstick prices were identical	Benchmark is avg. 1984-88 yardstick prices of non-colluding processors in adjacent counties (\$0.1223); avg. winning prices of duopoly is \$0.1363; peak in 1988	11.5	21.9	Lanzillotti (1996:Figure 3c, p.433)
10A. Bid rigging school milk contracts, half pints, Dade and Broward counties, Florida, 1980-1985	Average 1986-89 post-conspiracy prices (\$0.145) is the benchmark vs. avg. 1980-85 price (\$0.164); peak is 1984 (\$0.17)	13.1	17.2	Lanzillotti (1996:Fig. 8a, 443)
10B. Same as 10A	Pre-conspiracy price (\$0.142) is the benchmark vs. avg. 1980-85 price (\$0.164); peak is 1984 (\$0.17)	15.5	19.7	Lanzillotti (1996:Fig. 8a, 443)
11A. Bid rigging school milk contracts, Tampa	Average 1986-89 post-	2.3	12.8	Lanzillotti (1996:Fig.

Bay area (three counties), Florida, 1980-1985	conspiracy prices (\$0.133) is the benchmark vs. avg. 1980-85 price (\$0.136); peak is 1985 (\$0.15)			8b, p. 433)
11B. Same as 11A	Pre-conspiracy price (\$0.132) is the benchmark vs. avg. 1980-85 price (\$0.136); peak is 1984 (\$0.17)	3.0	28.8	Lanzillotti (1996:Fig. 8b, p. 433)
12A. Bid rigging school milk contracts, Danville, Kentucky 1983-1988; author shows that in nearby unaffected counties, state and school bids were nearly same during 1983-88	Yardstick is avg. price bid to state agency in same county in 1983-88 (\$0.1045) vs. school district (\$0.1555); peak is 1988	48.8	59	Lanzillotti (1996: Fig. 9c, p. 447)
12B. Same as 12A	Benchmark is 1989 post-cartel price (\$0.125) vs. school district (\$0.1555); peak is all years except 1986	24.4	27.2	Lanzillotti (1996: Fig. 9c, p. 447)
13A. Bid rigging school milk contracts, Owensboro, Kentucky 1983-1988; author shows that in nearby unaffected counties, state and bids were nearly constant.	Yardstick is avg. price bid to state agency in nearby counties in 1983-88 (\$0.1195) vs. school district (\$0.122); peak is 1988	2.1	4.9	Lanzillotti (1996: Figs. 8 and 9c, p. 447)
13B. Same as 13A	Yardstick is 1989 post-cartel price (\$0.125) vs. school district (\$0.1555); peak is all years except 1986	24.4	27.2	Lanzillotti (1996: Figs. 8 and 9c, p. 447)
14. Bid rigging school milk contracts, Kentucky "core conspiracy area," 1981- 1988	Geographic yardstick is median price in surrounding competitive counties (\$0.117) vs. core conspiracy (\$0.1294); peak is 1986	10.4	35.1	Lanzillotti (1996:Fig 10a, p. 448)
15. Bid rigging school milk contracts, summary of several selected school districts of school-milk bid rigging in southeast of U.S., 1979-1988, 2 to 9 bid riggers; estimates prepared for trial and used for settlements, from among 109 specific cases listed; may include observations 9-14 above	Various methods used for observations numbered 9 to 14 above	15-20	--	Lanzillotti (1996:452)
16A. Price fixing of nitrogen and nitrate (nitrate of soda and its substitute ammonium sulfate) international private cartel, including some national cartels; called the Convention de l'Industrie de l'Aziote (CIA); included Chilean miners' national export cartel (See also Cartel #217 below) and French, UK and German producers of coke-byproduct and synthetic manufactures; had 98% of Europe and 80% of world capacity; after four years of sharply falling prices, first episode began July 1929; collapsed July 1931.	Posner's method compares the UK price 30 days <i>after</i> the collapse with the six-monthly prices before the 1931 collapse, which is 43% in the original source (S&W 1946:163)	75.4	--	Posner (1975:818-820 and 2001:304), Stocking and Watkins (1946:163), Wallace and Edminster (1930: 54-56)
16B. Same as 16A, except UK market	Ammonium sulfate average UK prices in all of 1932 (128.8s.) <i>after</i> the collapse compared with 1930 average of 1940s, which is 33.6%.	50.6	--	Stocking and Watkins (1946:163)
16C. International cartel was reformed (second episode) at end of 1932 and continued to	Average U.S. nitrate of soda price index in 1936-39 relative	10.7	13.8	Stocking and Watkins (1946:165)

operate until at least 1947; a period of rising demand; wartime is omitted.	to the "before" 1935 price index; peak years are 1938-39			
16D. Same as 16C, except that prices rose immediately after 1932	Average U.S. ammonium sulfate price index in 1933-39 relative to the "before" 1932 price index; peak is 1938	24.1	38.1	Stocking and Watkins (1946:165)
16E. Same as 16C	Ave. UK ammonium sulfate prices in 1933-39 relative to 1932; peak years 1937-38.	15.4	21.1	Stocking and Watkins (1946:163-65)
16F. Same as 16A, but probably world prices	Lerner index predicted from econometric model	30	--	Griffin (1989:189-190)
16G. Same as 16C, but probably world prices	Lerner index	22	--	Griffin (1989:189-190)
16H. Same as 16A, but probably world prices.	When the cartel dissolved in July 1931, a price war caused prices to drop by 50% in 8/1931 to 6/1932.	100	--	Lamer (1957: 171-173)
16I. Same as 16A, except new episode, 2010-2012 world prices.	Econometric model using an estimated supply relationship; "The dynamic Lerner index averaged about 0.4 over 2010-2012"	40	--	Taylor (2013: 50)
17A. Second episode of price fixing of beet and cane sugar ; international quasi-private cartel comprised of "advisors" (mostly diplomats or civil servants) of the 21 governments with 85-90% of world sugar output and consumption; no treaty; began Sept. 1937, ended Sept. 1939; agreement froze the export shares of all exporting regions but also operated in part to placate consuming countries (i.e., buyers' cartel).	Ave. prices on the London market in Sept. 1937-Sept. 1939, relative to 1935-36 prices	30	--	Posner (1975:818-820), Posner (2001:304), Stocking and Watkins (1946:46)
17B. Same as 17A	Lerner index	6	--	Griffin (1989:189-190)
17C. Huge increases in global inventories and plunging prices from 1922 to 1932 was the main cause of the formation of international cane and beet sugar <i>exporters'</i> cartel of May 1931- Sept. 1935; a private agreement among national industry associations, with possible government encouragement/enforcement in the background, applied to the national sugar cartels of Cuba, Java, Peru, and five European countries to reduce output and set export quotas; no price agreement; global stocks fell 28%; Hexner calls this episode a dismal failure because importing countries outside the cartel boosted their production and self-sufficiency; Plummer says only Hungary passed legislation to enforce the agreement	Lerner index calculated by Griffin	13	--	Griffin (1989:189-190), Hexner (1946:192-193), Plummer (1934:20-23)
17D. Same as 17A+17C, but with no pause in collusion from 1935 to 1937	Mean annual deflated wholesale price 1931-38 relative to 1931 price; peak is 1931	0	0	Suslow (2005:733)
17E. Same as 17A+17C, but with no pause in	Mean annual deflated	13.9	100	Suslow (2005:733)

collusion from 1935 to 1937	wholesale price 1931-38 relative to 1939 price; peak year 1931			
17F. Same as 17A	Mean 1938 price (2 nd episode) in London market compared to 1932 (before 1 st episode)	17.0	--	Stocking and Watkins (1946:51)
17G. Same as 17A	Mean 1933-36 prices in London market compared to 1932 (before 1 st episode)	11-16.5	--	Stocking and Watkins (1946:51)
18. Price fixing and territorial quotas of aluminum metal . Six episodes beginning Oct. 2, 1901 and ending early 1939.				Posner (1975:818-820), Posner (2001:304), Stocking and Watkins (1946:228), Eckbo (1976:33)
18A. The first international private cartel of the world's five sole manufacturers, all located in Western Europe, was formed by contract on Nov. 2, 1901 which was in effect until late 1906	Price in Europe in 1905 compared to early 1901	--	100, 100 ^b	Posner (1975:818-820), Posner (2001:304)
18B. Second international cartel episode; same membership as 18A, but a tighter contract signed in late 1906; members and outsiders added 200% more capacity in 1905-08; entry, excess capacity, and a late 1907 recession put stress on the cartel; it formally dissolved Sept. 30, 1908	Benchmark is German ingot prices in late 1908 relative to mid 1907; decline in part due to fall in demand	--	50	Stocking and Watkins (1946:233)
18C. Same as 18B	Author's interpretation of case studies of other researchers	50+	--	Eckbo (1976:33)
18D. Same cartel as 18B, but data are from a top manager of the cartel in its later years who is an apologist for the benefits of cartels	Exact transaction prices from 1906 to 1908 in gold French francs; the base of comparison is the price demanded by the cartel's French members in Jan. 1908 which would have guaranteed a good rate of return; cartel dissolved in April 1908 and prices fell far below the base price; peak is all of year 1907	83	167	Marlio (1947: 13)
18E. Same as 18A and 18B combined, but tracks prices in U.S. market; imports flood into the U.S. market in 1910-1912	Alcoa's U.S. prices in 1910-1912 compared to 1902-07 average cartel U.S. prices	65	82	Stocking and Watkins (1946:229,233)
18F. Third international cartel agreement reached June 12, 1912 (5 days after Alcoa accepted a DOJ consent decree to end an antitrust probe!); ended by outbreak of war in August 1914	Average annual U.S. price in 1913 versus 1912	5.0	--	Stocking and Watkins (1946:238-245, note 44)
18G. Same as 18F above	Average European transaction prices Jan. 1913 to Jan. 1915; peak is 1914; compared to same base price as in 18D above	30.4	33.3	Marlio (1947: 18)
18H. Prices fall after end of war prompting a 4th, unwritten cartel agreement in 1923; lasted until 1926; Alcoa hid its participation by	Method not explained and numbers not found in S&W; S&W refers to 1922-1924	--	38, 59 ^b	Posner (2001:304), Stocking and Watkins (1946:251),

forming a holding company for its burgeoning European assets which was controlled through its Canadian subsidiary; European members refrained from exporting to US and Alcoa did not export to Europe at less than cartel's prices	price changes of 33% in Europe and 44% in the U.S.; Elliott considers 1923-25 boom "mainly" responsible for price increases			Elliott <i>et al.</i> (1937:256)
18I. Same as 18H above	Author's interpretation of case studies of other researchers	50+	--	Eckbo (1976:33)
18J. Fifth international private cartel, 1926-1930; unlike some others, this author interprets new cartel agreement in 1926 as start of a new episode; other authors consider 1924-1938 as one episode	Author's interpretation of case studies of other researchers	50+	--	Eckbo (1976:33)
18K. Sixth episode in Europe by 8 companies that owned a common joint venture, the Alliance Aluminum Co., lasted from July 1931 to early 1939; joint venture purchased and sold aluminum stocks to members; cost-saving technological change rapid in 1930s	London list or "official" price compared to the price members could buy out of Alliance Aluminum stocks; peak is Nov. 1931	45	75.1	Marlio (1947: 37-40)
18L. Same as 18K.	Transaction prices from Nov. 1931 to Dec. 1936 in gold French francs compared to Mar. 1938-Jan. 1939 (1.1 FF), a period the author, an expert insider, calls cooperative but not very effective; peak is Nov. 1931	83.6	101.2	Marlio (1947: 39-40)
18M. Same as 18K above	Author's interpretation of case studies of other researchers	50+	--	Eckbo (1976:33)
18N. Study that measures the U.S. market power of Alcoa during three episodes when it was a monopolist in the U.S. market (1923-1940) partly because of agreements with European producers that limited imports	Econometric model with excellent data that measures short-run and long-run mark-up over Alcoa's U.S. marginal costs, including accounting profits	59-65	--	Posner (2001:304), Suslow (1986: 399-400)
18O. Same as 18J above	Compares average London metal price 1926-29 with price in late 1930 after US-Canadian entry	24.4	--	Oualid (1938:20-21)
18P. Same as 18K above	Average London price 1932-36 with July 1931 or late 1930	5.3-17.7	--	Oualid (1938:20-21)
18Q. Same as 18K above	Same as 18P, except base of comparison is price in "cartel-free" markets Belgium, Netherlands, and Central Europe	17.7-25	--	Oualid (1938:20-21)
18R. Same as 18A	Lerner index predicted from econometric model	67	--	Griffin (1989:189-190)
18S. Same as 18F	Lerner index predicted from econometric model	40	--	Griffin (1989:189-190)
18T. Same as 18J	Lerner index predicted from econometric model	31	--	Griffin (1989:189-190)
18U. Same as 18K	Lerner index predicted from econometric model	34	--	Griffin (1989:189-190)
18V. Same as 18A, but authors believe that 1904-07 prices were strongly affected by a	European price change from 1900 to 1902	25	--	Elliott <i>et al.</i> (1937:226)

boom in demand				
18W. Same as 18H above	Changes in prices in the US from 1922 to 1924	44	--	Stocking and Watkins (1946:251)
18X. Same as 18F	European prices in 1912-14 relative to competitive 1908-11 period	0-70	--	Elliott <i>et al.</i> (1937:228)
18Y. Same as 18H, except that transactions prices are taken from an exhibit from a private antitrust suit against Alcoa	Peak U.S. price in Dec. 1925 relative to 1920-21 when Alcoa faced large European import competition; adjusted for \$.03 rise in U.S. tariff in Sept. 1922	--	32	Elliott <i>et al.</i> (1937:255)
18Z. Same as 18H; author believes that over-capacity, increased scrap supplies, and depression caused prices to decline 20%; costs also declined by 20% 1926-1930/31	Cartel was able to bring off an "orderly reduction in prices" with no change in profits	0	--	Elliott <i>et al.</i> (1937:260)
18AA. Same as 18H above	Changes in prices in Europe from 1922 to 1924	33	--	Stocking and Watkins (1946:251)
18BB. Same as combination of 18H and 18J.	Average U.S. net realization prices in 1924-1938 compared to 1921-22; peak is 1937; includes Great Depression.	13	38	Stocking and Watkins (1946:229,252-269)
19. Bid rigging of Dallas-Fort Worth school milk contracts in 1980-1992 by 9 dairy processors, which paid a large settlement to end a civil suit.	Examines winning bids in DFW to those in San Antonio, Texas for several types of milk	5.0-6.0	--	Lee (1999)
20A. Price fixing of crude natural rubber international private cartel, London-based Rubber Growers' Assn., agreed in recession year 1920 to cut output by 25% in 1921; Dutch producers supported cut; in November 1921 UK and colonial legislatures made it a mandatory government program; price effects were large from 11/21 to 1925-26, but no analysis presented here; UK government rubber-quota program encouraged expansion of Dutch East Indies production; by 1926-27 it was no longer effective; officially abandoned Oct. 1928	World price change from just before cartel (1920- early 1921) to late 1921	--	100	Posner (1975:818-820), Posner (2001:304), Stocking and Watkins (1946:64-65)
20B. New scheme implemented June 1934-April 1944; the Intl. Rubber Regulation Cmte. in London with government and industry members set output and export limits, which were negotiated by Britain, Holland, France (and their colonies) and Siam; Suslow judges the IRRC to be a private cartel	Real world prices in 1934-39 compared to base years 1930-33; peak year is 1937	119	149	Suslow (2001: 57), Hexner (1946: 280-293)
20C. Same as 20B; IRRC based its price objective on covering full costs of production plus a rate of return on assets of about 7.5%; extensive studies of plantation costs in all areas were commissioned	Nominal prices 1936-1939 compared to upper limit of full costs of production	15-134	141	Hexner (1946: 287)
20D. Same as 20B	Lerner index	66	--	Griffin (1989:189-190)
20E. Same as 20B	Mean annual deflated	138	287	Suslow (2005:732)

	wholesale prices for 1934-1939 relative to 1929-31; peak is 1937			
21A. Price fixing and quotas for electric incandescent light bulbs , global, international private cartel formed as Phoebus SA, incorporated in Switzerland, by contract on Dec. 23, 1924 by British, German, Dutch, Hungarian, Japanese, French, and U.S. companies; ended Sept. 1939; reestablished 1945-55, but weak after GE withdrew in 1945	Method not explained by Posner; cannot find such price change in the original source (S&W)	37	--	Posner (1975:818-820), Posner (2001:304), Mirow and Maurer (1982), Stocking and Watkins (1946:340-45)
21B. Same as 21A above	Prices of 25, 40, 60 Watt bulbs in Holland in 1938 relative to U.S. (yardstick) prices; average assumes 25 W accounts for 50% of market and other sizes 25% each	222	367	Stocking and Watkins (1946:344)
21C. Same as 21A above	Same as above except Germany vs. USA	140	220	Stocking and Watkins (1946:343)
21D. Same as 21A above	Same as above except Sweden vs. USA	77	110	Stocking and Watkins (1946:343)
21E. Same as 21A above	Compare (retail?) prices of 60W bulbs in Germany in 1929-30 with same bulbs before cartel began (1924-25); no adjustment for cost reductions	-11	--	Benni <i>et al.</i> (1930:75)
21F. Same as 21A above	Cartel price reduction in Sweden as new local lamp factory was being built in the early 1930s	27	--	Stocking and Watkins (1946:343 and footnote 106)
21G. Same as 21A	From Phoebus' records, average net 1937-38 manufacturers' prices in 8 W. European member countries, relative to Japan, the only nonmember in the world	322	--	UK Monopolies Commission (1951: 196)
21H. Same as 21A	Same as above for British Empire prices	281	--	UK Monopolies Commission (1951: 196)
21I. Same as 21A	Same as above for Brazil	148	--	UK Monopolies Commission (1951: 196)
21J. Same as 21A	Same as above for China	111	--	UK Monopolies Commission (1951: 196)
21K. Same as 21A	Same as above for non-Phoebus Europe	276	--	UK Monopolies Commission (1951: 196)
21L. Same as 21A	Same as above for rest of the world	214	--	UK Monopolies Commission (1951: 196)
22A. European copper metal market was cornered by the "Secrétan" syndicate of four UK and French firms by signing long term contracts with major mines worldwide to reduce supply; thus, in effect, a global cartel;	London Metal Exchange (world) prices in late 1888 compared with costs (mine contract prices held by syndicate); maximum price is	31	129	Elliott <i>et al.</i> (1937: 395)

Sept. 1887-Mar. 1889; Mar. 1889 crash came after unexpected increases in mine output and recycled Asian supplies arrived.	compared to LME price at end of March 1889			
22B. The “Amalgamated Pool” raised \$155 million to finance purchase of large stocks of U.S. copper metal in April 1889; world price rose in late 1901 and crashed at end of 1901 when pool owned 200,000 tons	London Metal Exchange (world) Price in mid 1901 compared with end of 1901	35	--	Elliott <i>et al.</i> (1937: 397-98)
22C. Amalgamated Copper Co. organized a US supply-control cartel in 1906; effective 1907-1912.	London Metal Exchange (world) Average prices late 1907-1912 compared to 1906; peak effect was from early 1906 to “Panic of 1907”	35	127	Elliott <i>et al.</i> (1937: 398)
22D. Copper Export Assn. was formed by 4 US producers in Dec. 1918 covering 95% of US production; it agreed (illegally) to reduce output by 42% during 1919; all mines were closed for 9 months in 1921; by 1923 large post-war govt. stocks were liquidated and it disbanded; prices recovered but new African mines opened in the 1920s; 1923-26 was one of the few normal, competitive periods in the copper market, with world prices fairly steady at \$0.13/lb.	Authors’ analysis of London Metal Exchange (world) price elevation late 1919 to 1923 above competitive levels in early 1919	29	--	Elliott <i>et al.</i> (1937: 418-419)
22E. Price fixing of copper metal by Copper Exporters Inc., the first Webb-Pomerene Association to have foreign (non-U.S.) members; U.S. and African mine companies coordinated output from 10/1926 to 12/1932 through “the Copper Institute,” ostensibly a statistical agency; effective in propping world prices October 1926 - May 1930; coordinated large output cuts in 1930-31 also, but price fell to \$0.05/lb. by 12/32.	Posner’s method not explained; Posner cites Stocking and Watkins, but I cannot find Posner’s estimate in the original source (however, it is close to 22G below)	31	--	Posner (1975:818-820), Posner (2001:304), Stocking and Watkins (1948:125-131)
22F. Same as 22E above; world prices during 10/1926-5/1930 peaked at \$0.212/lb in March 1929	Based on the narrative, average prices waer \$0.175/lb.; benchmark is average of \$0.13 during 3 years before cartel contract signed	34.5	63.1	Stocking and Watkins (1948:127-128)
22G. Same as 22E; world copper prices in year following Great Crash, May 1929-May 1930; cartel lost control of prices after May 1930 when more large African mines opened; formally dissolved in 1932	Same as above	38	--	Stocking and Watkins (1948:127)
22H. Same period as 22E; an early economic study of international cartels, most of them European based, that depends on information from previously published economic studies and press accounts; writing at the beginning of the Great Depression, the author is more impressed by the failures of cartels to raise prices than their successes; of scores of private cartels studied, only two have data on their price effects; international copper cartel maintained near monopoly over supply, but experienced rapidly falling demand and rising	World export prices in Dec. 1932 compared to peak period May 1929-April 1930	--	-72	Plummer (1934:149-152)

stocks				
22I. Same as 22B, but judged effective only from early 1899 to Dec. 1901; ended by lack of European cooperation and domestic cheating	New York wholesale prices 1899-1901 compared with 1898	31-64	--	Herfindahl (1959:81)
22J. Same as 22B	New York wholesale prices 1899-1901 compared with 1902-03	55-64	--	Herfindahl (1959:81-82)
22K. Same as 22C; Herfindahl is skeptical that any of the collusive arrangements alleged by other researchers in 1904-05, 1906-07, 1908, 1909, or 1912-13 were effective	New York wholesale prices 1904-13 compared with early 1906 benchmark	0	--	Herfindahl (1959:92-99)
22L. Same as 22D, except slightly shorter conspiracy period; the CEA was successful in restricting supply in 1921-22 and possibly in 1918-20 also.	New York wholesale prices 1921-22 compared with 1923-26 benchmark; price effects were weak and brief	1	--	Herfindahl (1959:92-99)
22M. Same as 22E above.	Compared world prices March 1929 with average of 3 years before cartel contract signed	--	63.1	Stocking and Watkins (1948:127)
22N. Same as 22E, except shorter effective period of 4/1929 – 4/1930	New York wholesale prices April 1929-April 1930 compared with competitive 1926-28	28	--	Herfindahl (1959:208)
22O. Same as 22N	New York wholesale prices April 1929-April 1930 compared with 1931	88	--	Herfindahl (1959:208)
22P. Same as 22D; a 1918-1922 (or 1924) U.S. Webb-Pomerene Assn. that liquidated large wartime (WWI) stocks, but may not have affected export prices	Lerner index	0	--	Griffin (1989:189-190), Hexner (1946:224)
22Q. Second international copper cartel (first is 22A); formed with exporters of all countries except Canada as members; active May 1935 – Sept. 1939; agreement on output reductions; New York export prices	Base price late 1934-early 1935 compared to 1938-1939 average price; peak price March 1937 affected by “war fever”	11-33	84	Stocking and Watkins (1948:129), Herfindahl (1959:115)
22R. Same as 22Q; London exchange prices, which S&W assert are better reflection of output and export quotas	Comparison of May 1937 price with May 1935 price	--	150+	Stocking and Watkins (1948:129)
22S. Same as 22Q; average annual prices of spot purchases of standard copper on the London exchange, in pounds sterling ; author believes that rise chiefly due to increased demand	Base is 1932-34 prices compared to 1936-39; peak is 1937	40	73	Hexner (1946: 228)
22T. Same as 22E; League of Nations copper price series; authors state that cartel aimed at a price of \$0.18/lb. and tried to stabilize market by reducing prices during early 1929 demand spike; it lost control of price after late April 1930	Price before contract signed compared to May 1929-mid April 1930 when cartel achieved its target price; peak was a few days in April 1929	29	71	Benni <i>et al.</i> (1930:21)
22U. Same as 22E above; second study of same cartel by League of Nations researcher, but 8 years later	Considers the cartel a failure because it could not control prices when demand dropped in early 1930 and African mines opened compare 1929 price with lowest in 1930s (1932)	--	-72	Oualid (1938:35)
22V. Same as 22Q above	Author believes that March	36.6	90.3	Oualid (1938:37)

	1935-Sept. 1936 primarily the result of quotas; but peak rise in Jan. 1937 heavily influenced by surge in demand			
22W. Same as 22E	Lerner index for 1926-1930	0	--	Griffin (1989:189-190)
22X. Same as 22Q	Lerner index for 1935-1939	0	--	Griffin (1989:189-190)
22Y. Same as 22Q above; author is careful to identify periods when demand was weak or strong enough to affect prices; 1936-38 were years with steady or mixed growth in demand	New York electrolytic quality copper, f.o.b. prompt delivery; change from 1931-34 to 1936-38 average; 1937 is peak year	37	67	Walters (1944:146)
22Z. Same as 22Q	Same as 22R above, except base year is 1934, the one with the most comparable demand conditions to 1936-38	50.3	83.2	Walters (1944:146)
22AA. Same as 22A; a Paris-based cartel operating in "the late 1890s" (probably 3/1887-3/89) had almost a monopoly, but "little effect" on prices	Method not explained	1	--	Jenks (1907:49)
22BB. The next-to-last (third) known phase of the international copper agreement (began ca. 1964, ended in 1966); members of the cartel agreed to sell "outside normal marketing channels" to certain preferred customers (who were forbidden to resell) at a lower price fixed for 2 years at a time; all other buyers purchased copper on the London Metal Exchange, which was manipulated by the cartel through occasional large purchases by the cartel on the LME; author hints at a U.S.-African agreement on exclusive territories	No estimates are available for non-U.S. sales; in the mid 1960s U.S. producers kept domestic prices higher than the yardstick: the "export" (LME) price	1	--	Kronstein (1973)
22CC. Same as 22E	Average 1929 prices compared to competitive 1923-26 prices or to Mar. 1932 price; peak was Mar. 1929	30	75	Elliott <i>et al.</i> (1937: 441)
22DD. Same as 22A	London cash prices during Jan. 1888-Feb. 1889, compared to either early 1887 and late 1889, respectively	75-118	--	Andrews (1889:509-514)
22EE. Last (4 th) international copper cartel episode; lasted from 1968 to as late as 1988	Econometric model that predicts a Lerner Index	20	--	Griffin (1989:189-190)
22FF. Same as 22A	Econometric model that predicts a Lerner Index	34	--	Griffin (1989:189-190)
22GG. Same as 22D	Econometric model that predicts a Lerner Index of -1.	0	--	Griffin (1989:189-190)
22HH. Same as 22E	Econometric model that predicts a Lerner Index of -4.	0	--	Griffin (1989:189-190)
22II. Same as 22Q	Econometric model that predicts a Lerner Index of -6.	0	--	Griffin (1989:189-190)
22JJ. Same as 22A	London Metal Exchange prices from "late 1887" (before) to a few months later	--	100+	Prain (1975: 103)
22KK. Same as 22E, except that authors believe cartel not effective until after 9/1927	Price increase from before cartel effective (9/1927) to	--	65	Wallace and Edminster

	3/1929			(1930:261)
22. LL. Same as 22Q	Econometric model with emphasis on fringe producers	1.0	--	Montero and Guzman (2005:17)
23A. Bid rigging of purchases by municipalities cast-iron pipes , used for rail beds, culverts, drainage, or sewage; all U.S. states west and south of Pennsylvania and Virginia, circa 1895-1896; found guilty at trial; Judge Taft concluded that an f.o.b. plant price of \$13/t for 16" or smaller pipe and \$15/t for 30-36" pipe was sufficient for a reasonable profit	Dates, cities and method not explained, but probably judge's reasonable profit benchmark; apparently Posner's interpretation of this famous Supreme Court case	39	--	Posner (1975:818-820), Posner (2001:304), <i>U.S. v. Addyston Pipe</i>
23B*. Same as 23A for an Omaha, NE municipal tender for 512 pieces of 20" pipe in 12/1895	Trial documents reveal that a "premium" or "bonus" of \$23.40/ton (a profit yardstick) was the overcharge split among the cartel, whereas the delivered cartel price was \$15.40	52.0	--	<i>U.S. v. Addyston Pipe</i>
23C*. One of the episodes in 23A for a St. Louis, MO tender, exact date unknown	Bonus of \$6.50/t on a winning bid price of \$24/t	37.1	--	<i>U.S. v. Addyston Pipe</i>
23D*. Same as 23C	Bonus of \$6.50/t when the delivered but-for price was \$17 to \$18/t	36-38	--	<i>U.S. v. Addyston Pipe</i>
23E*. One of the episodes in 23A for an Atlanta, GA contract of 12/1895, size of pipe and winning bid not mentioned	Bonus was \$7.10/t; reasonable profit yardstick is the but-for price of \$13 to \$15/t	47-55	--	<i>U.S. v. Addyston Pipe</i>
23F*. One of the episodes in 23A ; average bonus of \$3.63 made by cartel from 6/1/1895 to 12/31/1895	Bonus relative to reasonable profit yardstick	20-21	--	<i>U.S. v. Addyston Pipe</i>
23G*. Some of the episodes in 23A; sales of So. Pittsburg Co. in WV, MI, and OH; a non-member of the cartel was located in Columbus, OH	Bonus varied from \$1/t to \$1.50/t; yardstick is reasonable profit price	5.6-8.8	--	<i>U.S. v. Addyston Pipe</i>
23H*. Some of the episodes in 23A; Chattanooga Co. generated a \$3/t bonus on all sales in West-central Tennessee	Yardstick is reasonable profit price	16.7-17.7	--	<i>U.S. v. Addyston Pipe</i>
23I*. Some of the episodes in 23A; in Jan. 1896 cartel made an average bonus of \$7 to \$8/t	Yardstick is reasonable profit price	39-47	--	<i>U.S. v. Addyston Pipe</i>
23J. Same as 23A	U.S. Appeals Court decision	35-43+	--	Appendix Table 4: entry 1 below
Numbers 24 to 27 are listed only because they are cited by Posner (see asterisked footnote below #27)				
24. Sophisticated oligopoly model that measures sellers' market power in the U.S. crude petroleum and natural gas markets 1947-1971; Appelbaum's model does not distinguish tacit from overt collusion, but Posner asserts that this study refers to collusion; some members non-U.S.	Econometric model prediction of average mark-up on full marginal costs	6.5*	--	Posner (2001:304), Appelbaum (1979:283)
25A. Mark-ups in the U.S. automobile industry ; study is a general one of mark-up and productivity change; it does not distinguish overt from tacit behavior; oddly, 6 of 17 industry groups have higher average mark-ups than "automobiles" (e.g., chemicals is 61%); financial profits for the industry averaged only	Morrison uses a large scale, sparsely specified, pooled 1953-1986 time-series econometric model of 18 major industry groups in manufacturing, one of which is transportation equipment	14*	--	Posner (2001:304), Morrison (1990:25,43)

3.2%; source is a 1990 NBER working paper, but results same in 1993 refereed journal paper				
25B. Same as 25A above	Tables 2, 2A show mark-ups average 30.6%; Table 2A shows the largest mark-up of 38.5% in 1978	31*	39*	Morrison (1990: 25,43), Morrison (1993: Tables II and V)
26. Price elevation due to oligopoly market power from all sources (unilateral, tacit collusive, and overt collusive) in the U.S. cigarette manufacturing industry.	Large-scale, richly specified oligopoly econometric model fitted to 1955-90 data; focused on excise tax incidence; average wholesale price (with taxes) divided by the sum of variable production cost, advertising expenditures, and excise taxes	37*	--	Posner (2001:304), Barnett <i>et al.</i> (1995: tables 1 and 3)
27. Price elevation due to all sources of market power (unilateral, tacit, or overt) of the U.S. soft drinks bottling industry (does not include the syrup makers like Coca-Cola)	A cross-sectional econometric model applied to 1972-1987 data on 40 food processing industries; Lerner index of market power is 3 rd highest and virtually tied with the 4 th and 5 th highest	37.5*	--	Posner (2001:304), Bhuyan and Lopez (1997:1039-40)
* These figures are not, in the opinion of the present author, cartel overcharges, and are therefore excluded from the spreadsheet.				
28A. International patent-pooling cartel in magnesium metal market combined with exclusive supply contract by Dow Chemical with fabricator AMC (a General Electric affiliate), July 1927-1942, which raised prices to all U.S. buyers	Prices charged to all U.S. buyers 6/33-11/38 compared to yardstick of AMC's prices or export prices	27-37	--	Stocking and Watkins (1946:295)
28B. Dates of cartel above are changed to Oct. 1932 (the date Alcoa signs a contract with I.G. Farben) to April 1942 (Alcoa, Dow and 3 others indicted by DOJ); U.S. cartel member pleaded <i>nolo</i> and paid fines; beginning in 1942, wartime price controls were imposed at levels to guarantee high profits	Real net prices charged by Dow Chemical on exports to foreign (non-US) customers during 1933 -1941 compared to 1942-1943; "after" prices more reasonable because of rapid cost reductions before and during earlier years of cartel; peak year 1933	9.4+	47	Suslow (2001:56), Stocking and Watkins (1946:274-303)
28C. Same as 28A for years 1927-1929	Lerner index	38	--	Griffin (1989:189-190)
28D. Same as 28B for years 1934-1937	Lerner index	25	--	Griffin (1989:189-190)
28E. Same as 28B	Mean annual deflated wholesale price for 1932-1943, relative to mean 1929-31 price; peak year 1932	0	0	Suslow (2005:731)
28F. Same as 28B	Mean annual deflated wholesale price for 1932-1943, relative to 1943 price; peak year 1932	22.6	58	Suslow (2005:731)
29. Auctions for U.S. Forest Service timber , 1975-1981, Pacific Northwest; evidence that buyers colluded against Forest Service; 108 auctions in an area with high timber density and	Econometric model of collusion with supply effects; mean compared to model of competitive market price	5.7	--	Baldwin <i>et al.</i> (1997)

several buyers; most other forest areas are less competitive				
30A. School district milk-supply -contract bid rigging in Cincinnati, Ohio by three dairies, 1980-1990, for 2% chocolate milk in pints; from a trial with finding of guilt	Average price of winning bids relative to competitive control group of dairies, effective years, from fitted econometric model; maximum is highest year	-6.5	-11.3	Porter and Zona (1999:263), Porter and Zona (2004:229)
30B. Same as 30A, except only for school districts in which a defendant was an incumbent in the previous year	Average price of winning bids relative to competitive control group of dairies, effective years, from fitted econometric model; maximum is highest year	-24.6	-49	Whinston (2006: 35), Porter and Zona (1999:263), Porter and Zona (2004:229)
32. Winning bids in 134 construction contracts for Government of Korea public works construction projects worth more than \$10 million each, Jan. 1995-June 1998	Econometric model using forecasting approach	15.5	--	Lee and Hahn (2002:83)
33A. Bid rigging by three contractors on city contracts for sewer construction in a Southeastern U.S. city, late 1970s to Jan. 1980, from plaintiff's expert opinion prepared for a trial held in 1985-1988	Direct court testimonial evidence on City Project No. 67	18+	--	Howard and Kaserman (1989:389)
33B. Same as 33A	Three statistical models applied to six other projects (ratio, dummy variable, and forecasting methods)	27-41	--	Howard and Kaserman (1989:389)
33C. Same as 33A	Statistical model applied to Project No. 67	25-47	--	Howard and Kaserman (1989:389)
34A. Bid rigging in 2,014 No. Carolina and So. Dakota state highway construction projects, 1975-1982, with identity of some collusive firms certain and others suspected	Econometric model for NC price data	18	--	Werden (2003:2); Brannman and Klein (1992)
34B. Same as 34A	Econometric model, auction prices in SD	6.5	--	Werden (2003:2); Brannman and Klein (1992)
35. From well-known price-fixing trial, <i>U.S. v. Socony-Vacuum</i> , of 24 integrated Midwest petroleum refiners (of which 12 were convicted); agreement to restrict refinery output, March 1935-April 1936; prices are Midwestern spot 3 rd grade gasoline, 60-62 octane, f.o.b. Oklahoma	But-for prices are averages of 1934, 1933-34, or 1932-34; max. price was 5.4 ¢ per gal. in 12/35	23-31	36-46	Johnsen (1991:179)
36. Five fish processors pleaded guilty to bid rigging U.S. Dept. of Defense procurement contracts for supplying frozen fish , 1981-Sept. 1989, consisting of three distinct episodes	Econometric model that uses post-conspiracy prices to predict bid prices with no bid rigging.			Froeb et al. (1993:419-423)
36A. Same as 36, for 11/86-7/88 (103 bids)	Backcast period A	30	--	
36B. Same as 36, for 6/84-11/86 (74 bids)	Backcast period B	23	--	
36C. Same as 36, for 9/88-9/89 (44 bids)	Forecast period C	23	--	
37. Bakers of Washington State colluded on price of white pan bread from about 1954 to 1964; confirmed by a decision of the U.S. 9 th Circuit Court	Yardstick is conservative, the average U.S. retail price; maximum price difference is late 1958	15+	20.5	Mueller and Parker (1992:79)

38. An event study of the impact on stock prices of price-fixing indictments, mostly U.S. manufacturing sector , announced during 1962-1980 on 127 publicly traded U.S. firms in 57 conspiracies (out of 200 total); at least 85% pleaded guilty and were fined	Econometric study; estimated additional revenues from the conspiracies are compared to the companies' total sales;	8.7	--	Bosch and Eckard (1991: 315)
39. EU carton board cartel; manufacturers colluded on selling prices 1/86-12/91	EC decision to impose fines, 7/13/94, contains estimate	20-26	--	Connor(2003: Table A.5), Levenstein and Suslow (2002: 49), EC (7/13/94)
40. An international cartel in iodine was formed in 1878 by Chilean, English, and French companies; in the 1930s these companies and others from Germany, Italy, and Norway were linked by a common selling organization in London; Japanese producers joined in June 1937; ended in Sept. 1939	Eckbo's estimate is in a table, but he provides no discussion of his reasoning	50+	--	Eckbo (1967:37), Hexner (1946: 254-255)
41. Ferry Operators , English Channel Freight, raised prices to passengers, 10/92-12/92; EC fines	EC orders nullification of collusive rate increase	10	10	Levenstein and Suslow (2002:Table 15), Connor(2003: Table A.5)
42A. International fine-art auction house services 1993-2000, two firms (Sotheby's and Christies) convicted by U.S.D.O.J, EU, and large (up to \$512 mil.) private plaintiffs' settlement; collusion began either 1/93 (plaintiffs' position) or 3/95 (DOJ's) and ended 2/2000; appears that both sellers' and buyers' fees were fixed.	Plaintiffs' assertion vetted by Levenstein and Suslow; not clear whether the percentage applies to fees only or (more likely) the sales' value of the art itself.	0-20	--	Levenstein and Suslow (2002:Table 15)
42B. Same as 42A above	Information about changes in U.S. commission rates paid by all clients, buyers and sellers	91-200	--	Connor (2003: Table A.4)
42C. Same as 42A above; estimate for sellers' commissions (30% of revenues) increased to include buyers' commissions also; both commissions were basis of successful civil trial	Based on unchallenged testimony at US trial about Sotheby's increased profits of \$50-75 million, its market share (50%), and its revenues from seller's commissions only	104-168	--	Ashenfelter and Graddy (2002:section 6), Donovan (2005: 210)
42D. Same as 42A above, adjusted as for 42C	US Government's calculation of overcharge and affected commission revenues of sellers' only, accepted by judge for sentencing of Sotheby's owner	91-98	--	AP (4/23/2002), <i>NY Law J.</i> (4/23/2002), Donovan (2005: 210)
42E. Same as 43A above	Calculations of class-action lead counsel and defense counsel of total damages (\$286- \$300 million) and from transactions data on buyers' and sellers' commissions	94-100	--	Stewart (2001), Donovan (2005:209, 233)
42F. Same as 43A	Reading of the US court decision	50	150	Appendix Table 4: entry 9 below
42G. Same as 42A	EC decision gives internal projection of likely fee-revenue effect of raising the	149-190	202	EC (Oct. 30, 2002: ¶104-105, 131-137)

	buyers' commission schedule; compared to revenues before collusion started; actual revenue increases in 1995-96 verify profit increases			
42H. Same as 42A	Judge's decision in <i>Auction Houses Antitrust Litigation</i> : US settlement (\$512) was 1.8 to 4 times overcharge	25-47	--	Lande and Davis (2007: Case 2), Connor (2007a)
43A. Shipping conference , France to Central & West Africa 1975-1992; fined by EC 4/1/92	From decision of the European Commission printed in the <i>Official Journal</i>	34-39	--	Levenstein and Suslow (2002:Table 15), Connor(2003: Table A.4), <i>EC Official Journal</i> L134 (5/18/92:3)
43B. Same as 43A	From decision of the European Commission printed in the <i>Official Journal</i>	43.1		Connor (2013), <i>EC Official Journal</i> L134 (5/18/92:3)
43C. Same as 43A	From decision of the European Commission printed in the <i>Official Journal</i>	35.5		Connor (2013), <i>EC Official Journal</i> L134 (5/18/92:3)
44. A 1952 U.S. court decision concluded that 3 beet-sugar refiners (buyers' cartel) had conspired to undercharge sugar-beet farmers in the 1939-1941 crop years by \$0.25 /ton	Prices paid to growers by processors in 1939-1941, excluding Sugar Act payments; lowest (peak) price is from 1939	-4.6	-7.6	Adams and Bock (1980; 143-144)
45. U.S. jury trial concluded that grocery retailers in California had conspired from 1953 to 1970 to under pay their suppliers of beef	1953-1970 wholesale prices of beef compared the three years after the conspiracy terminated	-47	-65	Adams and Bock (1980; 145-146)
46A. Smelters of vanadium ore conspired to lower prices to certain Colorado miners in 1933-March 1948; a rare monopsony case; jury trial decision in 1961	But-for price was that paid for the same grade of ore at the same time by the U.S. Government	-39?	--	Adams and Bock (1980; 146)
46B. Same as 46A	Reading of the court decision	-22.5	-38 to -47.5	Appendix Table 4: entry 18 below
47A. First international platinum cartel was formed in 1903; one UK and one French marketer of Russian metal; fixed non-Russian world prices; ended 1914	Average stabilized price 1905-14 compared to 1903	125	--	Elliott <i>et al.</i> (1937:152)
47B. Second intl. wholesalers' cartel formed 1920; included original 2 members plus one U.S. firm and "German interests"; ended in early 1931 after new mines began opening after 1927 in Russia, Columbia, So. Africa, and Canada	Cartel's peak effectiveness was 1920-1927; peak price of \$120/oz. reached in 1925; comparison is with price early 1931	--	336	Elliott <i>et al.</i> (1937:153)
47C. The second international platinum (a byproduct of gold, copper, or nickel mining); global miners cartel was formed in 1918 by companies mining and smelting in Russia, UK, Canada, So. Africa, Columbia, Germany, and France; Russia withdrew in 1927; did not control substitute palladium prices; may be related to 47B	Real prices 1919-1927, compared to non-cartel period 1929-1931; peak is 1924	74	122	Suslow (2001: 56), Hexner (1946: 235-237)
47D. The third international platinum miners' cartel began Oct. 1931 with establishment of	Real prices in 1932-1933 compared to 1930-31; 1932 is	4.6	11	Suslow (2001: 56), Hexner (1946: 235-

Consolidated Platinums Ltd. in London which managed export quotas and set refined metal prices; probably collapsed 1933	peak year			237)
47E. Same as 47D above	Real prices in 1932-33 compared to 1935-38 or to 1935 alone because 1936-38 had better demand conditions than 1935	3.8-28.0	10-36	Suslow (2001: 56), Hexner (1946: 235-237)
47F. Same as 47C	Lerner index, econometric model	43	--	Griffin (1989:189-190)
47G. Same as 47D	Lerner index Lerner index, econometric model	10	--	Griffin (1989:189-190)
47H. Same as 47B, but Suslow judges the end date to be 1928 instead of 1931	Mean annual deflated wholesale price for 1919-1928, relative to 1919 price; peak year 1924	27.1	64	Suslow (2005:731)
47I. Same as 47B, but Suslow judges the end date to be 1928 instead of 1931	Mean annual deflated wholesale price for 1919-1928, relative to 1928-29 price; peak year 1924	29.4	67	Suslow (2005:731)
47J. Same as 47D	Mean annual deflated wholesale price for 1932-35, relative to 1930-31 price; peak year 1932	0	13.3	Suslow (2005:731)
47K. Same as 47D	Mean annual deflated wholesale price for 1932-35, relative to 1935-36 price; peak year 1932	3.5	17.2	Suslow (2005:731)
48A. Electric power equipment (generating and transmission) , bid rigging against U.S. electric utilities on 20 products with total affected sales of about \$14.7 billion (possibly largest in U.S. history); collusive period 3/1950 to 12/1960; for some products began in 1930s but data available only for 1/1948 to 12/1960; average overcharges of about \$175 million per year in 1950s, 29 corporations pleaded guilty in 1960 and paid fines of almost \$2 million, almost 2000 private treble-damages suits filed with settlements of over \$400 million	Result of five-year study by joint committee of Congress; average price increases on all products from pre-cartel prices	9-10	--	Carlton and Perloff (1990:213-216), U.S. Congress (1965)
48B. Same as 48A; widely cited study by FTC staff members; covers eight of the most important product classes out of 20 that were cartelized; the authors divide the conspiracy period into three sub periods (1950-1954, 1955, and 1956-59)	Econometric model applied to data from special survey of 70 firms in industry, 553 annual observations 1950-1970; overcharge calculated for 1950-1954	6.7	--	Carlton and Perloff (1990:216), Lean et al. (1985:836)
48C. Same as 48A	Same as 48B, except overcharge during a temporary lapse in cartel discipline called the "White Sale" of 1955	2.8	--	Carlton and Perloff (1990:216), Lean et al. (1985:836)
48D. Same as 48A	Same as 48B, except final collusive episode of 1956-1959	3.7	--	Carlton and Perloff (1990:216), Lean et al. (1985:836)
48E. Same as 48A ; Turbine electric generator ; estimated from quarterly transaction	Very complex econometric simulation model that	8-9	49	Carlton and Perloff (1990:216), Sultan

prices 1948-1963 from industry trade association; Sultan concludes that conspiracy was “ineffectual” (p ix) and had no “measurable impact on price... when measured with the dummy variable technique” (p.111); yet hidden in an appendix is a Version II model cited by Carton and Perloff that includes both direct and indirect effects; this analysis finds positive 1960-72 price differences, which seem to be due to tacit behavior	compares average 1955-59 prices with and without conspiracy effects; average price differences are much larger in 1958-1960 than after 1960; maximum effect is 1960			(1975:346-348)
48F. Same as 48A ; Large electric power transformers 1947-late 1959	Simple comparison of defendants’ transaction prices with the 10 quarters of prices after the cartel was prosecuted; peak prices 1956	30-38	90	Kuhlman (1967: 553)
48G. Same as 48A; a journalistic monograph of the U.S. electrical equipment conspiracy based on interviews, court proceedings, and Congressional hearings	Comparison of “book” (list collusive) prices in 1950-1954 with late 1949 and early 1955 price war “discounted” prices, all products	--	40-45	Smith (1963: 110)
48H. Same as 48A above, but for one product, large electrical circuit breakers	Benchmark price in winter of 1957-1958 price war among members of the electrical circuit breakers cartel, compared to previous book prices 1950-1956	60	60	Smith (1963: 112)
48I. Same as 48A above, large electrical switchgear	Same as 48H above for 1958 prices	--	40-45	Smith (1963: 114)
48J. Same as 48A and E, except 1950-1959 period; decision from a bench trial in <i>Ohio Valley Electric v. General Electric</i>	Judge compared actual prices paid with post-conspiracy prices and adjusted the price difference downward to account for a number of changes in demand and supply conditions	21	--	Finkelstein and Levenbach (1983)
48K. Same as 48A, except steam turbine generators 1950-1960; estimates made by two academic economists in late 1962 working for the Anti-Trust Investigation Group, a consortium of 164 plaintiffs’ counsel for the 1,912 treble-damage suits;	But-for prices were before, during, during, and after (1948, 1950, 1955, and 1961) with the last year giving the largest overcharges; analysis used both list prices and buyers’ prices paid from 1948 to end of 1961 and corrected price increases for labor and material costs; “conservative” Blue Book figures used all four years	10-11	--	Bane (1973:217-219)
48L. Same as 48A and H, large circuit breakers 1956-1959	Same as 48K above	28	--	Bane (1973:217-219)
48M. Same as 48A and K above, large power transformers 1956-1959	Same as 48K above	37	--	Bane (1973:217-219)
48N. Same as 48A and K above, except watt-hour meters 1956-1959	Same as 48K above	13	--	Bane (1973:217-219)
48O. Same as 48A; result of a jury trial in 1964 in <i>Philadelphia Electric v. General Electric et</i>	Jury decision on actual damages	8.7	--	Bane (1973:314)

<i>al.</i> for a mix of products purchased by the plaintiff				
48P. Same as 48A; result of a bench trial in 1964 in <i>Ohio Valley Electric v. General Electric et al.</i>	Bench decision on actual damages	11	--	Bane (1973:314)
48Q. Same as 48A; result of a court's special master's analysis, Prof. Kessel of the Univ. of Chicago, in <i>Atlantic City Electric v. I-T-E Circuit Breaker</i> trial; plaintiffs included Gulf State and Kansas City Power and Light; after the Special Master's report was issued, I-T-E quickly settled	Range of estimates is for different mix of purchases by two utilities	21-24	--	Bane (1973:217-219)
48R. Same as 48A and E	Previous estimate in 48E is from the text; this one is from Table A18.4 for 1955-59	13.3	--	Sultan (1975:348)
48S. Same as 48A, but in <i>Ohio Valley Electric Corp. v. General Electric Co.</i> , 244 F. Supp. 914 (SDNY 1965) the court found that there was bid rigging against the Ohio Valley Electric Corp.	Reading of the court decision	10.9	--	Appendix Table 4: entry 13 below
49A. Oft-replicated classic empirical study of the "Joint Executive Committee," a famously unstable U.S. railroad cartel that fixed prices and market shares on transport from Chicago to East Coast cities for 328 weeks from 1880 to 1886 prior to the passage of the Sherman Act; JEC had 3 members in 1880 but accommodated two more entrants during its life by reallocating shares; one Canadian railroad joined the cartel. Degree of collusion (CMI) was 40% of monopoly price for the cartel's entire life.	Average price increase during "cooperative periods" identified by the JEC's detailed internal records from an econometric model	66	--	Porter (1983), Ulen (1980)
49B. Same as 49A; an econometric analysis of the Joint Executive Committee, one of the most intensely examined cartels in history; the model specifies both demand and supply relationships and, unlike Porter (1983), corrects for serial correlation; Ellison calculates the "degree of collusion" reached 80% of monopoly price.	To derive the average equilibrium price during collusive periods, one must solve the supply equation for logP in terms of estimated coefficients	50.8	--	Ellison (1994: Table 2, p.42), Ellison (2003)
49C. Same product market as 49A, except for 1871-74 duopoly period prior to the JEC period; distinguishes between "warm" months when Great lakes shipping via Buffalo was competitive with rail and "cold" months when ships could not sail.	Author's econometric model uses 1871-1898 data on 56 semiannual observations of real prices of grain shipments; controls for a few railroad costs and demand factors; "winter" (cold weather) rates	24.4	--	Briggs (1989:201)
49D. Same as 49C above	Same as 49C above except rates when there was a large fringe of ships competing with two railroads in warm months	19.5	--	Briggs (1989:201)
49E. Same as 49A above; the period of interest is during operation of the JEC when there were 4 and then 5 members in the cartel	Econometric model estimates that cold-weather and warm-weather rates have the same price effects	15.5	--	Briggs (1989:201)
49F. Same as 49A	Same as above except warm-weather rates	15.5	--	Briggs (1989:201)

49G. Same as 49A; model is based on weekly prices; has two equations solved simultaneously, which allows for feedback effects; covers only the JEC cartel period; has a greater array of controls for demand and supply shifters, including market concentration	Alternative model specifications result in some variation in the estimated coefficient for price; larger effects are highly significant	13.7-30.8	--	Briggs (1989:203)
50A. Quebracho (tanning agent) cartels organized voluntarily by about 20 Latin American and 1 UK firm in four agreements 1916-17, 1919-22, 1926-31, and 1935-44; sellers' cartels were "reinforced by decrees of the Argentinean and Paraguayan governments"; nevertheless, the cartel's U.S. agents were prosecuted by the DOJ in 1942; this analysis refers to the 3 rd episode	New York import prices for 1926-30 compared to 1923-25 "before" prices from Hexner (1946)	5	--	Hexner (1946: 281), Suslow (2001: 57), Wallace and Edminster (1930:359-361)
50B. Same as 50A above, except for 2 nd episode, years 1919-1922	Real prices in 1920-22 taken from Berge (1944) compared with 1924-1925; peak is 1920	12.4	15	Suslow (2001: 57), Berge (1944: 112-120)
50C. Same as 50A above	Real prices in 1926-31 compared with 1924-1925 and with 1932-34; peak is 1930	26	45-60	Suslow (2001: 57), Berge (1944: 112-120)
50D. Same as 50A above, except for 4 th episode, years 1935-1942	Real prices in 1935-39 compared with 1932-34; peak is 1939	23	35	Suslow (2001: 57), Berge (1944: 112-120)
50E. Same as 50A above	NY import prices for 1935-39 compared to 1932-33	52	--	Hexner (1946: 281)
50F. Same as 50A above	Eckbo's interpretation of Hexner and information from the 1942 U.S. antitrust indictment	50+	--	Eckbo (1976: 38-39), Hexner (1946: 279-281)
50G. Same as 50A above, but Eckbo extends dates to 1934-1946	Same as 50F above	50+	--	Eckbo (1976: 38-39), Hexner (1946: 279-281)
50H. Same as 50A above; information from Congressional testimony in 1942 and from court documents when six trading companies pleaded <i>nolo</i> in 1942	Last of six price increases from Nov. 1934 to Jan. 1941, compared to pre-Nov. 1934 price	--	95	Berge (1944:118)
50I. Same as 50A	Real prices in 1926-31 compared with 1932-34; peak is 1930	40	45-60	Suslow (2001: 57), Berge (1944: 112-120)
50J. Same as 50B	Mean annual deflated wholesale price for 1920-24, relative to 1920 price; peak year 1920	0	0	Suslow (2005:732)
50K. Same as 50B	Mean annual deflated wholesale price for 1920-24, relative to 1923-25 price; peak year 1930	17.8	46.7	Suslow (2005:732)
50L. Same as 50A	Mean annual deflated wholesale price for 1926-32, relative to 1923-25 price; peak year 1930	10.2	28.9	Suslow (2005:732)
50M. Same as 50A	Mean annual deflated wholesale price for 1926-32, relative to 1932-33 price; peak	25.5	46.8	Suslow (2005:732)

	year 1930			
50N. Same as 50D	Mean annual deflated wholesale price for 1933-39, relative to 1932-33 price; peak year 1939	20.3	0	Suslow (2005:732)
50O. Same as 50D	Mean annual deflated wholesale price for 1933-39, relative to 1939 price; peak year 1939	0	0	Suslow (2005:732)
51. Ready-mix concrete bid-rigging cartel in Denmark, January 1994 to January 1996; prices on several grades from 18 sites; collusion was facilitated by detailed price reports issued by the Danish Competition Authority that made previously secret discounts known to sellers; study controls for costs; no mention of prosecution	Average prices compared to quarter before new government price reporting began	19	25	Albaek <i>et al.</i> (1997:433,440)
52A. Bid rigging of English oral auctions of 340 quality-graded used 1988 Chevrolet Caprice police cars , New York City, January 1990-May 1991; alleged bidding ring (buyers' cartel) active in 3 of 13 auctions; reduced price received by City of NY; civil case settled out of court	Ratio approach statistical analysis of Howard and Kaserman (1989); mean of three auctions	-17.1	-22.4	Nelson (1993:385)
52B. Same as above	Dummy variable model following Howard and Kaserman (1989); from Equation 1	-16.6	-21.4	Nelson (1993:390)
53. Bid rigging ring in Washington, DC of 680 houses sold at public auction (mortgage foreclosures or NISI proceedings), Jan. 1967-August 1990, followed by English "knockout" auctions among ring members to distribute profits; reduced prices received by DC govt.; 6 members pled guilty, 6-9 found guilty at trial.	Econometric model with almost perfect fit to sample of bids by members found guilty at trial; model accounts for complex profit payout system	-32.5	-59	Kwoka (1997: Tables 1 and 2)
54. Regional market power of AMPI dairy cooperative with 30,000 members; concerns 1972-April 1975 period (up to date of DOJ consent decree) power over raising farm milk prices	Econometric dummy-variable model of the price premium in markets with average market shares, relative to post-decree margin, as a proportion of U.S. average blend price of farm milk	3.0-4.0	--	Madhaven <i>et al.</i> (1994: Tables 1 and 4)
55. Intensive case studies of 40 cartels in UK manufacturing before and after the 1956 antitrust legislation and Restrictive Practices Court decisions from 1959 and later made 85% of the sample cartels illegal. Despite strong demand increases and moderate inflation in early 1960s, 39 of 40 cartels showed significant price declines.	Change in nominal wholesale UK prices reported by sellers or major buyers from 1956-59 price levels to various periods following first negative Court ruling in 1959	0-30	--	Swann <i>et al.</i> (1974: 156-57, 166)
56. Same as 55 above, UK wire ropes , non-marine, 1956-59	Price 36 months after negative ruling	15.3	--	Swann <i>et al.</i> (1974: 156-57, 166)
57. Same as 55 above, UK porcelain sanitary bathroom fixtures , 1956-59	12 months after	20.0	--	Swann <i>et al.</i> (1974: 156-57, 166)
58. Same as 55 above, UK steel pipes, sewage	36 months after	25.0	--	Swann <i>et al.</i> (1974:

and drainage, 1956-59				156-57, 166)
59. Same as 55 above, UK rubber and plastic coated cable , 1956-59	6 months after	25-30	--	Swann <i>et al.</i> (1974: 156-57, 166)
60. Same as 55 above, UK small electric motors , 1956-59	36 months after	20-25	--	Swann <i>et al.</i> (1974: 156-57, 166)
61. Same as 55 above, UK electric meters ; probable bid rigging against government electricity-generating companies	72 months after, as reported by one buyer	15.0	--	Swann <i>et al.</i> (1974: 156-57, 166)
62. Same as 55 above, UK carpets , mechanically woven, 1956-59	Up to 10 years later	0	--	Swann <i>et al.</i> (1974: 156-57, 166)
63. Same as 55 above, UK iron bath tubs , 1956-59	Average 1965-69 prices	30+	--	Swann <i>et al.</i> (1974: 156-57, 166)
64. Same as 55 above, UK steel drums , 1956-59	Average 1960-69 prices	--	10	Swann <i>et al.</i> (1974: 156-57, 166)
65. Same as 55 above, UK electricity transformers, largest sizes ; probable bid rigging against government electricity-generating companies, 1956-59	Average 1960-1970 prices	--	25	Swann <i>et al.</i> (1974: 156-57, 166)
66. Same as 55 above, UK electricity transformers, system and distribution; probable bid rigging against government electricity-generating companies, 1956-59	Average 1960-1970 prices	--	25-41	Swann <i>et al.</i> (1974: 156-57, 166)
67. The U.S. cane Sugar Trust was formed in Nov. 1887 and had a near monopoly in the Eastern U.S. until late 1889 (1st episode); followed by a price war with large entrant Spreckles from 1/1890 to 6/1892; 2nd monopoly mid 1892 to 7/1898 (2nd episode); 2nd price war when 2 entrants appear 9/1892-6/1900; then "mixed regime" oligopoly (3rd episode); finally break up of cartel when U.S. sues 1/1910 to 1914 (4th episode). The 5th episode was the Istitute 12/1927-1936.				Jenks and Clark (1929: 82-98), Genesove and Mullin (2001:382), Boone and Leuvensteijn (2010)
67A. First, monopolistic episode was effective in eastern U.S. until the large Spreckels factory in Philadelphia opened in mid 1889; collusion is signaled by a rise in the gross margin from its pre-cartel level of \$0.50 to \$0.75/lb. When the Trust gave up trying to drive the new entrant out of the market in 1900, authors believe margins returned to normal until 1914.	The increase in gross margins in 1888-89 divided by the average wholesale price in the three years before Trust was formed; peak is Sept. 1889; UK and German yardsticks show that no technological change affected prices	6-14	15	Jenks (1900:133-145), Jenks and Clark (1929: 82-98)
67B. Same as 67A, except a 2 nd monopolistic episode that began in mid 1892 when the Trust bought out Spreckels; episode ended when a new rival firm (Arbuckle) appeared in Sept. 1898	The increase in gross margins in 1892 to mid 1898 relative to average price 1/1892-9/1898; peak is ca. June 1896	7-9	16	Jenks (1900:133-145)
67C. Authors distinguish 4 episodes: 1st cartel, 2nd cartel, a "mixed regime" of oligopoly, and the break-up period (4th episode). Authors fit a new index of low market power (the Profit Elasticity) econometrically to the Genosove and Mullin data for the 2 price-war periods.	find that the PE is highest, as expected, during the 2 competitive interludes, the duopoly price war and the triopoly price war	1.5	16.6	Boone and Leuvensteijn (2010), Boone (2011)
67D. Same as 67A and 67B combined "monopoly regime": 1st cartel and 2nd cartel episodes.	find that the PE is lowest, as expected, during the 2 cartel episodes; figures are increases	9.5	16.6	Boone and Leuvensteijn (2010), Boone (2011)

	from price-war levels in 67C			
67E. The "mixed regime" of oligopoly between the Trust and episode with 2 rivals (1900Q3-1909Q4). This estimate refers to the mixed "oligopoly" period (3rd episode).	find that the PE is at a moderate level, as expected, during the oligopoly period; overcharges are increases from price-war levels in 67C	4.6	10.1	Boone and Leuvensteijn (2010), Boone (2011)
67F. In the break-up period (4th episode), Trust is sued by Justice Dept., but also begins to dissolve voluntarily after the Std. Oil case decision in 1911.	find that the PE is close to price war level, as expected; overcharges are increases from price-war levels in 67C	1.8	10.1	Boone and Leuvensteijn (2010), Boone (2011)
67G. From "narrative evidence," weekly memos of meetings of the Sugar Institute, a trade assn. of the 14 U.S. cane sugar refiners from Dec. 1927 to 1936 (4th episode) when Supreme Court declared it to be an illegal cartel; Institute achieved higher prices solely through collusion on trading rules, in face if increasing competition from beet sugar and imports	Comparison of prices in relatively competitive period 1926-27 (Lerner Index was 0.031) to cartel period (Lerner ave. 0.085 and monopoly index 0.110) and adjusts for only source of cost changes (raw cane sugar)	6.3	11.9 (calculated to be 95% of monopoly price)	Levenstein and Suslow (2001: 42) Genesove and Mullin (2001:382),
67H. Same as 67G above	But-for price is from 1937-1939, after the 4th episode ends	1.1	--	Genesove and Mullin (2001:382)
67I. Same as 67B (part of 2nd episode); Eastern U.S. Sugar Trust Am. Sugar Refining Co.'s market share fell from 91% in 1892 to 71-86% in 1893-97 to below 62% after 1901; study finds 4 periods of effective collusion (authors do not treat them as different episodes, but I impose the ones asserted by other authors above). [NB the 1890-1914 cartel price averages 70% to 83% of the pure monopoly price]	From a quantitative NEIO model fitted to 1890-1914 price, demand, and cost data; elasticity-adjusted Lerner indexes significantly greater than zero for 1893-1897, between two price wars; peak 1893	23.4	39.0	Genesove and Mullin (1998:368)
67J. Same as 67B (part)	Elasticity-adjusted Lerner indexes significantly greater than zero for 1901-02	15.5	20.0	Genesove and Mullin (1998:368)
67K. Same as 67C	Elasticity-adjusted Lerner indexes significantly greater than zero for 1908	7.0	7.0	Genesove and Mullin (1998:368)
67L. Same as 67D	Elasticity-adjusted Lerner indexes significantly greater than zero for 1913	3.0	3.0	Genesove and Mullin (1998:368)
67M. 67B+67C+67D (1890-1924 average)	Elasticity-adjusted Lerner indexes, including 17 years non-significantly greater than zero	11.8	29.0	Genesove and Mullin (1998:368)
68. History of several brief early attempts (beginning in 1847, 1862, and 1885) at forming national zinc cartels in France and Belgium that held stocks of zinc off the market to raise prices; the first was "successful" for 13 years (viz., 1847-60), the others were not.		--	--	Devos (1994)
68A. The first national episode was "successful" for 13 years (viz., 1847-60), the others were not.	Historical case study, but no price data discussed; method unclear	1	--	Devos (1994)
68B. First <i>international zinc</i> export cartel (and 4 th episode) began 1910, ended Sept. 1914; included all the largest firms in AT, BL, UK,	No prices available, but characterized by Plummer as a "weak" cartel	1	--	Plummer (1934:102), Benni <i>et al.</i> (1930)

FR, DE, and NL with 62% of world production; the large US market was protected by tariffs.				
68C. Second international zinc cartel (5 th episode); organized like 68A, but began Sept. 1928, revised in Jan. 1929, and dissolved Dec. 1929 because market price stayed above its target price; members signed only 3-month contracts	A “weak” cartel also, presumably because of the cartel’s low target prices	1	--	Plummer (1934:102), Benni <i>et al.</i> (1930)
68D. Same as 68C; Griffin gives different dates for the 2 nd international zinc cartel: May 1928-late 1929	Lerner index estimated from an econometric model	27	--	Griffin (1989:189-190), Hexner (1946:249)
68E. Same as 68C; members included all major European producers; monthly agreements on production cuts of 5% to 10%; no control over new electrolytic-zinc process factories and friction between vertically integrated and nonintegrated members	European prices from Mar. 1929 to lowest level in May 1931	63	--	Elliott <i>et al.</i> (1937)
68F. The 3 rd intl. cartel: a revival of the 1928-29 European cartel with Australia and Canada added; output adjusted every 3 months if price exceeded or fell below £24/t; mid 1931-1934 (or 1935)	Lerner index estimated from an econometric model	13	--	Griffin (1989:189-190), Hexner (1946:249), Plummer (1934:102-103)
68G. Same as 68F; beginning in July 1931 and continuing through 1933, European producers reduced production to 45% below rated capacities; stocks reached normal levels by 1933 causing prices to rise through mid 1934; end date unclear	No precise data provided, but analysis consistent with 68E above	1	--	Elliott <i>et al.</i> (1937:764)
68H. Historical case study based on internal memorandums of 4th international zinc cartel; the Zinc Producers Group of 22 companies in Australia, UK, Germany, France, Spain, and Canada; formally in operation from 1945 to 1975 using output restraints, purchases of stocks, list price targets, and manipulation of the zinc contracts on the London Metals Exchange; refers to 1945 to about 1963	Examination of cash prices on the London Metals Exchange, but method of analysis unknown	0	0	Tsokhas (2000: Table 1)
68I. Same as 68H, except July 1964 to Dec. 1968	But-for price is 1960-62 or 1961-63 average f.o.b. cash prices on the London Metals Exchange compared to July 1964 - Dec. 1968 average; peak is 1965 average	39-46	53	Tsokhas (2000: Table 1)
68J. Same as 68H, except 1969 to 1975	Examination of cash prices on the London Metals Exchange, but method of analysis unknown	0	0	Tsokhas (2000: Table 1)
68K. Same as 68A, except the second national episode (1862-?) was “unsuccessful.”	Historical case study, but no price data discussed; method unclear	0	--	Devos (1994)
68L. Same as 68A, except the third national episode (1885-?) was “unsuccessful.”	Historical case study, but no price data discussed; method unclear	0	--	Devos (1994)
69A. Same companies (from 6 countries), conduct, and similar time period as 68H above,	Base period is 1960-64 or 1961-65 LME cash contract	34-53	49-69	Tsokhas (2000: Table 2)

1945-1967, except for the Lead Producers Group ; price increases effective only in 1965-1967.	prices; collusive period is 1965-1967; peak is 1966			
69B. Lead cartel, all leading mining and smelting companies in 8 countries, signed an agreement 11/1/38, abandoned 9/39, but considerable doubts about whether agreed reductions in sales were ever implemented	London spot exchange prices Nov. 1938 to August 1939	0	--	Hexner (1946: 230)
69C. International lead cartel 1921-1923	Lerner index from econometric model	17.0	--	Griffin (1989:189-190)
69D. This author states that there were no (effective?) international agreements prior to April 1931, the month by which London prices had declined by 60% since 1929; in 1930 and 1931 the Lead Producers' Association cut non-US production by 80-85%	Production quotas caused late 1931-1932 prices to rise above the lowest previous price observed in June 1931	10-50	--	Elliott (1937:662)
69E. Same as 69A, but for years 1945 to 1964	Examination of cash prices on the London Metals Exchange, but method of analysis unknown	0	0	Tsokhas (2000: Table 2)
69F. Same as 69A, but for years 1968 to 1975	Examination of cash prices on the London Metals Exchange, but method of analysis unknown	0	0	Tsokhas (2000: Table 2)
69G. Same as 69A; refers to Rio Tinto-led cartel from 1964 to 1976; share of world production was very low -- about 55%	Cartels tried to manipulate prices on the London Metal Exchange; no method cited	0	0	MacKie-Mason and Pindyck (1987: 210)
70A. South African cement cartel fixed prices and quotas from at least 1922 to 1994; adopted a multiple basing-point pricing system in 1956; legally exempted after 1986 by the So. African Competition Board, which reversed its position in 1995; Leach's extensive apologia of cartels fails to criticize the Natal-import episode	Prices set by cartel in Natal area compared to bulk prices charged by a new importer of Spanish cement in 1984-85; cartel later cut prices in Natal by 24% and drove importer out of business	5-10	--	Fourie and Smith (1994:130), Leach (1994), Levenstein and Suslow (2001: 42)
70B. Same as 70A above	Authors derive average 1972-1990 mark-up by comparing cement price-cost margins with those in buildings-materials mfg. and all manufacturing	17-26	--	Fourie and Smith (1995)
71. Historical/political-science study of the So. African gem diamond cartel, the Diamond Syndicate, that got control of all major mines in 1888 and began to reduce sales in that year; news reports say that the cartel gave up supply control around 1998 in favor of a new strategy that emphasizes building the De Beers brand of diamonds at retail. In the 1990s, new supplies of yellow-brown gem diamonds were discovered in Australia and later in Canada. In 2008, a secret supply arrangement between De Beers and Alrosa of Russia (the 2 nd -largest supplier of white gem diamonds) that began in the 1950s was ended in 12/2008 by a decision of the EC in 2006; this may have been the final blow to the cartel's formal supply control. In 2013 Alrosa	Prices in 1889 to 1890 compared to 1888	50	80	Spar (1994), Levenstein and Suslow (2001: 42), EC (2/22/2006)

opened a public rough-diamond exchange.				
72A. A mercury export cartel (“Mercurio Europeo”) organized in 1928 by one Spanish and two Italian mines, each with partial or full government ownership; together with a side agreement with a Mexican mine, the cartel controlled 60-70% of world exports in late 1940s; cartel reserved home markets for each company and operated exports through joint sales agents first in Switzerland, later in London and in the importing countries; interrupted briefly by Spanish Civil War in 1936	Eckbo’s interpretation of case studies by others; prices may refer to export markets that were subject to antitrust actions	50+	--	Eckbo (1976:33), Hexner (1946: 232-233); MacKie-Mason and Pindyck (1987:192-203)
72B. Same as 72A above, except for 1939-1949; in late 1949 one Italian mine was accused of cheating on a sale to the U.S. government stockpile; the Spanish mine cut prices to the Italian mine’s cost of production for 10 months in 1951	Eckbo’s interpretation of case studies by others; prices may refer to export markets that were subject to antitrust actions	50+	--	Eckbo (1976: 33), Hexner (1946: 232-233); MacKie-Mason and Pindyck (1987:192-203)
72C. Same as 72B above from period when sole selling agency was established in London until it was nationalized by the UK government in 1942	Eckbo’s assumption on the basis of the UK nationalization	50+	--	Eckbo (1967: 40)
72D. Same as 72A; from an early economic study of international cartels, most of them European based; writing at the beginning of the Great Depression, the author is more impressed by the failures of cartels to raise prices than their successes; of scores of private cartels studied, only two have data on their price effects, one of them the international mercury cartel, which controlled 88% of global supply in 1927 and 58% in Aug. 1932, during a period of rapidly falling demand	Price change from May 1931 to August 1932 in UK, from information in previously published economic studies and press accounts; author interprets failure to stop fall in prices as evidence of ineffectiveness	--	-58	Plummer (1934:149-152)
72E. Same as 72A above, except dates of operation are 1926-30; in 1931 mercury cartel control dropped to 57%; prices are minimum ones from annual League of Nations series	Average 1926-30 prices compared to relatively competitive 1932-35 period; peak is 1926	99	126	Oualid (1938:22-23)
72F. Same as 72A and 72B combined	Lerner index, econometric model	52.0	--	Griffin (1989:189-190)
72G. Same as 72A, except 1954-1970	Lerner index, econometric model	73.0	--	Griffin (1989:189-190)
72H. Same as 72A, except 1975-1982	Lerner index, econometric model	30.0	--	Griffin (1989:189-190)
72I. Same as 72B	Average 1947-1949 world export prices are compared to 1950 price; peak is 1947	3.3	11.2	MacKie-Mason and Pindyck (1987:192-203)
72J. Same as 72B	Average world export price 1947-1949 compare to conservative estimate of costs of production of high-cost mine in cartel; peak is 1947	20.4	29.6	MacKie-Mason and Pindyck (1987:192-203)
72K. Same as 72G for slightly different 1951-1970 period	Average 1951-1970 world export price compared to the 1950 price; peak is 1965	191.7	407	MacKie-Mason and Pindyck (1987:192-203)
72L. Same as 72G for slightly different 1951-1970 period	Average 1951-1970 world export price compared to	239.9	490	MacKie-Mason and Pindyck (1987:192-

	average total costs of production; peak is 1965			203)
72M. Same as 72H	Average 1951-1970 world export price compared to non-cartel 1972 price; peak is 1965	94.7	239	MacKie-Mason and Pindyck (1987:192-203)
72N. Same as 72H	Authors use a formal cartel model and estimates of elasticities to predict the peak 1965 price for the Italian member of the cartel	--	391	MacKie-Mason and Pindyck (1987:202)
72O. Same as 72H	Authors use a formal cartel model and estimates of elasticities to predict the peak 1965 price for the Spanish member of the cartel	--	454	MacKie-Mason and Pindyck (1987:202)
73A. From 1897 to 1919, the German potash cartel, the Deutsche Kali Syndikat, which contained a mix of private and state-owned mines, had a near monopoly on world exports; Newman states that industry was nationalized and all producers compelled to join the cartel in April 1919; Schroeter judges that the cartel began as early as 1876 and that the Prussian state began controlling the cartel in late 1910; Tosdal believes start date is 1879	In June 1909 the cartel's contract expired and three dissident members signed contracts with U.S. importers at prices well below the 1908-early 1909 U.S. c.i.f. import price	45+	--	Newman (1948: 578), Schroeter (1994), Tosdal (1916)
73B. Same as 73A above	As interpreted by Levenstein, prices in 1910 reached "double average costs"	--	50+	Levenstein (2000), Schroeter (1994), Spar (1994), Levenstein and Suslow (2001: 42)
73C. Same as 73A above	German price of chloride of potash in 1878 compared to the 1896-1906 average	55	--	Levy (1927:295)
73D. Same as 73A above	Estimates price-cost margin in 1910 to be 200%; costs appear to be close to LRMC	100+	--	Schroeter (1994:76)
73E. First international potash cartel formed in August 1924, after deep price cuts during 1919-1923; voluntary agreement between the German and French national (both were government-controlled) cartels to set prices and quotas (70%, 30% respectively) for U.S. (and eventually world) exports; in 1929 the only significant U.S. producer was secretly bought and controlled by the German cartel up until 1942; lasted in its original form until 1932; overcapacity was cut and the industries rationalized, causing production costs to decline in 1920s and 1930s; no cost changes in 1920s	U.S. import prices of Manure salts (20% potash) set at start of cartel compared to competitive 1909-10 U.S. import prices	25.8	--	Newman (1948: 583), Schroeter (1994:77), Wallace and Edminster (1950:105)
73F. Same as 73E above	Same as 73E for muriate of potash (51% potash)	42.7	--	Newman (1948: 583)
73G. Same as 73E above	Same as 73E for sulfate of potash (49% potash)	50.7	--	Newman (1948: 583)
73H. Same as 73E above	Change in U.S. import prices from September 1924 to May	65.2	--	Newman (1948: 583)

	1929 for manure salts			
73I. Same as 73E above	Change in U.S. import prices from September 1924 to May 1929 for muriate of potash	12.4	--	Newman (1948: 583)
73J. Same as 73E above	Change in U.S. import prices from September 1924 to May 1929 for sulfate of potash	11.4	--	Newman (1948: 583)
73K. Second international cartel; Polish producers were added in 1932 as members and given a 4% export share; Spanish production expanded rapidly under French and British ownership from 1932 to 1934 when it captured 33% of U.S. market	Prices of U.S. imports in 100%-potash-equivalents fell from 1933 to 1934 because of Spanish entry into the world export market	71.6	--	Newman (1948: 584)
73L. Third international cartel; signed a new agreement with Spanish producers in 1935 giving them 15% world export share; outbreak of Spanish Civil War in 1936 reduced Spain's exports; new Russian and Palestinian mines co-opted (added to cartel in 1936); probably ended Sept. 1939; convicted by US of antitrust violations, but remedies unenforceable.	Same as 73E above for years 1934 to 1937-1941	37.7	--	Newman (1948: 583)
73M. Unlike most other authors, Oualid views 1st, 2 nd , 3rd international potash cartels 1926-35 (73E + 73K + 73L) as one continuous cartel episode	Compare average 1927-35 German potash prices with price in 1926; peak is 1934	24	33	Oualid (1938:26)
73N. Same as 73M	Compare 1926-35 French prices with 1926; peak is 1927-29	40	46	Oualid (1938:26)
73O. Same as 73M	Lerner index	36.0	--	Griffin (1989:189-190)
73P. Same as 73E; Schroeter ascribes price increase to a renewed agreement in May 1925 that adjusted the French-German export quotas and set of 50-50 common sales agencies in the importing countries.	Berlin potash prices in late 1925 compared to 1924 and early 1925 prices	50+	--	Schroeter (1994:78)
73Q. Same as 73E	Average Berlin prices in 1928-1932 relative to 1924 prices	55-65+	--	Schroeter (1994:80)
73R. Polish potash mines opened in 1927 and were admitted to intl. cartel with a national hegemony and a 4% export share in 1932; Russian cartel entered with a 10% quota in April 1934; but failure to incorporate large Spanish production from 1932 to May 1935 was the cause of a price crash in 1934-35	Berlin prices in 1928-32 relative to 1934-35; peak price in 1931	73	89	Schroeter (1994:80)
73S. Same as 73E; in May 1935 Spanish producers were allotted a national hegemony and a 15% world export share; U.S. producers made a secret agreement in 1935 to follow the intl. cartel's prices, for which they were found guilty in US court in 1940	Berlin prices in 1936-37 after Spain joined cartel compared to 1934-35	26	--	Schroeter (1994:78)
73T. Same as 73A	Compares prices in 1908 with prices offered during cartel suspension on two-year 1909-1910 contracts to US importers	25-40	40	Wallace and Edminster (1950:97)
73U. Same as 73E	Compares average 1926-28	7.8	13.5	Wallace and

	muriate of potash US import prices with period of weak cartel power 1924-25; peak is 1928			Edminster (1950:105)
73V. Same as 73E	Compares average 1926-28 potash sulphate US import prices with period of weak cartel power 1924-25; peak is 1928	6.1	11.3	Wallace and Edminster (1950:105)
73W. Same as 73E	Compares average 1926-28 manure salt US import prices with period of weak cartel power 1924-25; peak is 1928	19.2	27.4	Wallace and Edminster (1950:105)
73X. Same as 73E	Compares average 1926-28 kainite of potash US import prices with period of weak cartel power 1924-25; peak is 1928	22.0	30.3	Wallace and Edminster (1950:105)
73Y. Same as 73A.	Yardstick is prices (approx. 1900-1910) of profitable German mines not in cartel	30	--	Tosdal (1916:830)
73Z. Same as 73 E.	Compares North American import prices in 1924-33 with the price after the cartel fell apart in 1934.	107-110	--	Canada (1945: 3)
73AA. Same as 73 L.	Compares North American import prices in 1937-39 with the price before in 1934.	57	--	Canada (1945: 3)
74A. International steel cartel centered in Western Europe in late 1920s and 1930s; cartel raised prices in domestic markets of members, but sold steel in the U.S. and elsewhere at lower, possibly competitive prices; this study seems to cover two episodes below (74B and 74C)	Prices in Germany above world price, apparently from Barbezat's studies; Baker applies a general oligopoly model to U.S. data from 1933-39; Gallet's model refers to oligopoly pricing in the US 1950-1988	33	--	Levenstein and Suslow (2002:12,42), Barbezat (1989, 1990, 1994), Baker (1989), Gallet (1997)
74B. First international steel cartel of Sept. 1926-March 1931	S & W conclude that it "...lacked power over prices"; Benni et al. agree with S&W for most of the period; peak is Sept. 1928-March 1929	1	20	Stocking and Watkins (1946:203), Benni <i>et al.</i> (1930:14)
74C. Second international steel cartel of June 1933- Sept. 1939	This reorganized cartel was bigger and more successful than the first, but S&W Believe that its power over price cannot be disentangled from the recovery of the world economy from the Great Depression	?	?	Stocking and Watkins (1946:182-211)
74D. Same as 74C, except author seems to claim that his method takes care of simultaneity	Lerner index	28	--	Griffin (1989:189-190)
74E. Same as 74C, but League of Nations prices collected f.o.b. Antwerp in pounds sterling, which author states are the same as found all over continental Europe	Average prices July 1933-Oct. 1936 compared to either Jan. or April 1933	9.3-17.5	--	Oualid (1938:40)

74F. Same as 74A	Lerner index	12	--	Griffin (1989:189-190)
75. International lysine cartel June 1992-July 1995, prosecuted and sanctioned by the U.S., EU, Canada, and Mexico; global cartel with two episodes separated by a disciplinary price war from about May 1993 to Sept. 1993.				
75A. First US episode began in June 1992 and ended about April 1993 when a brief price war began; cartel bickered about market shares	Selling prices in U.S. relative to LRMC in U.S. of \$0.75 to \$0.80 per lb.	7.9-15.1	22.5-30.7	Connor (2001b, 2004)
75B. Second and more effective episode began in Oct. 1993 when members finally agreed to constant world volume-of-sales shares and a fifth small producer joined the cartel; ended June 1995	Change in U.S. prices from intermediate price war in early 1993 to late 1993 peak prices; from a trade journal	--	67	Levenstein and Suslow (2003:50), <i>Chem. Market Reporter</i> 7/17/95
75C. Seems to be an average of two episodes, 75A and 75B, US market	Official estimate of US overcharge during 1992-95, combined with court records of U.S. affected sales	17.1	--	Connor (2007c), OECD (2002:55)
75D. Same as 75C	Selling prices in U.S. relative to: sum of U.S. LRMC and generous allowance for LR competitive accounting profits	17.6	56	Connor (2001b, 2007b, 2004a)
75E. Same as 75C	Econometric model of the U.S. lysine market	17.6-18.0	56-57	Morse and Hyde (2000)
75F. Same as 75C, except Canadian market data	Benchmark is pre-cartel Canadian prices	22	--	Connor (2001b, 2003: Table A.1)
75G. Same as 75C, except EU data	Benchmark is average pre-cartel EU price	17	--	Connor (2003: Table A.1), EC decision of 6/27/2000
75H. Same as 75C, except world market	Benchmark is pre-cartel world prices	14	--	Connor (2001b, 2003: Table A.1)
75I. Same as 75A, except Asia and Latin America data	Residual analysis from 75D,F,G, and H above	8	--	Connor (2001b, 2003: Table A.1)
75J. Same as 75F	Magazine article; Canadian peak prices	--	50	Levenstein and Suslow (2002:Table 15)
75K. Same as 75C	Prediction of US price change due to collusion from a dynamic simulation model of the lysine industry that focuses on the role of ADM's entry	24.6	--	De Roos (2004a:50)
75L. Same as 75C , except imports to selected developing countries	Import price decline after the demise of the cartel	10	--	Yu (2003:10)
75M. Same as 75C	Reading of U.S. court decision	--	71.4	Appendix Table 4: entry 21 below
75N. Same as 75C	Prediction of change in US mark-up from a dynamic simulation model	45.6	--	De Roos (2004b: Table 3, Model 1)
75O. Same as 75C	Prediction of change in US mark-up from a dynamic simulation model	44.1	--	De Roos (2004b: Table 3, Model 2)
75P. Same as 75C	Sophisticated GARCH econometric model applied to US prices	33.3	--	Bolotova <i>et al.</i> (2005)

75Q. Same as 75B	Selling prices in U.S. relative to LRMC in U.S. of \$0.75 to \$0.80 per lb.	39.9-49.3	53.8-64.0	Connor (2001b, 2004)
75R. Same as 75B	Compares EU selling prices with intervening price war benchmark	36.4	51.2	Connor (2003: Table A.1), EC decision of 12/5/2001
75S. Same as 75C	Changes in world prices compared to pre-cartel prices	--	41	Levenstein and Suslow (2003:49), <i>The Observer</i> 10/25/98
75T. Same as 75A	Compares U.S. transaction prices to 3 months before cartel began	23.3	40.0	Connor (2003: Table A.1)
75U. Same as 75B	Compares U.S. transaction prices to 3 months before cartel began	59.9	75.7	Connor (2003: Table A.1)
75V. Same as 75A	Compares U.S. transaction prices to 3 months during brief price war	23.3	40.0	Connor (2003: Table A.1)
75W. Same as 75B	Compares U.S. transaction prices to 3 months during brief price war	59.9	75.7	Connor (2003: Table A.1)
75X. Same as 75A	Compares EU selling prices with pre-cartel benchmark	10.0	22.3	Connor (2003: Table A.1), EC decision of 12/5/2001
75Y. Same as 75B	Compares EU selling prices with pre-cartel benchmark	34.7	48.9	Connor (2003: Table A.1), EC decision of 12/5/2001
75Z. Same as 75A	Compares EU selling prices with intervening price war benchmark	11.7	51.2	Connor (2003: Table A.1), EC decision of 12/5/2001
75AA. Same as 75C	Prediction of US price above marginal cost due to collusion, from a dynamic simulation model of the lysine industry that focuses on the role of participants' asymmetries	61.5	140	De Roos (2006:Table 3, Fig. 7)
75BB. Same as 75A	Prediction of US price above marginal cost due to collusion, from a dynamic simulation model of the lysine industry that focuses on the role of participants' asymmetries	75	120	De Roos (2006: Fig. 7)
75CC. Same as 75B	Prediction of US price above marginal cost due to collusion, from a dynamic simulation model of the lysine industry that focuses on the role of participants' asymmetries	100	140	De Roos (2006: Fig. 7)
75DD. Same as 75B for US	Davies and Marjumdar's interpretation of White's graphical analysis of before and after benchmark prices	25+	--	White (2001), Davies and Majumdar (2002)
75EE. Same as 75C for CA	Selling prices in U.S. relative to: sum of U.S. LRMC and	17.7	--	Connor (2013, 2001a)

	generous allowance for LR competitive accounting profits			
75FF. Same as 75C for EU	Benchmark is average pre-cartel EU price; better sales data	17.4	--	Connor (2013, 2007b), EC decision of 6/27/2000
75GG.. Same as 75C for US	Selling prices in U.S. relative to: sum of U.S. LRMC and generous allowance for LR competitive accounting profits	16.2	--	Connor (2013, 2001a)
75HH. Same as 75C for world	Benchmark is pre-cartel world prices; better sales data	13.3	--	Connor (2013, 2001a)
76A. International citric acid cartel, met from Mar. 1991 to May 1995; convicted and fined in the U.S. and EU; global cartel with only one time episode	Transaction prices in US compared to a range of long run full economic costs	16-20	18-33	Connor(1998 and 2007b), Connor (2003: Table A.1)
76B. Same as 76A, for Canada	Benchmark is pre-cartel prices in Canada	19-32	--	Connor (2003: Table A.1)
76C Same as 76A, for EU	Benchmark is pre-cartel prices in EU	45-50	--	Connor (2003: Table A.1), EC decision of 12/5/2001
76D. Same as 76A, for world	Benchmark is pre-cartel world prices	30-34	--	Connor (2003: Table A.1)
76E. Same as 76A, for US	Official U.S. government estimate, method not reported	31.25	--	OECD (2003:55)
76F. Same as 76A, for EU	Statement of EC Commissioner M. Monti 9/13/00 after fines imposed	--	50	Levenstein and Suslow (2003:50), <i>European Report</i> 9/13/00
76G. Same as 76A, for developing countries	Developing countries' import prices decline after the demise of the cartel	20	--	Yu (2003:10)
76H. Same as 76A.	Sophisticated GARCH econometric model applied to US prices	13.6	--	Bolotova <i>et al.</i> (2005)
76I. Same as 76A.	Econometric trade model of short-run (1 to 2 years) world-trade price effects after cartel collapses.	4.5-8.8	--	Levenstein et al. (2011: Tables 4 and 5)
76J. Same as 76A.	Econometric trade model of long-run (3 to 4 years) price effects after cartel collapses.	7.5-14.2	--	Levenstein et al. (2011: Tables 4 and 5)
76K. Same as 76A.	Transaction prices in US compared to a range of long run full economic costs; more precise sales data	18.3	--	Connor (2013, 2007b)
76L. Same as 76B.	Benchmark is pre-cartel prices in Canada; more precise sales data	33.3	--	Connor (2013, 2007b)
76M. Same as 76F.	Benchmark is pre-cartel prices in EU; more precise sales data	47.5	--	Connor (2013), EC decision of 12/5/2001
76N. Same as 76G.	Benchmark is pre-cartel prices; more precise sales data	30.8	--	Connor (2013, 2007b)
76O. Same as 76D.	Benchmark is pre-cartel world prices	14	--	Connor (2013, 2007b)

77A. International sorbates cartel 1979-1997, successfully prosecuted by U.S. DOJ, Canada, EU, and private plaintiffs in U.S.; global cartel with only one episode	Press report from anonymous source on US price effects	14	--	Levenstein and Suslow (2003:50), <i>WSJ</i> 10/1/98
77B. Same as 77A, for US	Benchmark is pre-cartel and post-cartel U.S. prices from trade magazines	35-45	--	Connor (2003: Table A.1), <i>Chem. Market Reporter</i> (various dates)
77C. Same as 77A, for Canada	Same as above for Canada	37-47	--	Connor (2003: Table A.1)
77D. Same as 77A, for world	Same as above, world prices	42	--	Connor (2003: Table A.1)
77E. Same as 77A, for US	Trade journal.; simple increase in U.S. transaction prices	--	14	Levenstein and Suslow (2002:Table 15)
78. International cartel in methionine , Feb. 1986 to Feb. 1999, successfully prosecuted by EU and large private settlements in U.S.; global cartel with three episodes	Benchmark is pre-cartel U.S. prices from trade magazine sources for entire conspiracy period 2/86-2/99 (3 episodes)	10-14	--	Connor (2003: Table A.1), Borgeson (1999), STAT-USA (1999)
78A. From 2/86 to 9/88 (first episode) all four major world suppliers agreed to both list and "rock bottom" (contract) prices everywhere in world; US and Japan were duopolies; fringe small; CR4 =92%; EC report says price increase highest of 3 episodes	Prices unavailable in EC report, but infer that EU price increases are somewhat higher than for 78B below	30-90	--	<i>EC Official Journal</i> L255 (10/8/2003):1-32;
78B. From 9/88 to July 1990 (2 nd episode) Sumitomo withdrew from meetings of cartel but may have cooperated passively with cartel of 3 firms; nonmember Monsanto had 18-20% global share in late 1980s but in 1988 began aggressive expansion of liquid methionine in US; Russian producers increased exports to EU, but price effects weakly positive	U.S. list or spot prices for 99% pure DL-methionine in dry form for 1990 compared to 1980 and 1985 benchmark; long-term supply contract prices track spot prices very closely	26-78	--	<i>EC Official Journal</i> L255 (10/8/2003):1-32; Borgeson (1999:77)
78C. From July 1990 to Feb. 1999 (3 rd episode), Sumitomo not in cartel but sold its product through the cartel in the EU; in 6/93 cartel got an agreement from Russian suppliers to limit their EU imports to 75Kt;	Narrative of meetings gives both EU target and transaction ("going") prices from mid 1990 to Feb. 1999; overstated benchmark (proxy for pre-cartel price) is mid 1990 price; peak is mid 1993	13.5+	15.6+	<i>EC Official Journal</i> L255 (10/8/2003):1-32
78D. Same as 78C for US prices	Average U. S. import prices 1991 to 1997 compared to 1981-84 prices; peak is 1997	14.1	37	Connor (2003: Table A.1), Borgeson (1999), STAT-USA (1999)
78E. Same as 78C for US prices	Same as above but benchmark is 1990 import prices	37.5	65	Connor (2003: Table A.1), Borgeson (1999), STAT-USA (1999)
78F. Same as 78C for US prices	U.S. list or spot prices for 99% pure DL-methionine in dry form for 1991-1998 compared to 1980 and 1985 benchmark; long-term supply contract prices track spot prices very closely; peak is 1997	38-95	40-99	Connor (2003: Table A.1), Borgeson (1999:77)

78G. Same as 78C	List prices in the EU from July 1990 to Feb. 1999, using July 1990 price as a benchmark (well above pre-1986 prices)	13.5	15.6	EC (Oct. 8, 2003)
78H. Same as 78C	Econometric model using world trade prices during and after the cartel	22-24		Levenstein <i>et al.</i> (2008: Tables 6 and 7)
78I. Same as 78A	Econometric trade model of short-run (1 to 2 years) price effects after cartel collapses.	6.4-28.8	--	Levenstein <i>et al.</i> (2011: Tables 4 and 5)
78J. Same as 78A	Econometric trade model of long-run (3 to 4 years) price effects after cartel collapses.	25.9-32.3	--	Levenstein <i>et al.</i> (2011: Tables 4 and 5)
78K. Same as 78A+B+C+D, except for all areas affected	See 78A, 78B, 78C and 78D above	13	--	Connor (2013) sales
79. International sodium chlorate cartel formed by exporters from Switzerland, Sweden, Italy, Germany, France, and Czechoslovakia 1931; ended in Sept. 1939	Real mean annual wholesale world export prices in 1931-1939 compared to nearly constant prices in 1920-1930, a period of relatively robust demand; peak year 1934	45	67	Suslow (2001: 58), Hexner (1946: 339-340)
80. International cartels in 16 bulk vitamins and Carotenoids (plus “all vitamins” and the “Global Branch” of Choline chloride no. 81), various dates between 1988 and 1999; prosecuted by U.S. DOJ, EC, Canada, Australia, Korea, and private plaintiffs in U.S.; global cartel with 16 distinct products and, for some products, multiple time episodes; dry and liquid forms are classified in the same market.				
80A. All vitamins in US, late 1989-Feb. 1999 ^a	Press report of U.S. class-action counsel estimate mentioned as credible by scholars	20	--	Levenstein and Suslow (2002: Table 15)
80B. Same as 80A for Canada, late 1989-Feb. 1999 ^a	Statement of Bureau of Competition officials	30	--	Levenstein and Suslow (2002: Table 15)
80C. Vitamin E in US, Jan. 1990-Feb. 1999	Analysis of U.S. list or spot prices before cartel operated	55-65	82-90	Connor (2003: Table A.1), Connor (2001a:322-330)
80D. vitamin B1 in US, Jan. 1991- Dec. 1994	Analysis of U.S. list or import prices pre-cartel	9-11	16	Connor (2003: Table A.1)
80E. vitamin B2 in US, Jan. 1991- Dec. 1995	Analysis of U.S. list or import prices before and after cartel for vitamin B2	12-19	21	Connor (2003: Table A.1)
80F. vitamin B5 (calpan) , Jan. 1991- Dec. 1998	Analysis of U.S. list or spot prices before cartel	25	59	Connor (2003: Table A.1), Connor (2001a:322-330)
80G. folic acid (B9) , in US Jan. 1991- Dec. 1994	Analysis of U.S. list or import prices before cartel for folic acid (a B vitamin)	23	38	Connor (2003: Table A.1), Connor (2001a:328)
80H. vitamin C , in US Jan. 1991-Dec. 1995	Analysis of U.S. list or import prices pre cartel	10-23	31	Connor (2003: Table A.1), Connor (2001a:322-330)

80I. vitamin B3 (niacin) , in US Jan. 1992- March 1998	Analysis of U.S. import prices before cartel	33	71	Connor (2003: Table A.1), Connor (2001a:329)
80J. vitamin B12 , in US, Jan. 1991- Dec. 1994	Analysis of U.S. list or spot prices pre cartel	13	73	Connor (2003: Table A.1)
80K. beta carotene , in US Jan. 1991- Dec. 1998	Analysis of U.S. list or import prices pre cartel	25-35	--	Connor (2003: Table A.1)
80L. vitamin B12 in Canada, Jan. 1991- Dec. 1994	Analysis of Canadian list or import prices pre cartel	14	72	Connor (2003: Table A.1), Connor (2001a: 322-330)
80M. Vitamin A for world, late 1989-Feb. 1999 ^a	Analysis of world list prices pre cartel	25-30	--	Connor (2003: Table A.1, 2001: 322-330)
80N. Same as 80D, vitamin B1 , world, Jan. 1991- Dec. 1994	Analysis of world list prices before cartel	9-10	--	Connor (2003: Table A.1, 2001: 322-330)
80O. Same as 80E, vitamin B2 , world, Jan. 1991- Dec. 1995	Analysis of world list prices before cartel	12-19	--	Connor (2003: Table A.1, 2001: 322-330)
80P. Same as 80F, vitamin B5 , world, 1/1991- 12/1998	Analysis of world list prices before cartel	25	--	Connor (2003: Table A.1, 2001: 322-330)
80Q. vitamin B6 , world, Jan. 1991- Dec. 1994	Analysis of world list prices before cartel	4-40	--	Connor (2003: Table A.1, 2001: 322-330)
80R. Same as 80G, follic acid (B9) , world, 1/1991 – 12/1994	Analysis of world list prices before cartel	23	--	Connor (2003: Table A.1, 2001: 322-330)
80S. Same as 80H, vitamin C , world	Analysis of world list prices before cartel	11-23	--	Connor (2003: Table A.1, 2001: 322-330)
80T. Same as 80K beta carotene , world	Analysis of world list prices before cartel	25-30	--	Connor (2003: Table A.1, 2001: 322-330)
80U. Same as 80K other Carotenoids in US	Analysis of U.S. list prices before cartel	9-13	--	Connor (2003: Table A.1, 2001: 322-330)
80V. Same as 80K other Carotenoids , world	Analysis of world list prices before cartel	25-30	--	Connor (2003: Table A.1, 2001: 322-330)
80W. Same as 80I vitamin B3 , but world	Analysis of world list prices before cartel	33	--	Connor (2003: Table A.1, 2001: 322-330)
80X. Same as 80J vitamin B12 , but world	Analysis of world list prices before cartel	33	--	Connor (2003: Table A.1, 2001: 322-330)
80Y. Same as 80A (all vitamins), but all world; 90 importing nations ; with or without anticartel laws; model predicts quantity and price effects of the global vitamins cartel ; total overcharge is \$2,626 million	Trade model is fitted to international trade data; covers the years 1985-1997 (misses last 14 months of cartel); converted into 2000 U.S. dollars; simple average of 90 overcharges on imports	19.7	60.5	Clarke and Evenett (2002: Table 7)
80Z. Same as 80A, except All vitamins for 24 countries identified by the OECD as having effective anticartel laws during the affected period (a possibly generous designation)	Weighted average of 24 overcharges on vitamins imports; peak is for South Africa.	22.8	150	Clarke and Evenett (2002: Table 7)
80AA. Same as 80A except All vitamins, imported , but excluding five countries from 24 above that the authors believe did not effectively enforce their laws during most of 1989-1999: So. Africa., China, Romania, Peru, Bulgaria, Zambia.	Simple average of 19 countries	13.2	60.5	Clarke and Evenett (2002: Table 7)
80BB. Same as 80A, except All vitamins for 20 largest countries with no anticartel laws	Simple average, as above	30.1	34.8	Clarke and Evenett (2002: Table 7)
80CC. Same as 80A, except All vitamins for	Simple average, as above	33.0	60.5	Clarke and Evenett

20 no-antitrust countries in 80BB plus 5 mentioned in 80AA				(2002: Table 7)
80DD. Same as 80A, except All vitamins , South Korea, 1990-99	Comparison of 1997 import price relative to 1990, year before cartel	70.0	--	KFTC (2003: 2)
80EE. Same as 80DD, except All vitamins , South Korea, 1990-99	Comparison of 1997 import price relative to 2000, year after cartel	38.4	--	KFTC (2003: 2)
80FF. Same as 80H; vitamin C in US; one of the weakest and least durable of the vitamins cartels because of large Chinese exports	Sophisticated simulation model estimated with accurate industry parameters that predicts "no collusion" price of \$27/kg. and collusive price with Chinese fringe of \$33	22.2	--	de Roos (2001:20)
80GG. Same as 80H ; vitamin C in US	Same as 80FF except that but-for price of \$29.96 is from noncooperative oligopoly regime; peak price assumes no fringe	22.3	29.5	de Roos (2001:28)
80HH. Same as 80H ; vitamin C in US	Same as 80 GG except that but-for price of \$29.00 is punishment-phase price war	26.3	33.8	de Roos (2001:28)
80II Same as 80Q, vitamin B6 , Jan. 1991-Dec. 1994	Analysis of U.S. list or import prices before and after cartel	7-28	19	Connor (2001a:326)
80JJ. Vitamin D3 , 1992-1998, but end date is slightly uncertain	Analysis of U.S. list or import prices before cartel	36	47	Connor (2001a:323)
80KK. Same as 80H, vitamin C in US	Analysis of U.S. list or import prices after cartel	10	21	Connor (2001a:326)
80LL. Same as 80Q and 80II, vitamin B6 in US	Analysis of U.S. list or import prices after cartel	48	79	Connor (2001a:326)
80MM. Same as 80D, vitamin B1 in US	Analysis of U.S. list or import prices after cartel	50	59	Connor (2001a:326)
80NN. Same as 80I, vitamin B3 in US	Analysis of U.S. list or import prices after cartel	16	33	Connor (2001a:329)
80OO. Same as 80M, vitamin A in EU	Average annual 1991-98 EU transactions prices in euros vs. before (1990) prices; peak is 1998	25.0	40	EC (2001:86)
80PP. Same as 80C, vitamin E in EU	Average annual 1991-98 EU transactions prices in euros vs. after (1999) prices; peak is 1998	51.9	67.2	EC (2001:86)
80QQ. Same as 80C, vitamin E in EU	Average annual 1991-94 EU transactions prices in euros vs. after (1999) prices; peak is 1998	10.6	19.2	EC (2001:86)
80RR. Same as 80D, vitamin B1 in EU	Average annual 1991-94 EU transactions prices in euros vs. before (1989-90) prices; peak is 1993	4.6	16.4	EC (2001:87)
80SS. Same as 80D, vitamin B1 in EU	Average annual 1991-98 EU transactions prices in euros vs. after (1996-99) prices; peak is 1993	62	79	EC (2001:87)
80TT. Same as 80E, vitamin B2 in EU	Average annual 1991-94 EU	19.4	30	EC (2001:87)

	transactions prices in euros vs. before (1990) prices			
80UU. Same as 80E, vitamin B2 in EU	Average annual 1991-98 EU transactions prices in euros vs. after (1997-99) prices	29.9	35	EC (2001:87)
80VV. Same as 80F, vitamin B5 in EU	Average annual 1991-94 EU transactions prices in euros vs. before (1990) prices	39.6	58.3	EC (2001:88)
80WW. Same as 80Q and 80II, but vitamin B6 EU	Average annual 1991-94 EU transactions prices in euros vs. before (1990) prices	67	86	EC (2001:88)
80XX Same as 80Q and 80II, but vitamin B6 in EU	Average annual 1991-94 EU transactions prices in euros vs. after (1996-99) prices	91.5	144.7	EC (2001:88)
80YY. Same as 80H, vitamin C but EU	Average annual 1991-95 EU transactions prices in euros vs. before (1989-90) prices	14.8	30.4	EC (2001:89)
80ZZ. Same as 80H, vitamin C but EU	Average annual 1991-95 EU transactions prices in euros vs. after (1997-99) prices	76.0	100	EC (2001:89)
80AAA. Liquid vitamin A in US, late 1989-Feb. 1999	Benchmark is pre-cartel spot and list US prices	70-75	200	Connor (2001a:320,331)
80BBB. Dry vitamin A in US, , late 1989- Feb. 1999	Benchmark is pre-cartel spot and list US prices	40-45	70-75	Connor (2001a:320,331)
80CCC. Vitamin E , world, , late 1989- Feb. 1999	Benchmark is pre-cartel price	35	--	Connor (2001a:336)
80DDD. Same as 80A (all vitamins), except refers to imports to selected developing countries	Import price decline after the demise of the cartel	35	--	Yu (2003:10)
80EEE. Biotin (vitamin H) , in EU Oct. 1991 to April 1994	Post-cartel decline in prices, conservatively estimated (because quantity increases) from the sales decline from 1994 to 1997-98	31	--	EC (1/10/03:para 18)
80FFF. Same as 80E Vitamin B2 in EU from Jan. 1991 to Sept. 1995	Post-cartel decline in prices, conservatively estimated (because quantity increases) from the sales decline from 1994-95 to 1997-98; peak is 1995	21	24	EC (1/10/03:para 18)
80GGG. Same as 80S, DC (human) grade vitamin C , 1/1991 – 12/1995	UK transaction prices 1995 compared to 1997-2000 post cartel prices	--	51	UKCC (2001:64)
80HHH. Same as 80S, regular (feed) grade vitamin C , 1/1991 – 12/1995	UK transaction prices 1995 compared to 1997-2000 post cartel prices	--	62-65	UKCC (2001:10)
80III. Same as 80E, except food-grade vitamin B2 , 1/1991 – 12/1995	UK transaction prices 1995 compared to 1997-2000 post cartel prices	--	42-48	UKCC (2001:10)
80JJJ. Same as 80E, except feed-grade vitamin B2 , 1/1991 – 12/1995	UK transaction prices 1995 compared to 1997-2000 post cartel prices	--	67-72	UKCC (2001:10)
80KKK. Same as 80M vitamin A , except in Canada for conspiracy period 1/1990 – 2/1999	Econometric model explaining purchase prices of two large buyers from July 1991 to	16.6	--	Ross (2005: Table B1)

	October 2000.			
80LLL. Same as 80H vitamin C , except in Canada for conspiracy period 1/1990 – 12/1995	Econometric model explaining purchase prices of two large buyers from July 1991 to October 2000.	16.2	--	Ross (2005: Table B2)
80MMM. Same as 80C vitamin E , except in Canada for conspiracy period 1/1990 – 2/1999	Econometric model explaining purchase prices of two large buyers from July 1991 to October 2000.	16.2	--	Ross (2005: Table B3)
80NNN. Same as 80A, all bulk vitamins in the U.S. market	A benchmark industry price is developed from the U.S. producer price index for all vitamins products; unadjusted	26.8	--	Breyer (2000: Table 2)
80OOO. Same as 80A, but all bulk vitamins in the U.S. market [Note that Breyer also models a 1988-1989 base period, but the EC decision states that 1988 was a collusive period in the EU, and Connor (2001) shows that the U.S. market was also cartelized in 1988]	A benchmark industry price is developed from the U.S. producer price index yardstick for all vitamins products and a 1989 base period; adjusted for 50% demand and 50% exchange-rate pass-through	21.4	--	Breyer (2000: Table 2)
80PPP. Same as 80OOO, all bulk vitamins in the U.S. market	A benchmark industry price is developed from the U.S. producer price index for all vitamins products and a 1989 base period; adjusted for 100% demand and 100% exchange-rate pass-through	15.7	--	Breyer (2000: Table 2)
80QQQ. Same as 80A, all bulk vitamins in the U.S. market	Same as above plus an adjustment for manufacturing costs changes in Switzerland	15.0	--	Breyer (2000: Table 2)
80RRR. Same as 80A, all bulk vitamins in the U.S. market	A benchmark industry price is developed from the U.S. producer price index for all vitamins products and a 1999 base period; adjusted for 50% demand and 50% exchange-rate pass-through	15.7	--	Breyer (2000: Table 2)
80SSS. Same as 80A, all bulk vitamins in the U.S. market [Breyer in Equation 2 states that he has estimate a Lerner index of 13.5%, which here is converted to an overcharge]	Econometric model with demand, costs, and exchange rates explaining monthly transactions selling prices of the six largest sellers from 1980 to 1998.	13.5	--	Breyer (2000: Table 2)
80TTT. Vitamin premixes in the US market, plea period	Detailed, sophisticated econometric study using defendant's internal prices	28.5-30.2	--	Bernheim (2002: 8)
80UUU. Same as 80C, Vitamin E in US	Detailed, sophisticated econometric study using defendant's internal prices	37.1-40.5	--	Bernheim (2002: 8)
80VVV. Same as 80BBB, Dry vitamin A in US,	Detailed, sophisticated econometric study using defendant's internal prices	32.3-33.7	--	Bernheim (2002: 8)
80WWW. Same as 80H	Detailed, sophisticated econometric study using defendant's internal prices	23.2-23.8	--	Bernheim (2002: 8)

80XXX. Same as 80F	Detailed, sophisticated econometric study using defendant's internal prices	29.2-34.3	--	Bernheim (2002: 8)
80YYY. Same as 80I	Detailed, sophisticated econometric study using defendant's internal prices	14.5-17.5	--	Bernheim (2002: 8)
80ZZZ. Same as 80E	Detailed, sophisticated econometric study using defendant's internal prices	22.9-23.1	--	Bernheim (2002: 8)
80AAAA. Vitamin biotin (H) in the US market	Detailed, sophisticated econometric study using defendant's internal prices	17.1-19.2	--	Bernheim (2002: 8)
80BBBB. Same as 80D, vitamin B1 in US	Detailed, sophisticated econometric study using defendant's internal prices	16.5-18.6	--	Bernheim (2002: 8)
80CCCC. Same as 80J	Detailed, sophisticated econometric study using defendant's internal prices	43-48.9	--	Bernheim (2002: 8)
80DDDD. Same as 80II	Detailed, sophisticated econometric study using defendant's internal prices	21.7-24.9	--	Bernheim (2002: 8)
80EEEE. Same as 80U	Detailed, sophisticated econometric study using defendant's internal prices	19-20	--	Bernheim (2002: 8)
80FFFF. Same as 80JJ	Detailed, sophisticated econometric study using defendant's internal prices	13.5	--	Bernheim (2002: 8)
80GGGG. Same as 80G	Detailed, sophisticated econometric study using defendant's internal prices	22.3	--	Bernheim (2002: 8)
80HHHH. Same as 80K	Detailed, sophisticated econometric study using defendant's internal prices	30.4-31.7	--	Bernheim (2002: 8)
80IIII. Same as 80A, all bulk vitamins in US	Detailed, sophisticated econometric study using defendant's internal prices	29.2-31.9	--	Bernheim (2002: 8)
80JJJJ. Same as 80M, except for 1995 only. Author uses a structural, numerical analysis that estimates demand and posits various forms of conduct for each supplier.	Assumes cartelists' margin 0.53 to 0.66, elasticity of demand -1.50, and cartel share 95%	15-36	36	Zona (2010: 13)
80KKKK. Same as 80M, except for 1995 only. Author uses a structural, numerical analysis that estimates demand and posits various forms of conduct for each supplier.	Assumes cartelists' margin 0.60, elasticity of demand from -0.75 to -1.50, and cartel share 95%	31-50	50	Zona (2010: 13)
80LLLL. Same as 80M, except for 1995 only. Author uses a structural, numerical analysis that estimates demand and posits various forms of conduct for each supplier.	Assumes cartelists' margin 0.60, elasticity of demand -1.50, and cartel share 99%	51-52	52	Zona (2010: 13)
80MMMM. Same as 80M	Econometric trade model of short-run (1 to 2 years) price effects after cartel collapses.	33.1-36.4	--	Levenstein et al. (2011: Table 4 and 5)
80NNNN. Same as 80M	Econometric trade model of long-run (3 to 4 years) price effects after cartel collapses.	17.3-27.2	--	Levenstein et al. (2011: Table 4 and 5)
80OOOO. Same as 80W	Econometric trade model of	3.8-30.8	--	Levenstein et al.

	short-run (1 to 2 years) price effects after cartel collapses.			(2011: Table 4 and 5)
80PPPP. Same as 80W	Econometric trade model of long-run (3 to 4 years) price effects after cartel collapses.	29.9-46.3	--	Levenstein et al. (2011: Table 4 and 5)
80QQQQ. Same as 80C, vitamin E , except world	Econometric trade model of short-run (1 to 2 years) price effects after cartel collapses.	7.1-79.7	--	Levenstein et al. (2011: Table 4 and 5)
80RRRR. Same as 80C, vitamin E , except world	Econometric trade model of long-run (3 to 4 years) price effects after cartel collapses.	76.6-91.5	--	Levenstein et al. (2011: Table 4 and 5)
80SSSS. Same As 80Y AND 80MMMM	Authors calculate the mean price changes with and without collusion and show significant changes in mean and dispersion.	16.4	--	von Blanckenburg <i>et al.</i> (2010: Table 2)
80TTTT. Same as 80OO Vitamin A in EU.	Econometric trade model of long-run (3 to 4 years) price effects after cartel collapses.	26.0	--	Levenstein et al. (2011: Table 4 and 5)
80UUUU. Vitamin A in ROW.	Econometric trade model of long-run (3 to 4 years) price effects after cartel collapses.	35.6	--	Levenstein et al. (2011: Table 4 and 5)
80VVVV. Same as Vitamin A 80AAA+80BBB.	Detailed, sophisticated econometric study using defendant's internal prices	32.8	--	Bernheim (2002: 8)
80WWWW. Same Vitamin A as 80M.	Econometric trade model of long-run (3 to 4 years) price effects after cartel collapses.	30.3	--	Levenstein et al. (2011: Table 4 and 5)
80XXXX. Same as 80D, vitamin B1 in EU	Average annual 1991-98 EU transactions prices in euros vs. after (1996-99) prices	6.4	--	EC (2001:87)
80YYYY. Same as Vitamin B1 , ROW	Analysis of U.S. list or import prices after cartel	15.2	--	Connor (2003, 2013)
80ZZZZ. Same as Vitamin B1 , US & CA	Detailed, sophisticated econometric study using defendant's internal prices	18.2	--	Connor (2013), Bernheim (2002: 8)
80AAAAA. Same as 80N. Same as Vitamin B1 , world	Analysis of U.S. list or import prices after cartel	12.1	--	Connor (2003, 2013)
80BBBBB. Same as 80D, vitamin B2 in EU	Average annual 1991-98 EU transactions prices in euros vs. after (1996-99) prices	26.7	--	EC (2001:87)
80CCCCC. Same as Vitamin B2 , ROW	Average annual 1991-98 EU transactions prices in euros vs. after (1996-99) prices	35.6	--	EC (2001:87)
80DDDDD Same as Vitamin B1 , US & CA	Detailed, sophisticated econometric study using defendant's internal prices	23	--	Connor (2013), Bernheim (2002: 8)
80EEEEEE. Same as Vitamin B2 , world	Average annual 1991-98 EU transactions prices in euros vs. after (1996-99) prices	30.3	--	EC (2001:87)
80FFFFFF. Same as 80D, vitamin B3 in EU	Average annual 1991-98 EU transactions prices in euros vs. after (1996-99) prices	26.6	--	EC (2001:87)
80GGGGG. Same as 80D, vitamin B3 in EU	Straight-line method, « before » but-for price	15.6	--	EC (2001:87), sales from Connor (2013)

80HHHHH. Same as Vitamin B3 , ROW	Detailed, sophisticated econometric study using defendant's internal prices	15.6	--	Bernheim (2002), sales from Connor (2013)
80IIIII. Same as Vitamin B3 , US & CA	Detailed, sophisticated econometric study using defendant's internal prices	15.6	--	Bernheim (2002), sales from Connor (2013)
80JJJJJ. Same as Vitamin B3 , world	Detailed, sophisticated econometric study using defendant's internal prices	15.6	--	Bernheim (2002), sales from Connor (2013)
80KKKKK. Same as Vitamin B5 , ROW	Straight-line method, « before » but-for price	44.4	--	Connor (2003, sales from Connor (2013)
80LLLLL. Same as Vitamin B5 , US & CA	Detailed, sophisticated econometric study using defendant's internal prices	31.0	--	Bernheim (2002), sales from Connor (2013)
80MMMMM. Same as Vitamin B5 , world	Compares price before collusion began.	30.3	--	Connor (2003: Appendix Table 6A)
80NNNNN. Same as 80D, vitamin B6 in EU	Analysis of list or import prices after cartel	42.5	--	EC Decision (2001)
80OOOOO. Same as 80D, vitamin B6 in ROW	Analysis of list or import prices after cartel	53.4	--	EC Decision (2001)
80PPPPP. Same as Vitamin B6 , US & CA	Detailed, sophisticated econometric study using defendant's internal prices	24.0	--	Connor (2003: Appendix Table 6A)
80QQQQQ. Same as Vitamin B6 , world	Analysis of list or import prices after cartel	41.9	--	EC Decision (2001)
80RRRRR. Same as 80D, vitamin B9 in EU	Compares price before collusion began.	64.1	--	Connor (2003: Appendix Table 6A)
80SSSSS. Same as 80D, vitamin B9 in ROW	Compares price before collusion began.	20.0	--	Connor (2003: Appendix Table 6A)
80TTTTT. Same as Vitamin B9 , US & CA	Detailed, sophisticated econometric study using defendant's internal prices	22.0	--	Bernheim (2002), sales from Connor (2013)
80UUUUU. Same as Vitamin B9 , world	Compares price before collusion began.	43.4	--	Connor (2003: Appendix Table 6A)
80VVVVV. Same as 80X, vitamin C in EU	Compares price before collusion began.	25.1	--	EC Decision (2001)
80WWWWW. Same as 80X, vitamin C in ROW	Compares price before collusion began.	29.2	--	EC Decision (2001)
80XXXXX. Same as Vitamin C , US & CA	Detailed, sophisticated econometric study using defendant's internal prices	23.6	--	Bernheim (2002), sales from Connor (2013)
80YYYYY. Same as 80K, Other Carotenoids, world	Compares price before collusion began.	89.0	--	Connor (2003: Appendix Table 6A)
80ZZZZZ. Same as Vitamin C , world	Compares price before collusion began.	26.2	--	EC Decision (2001)
80AAAAA. Same as 80X, vitamin D3 in EU	Detailed, sophisticated econometric study using defendant's internal prices	11.2	--	Bernheim (2002), sales from Connor (2013)
80BBBBB. Same as 80X, vitamin D3 in ROW	Detailed, sophisticated econometric study using defendant's internal prices	15.4	--	Bernheim (2002), sales from Connor (2013)
80CCCCC. Same as Vitamin D3 , US & CA	Detailed, sophisticated econometric study using defendant's internal prices	13.5	--	Bernheim (2002), sales from Connor (2013)
80DDDDD. Same as Vitamin D3 , world	Detailed, sophisticated	13.1	--	Bernheim (2002),

	econometric study using defendant's internal prices			sales from Connor (2013)
80FFFFFF. Same as 80X, vitamin E in EU	Analysis of list or import prices after cartel	50.1	--	EC Decision (2001)
80GGGGGG. Same as 80X, vitamin E in ROW	Detailed, sophisticated econometric study using defendant's internal prices	53.2	--	Bernheim (2002), sales from Connor (2013)
80HHHHHH. Same as Vitamin E , US & CA	Analysis of list or import prices after cartel	38.7	--	EC Decision (2001)
80IIIIII. Same as Vitamin E , world	Detailed, sophisticated econometric study using defendant's internal prices	25.0	--	Bernheim (2002), sales from Connor (2013)
80JJJJJJ. Same as Vitamin H , CA	Analysis of list or import prices after cartel	33.2	--	EC Decision (2001)
80KKKKKK. Same as 80X, vitamin H in EU	Analysis of list or import prices after cartel	22.8	--	EC Decision (2001)
80LLLLLL. Same as 80X, vitamin H in ROW	Detailed, sophisticated econometric study using defendant's internal prices	17.4	--	Bernheim (2002), sales from Connor (2013)
80MMMMMM. Same as Vitamin H , US	Analysis of list or import prices after cartel	24.0	--	EC Decision (2001)
80NNNNNN. Same as Vitamin H , world	Detailed, sophisticated econometric study using defendant's internal prices	29.5	--	Bernheim (2002), sales from Connor (2013)
80OOOOOO. Same as 80X, vitamin Premixes in EU	Detailed, sophisticated econometric study using defendant's internal prices	35.4	--	Bernheim (2002), sales from Connor (2013)
80PPPPPP. Same as 80X, vitamin Premixes in EU	Detailed, sophisticated econometric study using defendant's internal prices	29.5	--	Bernheim (2002), sales from Connor (2013)
80QQQQQQ. Same as Vitamin premixes , US & CA	Detailed, sophisticated econometric study using defendant's internal prices	31.5	--	Bernheim (2002), sales from Connor (2013)
80RRRRRR. Same as vitamin Premixes , world	Compares price before collusion began.	30.7	--	Connor (2003: Appendix Table 6A)
80SSSSSS. Same as vitamin Premixes , US & CA	Compares price before collusion began.	36.8	--	Connor (2003: Appendix Table 6A)
80TTTTTT. Same as 80X, vitamin Premixes in EU	Detailed, sophisticated econometric study using defendant's internal prices	30.6	--	Connor (2003: Appendix Table 6A)
80UUUUUU. Same as Beta Carotene , US & CA	Compares price before collusion began.	31.7	--	Connor (2003: Appendix Table 6A)
80VVVVVV. Same as Beta Carotene , world	Compares price before collusion began.	19.4	--	Connor (2003: Appendix Table 6A)
80WWWWW. Same as Vitamins: Astaxanthin & Canthaxanthin , EU	Compares price before collusion began.	23.3	--	Connor (2003: Appendix Table 6A)
80XXXXXX. Same as 80X Astaxanthin & Canthaxanthin in EU	Detailed, sophisticated econometric study using defendant's internal prices	19.5	--	Bernheim (2002), sales from Connor (2013)
80YYYYYY. Same as Astaxanthin & Canthaxanthin , US & CA	Detailed, sophisticated econometric study using defendant's internal prices	21.9	--	Bernheim (2002), sales from Connor (2013)
80ZZZZZ. Vitamin B4, North American Branch , 1988-12/1998; the "EU Branch," was operationally distinct from the "No. American	Compares price before collusion began.	33.6	--	Connor (2007b)

Branch.”				
80 AAAAAAA. Same as 80ZZZZZZ, except Canada.	Compares price before collusion began.	30.8	--	Connor (2007b)
80 BBBBbbb. Same as 80ZZZZZZ, except EU	Compares price before collusion began.	39.9	--	Connor (2007b)
80 CCCCCCC. Same as 80ZZZZZZ, except US.	Compares price before collusion began.	29.9	--	Connor (2007b)
80 DDDDDDD. Same as 80ZZZZZZ, except WORLD.	Compares price before collusion began.	33.7	--	Connor (2007b)
81A. Choline chloride (a/k/a vitamin B4) cartel 1/1988-10/1998, the European Branch divided markets between No. American and European manufacturers; convicted by U.S. DOJ and EU and in a US civil jury trial; the “EU Branch,” was operationally distinct from the “No. American Branch.”				
81A. EU prices, EU Branch	This is an analysis of EU transactions prices, benchmark is pre-cartel EU prices	33.6	--	Connor (2003: Table A.2), EC (2001:86)
81B. Same as 81A, except No. Am. branch	Benchmark is 1988 price for analysis of U.S. import prices from Canada	30.0	57	Connor (2003: Table A.3), Connor (2001a:330)
81C. Same as 81B	US jury trial; jury chose plaintiffs’ expert’s econometric model estimate	33.7	--	Hausfeld (2003:5)
81D. Same as 81B	Benchmark is post-cartel price (1999) compared to U.S. import prices from Canada	66	88	Connor (2003: Table A.3), Connor (2001a:330)
81E. Same as 81B	Reading of U.S. court decision	38	--	Appendix Table 4: entry 24 below
81F. Same as 81B	Detailed, sophisticated econometric study using defendant’s internal US prices	33.7	--	Bernheim (2002: 8)
81G. Same as 81A, except world	Econometric trade model of short-run (1 to 2 years) price effects after cartel collapses.	5.4-27.8	--	Levenstein et al. (2011: Table 4 and 5)
81H. Same as 81G	Econometric trade model of long-run (3 to 4 years) price effects after cartel collapses.	22.3-25.5	--	Levenstein et al. (2011: Table 4 and 5)
81I. Same as 81A, except EU	Benchmark is 1988 price for analysis of U.S. import prices from EU	39.9	--	Connor (2003: Table A.3)
81J. Same as 81A, except EU	Benchmark is 1988 price for analysis of U.S. import prices from EU	9.1	--	Connor (2003: Table A.3)
81K. Same as 81A, except ROW	Benchmark is 1988 price for analysis of U.S. import prices from ROW	33.6	--	Levenstein et al. (2011: Table 4 and 5)
81L. Same as 81B	Detailed, sophisticated econometric study using defendant’s internal US prices	27.9	--	Connor (2013), Bernheim (2002: 8)
81M. Same as 81B	Detailed, sophisticated econometric study using defendant’s internal US prices	8.3		Connor (2013), Bernheim (2002: 8)
81N. Same as 81B	Detailed, sophisticated	30		Connor (2013),

	econometric study using defendant's internal US prices			Bernheim (2002: 8)
81O. Same as 81G	Econometric trade model of long-run (3 to 4 years) price effects after cartel collapses.	5.1		Levenstein et al. (2011: Table 4 and 5)
81P. Same as 81G	Econometric trade model of long-run (3 to 4 years) price effects after cartel collapses.	30.7		Levenstein et al. (2011: Table 4 and 5)
82A. Aluminum phosphide international cartel, colluded in US Jan. 1990 to Nov. 1990; some companies convicted by U.S. DOJ at trial	Benchmark is pre-cartel price	47	--	Connor (2003: Table A.3)
82B. Same as 82A	Estimate reported in press, method unknown	48	--	Levenstein and Suslow (2003:49), <i>Kansas City Star</i> 7/14/94
83. BT forest insecticide , bid-rigging of Canadian government tenders 1991-1992, convicted after CBC probe	Statement of CBC officials	65	--	Connor(2003: Table A.3)
84A. From March 1992 to February 1998, 10 firms colluded worldwide on prices of graphite electrodes , used to melt steel; heavily fined by EU, US, Canadian, and Korean antitrust authorities.	Statements of DOJ officials about U.S. prices; DOJ sentencing memo of 10/19/99 shows start price of \$1.00/lb.; peak is Feb. 1997.	24.8	56	Levenstein and Suslow (2003:49), DOJ (10/19/99, 11/30/00)
84B. Same as 84A, except Canadian market	Statements of CBC officials about Canadian prices; CCB press release 7/20/00; government report to OECD;	90	--	OECD (2003: 53), Levenstein and Suslow (2003:49), CBC (7/18/00)
84C. Same as 84A, except EU market	EC report to OECD, EU prices	--	50	OECD (2003: 54)
84D. Same as 84A, except Korean imports	KFTC report to OECD, Korean import prices	25.14	--	OECD (2003: 54)
84E. Same as 84A	U.S. govt. report to OECD about U.S. prices	--	65	OECD (2003: 55)
84F. Same as 84A	Benchmark is before prices in U.S.	51-65	--	Connor (2003: Table A.4)
84G. Same as 84A, except EU market	Benchmark is before prices in EU	50	--	Connor (2003: Table A.4)
84H. Same as 84A, except world market	Benchmark is before world prices	50-58	--	Connor (2003: Table A.4)
84I. Same as 84A ; data are imports to selected developing countries	Import price decline after the demise of the cartel	45	--	Yu (2003:10)
84J. Same as 84A; data are sales in the EU	Prices from June 1992 to Jan. 1998 in the EU in DEM compared to May 1998 price	34.0	55.6	EC(4/16/02)
84K. Same as 84A, except Korean imports	Average annual Korean import prices 1992-1997 compared to before (1988-1990 average)	36.9	57.4	Jeon and Kwangshik (2005: 19)
84L. Same as 84A, except Korean imports	Average annual Korean import prices 1992-1997 compared to after (1999-2001 average)	13.7	30.7	Jeon and Kwangshik (2005: 19)
84M. Same as 84A, except Korean imports	Regression analysis with 14 years' data and 3 independent variables; demand is misspecified; collusion dummy is positive but of borderline	42.8	--	Jeon and Kwangshik (2005: 20)

	significance (t=1.68)			
84N. Same as 84A.	Authors suggest that the US and EU fines of \$600 million were an imperfect proxy of the cartel overcharge, divided by US and EU affected sales.	14.5	--	Levenstein and Suslow (2006: 56), Connor (2006b: line 75)
84O. Same as 84A, except Korean imports	Korean FTC analysis of increase in import prices from cartel compared to a yardstick of prices of non-members	36.5	--	OECD (2006:141)
84P. Same as 84A; affected period is 7/1/92 to 6/30/98 (lagged price effects included)	Econometric model presented by plaintiff's expert at jury trial conviction of Mitsubishi; US affected sales from DOJ estimates	33.9	--	Lande and Davis (2006:32-34)
84Q. Same as 84A, except world market	Prices in world 1992-97 compared to average of 1989-1991 price; peak is 1997	29.6	48	Levenstein and Suslow (2003: 826-843)
84R. Same as 84A, except world market	Prices in world 1992-97 compared to July 2000 price; peak is 1997	10.0	23.4	Levenstein and Suslow (2003: 826-843)
84S. Same as 84A.	Prices in U.S. 1992-97 compared to average 1989-1991 price; peak is 1997	39.0	64.2	Levenstein and Suslow (2003: 826-843)
84T. Same as 84A.	Prices in U.S. 1992-97 compared to July 2000 price; peak is 1997	9.0	24.8	Levenstein and Suslow (2003: 826-843)
84U. Same as 84A, except Korean imports	Import prices in Korea 1992-97 compared to pre-cartel prices; peak is 1997; estimate by Korean FTC	25.14	48.8	Levenstein and Suslow (2003: 826-843)
84V. Same as 84A, except Canadian market	Import prices in Canada 1992-97 compared to pre-cartel prices; peak is 1997; estimate by Competition Bureau	--	90	Levenstein and Suslow (2003: 826-843)
84W. Same as 84A, except Canadian market	Benchmark is pre-cartel prices	52.6	--	Connor (2013)
84X. Same as 84A, except Rest of World	Benchmark is pre-cartel prices	59.9	--	Connor (2013)
84Y. Same as 84A.	Benchmark is pre-cartel prices	58.6	--	Connor (2013)
84Z. Same as 84A, except world market	Benchmark is pre-cartel prices	55.4	--	Connor (2013)
85. Global cartel in methyl glucamine 1990-1999, convicted by CBC and EC	Benchmark is pre-cartel prices	75	--	Connor (2003: Table A.4)
86. International bid-rigging cartel in shipping of chemicals in parcel tankers 1998-2002, convicted in U.S.	Estimates reported in business press	15	--	Connor (2003: Table A.4), <i>WSJ</i> 2002
87. International sulfur export cartel operated from 1906 to the late 1960s; originally a Sicilian monopoly from 1833 to 1906, when the sulfur Consorzio was established; in 1907 the sole U.S. producer made a bilateral agreement with the Consorzio to divide the world market 67/33%; in 1922, the legal U.S. export cartel Sulexco joined the Consorzio (75/25% world exports share agreement)				Eckbo (1976:39), Hexner (1946: 272-273); MacKie-Mason and Pindyck (1987:203-210)
87A. Refers to 1934-1939; four U.S. producers controlled 75-80% of world supply and Italy the	Eckbo's interpretation of Hexner's case study	50+	--	Eckbo (1976:39), Hexner (1946: 272-

rest				273)
87B. Same as 87A	Lerner index derived from an econometric model	45	--	Griffin (1989:189-190), Hexner (1946:273)
87C. Cartel 1907-1913; Union Sulfur Co. agreed to cease U.S. exports to Europe and vice-versa	Lerner index derived from an econometric model	53	--	Griffin (1989:189-190), Hexner (1946:272)
87D. Cartel during 1922-1932; an agreement between the U.S. Webb-Pomerene Assn. Sulxco of 3 members and the Consorzio to limit exports and set quotas for each party [see also cartel 291]	Lerner index derived from an econometric model	24	--	Griffin (1989:189-190), Hexner (1946:272)
87E. Cartel of 1947-1958	Lerner index derived from an econometric model	28	--	Griffin (1989:189-190)
87F. Same as 87C, except slightly longer period 1906-1917; two more U.S. suppliers entered by 1919, briefly ending collusion	Average world export prices 1906-1917 compared to 1919-1920 prices; peak is 1908	70	77.3	MacKie-Mason and Pindyck (1987: 203-210)
87G. Same as 87D, except 1922-1940	Average world export prices 1922-1940 compared to 1919-1920 prices; peak is 1932	36.7	93.6	MacKie-Mason and Pindyck (1987: 203-210)
87H. Same as 87D, except 1922-1940	Average world export prices 1922-1940 compared to long-run marginal costs; peak is 1932	201.8	327	MacKie-Mason and Pindyck (1987: 203-210)
87I. Same as 87D	Authors choose 1928 as a representative year and compare elevated discriminatory export prices to the domestic price	203	--	MacKie-Mason and Pindyck (1987: 206-208)
87J. Same as 87E, except 1947-1973; fringe supply grew in Mexico, Canada, and France; in 1968 posted prices replaced by delivered pricing	Average world export prices 1947-1973 compared to 1973 price; peak is 1954	69	131.6	MacKie-Mason and Pindyck (1987: 203-210)
87K. Same as 87D and E; cartel years 1922-1932 and 1947-1962	Econometric model predicts 8.3% decline in export volume during cartel years; price effect predicted from elasticity is statistically significant	6.3	--	Dick (1992:103)
87L. Same as 87D; dates U.S. collusion with the Consorzio from Dec. 1923	Compares prices in 1924-1929 with 11/1923	30	--	Wallace and Edminster (1930:262)
88. International cartel alleged in copper concentrate 2001-2003, probe by U.S. and EU	Press reports, method unknown	25	--	Connor (2003: Table A.4)
89A. EU carbonless paper cartel 1992-1995, fined by EC	From Eur. Commission decision with EU prices	10-24	--	Connor (2003: Table A.5), EC (8/8/2002)
89B. Same as 89A	From final EC decision, EU quarterly 1994-95 price increases of reels, mean across countries; average assumes 1992-93 increases same as 1994-95; peak is 9/95	58	116	EC(4/21/04:82-88)
89C. Same as 89A	From final EC decision, EU quarterly 1994-95 price increases of reels, mean across countries; average assumes 1992-93 increases same as	39	78	EC(4/21/04:82-88)

	1994-95; peak is 9/95			
89D. Same as 89A	From final EC decision, EU price increases 10/1993-7/1994 of reels, as interpreted by Harrington	29	--	EC(4/21/04:§143), Harrington 2007:84)
89E. Same as 89A, except for longer period, 1985 to at least 9/1995	???	16.9	--	Connor (2013)
90A. Global zinc phosphate cartel 1994-1998, fined by EC	Proxy prices are Special High Grade zinc quarterly prices, traded on a US exchange, 1994Q2 to Dec. 1997; pre-cartel 1992-93 benchmark	8.4	--	Connor (2003: Table A.5), EC 12/11/2001), <i>Purchasing Magazine</i>
90B. Same as 90A	Proxy prices are Special High Grade US zinc quarterly prices; post-cartel 1998-99 benchmark	17.8	--	Connor (2003: Table A.5), EC 12/11/2001), <i>Purchasing Magazine</i>
91A. EU steel, seamless tubes cartel 1990-1995, fined by EC	Analysis of "oil country tubes" EU prices; benchmark is pre-cartel (ca. 1986) corrected for general price inflation	15	--	Connor (2003: Table A.5), EC 12/8/1999), Levenstein (2002)
91B. Same as 91A	Analysis of "oil country tubes" EU prices; benchmark is post-cartel (ca. 1996) corrected for general price inflation	9	--	Connor (2003: Table A.5)
91C. Same as 91A, except prices of imports to selected developing countries	Import price decline after the demise of the cartel	10	--	Yu (2003:10)
91D. Same as 91A except prices of imports to selected developing countries	Econometric model (predicts monopoly price increase of 16.8%, so CMI=79%)	13.3	--	Yu (2003:47)
91E. Same as 91A.	???	12	--	Connor (2013)
91F. Same as 91C.	???	12	--	Connor (2013)
92A. EU flat stainless steel cartel 1993-1996, fined by EC	1994-97 prices of flat stainless steel coils, Type 304, cold rolled from trade magazines; EC statement gives peak price change in March 1995, which permits but-for price during cartel to be inferred	60.0	90+	Connor (2003: Table A.5), EC (1/21/1998)
92B. Same as 92A	Same as 92A above, except used 1997Q1 (post-cartel) price as the benchmark	66.9	100+	Connor (2003: Table A.5), EC (1/21/1998)
92C. Same as 92A	Apparently the authors' interpretation of the EC Decision	--	100	Levenstein and Suslow (2002: 50), EC (1/21/1998)
93A. EU cartel in district insulated heating steel pipes ; whole period of collusion is Nov. 1990-March 1996, but may have begun as early as 1988-89; three episodes: Denmark only 1990-1991, Italy and Germany added 1991-94, and the whole northern EU 1994-3/96; nine firms fined by EU; three firms paid €21 million in damages in Denmark's first private antitrust suit; all-EU prices.	There are about ten references to price changes induced by the cartel in the EC Decision; but-for prices are from 3/93 and 12/93-2/94 price wars; remaining annual price changes are weighted by annual EU sales to calculate the average; the peak period is 1/95-3/96	17	30	Connor (2003: Table A.5), <i>EC Official Journal</i> (1999/60/EC: 14,47)

93B. Same as 93A	Authors' interpretation of the full EC decision	10-20	--	Levenstein and Suslow (2002: 51), <i>EC Official Journal</i> (1999/60/EC: 14,47)
93C. Same as 93A, except Denmark only	Plaintiffs' estimate of single damages (€38.07 million) using 1999 price in Odense after the cartel collapsed as the but-for price; peak is 1992	54-67	69	Møllgaard (2006:7-8)
93D. Same as 93C	Defendants' estimate using the price in 1990 as the but-for price (the Court's expert/referee Møllgaard believes that price is inappropriate because collusion began 2 years earlier); peak is 1992	9-11	12.5	KPMG (2003), PriceWaterhouse-Coopers (2002:16), Møllgaard (2006:8-9)
93E. Same as 93C	The High Court of Western Denmark approved a private compensatory suit settlement of €21 million: 57% of plaintiffs' claimed damages and 3.5 times defendants' estimate	34	43	KPMG (2003), PriceWaterhouse-Coopers (2002:16), Møllgaard (2006:8-9), High Court of Western Denmark (2005)
93F. Same as 93C	Defendants' estimate using the cost-based method to develop a but-for price (the Court's expert/referee Møllgaard believes the normal rate of return used was exaggerated because of the defendants' X-inefficiency); peak is 1992	12	15	KPMG (2003), PriceWaterhouse-Coopers (2002:16), Møllgaard (2006:8-9)4
93G. Same as 93A	Before price and 1st price war price are the same; peak is 6/91-9/91	4.9	10.0	EC Decision (10/21/98)
93H. Same as 93B	Base is 1st price war price	10	--	EC Decision (10/21/98)
93I. Same as 93B	Base is 2nd price war price	22.2	44.4	EC Decision (10/21/98)
93J. Same as 93C	3rd episode called "the Euro Plan." Base is 2nd price war price; peak 1/1995-3/1996.	26.7	40.0	EC Decision (10/21/98)
93K. Same as 93C	4th episode called "the Euro Plan." Base is before price; peak 1/1995-3/1996.	24.8	--	EC Decision (10/21/98)
94. A magnesite export cartel was established by Austrian and Czech producers in 1923 (probably ended 1939) as a joint marketing venture; U.S. producers later developed "an understanding" with the cartel to divide the No. Am. and European markets, for which they were prosecuted by the DOJ in 1941	Eckbo's interpretation of the antitrust prosecution	50+	--	Eckbo (1967:40)
95. EU steel beams cartel 1984-1990, EC fines	Benchmark is EU prices in mid 1990 to late 1992 after the	20-30	--	Connor(2003: Table A.5), EC (2/16/94),

	cartel members were raided			<i>The Independent</i> (1/14/93)
96. British sugar refining cartel 1986-1990, fined by EC	From EC decision	50	--	Connor (2003: Table A.2), EC (10/14/1998)
97. Mobile telephone roaming charges in UK and Germany; EC probe underway 2003; dates uncertain (2000-2002?)	Trade journal reports of yardstick fees in other European countries	450	--	Connor(2003: Table A.5)
98. Explosives cartel in U.S. regions 1985-1993; some bid-rigging; U.S. convictions	DOJ indictment for the IL, IN, and KY prosecution, dated 11/5/1997; method unknown	3-4.5	--	Connor (2003: Table A.6), <i>Business Crimes Bulletin</i> (11/1997)
99A. International cartel in thermal fax paper sold in large rolls in U.S. 1990-1992, U.S. convictions	Press stories paraphrasing DOJ and CCB officials	10	--	Connor(2003: Table A.6), Levenstein and Suslow (2002: 51), DOJ officials quoted in <i>L.A. Times</i> (7/15/94)
99B. Same as 99A, except Canada	Press stories paraphrasing DOJ and CCB officials	10	--	Canada Bureau of Competition officials in <i>L.A. Times</i> (7/15/94)
100. International ferrosilicon cartel 1989-1991, convicted in U.S.	From a decision of the US Court of Appeals 2 nd Circuit of 11/1999 on the prices set by the cartel in its early months, compared to prices in 1989	5.2-10.3	--	Connor (2003: Table A.6), <i>NY Law J.</i> (11/19/1999), <i>Platt's Metals Week</i> (8/12/2002)
101A. International bid-rigging cartel, USAID wastewater plant construction projects in Egypt , 1988-1996, convicted in U.S. courts; court opinion gives details on profits made on one large bid (47%)	U.S. federal Court of Appeals 11 th Circuit (2002) decision gives restitution ordered to be paid to USAID and affected sales; also U.S. govt. report to OECD; consistent with profit rate minus a generous "normal" industry profit rate.	33-38	--	Connor (2003: Table A.6), OECD (2003:56)
101B. Same as 101A	Reading of U.S. court decision	16.4-39.2	--	Appendix Table 4: entry 20 below
101C. Same as 101A	Survey response of US DOJ to OECD	33.3	--	OECD (2003: 56)
102A. Canadian bid-rigging cartel in the compressed industrial gasses industry June 1989 – May 1990; fined by predecessor of the CCB	Statement of the Canada's Ontario Ministry of Health on the effects of the post-cartel price cut on its gas purchases	21	--	Connor (2003: Table A.6), <i>Globe and Mail</i> 2/8/1992)
102B. Same as 102A	Prices in Ontario compared to US border cities during conspiracy	40	--	Connor (2003: Table A.6), <i>Globe and Mail</i> 2/8/1992)
103A. International sulfuric acid cartel in U.S. and Canada 1988-1998; under DOJ and Bureau investigations 2003-08; no fines, but private plaintiffs win antitrust settlement in 2008	From <i>Chem Market Reporter</i> and other trade magazines, prices for bulk deliveries of pure or standard virgin grade to US, Gulf or Tampa; but-for US price is from year 2000	32-53	--	Connor (2003: Table A.6)
103B. Same as 103A, except 1/1988-1/16/2003	Same as above, but improved affected sales data from Connor (2013)	63.3	--	Connor (2013)

104A. An international price-fixing agreement between a U.S. toy and games manufacturer and two UK retailers to raise prices to manufacturer's "recommended retail" price; agreement in force from early 1999 to at least May 15,2001 (possibly as late as 9/2001); fined by UK Office of Fair Trade, upheld in April 2005 by the Competition Appeal Tribunal	UK Office of Fair Trade estimate	42	--	Connor (2003: Table A.6)
104B. Same as 104A	The simple arithmetic mean of changes in UK retail prices of five popular toys and games (Monopoly, Dr. X, Action Man, Tweenies Doodles, Knex construction set) from early 1999 to 2001; peak is Knex set	41.8	100.0	UK Office of Fair Trade Decision No. CA98/8/2003 (11/21/2003); <i>Times of London</i> (2/20/03:5)
104C. Same as 104A	Statement by UK OFT of fall in the two retailers' catalog prices from 2001 to 2003 of the Monopoly game	22.2-25.0	--	UK Office of Fair Trade Decision No. CA98/8/2003 (11/21/2003); AP 4/29/05)
105. International cartel in the markets for generic drugs (Warfarin and penicillin) sold by bidding for UK national health service contracts 1996-2000; under UK investigation, restitution paid to Health Service	UK National Health Service estimate	163	--	Connor (2003: Table A.6)
106 A. International cartel, cement , mostly bid rigging against several German government units 1991-2001; four geographic areas of collusion identified within Germany (E., S., N. and W-Central); fined in 2003 by the Bundeskartellamt (BKA); Higher Court heard private damages suits.	Press reports of BKA decision include BKA-estimated overcharges by cartel on a price per ton basis; trade sources on Belgian and EU-wide prices are used for a competitive "yardstick" price	11-23	--	Connor (2003: Table A.6)
106 B. Same as above 106A	Based on a real price index of cement in Germany compared to prices before (1978-82); peak is 1999	16.9	28	Lorenz (2006: 6)
106 C. Same as above 106A	Based on a real price index of cement in Germany compared to prices after (2004); peak is 1999	16.9	28	Lorenz (2006: 6)
106 D. Same as 106A, except refers to East Germany only	Econometric model finds no evidence that pricing conduct changed in 2002	0	0	Blum (2007)
106 E. Same as 106A	Analysis of Higher Court decision agrees with Court's position that prices after cartel was raided (e.g., late 2003) are good benchmark; peak price Jan. 2002.	9.4	22.5	Friederiszick and Roeller (2010: 6)
106 F. Same as 106A	Analysis (mainly non-German yardstick prices) of Germany's Federal Cartel Office performed to justify the fines (not to exceed 3X overcharges).	10-15	--	Frank and Lademann (2010:361)

106 G. Same as 106A	Econometric study of 2500 transaction prices, and where post-collusion benchmark price is determined by a novel “structural break analysis”	16.1	--	Hueschelrath and Veith (2011: Table 4, Equation 1)
106 H. Same as 106A	Econometric study of 2500 transaction prices, and where post-collusion benchmark price is determined by a novel “structural break analysis”	16.7	--	Hueschelrath and Veith (2011: Table 4, Equation 2)
106 I. Same as 106A	Econometric study of 2500 transaction prices, and where post-collusion benchmark price is determined by a novel “structural break analysis”	20.5	--	Hueschelrath and Veith (2011: Table 4, Equation 5)
106 J. Same as 106A	Same as 106 I, using the “basic method” of before-and-after regression.	20.7	--	Hueschelrath et al. (2012a: 12)
106 K. Same as 106A	Same as 106 I, using the “extended approach with instrumented cement demand” regression method.	20.3	--	Hueschelrath et al. (2012a: 14-15)
106 L. Same as 106A	Same as 106 I, using the “pooled OLS” before-and-after regression method.	23.0-26.0	--	Hueschelrath et al. (2012a: 17-18)
106 M. Same as 106A	Same as 106 I, using the “differences-in-differences” regression method.	26.2-26.5	--	Hueschelrath et al. (2012a: 21)
106 N. Same as 106A	Econometric study of 340,000 customer invoices, and where post-collusion benchmark price is determined by a novel “structural break analysis”	32.5	--	Hueschelrath et al. (2012b: Table 5, disaggregated data)
106 O. Same as 106A	Econometric study of 340,000 customer invoices, and where post-collusion benchmark price is determined by a novel “structural break analysis”	31.3	--	Hueschelrath et al. (2012b: Table 5, aggregated data)
107A. International bid-rigging cartel in large-scale construction projects , mostly purchased by the Norwegian government, 1994-2000	Estimate by the Norwegian antitrust authority, method uncertain	37	--	Connor (2003: Table A.6)
107 B. Same as 107A, except for the years 1993, 1995, 1996, and 1997; the number of bidders varied from N=2 to N=7, and the project sizes from NOK13 to NOK106 million.	The contract values of 5 rigged bids are divided into the side payments made to the losers (a yardstick for cartel profits), where the payments are adjusted by $N/(N-1)$; peak is 1997	3.17	5.66	Sunnevåg (2007)
108A. International bid-rigging of Dutch civil construction projects , exposed by parliamentary investigations in 2002-2003; 90% of the bids were for government projects; began before 1986, but illegal only after 1998; believed to have ended 2002; one-third of the bidding rings had 6 or more bidders; of the	Dutch government estimates from internal company documents; given in testimony at Parliamentary hearings; covers 1998-2001 period; method unknown	8.8	--	Connor (2003: Table A.6), Van Bergeijk <i>et al</i> (2006), Tweede Kamer (2002), Van den Heuvel (2005: 133)

1400+ firms, the Netherlands Competition Authority imposed fines of €306 million on 1,300+ firms during 2003-06				
108B. Same as 108A, but refers to the construction of government office buildings	A “detailed statistical study by SEO/TNO” (the NL Court of Audit) of construction costs	14	--	Van Bergeijk et al (2006:4), Van den Heuvel (2005: 146)
108C. Same as 108A, but refers to a broad analysis of more than 1300 bids during 1986-1998 and the secret internal cartel records (the “Bos Shadow Accounts”)	All “available national empirical studies”; methods unknown	9-16	--	Van Bergeijk et al (2006:8)
108D. Same as 108A, except refers to tenders that were lost by the Dutch cartels to profitable Belgian construction firms	Compares prices Belgian yardstick to prices of similar projects by Dutch firms	43	--	Van den Heuvel (2005: 136)
108E. Same as 108A.	“Conservative estimate” by economist, method unknown	10-15	--	Schinkel (2009)
109. International cartel in retail gasoline in Italy 1994-2000	Italian competition authority statement; method unknown	3.6	--	Connor (2003: Table A.6),
110. International cartel in retail gasoline on French superhighways 1999-2002; four international petroleum processors were fined €27 million in 2003	Estimate based on yardstick comparisons of prices in nearby, off-highway stations; costs of French superhighway stations actually lower than those in rest of Europe	25-30	--	Conseil Concurrence (2003), Connor (2003: Table A.6),
111. International cartel in retail gasoline in Sweden Nov. 1999-Feb. 2000, convicted by the competition authority and by Stockholm City Court on appeal	Estimate of the Swedish competition authority	8.3	--	Connor (2003: Table A.6), Fallenius (2001: 145, 148)
112A. International cartel of suppliers rigged bids for military fuels for the Korean defense procurement agency 1998-2000; heavy fines levied 9/00	Analysis by the Korean FTC presented with its fine decision	17	--	Connor (2003: Table A.6); KFTC (6/7/01)
112B. Same as 112A	Study (probably econometric) by Seoul University found an overcharge of \$99 million	18.1	--	<i>Energy Compass</i> (8/20/04), KFTC (6/7/01)
113. International flat glass cartel operating in U.S. 1991-1995; DOJ investigation, no indictments; civil settlement approved 2/2000 after jury finding of guilt in private treble-damages trial (but before damages phase)	Conclusion of plaintiffs’ expert’s (John Beyer) testimony from an econometric model	30-35	--	Connor (2003: Table A.6)
114. International cartel in ready-mix concrete in Germany 1995-1998; fined by Germany’s Bundeskartellamt (BKT)	Report of the German government to the OECD; method not revealed	9	--	OECD (2003:54), Connor (2003: Table A.6)
115. International cartel in manufacture of ball and roller bearings in France 1993-1997, fined by the French competition council	French Competition Council statement; method not revealed but probably 1992 price comparison	9.4	16.4	Connor (2003: Table A.6), Conseil Concurrence (9/23/02)
116A. International bid rigging by ABB and Siemens in the Norwegian electrical (hydro-power) equipment industry 1970?-1997; kept market shares constant at 67% and 33% for decades; fined by Norway	Norwegian competition authority report to OECD; method not revealed	9	--	OECD (2003:55)
116B. Same as 116A	Analysis by the chief economist of the Norwegian Competition Authority that shows price effects of 7 rigged	26.9	39	Sølgard (2007:16)

	contracts; method unknown			
117. International cartel that fixed the fees for Italian cell (mobile) telephone services 1998-1999, fined by Italian antitrust authority (AGCM)	Estimate of the Italian antitrust Authority AGCM; method not revealed	11	--	Connor (2003: Table A.6),
118. Bid rigging against Italy's national health service for pharmaceuticals treating respiratory illnesses 1995-1997, fined by AGCM	Statement of the AGCM; method not revealed	50	--	Connor (2003: Table A.6),
119. Bid rigging against Italy's national health service for pharmaceuticals treating high cholesterol 1995-1997, fined by AGCM	Statement of the AGCM; method not revealed	50	--	Connor (2003: Table A.6),
120. Frozen foods cartel in Tasmania, Australia , "late 1990s" (ca. 1996-99), prosecuted and fined by Australian Competition and Consumer Commission	Report of the government of Australia to the OECD	10-12	--	OECD (2003:53)
121. Installation of fire protection devices in Australia; ca. 1996-99; fined by Australian CCC	Report of the government of Australia to the OECD	5-15	--	OECD (2003:53)
122A. Bid-rigging by 260 electric wiring contractors and electricians in Denmark in late 1990s (ca. 1996-2001); convicted and fined by Danish courts	Report of the Government of Denmark to the OECD; method not revealed	20-30	--	OECD (2003:54), Gommesen (2003)
122B. Same as 122A	Analyses of "long run prices" by the Danish Competition Authority (DCA) using several yardsticks	12	--	OECD (2006:120)
122C. Same as 122A	A DCA survey of several property-management companies of the post 2001 change in prices	11.1	--	OECD (2006:120)
123. Bid rigging of public tenders for road markings in Germany in 1990s (ca. 1990-99); fined by BKA	Report of the government of Germany to the OECD; from a decision; method not revealed	13+	--	OECD (2003:54)
124A. Cables, high voltage electricity in Germany began in 1901; legal until 1958, and again 1975-84; formally ended when fined in 1997, but may have broken down after 1992-93 as a result of German unification; bid rigging conduct; national cartel protected from imports and entry by a separate intl. cartel; 34 members in 1968, declined to 24 in 1990; CR4=84% in mid 1990s; convicted by BKA in 1959, 1972, and 1974, then heavily fined by BKA in 1997.	Report of the German government to the OECD; refers to 1958-1997 period when price-fixing was mostly illegal in Germany; method not revealed	--	50	OECD (2003:54), Hahn and Normann (2001), Normann and Tan (2005, 2011, 2014)
124B. Same as 124A, except 1958-1990; cartel registered but ignored by BKA until fined in 1972 and 1974; from 1974 to 1985, cartel granted a "rationalization exemption" but secretly fixed prices contrary to rules through a trust and a trade association; ended 1997; no increase in efficiency detected, only profits.	Regression analysis of annual data for 1958-1990; profit increase during 11-year period cartel was exempted compared to non-exempt period	16.4	--	Normann and Tan (2005: 16-20)
124C. Same as 124B	Regression analysis of annual data for 1958-1990; profit increase during 11-year period cartel was exempted compared corrected for reduced output	13	--	Normann and Tan (2011: 18)

124D. Same as 124B	Authors and Fed Cartel Office decision suggest that decline in real prices in 1993-96 is evidence of overcharges in 1958-1992	59	--	Normann and Tan (2011: 22)
124E. Controlled market experiment with explicit communication; the parameters employed appear to be inspired by the structure of the cable industry: inelastic demand, homogeneous product, large number of buyers, constant costs, no supply constraints. Repeated Cournot game, without and then with explicit communication, and with N=2, 4, 6, or 8 sellers. Cheating is detected with certainty and immediately.	Authors compute increase in avg. selling prices observed in explicit communication relative to Cournot "implicit" noncooperative competition when N=2 sellers	85.5	--	Hahn and Normann (2001), Fonseca and Normann (2011: Figure 1)
124F. Same as 124E	Authors compute increase in avg. selling prices observed in explicit communication with N=2 relative to Cournot "implicit" noncooperative competition when N=4 sellers bidding	1255	--	Hahn and Normann (2001), Fonseca and Normann (2011: Figure 1)
124G. Same as 124E	Authors compute increase in avg. selling prices observed in explicit communication with N=2 relative to Cournot "implicit" noncooperative competition when N=6 sellers	2500	--	Hahn and Normann (2001), Fonseca and Normann (2011: Figure 1)
124H. Same as 124E	Authors compute increase in avg. selling prices observed in explicit communication with N=2 relative to Cournot "implicit" noncooperative competition when N=8 sellers	4918	--	Fonseca and Normann (2011: Figure 1)
125. Hotel association in Spain; ended late 1990s; fined by Spain's competition authority	Report of the government of Spain to the OECD; method not revealed	3	--	OECD (2003:55)
126. Sugar in Spain; ended late 1990s; fined by Spain's competition authority	Report of the government of Spain to the OECD; method not revealed	3	--	OECD (2003:55)
127A. The U.S. Railroad Express Cartel fixed prices for long-distance shipments of packages by rail or ship from 1851 to 1913, when its members came under the authority of the Interstate Commerce Commission; in its 62 years; only one price war, in response to a failed attempt at large-scale entry; only two brief episodes of dissention; annual profits in late 19 th cent. averaged 40% on invested capital despite very large side payments to shipping firms (which provided no free services)	Rates are taken from several archives of the internal business records of the five cartel members; mark-ups are calculated from the inter-member charges (costs) for transshipments between exclusive territories in 1885-1900	150-233	--	Grossman (1996:227)
127B. Same as above	Change in rates in overlapping cities during the only recorded price war in 1886 -1888	50-72	--	Grossman (1996:229)

128. To stem to steep decline in tea prices since 1927, a voluntary agreement in 1930 by four regional producer associations in Asia representing hundreds of tea plantations led to an agreement on significant output reductions in 1931-1932; followed by a mandatory British Empire cartel in 1933	Prices in 1931-1932 (the first since before 1927) compared to prices in late 1920s in the London market (handled 56% of world market) for four teas, weighted by the four regions' average quantities sold in 1931 and 1932.	29.0	--	Gupta (2001a: 146)
129A. The first episode of the global cartel in heavy electrical power equipment began in 1892 and ended 1914; the second lasted from 1919 to 1939; and the third called the International Electric Association operated from London from 1945 to at least the early 1980s; members rigged bids to private and public utilities, most in low-income countries; controlled 72-86% of world trade in heavy electrical power equipment in 1965-67; 1945 DOJ conviction of 2 nd episode and 1947 FTC consent decree covered only IEA trade with U.S.; U.S. Congress hearings and Brazilian investigation in early 1980s, but no legal actions after 1947; the IEA as a formal organization was still in existence in 1999 but effectiveness ended earlier (ca. 1990-95)	No price data for first two episodes.			Mirow and Maurer (1982: 276-282), Epstein (1971), Epstein and Newfarmer (1980: 52), Jenny (2003); Hexner (1946: 360-362)
129A . Refers to 3 rd episode	Detailed internal records of IEA's bids for large power transformers May 1965-Dec. 1967 show differences in winning prices between rigged and unrigged tenders (latter is the yardstick); average is for a large sample of industrialized countries; peak is for bids with single bidders	11.9	69	Mirow and Maurer (1982: 276-282), Epstein (1971), Epstein and Newfarmer (1980: 52)
129B. Same as 129A above	Winning bid prices in 1970s when by agreement only one IEA member bid and no outsiders bid vs. bids with outsiders	50	--	U.S. Congress (1980:125)
129C. Same as 129A	Same as 129A, but refers to mark-ups for less developed countries	18.7	69	Epstein and Newfarmer (1980: 52)
130A. International uranium metal cartel of world's major producers in France, Canada, Australia, UK, and South Africa was founded in 1972 and operated effectively from mid 1974 to Dec. 1975; a private U.S. suit filed against Gulf Oil (parent of Canadian member) resulted in payout of about \$1 billion; criminal DOJ misdemeanor case ended with Gulf pleading <i>nolo contendere</i> and paying \$40,000 fine, low because of Canadian government objections.	U.S. prices in Dec. 1974 to Dec. 1975 compared to early 1974; peak is Dec. 1975; world prices followed similar trend	244	471	Mirow and Maurer (1982: 95-118), U.S. Congress (1977)
130B. Same as 130A above; book by Canadian journalist identifies the effective cartel period as mid 1972 to Feb. or Mar. 1974, after which	Price data not very precise; appears that pre-cartel price outside U.S. was about	44	74	Gray (1982: 147,151,164)

market forces influenced primary control; by July 1974, world prices were 25% higher than the cartel's list price	\$4.50/lb.; cartel raised prices by \$2 to end of 1973 and by another \$1.34 in late Jan. 1974			
130C. Same as 130A	Lerner index predicted from econometric model	50	--	Griffin (1989:189-190)
130D. Same as 130A, except that price data from the US civil trial show that the cartel floor prices in 10/1973 and 1/1974 led the rise in spot US prices; author concludes that cartel had only short-run price effects.	Average US Nuesco spot prices in 10/73 to 12/74 compared to spot prices in 6/73 to 9/73 (\$6.25)	62.7	140	LeCraw (1977: 78)
130E. Same as 130A	Same as above except that the base price is total economic costs, including profit and a risk premium (also \$6.25)	67.2	140	LeCraw (1977: 78 and 82)
130F. Same as 130A	Author concludes that it was "unlikely" that cartel affected prices	0	0	Joskow (1976)
130G. Same as 130A	Reading of U.S. court decision	--	567	Appendix Table 4: entry 19 below
130H. Same as 130A, except authors suggest that cartel exhibited supra-normal prices from mid 1974 to about the end of 1989; prices from the 1969-1986 Nuexco Exchange spliced to 1987-2005 Ux U308 prices; the average annual price 1975-88 was about \$57 (in \$2005). Prices were declining from about \$27 in 1969 to \$22 in 1974 and continued to decline from \$19 in Dec. 1989 to \$12 to \$10 in the mid 1990s.	Authors calculate the real \$2005 prices and identify \$27 as the approximate "before" price; price peaked at \$110 in early 1977	111	307	Estimated by author from Davis and Garces (2009: Fig. 2 of chapter on damages)
130I. Same as 130H.	Authors calculate the real \$2005 prices and identify \$19 as the approximate "after" price; price peaked at \$110 in early 1977	200	479	Estimated by author from Davis and Garces (2009: Fig. 2 of chapter on damages)
131A. The first international (Dutch-German) Quinine cartel began in 1892. This cartel became global in 1913, with a Secretariat in Amsterdam and every producer in the world as members (except one large government-owned Indonesian firm). The cartel refused to buy Indonesian quinine. The Quinine Convention , intl. export cartel of two manufacturers in NL (Nedchem) and DE (Boehringer) began in 1959; in 1960 3 firms added from DE, FR, and UK (last owned by U.S. parent Rexall Drug and Chemical); unsigned agreements on reducing export quantities, stocks, and member quotas from 1959 to 1966; in 1961 it organized a monopsony to buy quinine bark; in late 1962 a price war begun by Nedchem; in 1963, the agreement was renegotiated without one UK firm that ceased production; in 1968 criminal indictments by U.S. DOJ resulted in <i>nolo</i> pleas and substantial fines; EC investigated 7/1967 and fined 6 firms	World prices in early 1964 to 1966 compared to prices in early 1960s; some of the increase was due to a surge in demand by the US military, but this is not corrected for	--	400	Mirow and Maurer (1982: 130), U.S. Congress (1966-67), Martin (2010: 669-671)

\$470,000 in 1970; ended early 1965?				
131B. Same as 131A for early 1930s	Price offered to League of Nations for relief programs compared to cartel price	77.5	--	Staley (1937:289-290)
131C. Same as 131A for 12/1962 to 12/1964	Before price in 1962 to end of 1964, aided somewhat by increased demand by the US military for Vietnam War.	--	500	Martin (2010: 669-671)
132. Red phosphorous cartel 1959-“early 1960s” (ca. 1963); three companies from UK, NL, and DE; price fixing and territorial division everywhere except Asia	Prices before cartel compared to cartel price in early 1960s	43	--	Mirow and Maurer (1982: 134-135)
133. The Southern Railway & Steamship Association was the second successful and stable U.S. cartel 1875-1887; all long distance freight and passenger transport among companies operating south of the Potomac and Ohio rivers and east of the Mississippi; historical study based on its internal records	An estimate made by the association in prior to its first month of operation of revenue losses due to discounting from regular rates	42	--	Hudson (1890: 71)
134A. The Western Ontario petroleum lamp oil refiners’ cartels operated 1870 to 5/1880; first episode was 1870-73	Econometric cartel model with monthly wholesale lamp oil prices Jan. 1870 to May 1880, with dummy variable for known collusive periods; difference between predicted competitive and collusive prices	31	55	Grant and Thille (2001: Figure 2)
134B. Same as 134A above, but for 2 nd episode 1874 to mid 1877	Same as above	68	84	Grant and Thille (2001: Figure 2)
134C. Same as 134A above, except for 3 rd episode mid 1877 to May 1880	Same as above	0	--	Grant and Thille (2001: Figure 2)
135A. The international 1926-1939 phosphate rock exports cartel began with the cooperation of the French and German national cartels (under government pressure); in 1933 the Phosphate Export Assn. (a U.S. Webb-Pomerene assn.) joined the European cartel, for which it was indicted by the DOJ in 1939; other phosphate cartels from North Africa, Egypt, and Curacao also joined in 1933-1934; ended 1939	Eckbo’s interpretation of the abuse of dominant position of the French-German cartel; compares domestic prices 1926-1933 relative to “unpublished” export prices; such prices are shown in Hexner (1946:265)	50+	--	Eckbo (1967:39), Hexner (1948: 264-266)
135B. New episode. U.S. national Webb-Pomerene phosphate export association, active 50 years, 1919-49; except for 1933-39, formally separate cartel from 135A for most of its existence	Econometric model with insignificant quantity effects; price effect almost significant	254	1156	Dick (1992:103)
135C. U.S. national Webb-Pomerene phosphate export association, second episode 1961-67; separate cartel from 135A for most of its existence	Econometric model with insignificant quantity effects; price effect almost significant	9.2	65.9	Dick (1992:103)
135D. Same as 135A, but Griffin studies only years 1933-1937	Lerner index from econometric model	42	--	Griffin (1989:189)
135E. Same as 135B. From 1919 to 1930, the	Author ascribes difference	42	85	Lamer (1957: 146-

Phosphate Export Assn. colluded on exports but competed on the domestic market; gap declined after 1922 because of Moroccan and Russian exports.	between export prices and domestic (yardstick) price to collusion; peak year is 1922			147)
135F. Same as 352C, but for new episode, 2010-2012..	Econometric model using an estimated supply relationship; “The dynamic Lerner index averaged about 0.4 over 2010-2012”	40	--	Taylor (2013: 50)
136A. “ Artificial silk ” (rayon) cartel re-formed in Germany, France, and Italy in late 1920s; unusual cartel because a technologically dynamic industry with rapid output and productivity increases	Author asserts that neither national nor international industry groups show any signs of market power in 1929-mid 1930; method unknown	0	--	Benni <i>et al.</i> (1930)
136B. Examines two earlier episodes of 136A, 1906-Oct. 1910 and 1911-14; members from DE, FR, IT, CH, BL, UK, and (after 1911) US; assigned export quotas and exclusive home-country monopolies	The Feb. 1913-1914 agreement allowed members to buy additional export quotas for a “commission”; a yardstick for monopoly profits	5	--	Coleman (1969:73)
137. An international linoleum cartel was formed Dec. 1911 by almost all the factories of Europe; invented in 1860, but production technology standardized in early 1900s; cartel enforced uniform quality standards and grades; cartel objective was constant prices, not higher ones; ended 1939 [UK branch #180 below ended operations 1960]	European prices from League of Nations show nearly flat prices 1924-1930, despite large increases in industry labor costs and two biggest material inputs (linseed oil and cork)	0	--	Benni <i>et al.</i> (1930:64)
138. Mechanical sulphite paper pulp cartel formed in 1930 after European prices fell 66% by leading companies from Austria, Germany and Scandinavia; probably ended 1939	Prices of sulfite pulp fell 22-26% 1930-35; but prices of yardstick (noncartelized sulphate pulp) fell more	2.8-10.0	--	Oualid (1938:26)
139. Bid-rigging on sales to U.S. government purchases of titanium metal 1970-1976; found guilty at trial in <i>U.S. v. RMI Co.</i> (1978)	Prediction from a time-series econometric model used for expert economic testimony	1.1	--	Duggan and Narasimhanm (1981:243)
140. The Wisconsin Alumni Research Foundation held the Steenbock patent to Vitamin D and licensed its manufacture; author, the U.S. AAG for antitrust alleges that its agreements with various buyers set prices in 1930s until the weakness of the patent became apparent in 1938-40	Compares agreement with du Pont for use in bread products with prices charged to Gen. Mills (1940) and Gen. Baking (1938)	48-233	--	Berge (1944:104-105)
141. A conspiracy (11/1900-7/1904) among three U.S. industry associations (for manufacturers, wholesalers, and retailers) to raise the retail prices of pharmaceuticals to a pharmacist by “blacklisting” him; from a U.S. jury trial decision in <i>Loder v. Jayne</i> (1906)	The Court decided the combined price effects of the three restraints on trade using the change in gross profit on sales from before the conspiracy to during	8.0	--	Timberlake (1961:258)
142A. U.S. corrugated cartons (containers) cartel 1960-1976; guilty finding confirmed by Supreme Court; private federal class-action suit (<i>In re Corrugated Container Antitrust Litigation</i>) against three last defendants, of which 2 settled before the trial’s conclusion	Jury decision after hearing class plaintiffs’ expert testify to a 8% to 19% overcharge and defense expert testify to a less than 1% figure	5	--	Finkelstein and Levenbach (1983:148)
142B. Same as 142A	Plaintiffs’ econometric model prediction; authors judge that it	7.8-19.1	--	Finkelstein and Levenbach

	has some major econometric estimation problems			(1983:148)
142C. Same as 142A	Plaintiffs' model is fitted to same data, but some if not all estimation problems are corrected	4.0-4.3	--	Finkelstein and Levenbach (1983:148)
142D. Second treble damages suit by opt-outs from federal class (see 142B above)	Revised econometric model by plaintiffs' expert, which authors judge to be more problematic than the original	26	--	Finkelstein and Levenbach (1983:149)
142E. Same as 142D above	Testimony by Defendants' expert finds numerous problems with plaintiffs' model	0	--	Finkelstein and Levenbach (1983:149)
142F. Same as 142D above	Jury's decision	0	--	Finkelstein and Levenbach (1983:149)
142G. Same as 142A	Plaintiffs' expert's econometric model prediction	7.8-26.0	--	Cohen and Scheffman (1989:345)
142H. Same as 142A	Defendants' expert's econometric model prediction	0	--	Fisher (1980:729)
143A. In <i>New Mexico v. American Pipe and Construction</i> bid-rigging on concrete pipes from Feb. 1968 to Dec. 1973; one of several similar cases	Plaintiff's expert predicted the but-for price from an econometric model using dummy variable for a brief competitive period; model judged sound by experts	15.5	--	Finkelstein and Levenbach (1983:150), Parker (1977)
143B. Same as 143A	Defendant's expert presented a rival econometric prediction using the "residuals" approach, which is inappropriate	0	--	Finkelstein and Levenbach (1983:149, 164)
144. In <i>In re Chicken Antitrust Litigation</i> (1980) only the plaintiffs presented econometric evidence on an alleged association program to raise prices Jan. 1971-March 1973; the DOJ imposed injunctive relief	Plaintiff's experts predicted a negative overcharge, which is judged to have serious autocorrelation problems; reruns indicate ineffective collusion	-5	--	Finkelstein and Levenbach (1983:165)
145A. In <i>In re Plywood Antitrust Litigation</i> , three manufactures were found guilty of price fixing (using basing-point pricing system) of plywood in Southern US from Feb. 1968-Dec. 1973 by a jury; jury ignored the statistical evidence and figured damages from the "phantom freight" charges and excess weight allowances.	Defendants' econometric model predicted no overcharge because of high demand during conspiracy, but later econometric experts judge the R&S model to be highly flawed	0	--	Finkelstein and Levenbach (1983:154-158), Rubinfeld and Steiner (1983)
145B. Same as 145A, but this author believes the Southern plywood cartel lasted from 1964 to Dec. 1973; system used Douglas fir plywood prices in Portland, OR plus Denver-to-East RR delivery prices; cartel had 4 members 1964 and 24 by 1974, when CR4 slipped to 55%	The average discount from the official basing price was 5% 1967-1973; post cartel discounts are the but-for prices; best measure is Feb. 1977 when all sellers shifted to F.o.b. plant pricing	19	--	Loescher (1980:16)
146A. International tin cartel Sept. 1929-March 1931; initially an entirely voluntary agreement	Lerner index predicted from an econometric model	13	--	Griffin (1989:189-190), Hexner

of British, Dutch and Bolivian producers to reduce production by major mines; when cuts became too large, British and Dutch governments stepped in to enforce them and buy stocks; in 1931 an intergovernmental commodity agreement was signed that strongly increased prices soon thereafter				(1946:240-242)
146B. Same as 146A; Plummer quotes only falling prices	London exchange prices from before cartel to 1930-early 1932	-10	--	Plummer (1934:92-94)
146C. Same as 146A	Judged to be “ineffective”	0	--	Elliott <i>et al.</i> (1937)
146D. Same as 146A	Price rise from fall 1932 to spring 1933 due to cartel’s cut in export volume; after spring 1933 demand increased prices	27-36	--	Staley (1937: 308)
146E. International cartel of 1921-1924	Econometric model predicts Lerner Index	18	--	Griffin (1989:189-190)
146F. International cartel of 1956-1981; possibly government sponsored	Econometric model predicts Lerner Index	32	--	Griffin (1989:189-190)
146G. Same as 146E	Mean annual deflated wholesale price for 1921-25, relative to 1920 price; peak year 1925	37.3	83	Suslow (2005:734)
146H. Same as 146E	Mean annual deflated wholesale price for 1921-25, relative to 1926-27 price; peak year 1925	0	0	Suslow (2005:734)
146I. Same as 146A, except 1931-32	Mean annual deflated wholesale price for 1931-32, relative to 1930 price; peak year 1931-31	0	0	Suslow (2005:734)
147A. International coke cartel April 1937-Sept. 1939; world export quotas for all major European producers administered by a joint venture in Brussels	Lerner index from econometric model	46	--	Griffin (1989:189-190), Hexner (1946:275-276)
147B. Same as 147A, except for year 1902	Compares 1902 domestic German price with price of exports to Austria (a yardstick)	53	--	Hirst (1905:115)
148A. The formal U.S. Whiskey Trust was formed in May or June 1887 to make distilled alcohol for cheap whiskeys; preceded by numerous short-lived pools that were briefly effective in raising prices during 1882-86; first successful episode ended late 1888; data from hearings of US (Congressional) Industrial Commission.	When pools were operating, gross margin increased about \$0.25/bu. of corn; avg. prices net of taxes and discount were \$0.85-\$1.12 for whiskey made from 1 bu.	22-29	--	Jenks (1900:146-150), Jenks and Clark (1929: 99-107)
148B. Same as 148A above, except 2 nd episode 1890-94	First effective period for formal trust is 1890-1894; comparison of gross margin increase with wholesale prices	12-18	--	Jenks (1900:146-150)
148C. Same as 148A above, except 3 rd episode 1896-99	Effective period is 1896-99; uses gross margin approach	0-9	--	Jenks (1900:146-150)
148D. Same as 148A above, except 4 th episode 1906-09	Gross margins in 1906-09 compared to competitive 1903-	7-12	--	Jenks and Clark (1929:100-105)

	06 period, taking into account upgrading of product quality			
148E. Studies 16 years of at least 4 episodes: the summer quarters of 1882 to 1898 (except for 1895); thus same as 148A to 148C plus 1882-86; peak cartel supply control of total US market was 40% to 48% in 1887-1892; slipped to 29% by 1895.	The authors fit four different demand functions to a complex econometric system of equations; the model predicts four elasticity-adjusted Lerner indexes; average overcharges are 83% to 94% below the monopoly overcharge; two peak periods, 4 quarters in late 1888 and 1824-93, are 58% to 84% below monopoly overcharge	8.2-9.1	18.3	Clay and Troesken (2003: 162-163)
148F. Same as 148E, but adds 22 new quarters of data from April 1888 to March 1895, a total of 38 quarters	Same as above, but for more observations	9.4-11.5	18.3	Clay and Troesken (2003: 162-163)
149A. The U.S. Wire Nails Pool lasted for 19 months in May 1895-Nov. 1896; very complex organization; made side agreement with similar cartels in Canada and Europe; also co-opted U.S. cut-nail makers; collapsed when new factories came on stream; ineffective after 1901	Comparison of prices in month before cartel with average prices in 18-month period; peak is last 6 months	97	117	Jenks (1900:62), Jenks and Clark (1929)
149B. Same as 149A	Method not explained, but probably constant-margin	113	--	Jones (1921:10)
149C. In January 1899, a 2nd episode began with the formation of the Am. Steel and Wire Co. trust, which controlled 65 to 95% of the US market. The gross margin increased from about \$0.70 in 1898 to \$1.00 in 1899; peak was \$1.40 in Oct. 1899 ended early 1900.	The price increased from about \$0.80 to \$0.90 in 1898 to \$1.50 to \$2.95 in 1899; peak was \$2.95 in Oct. 1899.	67-269	228-269	Jones (1900:165-170 and chart)
149D. Same as 149A, except that 3rd episode began when, in response to rapidly falling prices in early 1900 (about 25%), the Wire Trust closed several of its mills in April 1900; producers outside the Trust followed with closures of their own; gross margins rose well above 1897-98 levels and remained high until end of 1901.	Prices of wire nails stabilized in 4/1900, declining slowly until the end of 1901; competitive bench mark is 1897-98 prices; peak is 1/1991-9/1901.	73	77	Jones and Clark (1929: 121-122 and chart)
149E. Same as 149C.	Chicago-NY price per keg in 1888 \$1.45 compared to 1899-1900 average; peak is 12/1899-3/1900	85	143	U.S. Industrial Commission (1901: 561)
149F. Same as 149A.	Author gives monthly prices of 8 d. nails, the modal type; benchmark is prices for 4 months before May 1895; peak is May-Nov. 1896	75	113	Edgerton (1897:260)
149G. Same as 149A.	Same as above, but corrects for increase in major input price, No. 11 steel wire	50	88	Edgerton (1897:260)
149H. Same as 149A.	Benchmark is prices 4 months after cartel dissolved	69	106	Edgerton (1897:260)
149I. Same as 149A.	Same as above, but corrects for increase in major input price,	44	81	Edgerton (1897:260)

	No. 11 steel wire			
150. U.S. steel rails pool; analysts identify four episodes; Jones gives dates of the 1 st episode as 1887-93 and the 2 nd as 1894-98; Seager and Gulick describe a 3rd episode from 1897 to 1904; the association of 15 members controlled 90%+ of the U.S. market; set total tonnage and quantity shares to achieve an elevated price; later sued by US DOJ. The 4 th episode led by U.S. Steel was 2/1901 to 3/1916.				Jones (1921: 9-10), Seager and Gulick (1929:90-91)
150A. The latter part of the 1st episode seems to have started Feb. 1890 and ended Dec. 1894; prices absolutely flat during three sub-periods; possible price war Jan.- June 1895.	Report prepared by the Industrial Commission that used the constant-margin (cost-based) approach; avg. price \$28.07; war price \$22; peak in 1891-92	27.6	36.4	U.S. Industrial Commission (1901: 766-770)
150B. Same as A, except 1894-98.	Jones refers to a U.S. DOJ court brief that states that after 1897 prices fell 41% after the 2 nd episode of 1894-98 ended	69	--	Jones (1921: 9-10)
150C. Same as B: part of the 2nd episode, July 1895 to Dec. 1896; prices absolutely flat during all but one month; possible price war Jan.- June 1895.	Report prepared by the Industrial Commission used the constant-margin (cost-based) approach; avg. price \$27.83; war price of \$17 in late 1898; peak in Aug. 1895- Dec. 1896	63.7	64.7	U.S. Industrial Commission (1901: 766-770)
150D. Part of the 3rd episode, May 1900 to April 1901	Report prepared by the Industrial Commission that used the constant-margin (cost-based) approach; avg. price \$28.80; cartel war price \$17; peak in May 1900 to Aug. 1900	69.4	106	U.S. Industrial Commission (1901: 766-770)
150E. Same as 150B.	Jones refers to a U.S. DOJ court brief that states that after 1897 prices fell 41% after the 2 nd episode of 1895-96	69	--	Jones (1921: 9-10), Seager and Gulick (1929:90-91)
150F. A 4 th episode began in Feb. 1901 with the formation of the U.S. Steel Corp. and lasted until at least 3/1916, after which the effects of WWI begin to overwhelm the cartel led by U.S. Steel.	In late 1899 and early 1900, price was \$26/ton; despite general inflation and considerable shifts in demand and pig iron costs, from Feb. 1901 until Mar. 1916 price was an unwavering \$28.	7.7	7.7	Jones and Clark (1929: 122- 128 and chart)
150G. Same as 150F.	Testimony before the Industrial Commission is that rails were being exported (with normal profits) at \$20-21/ton vs. \$28 in US	33-40	--	U.S. Industrial Commission (1901: 555)
151. U.S. cartel in steel tubes from June 1899 to 1900	Prices in 1899 compared with before cartel	227	--	Jones (1921:264)
152A. U.S. Webb-Pomerene export association for carbon black , active for 48+ years 1923-51 and 1958-70+. The first episode lasted from 1/1923 to 12/1932.	Econometric model with dummy variable for the cartel's active years; quantities exported fell 19.8%	176	--	Dick (1992a:103)

152B. Same as 152A, except 2 nd episode 1/1934 to 12/1970.	Econometric model with dummy variable for the cartel's active years	50	--	Dick (1992a:103)
152C. Three firms colluded from 1/1999 to 11/2002; private plaintiffs got a \$20-million settlement in 6/2007. The EC investigated.	New price series compared to prices before collusion	5.9	--	<i>Purchasing Magazine</i> (2002)
153. Effects of concentration (numbers of firms) on the spreads of U.S. tax-exempt bond underwriting auctions ; a study of 9420 bond issues during 1959-1967; suggests bid-rigging behavior by bond buyers (buyers' cartel) against the Treasury/seller	Comparison of estimated regression coefficients of winning bids in issues with 9 or more bidders with price spread when only two bidders were in the auction	--	-2.35	Brannman (1989:73)
154. Same as 153 above for 2221 auctions for government offshore oil leases from the U.S. Department of the Interior 1954-1975; suggests bid-rigging behavior by buyers against seller	Same method as 153 above except competitive number of bidders in 10 or more	--	-2.5	Brannman (1989:73)
155A. The Rhenish-Westphalian (Ruhr) Coal cartel (a/k/a RKWS) was formed in 1893, a mix of private and state-owned mines; effective in raising prices until state price controls were imposed in March 1919; the Deutsche Mark experienced little or no inflation through at least 1909; this is the cautious Liefmann's only price estimate in a long book on cartels [Stockder splits 1893-1914 into 4 episodes]	The author states that Essen Coal Exchange prices were representative of the pre-cartel period 1891-93 (i.e., a competitive yardstick); average 1894-1913 prices and peak 1907-09 prices compared to the yardstick	16.5	34.6	Liefmann (1932:52)
155B. Same as 155A	Compares 1902 domestic German price with the yardstick price of exports to Belgium and Netherlands	5.8	--	Hirst (1905:115)
155C. Same as 155A	Compares coal exchange prices during the 1901-04 depression with the 1891-93 base period	14	--	Liefmann (1932:52)
155D. Part of A. Stockder distinguishes several possible episodes of the Ruhr coal cartel; during first of 4 episodes (1893-1898) there was significant undercutting of cartel annual supply contract prices by steel producers that were integrated backward into coal mining	Stockder shows annual 1893-1898 contract prices; but-for price is 1893 price of 7 marks per tonne	12.0	20.0	Stockder (1932: 121)
155E. Same as 155D	Stockder shows annual 1893-1898 contract prices; but-for price is 1922 post-cartel price of 7 marks per tonne	12.0	20.0	Stockder (1932: 121)
155F. Part of A. Second episode: in 1898 the cartel offered attractive incentives to the integrated steel-coal producers to observe the cartel's prices; other minor revisions in the cartel agreement occurred in 1903, 1909; ended 1914	1899-1914 annual contract prices are compared to 1893 pre-cartel price	47.5	71.4	Stockder (1932: 121)
155G. Same as 155F	1899-1914 annual contract prices are compared to 1922 post-cartel price	47.5	71.4	Stockder (1932: 121)
155H. In the 3 rd episode, 1915-1921, the cartel was effectively nationalized by the German Government (no longer private)	No information on price effects	--	--	Stockder (1932)

155I. After a 1922 price war, a new international-export agreement was created (4 th episode) in 1924 that lasted to about 1939; some historians argue that monitoring and sanction powers were absent; others believe that the common sales agency made the cartel quite disciplined about export sales and prices	Judged “ineffective” by Stockder, “effective” by Heaulme, but latter has no quantitative estimate	0	0	Stockder (1932), Heaulme (1948)
155J. Same as A.	Econometric study of stock prices of all listed coal mines in the cartel and their financial performance; concludes that the cartel reduced price variation and raised prices “above the competitive level.”	1 > 0	> 0	Luebbers (2009)
156. The second phase of a U.S. plumbing fixtures conspiracy involved 15 companies from Sept. 1962 (for cast-iron bath tubs) or Oct. 1962 (porcelain toilets) to 1968; most companies pleaded guilty and were fined, but three companies and three executive were found guilty at trial in late 1969.	Authors were guided by direct testimonial evidence accepted by the jury in the trial; these price changes apparently were only the first increases implemented by the cartel in late 1962	6-7	--	Demaree (1969:99), Davidow (1972:374)
157. A regression model fitted to 1950-1985 data on 12 legal Japanese export cartels; only the one for paints has results consistent with price mark-ups	Coefficient on export price	56.9	--	Dick (1992b:287)
158A. The U.S. gunpowder trust was formed in 1872 as a price-setting trade association; became a formal cartel of 7 producers in 1886-1902; later grew to 12 members; assigned quotas in 7 regions, had a penalty system and a trigger mechanism; after 1895 the agreement was kept secret and code names were used to prevent discovery; morphed into the du Pont monopoly by 1907; found guilty of price fixing and monopolization in 1912	In 1882-1884, members of the cartel that were over quota were required to compensate the others by selling powder at 16-25% below the fixed price	16-25	--	Curtis (1931:28), Stevens (1912a: 452)
158B. During 1896-1902, three new gunpowder firms briefly entered the Midwestern market; the strongest of the entrants was Indiana Powder; the trust built a new plant nearby and cut prices in its sales region	Difference between price in Indiana Powder sales region (the yardstick) and prices charges by trust in surrounding regions	29	--	Stevens (1912a:459)
158C. During the period 1851-1862 the big three black gunpowder makers raised prices east of Pittsburg for short periods; military sales were about 5% of national demand; saltpeter accounted for 75% of the materials, and it was imported by all US manufacturers; when the Union Army mobilized in mid 1861, both saltpeter and military-grade powder prices sold to US Army and Navy rose; demand slackened after 3/1865.	Using the constant-margin method and delivered prices in Philadelphia, the avg. margin in 9/1862-3/1865 is compared to the (oligopolistic) margins in 1/1857-8/1962; peak is 3/1965.	4.0	63	Wilson (2003: Figure 1)
158D. Same as 158C, except for higher priced commercial rifle powder .	Same as 158C; peak is 7/1965	10.4	65	Wilson (2003: Figure 1)
159A. The Swiss-German (international) synthetic dyestuffs cartel had dominated the Japanese market before WWI [this early date is	Comparison of Japanese prices of imported dyes (net of tariffs) in early 1928 with	5	--	Kudo (1994:216), Martin (2010: 671-672)

<p>inconsistent with other authors]. A domestic Japanese industry developed during the War to serve the rapidly developing textile industry; tariffs were imposed to protect Japanese dyestuffs in 1924 until the national industry negotiated a division of dye types between exclusively domestic lines and I.G. Farben import lines; made effective Aug. 1928; tariffs were eliminated; ended formally in 1945 but effectively in late 1939.</p> <p>The last episode of the international cartel was from Jan. 1964 to October 1967; 10 manufacturers (CR10 = 80% in EU, but cartel defined 5 national submarkets each with a clear leader) were convicted and fined by the EC on 24 July 1969. Each firm sold more than 1000 colors.</p>	<p>immediate price increase after bilateral agreement by Farben in Oct. 1928</p>			
<p>159B. Legal Swiss synthetic dyestuffs cartel was formed by three companies in 9/1918 to combat expected decline in export demand as major importing countries increase tariffs; starting in late 1918, quantity exported fell by 73% in 1924-25 compared to 1913; prices highest in 1918-1920, but this was an abnormal period; national cartels ended 1929 when Swiss, French, and German sellers joined together.</p>	<p>Real average Swiss export prices of dyestuffs in 1921-1925 are compared to prices in 1910-13; peak is 1922</p>	18.3	48.0	Schmitt and Weder (1998: Table 2)
<p>159C. A German dyestuffs national cartel was formed under I. G. Farben in 1925; joined with the French cartel in 1927 to form 1st international cartel that allocated world exports; 3 more episodes followed, when the Swiss joined in 1929, UK's ICI in 1932, and Japan's NSK in 1935; by 1938, 80-90% of world exports under its control; ended Sept. 1939</p>	<p>During 1932-1939, members could sell export quotas to each other for cash equal to 15-25% of the price; this is a monopoly profit yardstick</p>	15-25	--	Haber (1971: 275-76), Schroeter (1990:139)
<p>160. Beginning as early as 1829, railroads began vertically integrating by buying anthracite coal mines in 5 counties of NE Pennsylvania; they eliminated competition for coal by refusing to carry coal of independent mines (except under onerous tolling contracts); in early 1830s excess mine capacity developed; in 1870s dual ownership accelerated, even though PA constitution outlawed it from 1874; in 1873, top 5 RRs carried 90% of coal to Tidewater points; by 1900, the railroads controlled 62% of coal production, and in 1904-1923 it was 70%; court testimony in 1908 revealed that Reading RR was the collusive price leader; from 1864 to 1927 there were at least 11 documented episodes</p>				
<p>160A. First episode: NYC prices fell 54% 1864-72; various pool agreements began Jan. 1873 with 5 members; first cartel episode ended August 1876 but was renegotiated quickly</p>	<p>Curtis interprets "Pooling agreement" of 1873 that set supply limits; immediate effect on Eastern Tidewater price of</p>	38	--	Curtis (1931:343), Jones (1914)

	coal compared with before 1873 price			
160B. Second episode: August 1876 to December 1877	Same method as above for what Curtis calls the “1876 pool agreement”; Jones writes that pool unable to agree from Aug. 1876 to Dec. 1877	0	--	Curtis (1931:343), Jones (1914)
160C. Third episode: 1886; Jones says that this episode was 3/1886-12/1891; [note that Curtis omits mention of three successful pools that began 1/1878, 1879, and 12/1884].	Same method as above for 1886 pool agreement, which Curtis interprets as ineffective	0	--	Curtis (1931:343), Jones (1914)
160D. Tenth episode: 1907; [Curtis also omits mention of the pools that Jones judges to be effective that began in 1/1892, 2/1896, and late 1902]	Same method as above for 1907 pool agreement	0	--	Curtis (1931:343), Jones (1914)
160E. eleventh episode: 1921-26; Curtis notes that during 1923-27, average profit rates for railroad-owned anthracite mines were 14 times the rates of the seven railroads carrying the largest volume of coal	Easter Tidewater price in 1921-1926 corrected for inflation compared to the 1913 price	50	--	Curtis (1931:344)
160F. Prices in 2 nd episode in New York City from a report by the New York State Legislature in 1878	Cost-based estimate of f.o.b.-on-ships prices	53-63	--	Summarizing a 1894 <i>Atlantic Magazine</i> article, Demarest (1910)
160G. Same as 160A; Jones’ “first pool” of Jan. 1873 to Aug 1876; concentration of coal-tonnage hauling was high (HHI=1809)	Compares average 1873-75 prices of all grades f.o.b. NYC per long ton with 1872 price; peak year was 1875	32.2	37.5	Jones (1914: 41-42, 228)
160H. Same as 160A	Compares average 1873-75 prices of all grades f.o.b. NYC with 1877 price; peak year was 1875	108.1	116.4	Jones (1914: 41-42, 228)
160I. Fourth episode is Jones’ “2 nd pool” of Jan. 1878 to 12/31/1878; concentration fell slightly (HHI=1789)	Compares average 1878 prices of all grades f.o.b. NYC with 1877 price	29.1	--	Jones (1914: 45, 228)
160J. Same as 160I for 2 nd pool of Jan. 1878 to 12/31/1878	Compares average 1878 prices of all grades f.o.b. NYC with 1879 price	34.6	--	Jones (1914: 45,228)
160K. Fifth episode is Jones’ 3 rd pool of 1880-1884; unlike previous pool, no formal association was formed, just a “friendly understanding” after negotiations in 1879	Compares average 1880-84 prices of all grades f.o.b. NYC with 1879 price	56.9	--	Jones (1914: 46-47, 228)
160L. Sixth episode: Jones’ 4 th pool of Dec. 1884 to end of 1885; despite high concentration (HHI = 2363), ineffective because Penn. RR dissatisfied with its quota share; Reading RR went bankrupt in 1884	Prices fell throughout cartel episode	0	--	Jones (1914: 47-48, 228)
160M. Same as 160C, Jones’ 5 th pool organized by J. P. Morgan in March 1886; agreement in effect April 1886-Dec 1891, but set total output too high, so prices fell in 1891; HHI=2288	Compares average 1888-1890 prices of all grades f.o.b. NYC with 1891 average price	7.9	--	Jones (1914: 49, 228)
160N. Seventh episode: Jones’ 6 th pool effective Jan. 1892 to late 1894; dissolved sometime in 1895; Reading RR failed again in 1892, so this	Compares wholesale price of long ton of “stove coal” f.o.b. NYC in 1893-94 with 1895;	24.4	33.8	Jones (1914: 156-157)

year is ignored for price analysis	peak year 1893			
160O. Episode 8: Jones' 7 th pool; after numerous secret meetings among 11 railroads that controlled 100% of coal hauling (HHI=1105), in effect 2/1/1896 to late 1897; in early 1897 mines operated only 5-10% of the time; nearly perfect adherence to quotas until recession of 1898 leads to cheating; 1898-99 termed normal, competitive years	Compares wholesale price of long ton of "stove coal" f.o.b. NYC in 1896-97 with 1895; peak year 1897	24.6	28.1	Jones (1914: 55-58,156)
160P. Same as 160O	Compares wholesale price of long ton of "stove coal" f.o.b. NYC in 1896-97 with 1898-99	4.0	--	Jones (1914: 58, 156)
160Q. Episode 9: Jones' 8 th pool of late 1902 to 1911; RRs solved low concentration problem by RR mergers, cross-ownership, interlocking directorships, and elimination of rival mines (by 1907 RRs controlled 78% of all coal output; labor strikes in late 1900 and mid 1902 boost costs; during 1903-11 monthly prices nearly constant; collusion "nearly perfect" (p.180) despite 1908 antitrust trial and conviction.	Compares wholesale price of long ton of "stove coal" f.o.b. NYC in 1903-11 with 1898-99 prices adjusted upward for changes in total costs of mining	12.3	12.4	Jones (1914: 59-97, 156-157)
161A. Japanese public-works construction bid rigging, several cases discovered roughly 1970-1990; parameters are verified by guilty judgments in legal suits	Using data on the average number of bidders (10) and comparable Canadian data on the spread in bidders' costs, a mathematical model of competitive bidding can simulate the difference between the competitive and collusive price; an elaborate yardstick method	19-50	--	McMillan (2002:141-147), McMillan (1991:208)
161B. Same as 161A	Summary of estimates of scholarly Japanese studies and government commission findings	30-50	--	Woodall (1996: 48)
162. The Star Friendship Association with about 100 corporate members rigged bids on U.S. naval shipyard construction projects in Japan in "the 1980s" (ca., 1981-1988); the Japan FTC investigated and fined the firms in 1989; after a threat of a U.S. suit, the association paid \$32.6 million in compensation	Statements by U.S. government officials of the "low-end estimate" of the U.S. Navy's losses due to bid rigging, which were 8% higher than the firms' payout	32-35	--	McMillan (1991:209), <i>Time Magazine</i> (1/15/90), <i>New York Times</i> (11/24/89), <i>Los Angeles Times</i> (11/26/89)
163. Bid rigging on a kitchen construction project in Matsuyama City, Japan in 1982; bidders were convicted in court; average pre-tax operating income of civil engineering firms in Japan 1966-89 was 5.6% of total assets	Japanese court decision that total profits by the winning firm were an excessive 31% of revenues; I subtract 4-12% of sales as a normal profit	23-37	--	McMillan (1991:210-212), <i>Kensetsugyo Dokukin Mondai Kenkyukai</i> (1984)
164. Bid rigging on a river-dredging project in Tsukuba City, Japan in 1979 ; tried in court	Prosecution estimate of the excess profits made by the winning bidder	37	--	McMillan (1991:210)
165. Bid rigging among companies that delivered soil and gravel to build Kansai, Japan Airport in late 1980s	Comparison of winning bid with the government's (generous) ceiling price	9.7	--	McMillan (1991:210)
166. Coal buyers' cartels were formed by London coal-dealers (wholesale merchants a/k/a				Ashton and Sykes (1964), Levy (1927),

<p>Lightermen) to raise prices from 1595; Acts of Parliament against bid rigging were passed in 1642 and 1665.</p> <p>In 1729 a Parliamentary investigation found that 10 lightermen controlled 67% of purchases and blamed them for 1722-29 price increases; price controls for London were legalized in 1744, to be administered by three judges; in 1788 a law made any agreements among or partnerships of more than 5 coal buyers illegal “combinations in restraint of trade.”</p> <p><i>Informal</i> collusion by mine owners on sales of coal sent on ships from Newcastle (the Tyne and Wear Rivers) to London, England began in 1699; Ashton and Sykes find written evidence of effective overt agreements in 1710, 1727-30, 1738-39, 1743-44, and 1765; the <i>formal</i> Northeastern English Coal Gild (a/k/a the Newcastle Vend or Limitation of the Vend) was formed by Northern mine owners in 1771; began as a monopsony to suppress wages and labor mobility; it controlled an average of 90-92% of London’s market in late 18th century; supplies from Wales and Scotland constrained pricing 1800-1845 (simultaneously, the Vend reached its greatest degree of organizational sophistication); experienced many brief intermittent “fighting trades” (price wars) and at least 12 episodes (probably 22).</p> <p>Parliamentary inquiries in 1691, 1703, 1729, 1730, 1800, 1829, and 1830 generally found that consumer complaints about price manipulation by miners and London buyers were “not unfounded”; in 1711, 1730-38, and 1744 Parliament passed “restraining Acts”, but otherwise imposed no penalties. At the Vend’s peak in 1831, 100% of Newcastle coal was controlled by the Vend; effective, periodic labor strikes began in 1831; the formal Vend endured for 75 years until 1844-45 when rail shipments of coal from the Midlands to London became significant.</p>				Sweezy (1938), Hausman (1980), Tan (2003, 2009)
166A. 2 nd episode: the first Vend agreement of 1771 began to collapse between late 1780 and early 1781; prices stayed low 1782-85	Rochester Harbor prices in shillings per chaldron in 1780 are compared to 1785	17	--	Levy (1927:116)
166B. Cartel reformed in 1786-87 with more elaborate agreements on monthly quotas for each mine and fines for overproduction; but, according to Levy, not effective in raising prices until about 1824 and lost control in 11/1832; Levy’s 3rd episode is 1824 to mid 1832; however, Sweezy identifies 7 effective cartel episodes from 1810 to 1832 and 3 more short ones after that (see 166C to 166N).	Comparison of before (early 1832) price for best grade of coal with lowest month’s price (June 1833) during the Nov. 1832-Aug. 1833 price war	--	56	Levy (1927:120), Sweezy (1938)
166C. Sweezy Episode 9: 1836	Price at the mouth of the Tyne River in 1836 compared to	22-27	--	Levy (1927:138-139)

	“pre-cartel” year 1823			
166D. Sweezy Episode 10: 1844-1845	Same as 166C above, except price change from 1844	22	22	Levy (1927:161)
166E. First Sweezy episode: 1810-11	London price of best grade coal per chaldron before “open market” (competitive period) began in 1812	4-11	--	Sweezy (1938: 155)
166F. Sweezy Episode 4: 1823- July 1824	Same as 166E before open market of 8/1824-7/1825	12	--	Sweezy (1938: 155)
166G. Sweezy Episode 5: Aug. 1825- March 1826	Same as 166E above before open market of 4/1826-12/1826	16	--	Sweezy (1938: 155)
166H. Sweezy Episode 6: 1827- Feb. 1829	Same as 166E above before open market of 3/1829-8/1829	12	--	Sweezy (1938: 155)
166I. Sweezy Episode 7: Sept. 1829 - 1831	Same as 166E above before open market of 1/1832-3/1834	28	--	Sweezy (1938: 155)
166J. Sweezy Episode 2: 1813-14	London price best grade for 1-2 years after open market of 1812	11	--	Sweezy (1938: 155)
166K. Same as 166G	Same as above for open market of 8/1824-7/1825	7	--	Sweezy (1938: 155)
166L. Same as 166H	Same as 166E above for open market of 4/1826-12/1826	5	--	Sweezy (1938: 155)
166M. Same as 166I	Same as 166E above for open market of 3/1829-8/1829	9	--	Sweezy (1938: 155)
166N. Sweezy Episode 8: April 1834-1835	Same as 166E above for open market of 1/1832-3/1834	33	--	Sweezy (1938: 155)
166O. Same as 166D	Price change after the final collapse of the Vend in May 1845 when many small inefficient mines had closed, compared to late 1844 price	75	--	Sweezy (1938: 127, 155)
166P. Covers all 11 episodes of 1770-1845	Econometric models using annual data on wholesale prices; average of 11 episodes shown	6.9-7.8	--	Hausman (1984: 326)
166Q. 1 st episode: Covers the years 1699-1770 [no other author suggests that this was an effective Newcastle Vend episode]	Econometric model using annual data on retail prices paid by two London buyers	0	--	Hausman (1980)
166R. Covers years 1816-20	Econometric model prediction of London wholesale prices (controlling for fringe supply, demand, and railway development), which rise when the cartel's market share is higher.	15.1	--	Tan (2003: 22)
166S. Includes 166.F and years 1821-25	Econometric model prediction	12.9	--	Tan (2003: 22), Tan (2009: 259)
166T. Includes 166.H and years 1826-30	Econometric model prediction	12.2	--	Tan (2003: 22), Tan (2009: 259)
166U. Includes 166.N and years 1831-35	Econometric model prediction	12.4	--	Tan (2003: 22), Tan (2009: 259)
166V. Includes 166.C and years 1836-40	Econometric model prediction	16.1	--	Tan (2003: 22), Tan (2009: 259)

166W. Includes 166.D and years 1841-45	Econometric model prediction	15.9	--	Tan (2003: 22), Tan (2009: 259)
166X. Episode covers pre-Vend years 1727-29; during this period there were no wars or freezing of the Thames River (factors that raise prices).	A "Limitation Act" of Parliament restrained collusion in 1730-1738; Newcastle price in 1729 compared to 1730	58	--	Ashton and Sykes (1964: 212, 252-53)
166Y. Episode covers pre-Vend years 1739-1743; during part of this period (1739-40) there was a war, and the Thames River froze in 1739; thus, price change probably exaggerated.	A "Limitation Act" of Parliament restrained collusion in 1730-1738; Newcastle price in 1739 compared to 1738	37	--	Ashton and Sykes (1964: 212, 252-53)
166Z. Episode covers pre-Vend years 1739-43; during part of this period (1739-40) there was a war, and the Thames River froze in 1739; however 1743 was unaffected by either.	A "Limitation Act" of Parliament restrained collusion beginning in 1744; Newcastle price in 1743 compared to 1744	18.2	--	Ashton and Sykes (1964: 212, 252-53)
166AA. Same as 166A; during this period there were no wars or freezing of the Thames River	Newcastle price in 1781 compared to 1786	20.6	--	Ashton and Sykes (1964: 214, 252-53)
166BB. Refers to bid rigging in London by Lightermen in approximately 1700-02; during 1702-04 there was a war, but no freezing of the Thames River	Authors quote from a book that quotes the advance in retail prices from early 1700 as soon as buyers begin "engrossing" the coal supply	4.7-7.0	--	Ashton and Sykes (1964: 219, 252-53)
166CC. Refers to bid rigging by Lightermen in approximately 1723-29; during this period there were no wars or freezing of the Thames River	Parliamentary report charts increase from 1722 to 1729	21.7	--	Ashton and Sykes (1964: 219-20, 252-53)
167. The Birmingham Bedstead Makers' Alliance successfully raised prices on metal bed frames from 1891 to 1900; ended because of imports from European continent	Simple comparison of 1891-1900 prices with pre-1891 prices	100	--	Levy (1927:200)
168A. The British Salt Union was formed in Oct. 1888 by 64 firms that controlled 91% of UK white salt (a/k/a "common salt") supply, much of it exported; coal accounts for 90% of the cost of production; the Salt Union was acquired by ICI in 1937; mergers from 1945 to 1975 produced a virtual UK duopoly (see No. 215 below).				Levy (1927), UK Monopolies Commission (1990), McCrosty (1907)
168A. Salt Union raised UK prices strongly in Nov. 1888 to end of 1890; prices fell 1891-1898	Average export prices in 1878-1887 (the yardstick) compared to 1888-1891, corrected for the increase in coal prices	-1	--	Levy (1927:243), UK Monopolies Commission (1990)
168B. Same as 168A; evidence of geographic price discrimination	Average prices in the county where salt was produced in 1888-91 compared to 1878-87, corrected for increase in price of coal; prices briefly peaked in 1888	19	320	Levy (1927:243, 295)
168C. New salt producers entered in early 1890s and by 1892 began to depress prices, though they never dipped below 1878-87 levels; from 1888 to 1905, the cartel formed side agreements with non-Union mines, but entry continued and collusion formally ended late 1905 or early 1906; by 1907 former members of the Salt Union controlled only 46% of UK production;	Change in export prices from 1904 to 1907	13	--	Levy (1927:243)

although domestic power waned after 1907, power over export prices continued.				
168D. The drop in domestic prices from 1904 to 1906 caused a new cartel, the North-Western Salt Co. , to be formed in October 1906; achieved nearly 100% market control through at least 1927; used supply controls and fixed members' shares; profits in 1907 rose 46% over 1906 levels and were 355% higher in 1925	Change in export prices 1906-1907	9.1	--	Levy (1927:244)
168E. Same as 168A	Immediate change in price of common salt f.o.b. works from 10/1888 to 2/1889	--	100-133	Calvert (1913: xxiii)
168F. Same as 168A	Same as 168D above, but for prices of "fine" grade salt	--	100	Calvert (1913: xxiii)
168G. Same as 168A	Change in works price of finest "brisk" grade from 11/1888 to 9/1890	100	--	Calvert (1913: 15)
168H. Same as 168A	Same as above for 9/1890 to 3/1891	75	--	Calvert (1913: 15)
168I. Same as 168A	Same as above for 3/1891 to 8/1891	50	--	Calvert (1913: 15)
168J. Same as 168A	Comparison of "brisk" grade export price with UK price in 3/1889 to March 1891	52	--	Calvert (1913: 18-20)
168K. Same as 168A	Comparison of Prussian Rock Salt sold to chemical manufacturers versus all others, 12/1888 to 12/1889	38	--	Calvert (1913: 18-20)
168L. Same as 168A	Peak price in 4/1889 was 10.5s., avg. in 1887-88 was 5.5s.	--	91	McCrosty (1907: 181-83)
168M. Same as 168A	Prices of exported "lump" salt in 1888-89 compared with 1898-1906; peak is 1890	10.5	16.4	McCrosty (1907: 181-87)
168N. After a period of very low prices 1880-85, a combination was formed in 1885; failed summer of 1888; purchased by Salt. Union	Cartel had only "feeble" effects on UK prices	1	--	McCrosty (1907: 181-87)
169A. The European steel rails cartel included the leading manufacturers of the UK, Germany, and Belgium; first formed in 1883, but first episode was unstable until French producers joined in 1907 (2 nd episode), which ended August 1914	UK rail prices in 1907 compared to the 1904-06 average	35-75	--	Levy (1927:268)
169B. First episode 1883-1907; with a US-UK price difference of 12% in 1901, large US exports to UK had occurred, but there were none in 1907	UK prices compared to US export prices	21-25	--	Levy (1927:268)
169C. Same as 169B	Compares 1900 domestic German price with (yardstick) price of exports to Portugal	26	--	Hirst (1905: 115)
170. In 1902, German manufacturers of thorium nitrate were able to monopolize the only world source in Brazil of monacite, the key raw material; supply reduction raised price of thorium; ended sometime after 1904	The price of saltpeter in Germany in 1904 compared to early 1902	56	--	Levy (1927:295)

171A. A study of three British ocean shipping conferences 1870-1913; focus is on 47 episodes of entry and 15 price-fixing episodes punctuated by 14 predatory price wars, each from 2 days to 1 year long precipitated by entry; all wars saw price changes of at least 30%; no line lost money	Price during war compared to rate before war, average of 4 episodes 1891-1902	60	75	Scott-Morton (1997:693)
171B. Same as 171A above	Price during war compared to two episodes after war when entrant was admitted to cartel	49	75	Scott-Morton (1997:693)
172. Study of the determinants of all price wars among U.S. passenger airlines 1978Q2 to 1995Q4; discussion assumes that conduct observed is tacit collusion by price leadership, but later convicted of illegal signaling, a facilitating collusive device.	Econometric study, but no averages given	15-25+	--	Morrison and Winston (1996)
173. Buyers' cartel by 23 elite U.S. universities that met to fix the (purchase) price of needs-based graduate scholarships from 1958 to 1991; 22 found guilty by U.S. court, but DOJ settled (by means of a consent decree) with one university that appealed	Both econometric studies find that income was redistributed from high- to low-income applicants, but no average price effects	0	0	Carlton <i>et al.</i> (1995), Hoxby (2000)
174. Bid rigging by more than 2000 building construction companies in northern Germany in 1959-1973; 559 were prosecuted by the Federal Cartel Office (BKA), which provided a written report to the OECD on the 8000 projects	Federal Cartel Office analysis of overcharges on the 8000 projects	9	--	OECD (1976:24)
175. A report of the French Technical Commission on Cartels and Dominant Positions to the OECD on bid rigging on public tenders in electrical wiring construction ca. 1975	Estimated by the reduction in the winning bid on the same project after the cartel was disciplined	20	--	OECD (1976:26)
176. Same as 175 above, except for construction of a Mirail University building ca. 1970 - 1975	Same as 175 above	40	--	OECD (1976:26)
177. Same as 175 above, except for road building project in France in 1968	Same as 175 above	22	--	OECD (1976:26)
178. Based on a Japan FTC prosecution of Yuasa Timber Co. and 64 other plywood manufacturers that made identical bids for a public tender ca. early 1970s	JFTC report that found that the identical bids were exactly 10% higher than the previous winning bid for the same product	10+	--	OECD (1976:37)
179. The Northern Collieries Association fixed the price of black coal in the Newcastle, Australia region in six episodes from 1855 to 1893; the NCA accounted for 85% of colonial supply in the 1860s, but slipped to 60% by 1900.				Flemming (2000:50)
179A. First episode began with 2 mines in 1855, but high prices quickly (by ca. 1856) induced large-scale entry	Price increases ineffective in the long run	0	0	Flemming (2000:50)
179B. Second episode: 1861-62	"Price increases" only in the short run	1	--	Flemming (2000:50)
179C. Third episode: 1865-66	"Price increases" only in the short run	1	--	Flemming (2000:50)
179D. Fourth episode: mid 1866-1868	Comparison of real prices of	30	--	Flemming (2000:50)

	“Northern” coal in 1867-68 with early 1866 price			
179E. Same as 179D	Comparison of real prices of “Northern” coal in 1867-68 with 1870-72 average price	30	--	Flemming (2000:50)
179F. Fifth episode: 1874-1880	Comparison of real prices of “Northern” coal in 1874-80 with 1872 price	55	--	Flemming (2000:50)
179G. Same as 179F	Comparison of real prices of “Northern” coal in 1874-80 with 1881 price	80	--	Flemming (2000:50)
179H. Sixth episode: 1882-1893	Comparison of real prices of “Northern” coal in 1882-93 with 1881 price	46	--	Flemming (2000:50)
179I. Same as 179H	Comparison of real prices of “Northern” coal in 1882-93 with average 1895-1900 price	34	--	Flemming (2000:50)
179J. Seventh episode for coal shipped by 13 mining companies (with 90%+ of market) interstate in Sept. 1906-1910; from 1911 trial decision <i>Associated Northern Collieries, a/k/a “The Vend”</i> which also colluded with steamship and railway lines.	A cost-based method where costs were supplied by a mine that did not participate in the cartel; total affected sales were £275.6 million, about £61.25 million in 2006 when overcharge was £105,500; peak year 1910.	0.17	30	Shanahan and Round (2008: 15, 18)
179K. Same as 179J	Prices f.o.b. Newcastle harbor in 1907-1910 compared to pre-cartel 1905-1906 prices; peak price 1908	40	47	Wilkinson (1914: 85)
179L. Same as 179J	Delivered prices of large coal to eight large buyers in Victoria State in 1907-1910 compared to pre-cartel 1905-1906 prices; peak price 1908	46	51	Wilkinson (1914: 85)
179M. Same as 179J	Delivered prices of large coal to four large buyers in South Australia State in 1907-1910 compared to pre-cartel 1905-1906 prices; peak price 1910	50.5	51.5	Wilkinson (1914: 85)
179N. Same as 179J	Delivered prices of large coal to two large buyers in Western Australia State in 1907-1910 compared to pre-cartel 1905-1906 prices; peak price 1910	18.1	--	Wilkinson (1914: 85)
179O. Same as 179J	Delivered prices of large coal to Queensland Harbor in 1907-1910 compared to pre-cartel 1905-1906 prices; peak price 1910	29.8	33.3	Wilkinson (1914: 85)
180A. The UK Linoleum Manufacturers Association formed in 1905, formalized in 1934, was judged to have engaged in a long list of horizontal and vertical restrictive practices through 1955 that were anticompetitive;	The two UK nonmembers sell linoleum of the same quality and grade at prices 10% below LMA members	10	--	UK Monopolies Commission (1956b:26,66)

agreements with other European assns. guaranteed a UK monopoly for the LMA (see #137 above); the LMA controlled 80% of the market in 1955; setting common prices; though “not against the public interest,” pricing was deemed “perilous” by the Commission.				
180B. Same as 180A	The Commission seems to suggest that the “loyalty rebate” awarded to all LMA-“approved wholesalers” is a (rent-seeking) yardstick of the cartel overcharge	12.5	--	UK Monopolies Commission (1956b:28)
180C. Same as 180A for episode early 1887 to 1904	Pool kept prices at a constant \$28/t from 1887 to 1904, except for one brief, “ruinous” price war in (late?)1887	--	87	Seager and Gulick (1929:90-91)
181A. The British Non-Ferrous Metals Federation was created in 1945 by the merger of 12 metals associations, one founded in 1875; had 69 members in 1945 covering semi-manufactured copper, brass, zinc and nickel alloys; set common prices in UK and since 1946 in exports under the Lausanne Agreement, which protects UK market from European exports; many other restrictive practices that Commission says “operate against the public interest” and “keep prices up” ; ended 1955	In July 1946, export prices to British Commonwealth countries were raised by £7 to 10 at a time when (yardstick products) copper wire, strips, and tubes sold elsewhere for £242-415/tonne	2-4	--	UK Monopolies Commission (1955: 58,102-03, 208-11)
181B. Same as 181A	Same as 181A above, but £10-21 increase to non-Commonwealth countries	4-8	--	UK Monopolies Commission (1955: 58,102-03, 208-11)
182A. The UK Cable Makers Association, formed 1899, and Covered Conductors Assn. had 22 members in 1950 with 65-69% of UK market for insulated wires and cables ; prices fixed on exports from 1928 when Intl. Cable Development Corp. formed for power distribution cables; ended 1952	UK parliamentary Standing Committee on Trust reported that in 1921 non-CMA firms sold at 10% lower prices than CMA members	10	--	UK Monopolies Commission (1952a: 17)
182B. Same as 182A	Loyalty rebates in 1948 are rent-seeking portion of overcharge	10.0	--	UK Monopolies Commission (1952a:75)
182C. Same as 182A	Commission seems to suggest that profit/sales of 10% is reasonable; subtracted 10% from average actual profits on 7 types of cables	14.4+	--	UK Monopolies Commission (1952a: 167)
183A. The British Electrical & Allied Manufacturers Assn set common prices and terms of sale for 84% of the UK’s market for large electric power equipment ca. 1930 to 1957; covers 37 lines of business; cooperates with the Intl. Elec. Assn. on exports; analysis of price effects 1950-1957	In early 1950s, a yardstick firm, the Central Electric Authority, paid 5-15% lower prices on small transformers of same quality from non-BEAMA firms	5-15	--	UK Monopolies Commission (1957a: 169-77)
183B. Same as 183A	A large industrial firm got 13 bids for 1000 KVA transformers in Jan. 1949; 3	12.3	13.1	UK Monopolies Commission (1957a: 177)

	non-BEAMA bids were lower than 10 BEAMA firms			
183C. Same as 183A	Another large industrial buyer got lower bids from nonmembers on a tender for 17 transformers (10 to 4000 KVA) in 1951-53	8.5	21.5	UK Monopolies Commission (1957a: 178)
183D. Same as 183A	North Scotland Electric Board reports lower bids from nonmembers on small transformers of identical quality	5	--	UK Monopolies Commission (1957a: 178-79)
184A. Since 1905 the Electric Lamp Manufacturers Assn. of Great Britain fixed common prices and standardized product quality; 8 members (two dominant) have 90-95% control of UK electric bulb market; ELMA is affiliated with Phoebus (#21 above); price fixing is condemned; ELMA largely prevented superior long-life bulbs from being sold; ended 1951	In 1933-35, UK chain stores sold Japan-made bulbs at lower retail prices than ELMA members	37-66	--	UK Monopolies Commission (1951: 13), Prais (1974)
184B. Same as 184A	In 1939 5 firms not in ELMA sold 60W general-service filament bulbs of same quality to chain stores at 68-71% lower price than ELMA firms; after acquisition in 1950, prices only 31-32% lower	54-57	--	UK Monopolies Commission (1951: 41)
184C. Same as 184A	Price charged by intl. cartel in Sweden of most popular size bulb in 1930 when local consumer cooperative's bulb factory was being built, compared to ca. 1929 before construction began	28.0	--	Great Britain Board of Trade (1944: 126)
184D. Same as 184A	Same as above, except cartel's price change from 1929 to 1931 after cooperative's plant was on stream	39	--	Great Britain Board of Trade (1944: 126)
184E. Same as 184A	From 1931 to 1936, Swedish cooperative yardstick price declined 23% to 0.71 shillings, but cartel could not match it; peak is cartel's price reduction from 1929 to 1936	5.6	50	Great Britain Board of Trade (1944: 126)
185. German wire cartel in operation in early 1900s (ca. 1900-04)	Compares 1900 domestic German price with price of exports	38	--	Hirst (1905:115)
186. German nail cartel in early 1900s (ca. 1900-04)	Compares 1900 domestic German price with price of exports	44	--	Hirst (1905:115)
187. German steel girders cartel active in early 1900s (ca. 1900-04)	Compares 1900 domestic German price with price of exports to Belgium and Netherlands	20-30	--	Hirst (1905:115)

188A. The U.S. arc-light carbon industry began in 1879 and attempted to fix prices 3 times between 1885 and 1887; the first successful episode was by six leading firms in late 1886 (ca. 8/1886-12/1886)	Price increase from early 1886 to late 1886	20	--	Passer (1953: 60)
188B. Episode 2: ten leading firms with 75% of supply agreed to raise prices on April 15, 1887; ended because of large scale entry in July 1887 and inability to control coke (principal ingredient) supplies	Prices in mid 1887 compared to early 1887	100	--	Passer (1953: 61)
189A. U.S. incandescent electric light bulb industry became unconcentrated because the validity of GE's Edison patent was in doubt until a 1891 court decision affirmed its validity; in August 1896 GE made a price-fixing agreement with 6 other leading manufacturers through the Incandescent Lamp Manufacturers association; 10 more joined by 1901; cartel became a monopoly when smaller companies merged into a holding company controlled by GE in 1901-11; cartel controlled 95% of U.S. market for several years; federal antitrust suit and consent decree issued 1911 disbanded the monopoly	Change in price of light bulbs reported by Passer of various sizes from before cartel (1895-early 1896) to late 1896 and some time afterwards	11-67	--	Passer (1953:162-163), Bright (1949: 103-104, 144-156)
189B. Same as 189A. Bright reports that the price of a 16-candlepower lamp was \$1.00 in 1890-1896, but then fell steadily to early 1896 as large numbers of new manufactures entered production, but did not fall below the late 1886 "pool price" until it reached \$0.17 in 1910; virtual monopoly formally dissolved 1911	The "pool price" of \$.20 for 8- to 25-candlepower carbon-filament bulbs from late 1896 to about 1909 compared to prices (\$0.12 to 0.18) in early 1896	11-67	11-67	Bright (1949: 93, 103-104, 144-45, 151), U.S. Tariff Commission (1938: 32)
189C. General Electric's major electric bulb patents expired in 1929, ending the US monopoly period that began 1912; GE had a no-export agreement 12/1924-9/1939 with the international cartel (see cartel 21), but Japanese imports into US surged 1929-1933 until a dumping suit brought by GE resulted in higher tariffs.	Prices in US of a 60-watt tungsten-filament bulb (\$0.20) compared with yardstick: pre-tariff Japanese imports (\$0.08) and corrected for quality (US-made bulbs lasted twice as long)	20	20	Bright (1949: 262-269)
190. Major oil fields discovered in Texas and Oklahoma 1926-31 doubled U.S. reserves, causing price of crude petroleum to fall 92%; private cartelization attempted ca. 1926- Sept. 1933 resulted in an "imperfect cartel" that was "quite ineffective"; entry at small scales was easy; even imposition of legal quotas from 1929 by TX and OK state commissions was observed by only the top 25 producers that had 1% shares or more	Change in price per bbl. from 1926 to 1932 due mainly to huge shift in supply and some general deflation; no quantitative analysis of whether price decline was slowed by sporadic supply controls.	1	--	Wiggins and Libecap (1987)
191A. U.S. Webb-Pomerene crude sulfur association Sullexco effective in raising U.S. domestic prices for 50+ years 1922 to about 1973; by 1927 Sullexco successfully practicing price discrimination by keeping export prices about 25% higher than domestic	Average 1922-1940 prices compared to 1919-1920 price; peak is 1932	55.1	242	MacKie-Mason and Pindyck (1989:203-210)

191B. Same as 191A	Average 1922-1940 prices compared to long-run marginal costs; peak is 1932	16.6	57.3	MacKie-Mason and Pindyck (1989:203-210)
191C. Same as 191A, except US market	Authors use 1928 (before price) to illustrate U.S. price effects	147	--	MacKie-Mason and Pindyck (1989:206)
191D. Same as 191C, except 1947-1973 when Sulexco's power was waning	Average 1947-67 prices compared to 1973 price; peak is 1955	60.6	103.5	MacKie-Mason and Pindyck (1989:203-210)
192A. British Radio Valve Assn., formed in 1926, had 10 members in 1954-56 that controlled 97% of sales in the UK market for cathode ray and electronic vacuum tubes ; BVA exclusively supplied all UK manufacturers of radio and TV sets; fixed prices and terms of sale to manufacturers, wholesalers and retailers; condemned as "against the public interest"; ended Sept. 1956	Largest set makers (80% of sales to mfgs for new sets only) get 70-80% discount off list, smaller (20% of sales) got only 50-60% discounts	4	--	UK Monopolies Commission (1957b: 38-45,108-109)
192B. Same as 192A.	Analysis based on 1953-54 sales of tubes by #1 firm (Phillips with a 59% share); Phillips' price-cost margin on sales under BVA agreement was 16% higher than non-BVA sales; yardstick is PCM difference (-21%) of 9 smaller members	--	37	UK Monopolies Commission (1957b: 71)
192C. Same as 192A; at this time US imports were large (20% of UK sales) and subject to a 33% import duty, and a large number of consumers built their own radio sets	Compares 1936 retail prices of sales to retail customers through hobby magazines of a large variety of BVA-made tubes with U.S.-made tubes	160-175	--	UK Monopolies Commission (1957b: 71-80)
192D. Same as 192A	Price of BVA tubes in 1936, sales by leading UK wholesalers, compared to same tubes imported from US	20-27	--	UK Monopolies Commission (1957b:71-80)
192E. Same as 192A,	Median post-cartel price reduction of a change in 1955 BVA list prices of radio tubes, effective 9/56 in reaction to the impending (12/56) negative finding the UKMC on the 9 most common models; range was from 11% to 33%, simple average 16.0%	12.5	33	UK Monopolies Commission (1957b: vii, 71-80)
192F. Same as 192A	Median price reduction of 1955- August 1956 list prices of cathode ray tubes on the 3 most common models of cathode ray tubes; range was from 14.3% to 18%, simple average 15.5%	14.3	18	UK Monopolies Commission (1957b: vii, 71-80)
193. Bid rigging against the Korean government by 26 road construction firms in 1998-99 building the Western Coast	The average deviation of three winning bids from the government's pre-qualification	9.1-17.3	--	KFTC report to OECD (6/7/2001: 5-6)

Expressway; fined in 1999	review, compared to yardstick of the same ratio for all contracts			
194 The U.S. salt industry began with solar drying on the East Coast, though most of the supply was imports – ballast in sailing ships from the UK. In the 19 th cent. NY, WV, and MI became the main Eastern sources, using brine from wells, then dried with wood scraps or coal fires. Until transportation costs declined, salt markets were highly localized. Most regional cartels could not control fringe production for more than a year or two; attempted interstate cartels were not successful. Real secular prices declined in 19 th cent.				Jenks (1888), Levenstein (1995: 578-86)
194A. The Michigan Salt Association operated from April 1868 to at least 1888; supplied northern US west of Pennsylvania; controlled 75% to 95% of MI production; ineffective in raising prices for most of its existence but enjoyed first brief success in 1868	MI prices per bbl. in 1868 compared to linear price trend in the competitive periods during 1866-1877	13.8	--	Jenks (1888:92)
194B. Same as above, except second episode May 1881 to March 1882	May 1881 to March 1882 prices, compared to average monthly prices June 1880 to April 1881	22.6	--	Jenks (1888:94)
194C. Same as 194B	May 1881 to March 1882 prices, compared to average monthly prices April 1882 to Mar. 1883	28.7	--	Jenks (1888:94)
194D. Episode 3, approx. 5/1887-8/1887	Prices in mid 1887 compared to early 1887	6.1	--	Jenks (1888:92)
195A. A summary of a large number of federally prosecuted instances of bid-rigging, all over the U.S., road construction , mostly in the late 1970s and early 1980s	Various methods, used by the Dept. of Justice, not discussed	10	--	Werden and Simon (1987:925)
195B. Not clear, but appears to be same as 195A; cases ended between 1984 and 1987, but cartels probably operated 1975-1985; mostly construction projects financed by governments	Survey of 7 U.S. convictions, commissioned by the U.S. Sentencing Commission ; mean and median; peak is maximum case; methods of calculation unknown	20	35	Cohen (1989b: 607), Cohen and Scheffman (1989: 347)
196. A summary of an analysis of seven 1984-1987 U.S. federal court final decisions in bid rigging in construction and other industries involving a total of 12 defendants.	Trial decisions of a judge or jury based on direct testimony and perhaps other methods	20	35	Cohen and Scheffman (1989:347), Cohen (1989b)
197A. High fructose corn syrup (42 and 55) raised prices in the US market from Jan. 1989 to June 1995; the 5 defendants in a U.S. civil suit settled in mid 2004.	Estimated from the increase in USDA-reported wholesale list prices in 1986-87 and expert opinions in plaintiffs' briefs; peak is HFCS-55 in 1991.	9.9-15.7	33.2	Connor (2003: Table A.3)
197B. Same as 197A	???	13.1	--	Connor (2013)
198. Carbon fiber ; 1993 to May 2002; under US DOJ investigation	Press reports of rise from pre-cartel prices	25	--	Connor (2003: Table A.4)
199. Aluminum metal ; Feb. 1994 to Feb. 1996; some quasi-official national trade associations	Increase in prices in June 1994 relative to Nov. 1993 pre-cartel	30+	--	Connor (2003: Table A.4), Jenny (2003),

were members and openly signed a Memorandum of Understanding; investigated by US DOJ but not indicted, possibly because of international comity reasons (not an extension of #18 above)	prices; caused in part by increased demand			Stiglitz (1998:176)
200. Tobacco leaf ; bid rigging by buyers against sellers in US auctions 1996-2001; antitrust class action by 400,000 growers and quota holders settled by 4 defendants May 2003; trial for remaining manufacturer scheduled for 2004	Preliminary minimum yardstick estimate made from settlement worth \$1,400 million; gross farm sales from USDA data are \$15,588 million	-9.0 or more	--	Connor (2003: Table A.6), <i>Legal Times</i> (6/21/2004)
201A. Linerboard ; 10/1993 to 11/1995 in US market; US civil court case resulted in eight firms settling	Settlement of \$202 million is asserted to amount to about 50% of the overcharge; benchmark is pre-cartel price; peak occurred at end of cartel	42-55	96	Connor (2003: Table A.6), <i>Legal Intelligence</i> (4/22/2004)
201B. Same as 210A	Judge's decision in <i>Linerboard Antitrust Litigation</i> is that the \$203 mil. settlement is 42-55% of damages	6.6-8.6	--	Connor (2007a), Davis and Lande (2007: Case 18)
201C. Same as 210A	Same as above, revised sales data	8.2	--	Connor (2013), Davis and Lande (2007: Case 18)
202. Carbon dioxide ; Jan. 1968 to Nov. 1992 in US market civil case settled 7/1996 just days before trial was to begin	Estimated from Court comments on overcharge during fairness hearing on fees	16.5	--	Connor (2003: Table A.6)
203A. Two drug companies (US and French) conspired in 7/98-6-/99 to monopolize the US market for Cardizem CD hypertension drug (diltiazem hydro-chloride) and generic equivalents ; the French firm paid the US generic manufacturer \$10 million per quarter not to enter the market; private antitrust damages suit settled for plaintiffs in 2002; motion to dismiss denied 6/13/2003	The patent holder of Cardizem paid a maker of a generic substitute \$90 million as profit compensation to withhold the generic from the market; this is likely to be half or less of the monopoly profits earned by both companies	16-32+	--	Connor (2003: Table A.6)
203B. Same as 203A; the FTC issued an analysis and a consent decree to cease and desist private contracts to delay the introduction of generic drugs; FTC decision is contrary to decision of court in private damages suit	The FTC analysis states that the payment did not in fact delay entry by the US firm or other generic firms beyond what is prescribed by the Hatch-Waxman Act; the payment was 13.3% of affected sales	0	0	FTC (4/2/2001)
203C. Same as 202A	US District Court decision of 2/2/2004 (p.6)	8.2	--	Lande and Davis (2006:38-40), 2003 U.S. Dist. Lexis 25638
203D. Same as 203A	Plaintiffs' expert estimated overcharge is \$55 million, probably an econometric model	7.2	--	Lande and Davis (2006:15-20), Connor(2007a)
204. Asphalt, liquid ; Alabama bid rigging 1971-78; class-action suit of 133 government units was initiated in 1979 and settled a few years later	Overcharge is shown in Figure 2; based on an econometric model	126	165	Kamerschen and Morgan (2004:690)

205A. The Almond Board of California, a group of elected industry representatives operating under a USDA-enforced Marketing Order, controls 95% of the US market and two-thirds of the world market with inventory; cannot control tree plantings and sells to a concentrated processing sector; from about 1935 to 2004	An econometric model applied to 1962-1997 data predicts a Lerner Index for the US market that is 63% below the monopoly price	27.4	--	Crespi and Chacon-Cascante (2004:10)
205B. Same as 205A, except non-US export prices	Same as above for the world export market; the Lerner Index is 66% below the monopoly price	20.4	--	Crespi and Chacon-Cascante (2004:12)
206. Four-fifths of the world coconut oil market is controlled by a Philippines processors' export cartel after 1972 that was composed of 7 companies	An econometric model applied to 1959-1987 data to predict a Lerner Index for the pre-cartel (0.41) and cartel period (.89) 1973-87	88.1	--	Buschena and Perloff (1991: 1007)
207A. Fluid milk in the US is controlled by USDA-mandated Marketing Orders ; mid 1930s to 2004	Econometric model applied to producer (blend) prices in 38 markets (1960) and 46 in 1970; peak is 1970	14.4	17.8	Kwoka (1977:377)
207B. Same as 207A	Slightly different econometric model applied to 1973 blend-price data; range depends on elasticity of supply of raw milk	3.0-4.4		Ippolito and Masson (1978:54)
207C. Same as 207B	Effect on consumer prices is net effect of increases in fluid-milk products and decrease in manufactured-milk products	3.6	--	Ippolito and Masson (1978:55)
208A. Attempts to collude in the U.S. raisin market began as early as 1889, but middlemen countervailed; in 1913 the California Associated Raisin Co. (later Sun-Maid Raisin Growers) was formed with 9000 members and 76% of supply under control; by 1917 control rose to 90%; defectors from the cooperative's supply contracts were fined; acreage limits were imposed; in June 1920 Sun-Maid was found by the FTC to be illegally restraining trade; the Justice Dept. tried and failed to enjoin price increases in 1919 and 1920; in 1922 price fixing by farmers' was legalized.	Cost data showed that growers' production costs were at most \$0.015/lb.; grower prices for Muscat raisins were \$0.035/lb. in 1913-1915; a joint Dept. of Justice-FTC report stated that 1919-1920 prices were unreasonably high at an average of \$0.125/lb.; peak was \$0.15 in 1920	257	329	Jenks and Clark (1929: 132-34 and chart); Committee on the Judiciary (1921: 48-53)
208B. Same as 208A.	Wholesale prices for Muscat raisins were \$0.07/lb. in 1913-1915; a joint Dept. of Justice-FTC report stated that 1919-1920 prices were unreasonably high at an average of \$0.186/lb.; peak was \$0.2225 in 1920	166	218	Jenks and Clark (1929: 132-34 and chart); Committee on the Judiciary (1921: 48-53)
208C. The California raisin marketing order controlled by USDA mandate a reserve pool through an elected board or industry representatives since 1949; three joint products are made: raisins, fresh grapes, and raisins; price	Authors develop a complex econometric model of the US industry for 1963-1984, with 9 no-control scenarios; grower prices for juice grapes rise	0	--	French and Nuckton (1991: 591)

stabilization is achieved.	slightly but fall by a nearly equal amount on raisins and by a larger amount for fresh; net returns virtually zero			
209A. The California-Arizona navel orange USDA marketing order (1934-present) controls the supply of about 75% of US winter orange supplies; because of a freeze in Florida, the restrictions on selling fresh oranges were unexpectedly suspended in 1985	Predict the negative effect on FOB grower prices during the suspension of the marketing order from best-performing of 4 econometric models with 42 weeks of data from 2/1985 to 5/1987; they later repeat the analysis with more data	7.5	--	Thompson and Lyon (1989:657 and 1991)
209B. Same as 209A; the California-Arizona fresh navel orange industry was cartelized by a mandatory USDA marketing order in 1934; study covers equilibrium prices in 1970s; competition raises prices to growers	An econometric simulation mode predicts prices for oranges with and without the marketing order for Valencia oranges in the 1970s; no price effect	-20	--	Shepard (1986:118)
209C. Same as 209A	Same as above	-15	--	Shepard (1986:118)
210A. The California-Arizona lemon marketing order controls the US supply under a USDA mandate; in 1973 the policy was changed from one that emphasized constant prices to one that kept price constant; grower prices decreased and retail prices increased	An econometric model compares actual 1986-87 retail prices under the constant-price policy with the former consumer-friendly constant-quantity-policy yardstick	1.1	--	Carmen and Pick (1990:354)
210B. Same as 210A, but examines the effect of the new stabilization policy of returns to middlemen	Same as above, but calculates change in the marketing margin compared to the old policy yardstick	6.8	--	Carmen and Pick (1990:354)
211A . Two bid-rigging cartels in the Upper Midwest U.S. road seal-coating construction industry are detected from 1994-1998 data on almost 18,000 procurement contracts by private and public buyers; authors judge that prices in the upper quintile of contracts (3500 contracts) were affected by one or more of two duopolistic cartels.	A sophisticated econometric model incorporating Bayesian expert knowledge predicts cartel behavior on bids where the two largest firms are bidders; largest 20% of collusive markups are compared to the upper 20% of markups of competitive bids	8.0	--	Bajari and Yi (2003:Table 12)
211B. Same as 211A	Same as above, except cartel consists of the #1 and #3 firms	21.0	--	Bajari and Yi (2003:Table 12)
212A. The legal Norwegian cement cartel was established in 1923; until 12/1968 (when it became a monopoly through merger) it set market quotas based on capacity, charged a cartel price in Norway, and exported at world prices through a common sales agency; without capacity constraints, the cartel over-invested in capacity (high X-inefficiency) and exported the excess production at a loss.	Using an innovative econometric model, the authors predict LR marginal cost during 1955-1968; mean domestic price in real 1985 NOK was 524.44 per tonne and MC was 417.37; peak year 1968	34.5	43.7	Röller and Steen (2006:332, Figure 4)
212B. Same as 212A	Divided predicted change in consumer surplus for 1955-1986 due to moving from Cournot to cartel conduct by total revenue (2.01%) and converted to mark-up	2.05	--	Röller and Steen (2006:336)

212C. Same as 212A	Lerner Index provided by Steen (2006) from Equation (5) using 1955-86 means; using calculated marginal cost, move from duopoly to monopoly in 1968 merger increases the Lerner index by 39% two years later (1970)	7.70	--	Steen (2006), Röller and Steen (2006:336)
213A. Survey report of the Japan FTC on several bid-rigging schemes involving large companies for 21 episodes of construction of public projects and materials procurement by government in Japan 4/1996-3/2003 (estimate 2000)	Price change if bids were not rigged; method compares actual bid prices to prices of similar tenders “after FTC crackdowns”	18.6	--	Kishi (2004), JFTC (2004:8); Jiji wire service 3/9/04
213B. Bid rigging of a tender made by Osaka, Japan city government for germicidal chemicals used in sewer systems; sometime during 4/1996-3/2003 (estimate 2000); may be one of those in 213A	Price decline on product after a raid by the JFTC	41.5	--	Kishi (2004), JFTC (2004:8); Jiji wire service 3/9/04
213C. Bid rigging of a tender made by Osaka, Japan city government for one water purification plant ; sometime during 4/1996-3/2003 (estimate 2000); may be one of those in 213A	Price decline on product after a raid by the JFTC	28.0	--	Kishi (2004), JFTC (2004:8); Jiji wire service 3/9/04
213D. Same as 213C	Price decline on product after a raid by the JFTC	28.8	--	Kishi (2004), JFTC (2004:8); Jiji wire service 3/9/04
213E. Same as 213C	Price decline on product after a raid by the JFTC	29.0	--	Kishi (2004), JFTC (2004:8); Jiji wire service 3/9/04
214. Survey report of the Japan FTC summarizing the average overcharges of 14 price-fixing cartels manufacturing “basic materials” (food, plastic, steel, chemicals, drugs, etc.) in Japan; spans unknown; convicted during April 1992 to March 2003	JFTC staff studies that compare average fixed prices to prices after the cartels were exposed; peak is for largest of 14 cases	12.1	25.0	Kishi (2004), JFTC (2004:7), Jiji wire service 3/9/04
215. In 1986 the UK white salt duopoly was found to have colluded in the 1974-1984 period at least, but the duopoly failed to achieve the monopoly level of prices and costs (costs 2 to 5% above); see also #168 above.	Rees proves overt collusion using an unusual method: comparing the predictions of noncooperative oligopoly price-leadership models with predictions from an infinitely repeated game model; Rees suggests a profit yardstick of 7 to 16% return on assets	23-32	--	UK Monopolies commission (1986); Rees (1993:841)
216A. In the Euro-Zone banks case, the EC fined 5 German banks €100 million for fixing the commission for exchanging their customers’ local-currency bank deposits into Euros, from 1/1/1999 to 12/11/2001; the cartel consisted of at least 25 German and Dutch banks, but 20 consented to lower their fixed fees or variable fees in 2000; there may have been coordination among hundreds of major EU banks; most eliminated all fees after 10/01	Author explains the basis of the EC’s fine was to recover 90% of the banks’ illegal profits; fixed commissions were 3.0% and but-for yardstick margin was 0.3%; thus, mark-up was 2.7 percentage points	800	--	Guersent (2004:23)

216B. Same as 216A, except 5 German banks agreed to fix their foreign exchange fees for the Deutsche mark at 3% during the Euro transition period 1/98-12/01	One of the original members of the cartel (Bayerische Landesbank) agreed to eliminate its fixed fee and reduce its variable fee to 2%	50+	--	EC (5/3/01 and 12/11/01), OJ (1/21/03)
216C. Same as 216A above; information from an EC consent decree involving Westdeutsche Landesbank of Germany	Percentage charge reduced from 3.5% to 1.5%	133	133	EC (5/14/01)
216D. Same as 216A, except EC consent decree with Bank J. Van Breda of NL	Fixed fee of €2.48 eliminated, but 1.25% fee retained; assumed that a typical exchange amount was €50-200	50-80	--	EC (5/14/01)
216E. Same as 216A; information from an EC consent decree with ING, Postbank, and ABN AMRO Bank of NL	Minimum fee lowered from fl. 7.5 to 3.5, but 2.75% charge unchanged; assumed typical amount exchanged is €50-200	20-38	--	EC (5/7/01)
216F. Same as 216A; information from an EC consent decree with Fortis Bank Nederland	Fixed service fee reduced from fl.5 to 2.5	100	100	EC (5/7/01)
216G. Same as 216A; information from EC consent decree with ING Bank Group in Belgium	Reduced their minimum fee from BEL 100 to 45, but fee of 2.25% unchanged; assumed typical amount exchanged is €50-200	17-35	--	EC (5/7/01)
216H. Same as 216A; information from EC consent decree with Ulster Bank of Ireland	Reduced its fee from 2.25% to 1% and eliminated a minimum fee of €2.5; assumed typical amount exchanged is €50-200	56-80	--	EC (5/3/01)
216I. Same as 216A; information from EC consent decree with Bayerische Landesbank of Germany	Abolished its minimum fee of €2 and reduced its service fee from 3% to 2%; assumed typical amount exchanged is €50-200	33-50	--	EC (5/3/01)
217. Chilean miners of sodium nitrate , from the world's sole source of natural <i>caliche</i> deposits, formed a series of six voluntary export cartels from June 1884 to January 1914; each lasted an average of 3 years; exports grew 900% from 1880 to 1910; cartel set sales and export quotas for each mine and imposed penalties for violations but did not control entry; constant per ton export tax accounted for 30-70% of the export price. After 1929, the Chilean export cartel joined several others to form a supra-national cartel (see #16 above).	When first formed, each cartel saw an increase in prices, followed by a slump when it was dissolved because of entry. However, when Chilean producers joined into a global cartel initiated by German manufacturers of synthetic nitrogen in 1929, it was more effective (see Cartel #16 above)			Stocking and Watkins (1946: 120-127), Wallace and Edminster (1930: 26-56)
217A. First Chilean export cartel of 1884-1886	Chilean f.a.s. export prices 1884-86 compared to 1883; peak is 1886	7.4	21.6	Stocking and Watkins (1946: 121-123)
217B. Same as A; first Chilean export cartel of 1884-1886	Chilean f.a.s. export prices 1884-86 compared to 1887-1890; peak is 1886	30.1	47.3	Stocking and Watkins (1946: 121-123)
217C. Second Chilean export cartel of 1891-1894	Chilean f.a.s. export prices 1891-94 compared to 1887-90; peak is 1894	4.8	7.8	Stocking and Watkins (1946: 121-123)
217D. Same as C; second Chilean export cartel of 1891-1894	Chilean f.a.s. export prices 1891-94 compared to 1895;	7.7	10.8	Stocking and Watkins (1946: 121-

	peak is 1894			123)
217E. Third Chilean export cartel of 1896-1897	Chilean f.a.s. export prices 1896-97 compared to 1885; peak is 1896	0	3.4	Stocking and Watkins (1946: 121-123)
217F. Same as E: third Chilean export cartel of 1896-1897	Chilean f.a.s. export prices 1896-97 compared to 1885; peak is 1898-1900	9.7	13.6	Stocking and Watkins (1946: 121-123)
217G. Fourth Chilean export cartel of 1901-06	Chilean f.a.s. export prices 1901-06 compared to 1898-1900; peak is 1906	44.0	71.7	Stocking and Watkins (1946: 121-123)
217H. Fifth Chilean export cartel of 1907-08	Chilean f.a.s. export prices 1907-08 compared to 1909-1910	18.2	26.2	Stocking and Watkins (1946: 121-123)
217I. Sixth Chilean export cartel of 1913- July 1914; in July 1919 the Chilean Nitrate Producers' Assn. was formed with active government assistance (by 1925-26 with effective entry control tradable quota rights sold for 24% of the export price)	Chilean f.a.s. export prices in 1913 compared to 1909-1912	8.1	--	Stocking and Watkins (1946: 121-123, 128), Wallace and Edminster (1930: 48)
218. The "east of Burma" agreement covered flat rolled steel products in East Asia; began ca. 1985; still in operation 2003; steel mills in EU and Eastern Europe agreed to export only west of Burma; Japanese and Korean producers only east of Burma; fixed quotas annually and prices quarterly	Method not explained, but cites a 1993 OECD report by Alan William Wolff	25-30	--	Jenny (2003)
219. Roofing felt manufacturers in Belgium fixed prices and shares from at least 1/1978 to 4/1984; 9 companies controlled 60% of market; fined by EC in 1986	EC Decision mentions several times that the cartel agreed to limit discounts to certain buying groups the yardstick) while charging list to other customers	23-25+	--	EC (8/19/1986)
220A. Flour procurement collusion by the Taiwan Flour Mills Association, 32 member companies, from May 1997 to May 2000; fined by the Taiwan FTC in May 2000	Press release by Taiwan FTC estimates cost to consumers to be NT\$ 2 billion; method unknown	5.8	5.8	Taiwan Business News (5/5/2000), KFTC (2002)
220B. Same as 220A	Econometric model using 1994-1999Q1 quarterly data on 11 of the largest firms; overcharge derived from a conjectural elasticity and demand elasticity.	105	--	Ma (2005:18)
220C. Same as 220A	Econometric model using 1994-1999Q1 quarterly data on 11 of the largest firms; overcharge derived from a conjectural elasticity and demand elasticity.	49.3	--	Ma (2005a:166)
221. Distributors of natural gas in southern Taiwan (Pingtung-Kaohsiung and Tainan) fixed prices from 4/2000 to 1/2001 and were required to pay record fines by the Taiwan FTC	An analysis by the Taiwan FTC used the before price as a basis	175-300	--	China Post (1/12/2001), KFTC 2002)
222A. Bid rigging on road construction in Greeley, Colorado (the "Second 35 th Av. Project") around 1983	Autor's interpretation of bench-trial decision; damages from plaintiffs' econometric	10.6	--	<i>State of Colorado v. Goodell Brothers</i> (1987)

	model accepted by judge			
222B. Same as 222A, except for “Third 35 Av. Project”	Same as above	8.7	--	<i>State of Colorado v. Goodell Brothers</i> (1987)
222C. Same as 222A, except from <i>Colorado ex rel. Woodard v. Goodell Bros.</i> and years 1978-1980; court found Goodell guilty of bid rigging on Colorado road building projects in 1978-1980	Reading of U.S. Appeals Court decision by Profs. Lande and Davis.	9.6	--	Lande and Davis (2007)
223. Tetracycline manufacturers in the US settled a civil damages case brought by 43 states, many cities, and indirect purchasers; a previous criminal trial conviction was overturned by an Appeals Court panel; conspiracy dates uncertain, probably Nov. 1953 to 1960	Defendants offer is based on an overcharge assumed to be 66.7% (method unknown), but “allowing for uncertainties in law and in fact” a compromise offer was made.	41	66.7	<i>W. Virginia v. Chas. Pfizer</i> (1970)
224. In a class action by US buyers of polypropylene carpet , a Daubert challenge results in a court decision to accept the opinion of one of the plaintiffs’ experts	Econometric model predicts an overcharge for 1990-1995 for two types of carpets (rolls and cuts)	8.8	--	<i>In re Polypropylene Carpet Antitrust Litigation</i> (2000:32)
225. UK copper smelters , most in Swansea district of So. Wales, began rigging bids for purchased ore 1719-1726 and later rigged bids for export copper; first buyers’ cartel of 4 smelters 1719-1726; second more formal agreement (“Associated Smelters”) 1737-1779; Newell says second was “quite effective” at lowering ore prices and raising copper prices	No overcharges computed for the oligopsony phases of 1719-1779.			Read (1993), Newell (1998), Allen (1923)
225A. First episode: Cornish Metal Co., a sales-agency cartel, formed 1785 to buy all copper ore and set copper sales prices; controlled 2/3 by miners and 1/3 by smelters in Cornwall and later made side payments to Anglesea mines; collapsed in Oct. 1787 when stocks reached 2 years’ supply, imports increased, and Anglesea defected.	Compares copper prices in 1787-88 with early 1785; peak is 1787	13.3	16	Allen (1923)
225B. Episode 2: Dec. 1787 to early 1792; more successful because a new common sales agency covered both Cornwall and Anglesea districts and total production quotas were observed	Large stocks of copper were eliminated 1788-1790 at prices 8% above 1785; peak is 1791	12.0	21	Allen (1923)
225C. Episode 3: First Copper Trade Association formed 1824; failed Dec. 1829 because no agreement on quotas and leading firms’ shares dropped too far.	Author develops a price series on smelters’ price-cost margins for 1824-29 and compares margins after collapse of cartel	25-30	--	Newell (1998:183)
225D. Episode 4: Second Copper Trade Assn. formed 1844 and kept secret until it ended 1867; more elaborate organization and higher degree of control of the industry (CR4 = 70%); copper prices constant during cartel, but ore prices forced down	Author’s figures on copper prices and ore prices 1844-1867 compared to 1842-43 prices; profit figures confirm effectiveness of cartel	19	--	Newell (1998:191)
226. Associated Milk Producers was found guilty at trial of price-fixing, mostly in Southern US fluid milk markets from 1972 to 1980	Econometric model applied to 14 markets; dummy measures effect of DOJ consent decree; ave. is for all markets, peak for	4.5	5.3	Madhavan <i>et al.</i> (1984:161-69)

	monopolized markets			
227. Price fixing and market-sharing of cast iron and cast steel rolls covered virtually all of W. Europe from Jan. 1968 to June 1980; many changes in pricing and organization during cartel; originally target prices for all Europe, later separate minimum price increases for each currency area; the Intl. Roll Manufacturers' Assn. (IRMA) was the collusive cover from May 1971; from 1971-77, bids from steel companies were handled through a Zurich office (ATAG); 30 companies and national associations fined by EU in 11/83	EC decision recounts many price increases by IRMA that were "quite efficient": from Jan. 1969 10% in 10/69, 40% by 10/70, 46% by 1/73, 55% by 1/74, and 100%+ by 10/74; but general inflation was significant in 1969-74, about 40-50%, so real price increases are calculated	40-60	--	EC (11/15/83: 5-9)
228A. The EU fined 40 firms from No. Am. and W. Eur. for price fixing in the European market for bleached sulphate paper pulp sold in open markets ; two episodes, 1/75-12/76 and 1/79 to 12/84; Decision gives quarterly transaction prices of bright (GE>80) prime bleached softwood pulp from 1/74 to 1982	Episode 1 (1975-76) average prices compared to 1974 (before) prices; peak same years	23	23	EC (3/26/85: para 15, 24, 113)
228B. Same as 228A	Same as above, except benchmark is 1977-78 after prices	25	25	EC (3/26/85: para 15, 24, 113)
228C. Same as 228A, except episode 2 (1979-81)	Episode 2 average prices compared to 1977-78; peak is 4/80 to 12/81	49.9	64.2	EC (3/26/85: para 15, 24, 113)
228D. Same as 228C	Same as above, except benchmark is price after collusion	20	31	EC (3/26/85: para 15, 24, 113)
229A. The Taiwan Fair Trade Commission fined 27 distributors of liquefied petroleum natural gas (LPG) in southern Taiwan of price fixing from April 2000 to Jan. 2001	The increase in a kg. of gas in Pingtung-Kaohsiung was from NT\$0.50 to \$1.00 (before) to \$2.00 during	100-300	--	TWFTC (1/12/2001), TFTC-OECD (2001:11-13)
229B. Same as 229A, except in Tainan	Price increase was from NT\$0.80 to \$1.00 (before) to \$2.00	100-150	--	TWFTC (1/12/2001)
230. The EC fined 5 French producers and a Taiwanese export trade Assn. for a Jan. 1973 agreement to raise prices on sales of canned mushrooms in Germany in Mar. 1973; in Dec. 1975, the cartel became ineffective because of a surge in Chinese imports.	Prices were raised in Germany Mar. and April 1973 from Jan-Feb. levels	10	--	EC (1/8/1975)
231. The EC disbanded and fined an association of four manufacturers of wallpaper in Belgium that had fixed f.o.b. and retail prices and all terms of sale from 1922 to 1974; perhaps the most detailed set of uniform rules of any trade association ever recorded	The association had complex rules for awarding discounts to wholesalers on the basis of annual purchases from the members; the most revealing yardstick for gauging price effect is the discount offered to all contractors and builders regardless of size	33.3	33.3	EC (7/23/1974: para.13)
232A. In 1988, the EC fined virtually every major PVC manufacturer of polyvinyl chloride plastic for price fixing during 1980Q4 to 1983Q4; although the fines were overturned by	Average EU transaction prices for three years compared to price several months before the cartel started	56	70	EC (12/21/1988: para. 17-19), Messerlin (1990)

the European Court, the price effects were not questioned; the cartel was formed in response to a Nov. 1981 antidumping action by the EC against E. European suppliers that doubled the import tariff from 12.5% to 24.5%.				
232B. Same as 232A, except that collusive period is Feb. 1983 to Nov. 1984 <i>minimum estimate</i> assumes no anti-dumping tariffs imposed by EC	Compares EU market prices with benchmark of Nov. 1980 to Nov. 1981 avg. prices, before anti-dumping proceedings public; peak is 12/83-3/84	10.0	18.7	Messerlin (1990: Table 6)
232C. Same as 232B, except a preferred scenario in which cartel is aided by EC antidumping tariffs	Compares EU market prices with benchmark of Nov. 1980 to two yardstick prices: Japan export prices and domestic US prices ; peak is 12/83-3/84	14.0	16.0	Messerlin (1990: Table 6)
233B. Same as 233A, except for residential customers in NJ and Long Island, NY	Same as above	15	--	Reuter (1993:193)
234. In <i>Webb v. Utah Tour Brokers Association</i> , 568 F. 2d 670 (1977) the court found a conspiracy from Feb. 1973 to about Dec. 1974 by travel/tour brokers in Utah to deny plaintiffs entry through boycotts	Reading of U.S. court decision	5	--	Appendix Table 4: entry 26 below
235A. In 3/1999 SAS Airlines (a DK-SE-NO joint venture) and Maersk Air informed the EC about a new code sharing agreement. After raids in June 2000, the EC determined (the “Danish Air Routes” case) that Maersk had agreed to withdrawal from the Copenhagen-Oslo and Copenhagen-Stockholm routes in return for Maersk’s monopoly on the Billung-Copenhagen and Copenhagen-Venice routes plus monetary compensation; the agreement was effective from 3/99 to 4/01	The EC decision uncovered secret planning documents that showed that SAS would and did raise the fares on its route to Stockholm by DKK 100 to pay for the Maersk withdrawal; fares are about DKK2000-2500 on this route	4.75	--	EC (7/18/2001: para. 92-95)
235B. Same as 235A, except for the Copenhagen-Oslo route	Price increase of DKK 100 relative to fares of DKK 2100-2700	3.7-4.8	--	EC (7/18/2001: para. 92-95)
236A. A study of the Swedish roundwood (timber) procurement market in 1954-1984 found evidence of oligopsonistic pricing behavior by paper buyers against forest owners in two interrelated sub markets: sawtimber and pulpwood [an EC-FI antitrust probe was launched in 2004; 3 companies fined by Finland in 12/06].	A sophisticated econometric model simultaneously estimates the negative price effects on forestry firms for pulpwood in 1979-1984; peak is 1984	-25	-29.4	Brännlund (1989:702-703)
236B. Same as 236A	Same as above for sawtimber	-10	-11.8	Brännlund (1989:702-703)
237. The European Union fined 3 companies for price-fixing of flat glass products in Benelux ; 1978-1981	From internal documents of the cartel quoted in the EC decision (para. 14 and 41)	10-15	--	EC (8/8/84)
238A. The German steel and iron cartel of Mar. 1904 – June 1907 fixed prices of crude metal, rails, beams, rods, bars, sheets, axels, wheels, and castings; may be a successor to cartels #185-187 above; this refers to ingots .	Benchmark is 1895-1897 prices (the last normal demand period) of crude ingots	0	--	Walker (1906:860)

238B. Same as 238A, billets	Benchmark is 1895-1897 prices (the last normal demand period)	5.3	-	Walker (1906:860)
238C. Same as 238A, beams	Benchmark is 1895-1897 prices (the last normal demand period)	6.1-9.1	-	Walker (1906:860)
238D. Same as 238A, rails	Benchmark is 1895-1897 prices (the last normal demand period)	7.7	--	Walker (1906:860)
238E. Same as 238B, billets	Yardstick is f.o.b. Antwerp prices adjusted for transportation costs and subsidies	30	--	Walker (1906:864)
238F. Refers to Thomas-Bessermer pig iron in the Ruhr market 1879-1913	Author compares market prices 1883-1913 with the "internal price" (shadow or accounting price) yardstick of a major steel maker	10	--	Webb (1980: 311)
239. A U.S. Circuit Court convicted 16 companies for price fixing of enameled iron bath tubs from 6/1/1910 to 1/1/1911; one of the first cases of anticompetitive patent pooling	The decision quotes letters from the head of the Sanitary Enameled Ware Assn. complaining about cheaters undercutting the fixed price; peak price is from testimony of a nonmember of the cartel	15-17	45	Ripley (1916:614-616)
240. From 1982 to 1999, three companies colluded on harbor loading services in Taichung, Taiwan; fined by the TFTC	Based on yardstick prices for unloading scrap iron in two similar harbors	20-120	--	TWFTC-OECD (2001:14)
241. Bid rigging on a tender by National Taiwan University Hospital for surgical suture thread , by 3 Taiwanese, one U.S., and one German companies in August 1988	Yardstick is prices paid for same products by other Taiwan hospitals in 1997	50-80	--	TWFTC-OECD (2001:16)
242. The Taiwan Fair Trade Commission fined 15 distributors of liquefied petroleum natural gas (LPG) in Tamshui, Taiwan area of price fixing from May 1999 to May 2000	Before price NT\$400 raised to NT\$500 per cylinder	25	--	TWFTC-OECD (2001:18)
243A. The Taiwan FTC fined 5 cable TV operators for fixing the price of services from 1/1/2000 to 12/31/2000 in Kaohsiung City and County, Taiwan	TFTC calculated the monopoly profits of the 5 operators for 2000	30.5	30.5	TWFTC-OECD (2001:14,19)
243B Same as 243A	A TWFTC survey of cable prices in Jan. 1999 (weighted by subscribers, simple mean of 4 plans) compared to 1998; peak is annual fee	19.7	34.6	OECD (2006e:3)
243C Same as 243A, except for Neihu District of Taipei	A TWFTC survey of cable prices in Jan. 1999 (weighted by subscribers, simple mean of 4 plans) compared to 1998; peak is apartment building shared service	48.9	171.4	OECD (2006e:3)
243D. Same as 243A, except Keelung	No evidence of price increase from survey like 243A&B	0	0	OECD (2006e:3)
243E. Same as 243A, except Hinshu	No evidence of price increase from survey like 243A&B	0	0	OECD (2006e:3)

243F. Same as 243A, except Taichung	No evidence of price increase from survey like 243A&B	0	0	OECD (2006e:3)
243G. Same as 243A, except Fengshan District, Kaohsiung County	No evidence of price increase from survey like 243A&B	0	0	OECD (2006e:3)
245. The Chinese Anti-Monopoly Bureau fined 5 business groups for rigging a bid in October 1998 to construct a school building in Changding County, Fujian Province, China	The Bureau calculated the illegal gains of the winner to be RNB 9000 on the RNB 263.574 project	3.4?		Wang (2001:9-10)
246. International bromine cartel of 1995-1998, 2 US and one Israeli company; two of them convicted by the US DOJ	Import price decline in US after the demise of the cartel	15	--	Yu (2003:10)
247. Three construction firms were fined by the Competition Council of France in 12/1994 for rigging bids for the Normandy Bridge project in the early 1990s	The Competition Council used as a yardstick an estimate of costs of construction prepared by an international committee of experts	40	40	Agence France Presse newswire (12/13/94)
248. Five coffee companies (2 German, 2 US, 1 Swiss) were fined \$3.5 million in 12/94 by the Hungarian Competition Council for fixing prices from 6/15/94 to 10/15/94	In the second week of January 1995 in reaction to their fines, major coffee sellers dropped their prices 15%	15	--	Euromarketing 1/10/95), OECD (1994-95:474-475)
249. Three makers and 7 managers of electric pipes were found guilty of illegal price fixing and fined by the Israel Antitrust Authority and found guilty by trial in 2002; dates of cartel unknown (assumed to be 1995-2000)	Decision of an Israeli court reported by the IAA to the OECD (also in the IAA's 2003 annual report)	120	--	OECD (4/16/03: Israel 14), UNCTAD (2005:6)
250. The Korean FTC fined 11 auto insurance companies in 2001 for colluding from 11/99 to at least 8/00 on rate increases higher than the increases allowed in 2000 by the Financial Supervisory Service	Assuming that the Korean FSS based its allowed increases on changes in costs, the overcharge is the actual increase less the permitted increase	10	11.6	OECD (2001:Korea p. 11)
251A. Four manufacturers of batteries for automobiles were fined by the Korean FTC for price fixing from June 2003 to about Sept. 2004	KFTC report gives peak price change for large batteries May-Sept. 2004; for average, assumed equal price increases in 6/03, 1/04, and 5/04.	24.1	38.5	<i>KFTC News</i> (Dec. 2004)
251B. Same as 251A	Same as above, except for small batteries	20	31.9	<i>KFTC News</i> (Dec. 2004)
252. Three beer manufacturers in Korea were fined for price fixing from 2/1998-5/1999	Report of KFTC, using price before simultaneous price announcements	10	10	<i>Korea Herald</i> (5/29/99)
253A. Three suppliers of liquid propane gas (LPG) in Toluca, Mexico were fined by the Mexican Federal Competition Commission in 1998 for fixing prices in 1996	Report of the CFC to the OECD decided that the price increase of 26.8% could not be justified by the 8% increase in LNG price	18.8	--	OECD (1998:2)
253B. Same as 253A.	???	46.3	--	Connor (2013)
254A. In <i>Armco Steel Corp. v. North Dakota</i> , 376 F.2d 206 (U.S. App. 1967) the court found Armco guilty of fixing the price of corrugated steel road drainage culverts in ND from 1957 to June 1960	Reading of U.S. Appeals Court decision	18.5	--	Appendix Table 4: entry 2 below
254B. Same as 254A, except that plaintiff is Adams County, No. Dakota	Reading of U.S. Appeals Court decision	17.3-20.3	--	Appendix Table 4: entry 3 below
255. A series of cordage (sisal and Manilla)	No information on prices	--	--	Dewing (1913: 5)

hemp ropes) cartels were established among the major makers in the Eastern U.S. ports from Feb. 1861 to 1893. The 1 st episode (1861-July 1874), a loose “gentlemen’s agreement” on prices, is probably the first recorded US industrial cartel.				
255A. A series of informal agreements from 7/1874 to 12/1877 (2 nd episode) on price proved ineffectual.	Judgement of historian-author; no method cited.	0	0	Dewing (1913: 5)
255B. In Jan. 1878, a formal pool (an inventory of rope) was formed that assigned production quotas to each maker (from 0.25% to 11%); every month, members over quota sold to those under-quota at cost; ended Jan. 1881. Similar pools were reformed in 1882-84 and 1885-2/1888. (3 rd to 5 th episodes); pools controlled 70% of supply.	In early 1880, under-quota members paid 2 cents to buy from those over quota; price of hemp ropes ranged from 3.5 to 14.5 cents	75-625	--	Dewing (1913: 5-6:113)
255C. After a period of intense price competition due to cheating, the National Cordage Co. (6 th episode) was formed in July 1887, initially with 4 members with 30% of market, but many rivals were bought out so by 1/1892 it had 90% of supply; a common sales agency was used; Paid cordage machinery makers to have exclusive purchase contracts, freezing out rivals; made high profits 1891-92; high prices attracted new entry; NCC developed huge unsold stocks in early 1893 and began to borrow heavily; entered bankruptcy 5/5/93.	Before NCC formed, price of hemp was 7.5 cents/lb.; avg. price 11/1887-1/1891 about 9 to 10 cents; peak of 13 cents 4/1889	20-33	73	Dewing (1913: 6-16)
255D. Same as 255C.	After collapse of NCC in mid 1893, price of hemp fell to 3 to 3.62 cents	149-233	259-433	U.S. Industrial Commission (1901)
255E. Same as 255B	Author says that this pool “undoubtedly had [the] effect” of preventing price cutting.	1	--	Clark (1895: 491)
256. In <i>FTC v. Superior Court Trial Lawyers Association</i> , 493 U.S. 411 (1990) the court found that association of legal aid attorneys fixed their fees , paid by District of Columbia to assist indigent defendants, 9/6/83-9/20/83	Reading of U.S. Appeals Court decision	16.7	75	Appendix Table 4: entry 5 below
257. In <i>Freeman v. San Diego Ass’n of Retailers</i> , 322 F. 3d 1133 (2003) the court found a conspiracy to standardize realtors’ multiple-listing-service subscription charges from 1992 to March 2003 in San Diego, CA	Reading of U.S. Appeals Court decision	--	150	Appendix Table 4: entry 6 below
258. In <i>Greenhaw v. Lubbock County Beverage Ass’n.</i> , 721 F. 2d 1019 (5 th Cir. 1983) the court found a conspiracy in Texas to fix retail price of alcoholic beverages (liquor) during the period June 1970 to December 1974	Reading of U.S. Appeals Court decision	7.7	--	Appendix Table 4: entry 7 below
259. In <i>Homewood Theatre v. Loew’s</i> , 110 F. Supp. 398 (D. Minn. 1952) the court found a conspiracy in Minneapolis, MN from Jan. 1935 to Sept. 1948 involving rental of first run movie films	Reading of U.S. court decision	6.3	--	Appendix Table 4: entry 8 below

260A. In <i>New York v. Hendrickson Bros.</i> 840 F.2d 1065 (2d. Cir. 1988) the court found bid rigging on NY state highway construction contracts; first episode 1977 (and two other years below)	Reading of U.S. court decision	49.2	--	Appendix Table 4: entry 10 below
260B. Episode 2: 1978 contract	Reading of U.S. court decision	32.1	--	Appendix Table 4: entry 10 below
260C. Episode 3: contract	Reading of U.S. court decision	13.6	--	Appendix Table 4: entry 10 below
261. In <i>New York v. Cedar Park Concrete Corp.</i> , 85 Civ 1887 (2001) the court found bid rigging in the NY concrete superstructure construction industry during 1978-1985	Reading of U.S. court decision	5.9	--	Appendix Table 4: entry 11 below
262. In <i>North Texas Producers Ass'n v. Young</i> , 308 F. 2d. 235 (5 th Cir. 1962) the court found a conspiracy in Dallas, Texas from Nov. 1956 to Feb. 1961 to keep milk prices high by excluding a low cost fluid milk processor	Reading of U.S. court decision	36	--	Appendix Table 4: entry 12 below
263A. In <i>Palmer v BRG of Georgia</i> , 498 U.S. 46,47 (1990) the court found naked division of the Georgia state market by two providers of RAR/BRE Education services (Bar Review preparation courses) , from 1980 to approximately Nov. 1990	Reading of U.S. court decision	167	--	Appendix Table 4: entry 14 below
263B. Same as 263A.	Same as above, new sales data	15	--	Connor (2013), Appendix Table 4: entry 14 below
264. In <i>Pease v. Jasper Wyman & Son</i> , 2004 ME 29 (2004) the court found a conspiracy during August 1996 to October 1999 by four processors to suppress prices paid for wild blueberries in Maine	Reading of U.S. court decision	-21.6	-32.8	Appendix Table 4: entry 15 below
265. In <i>Story Parchment Co. v Patterson Parchment Paper Co.</i> , 282 U.S. 555 (1931) the court found a conspiracy by three U.S. manufacturers to monopolize and destroy plaintiff's business by predatory pricing in the market for vegetable parchment from Nov. 1927 to at least the bankruptcy of Aug. 1928	Reading of U.S. court decision	27.7	--	Appendix Table 4: entry 16 below
266. In <i>Strobl v. N. Y. Mercantile Exchange</i> , 582 F. Supp. 770 (1984) the court found a conspiracy from about Jan. 1976 to May 1976 by two Idaho food processors to lower the price of a Maine potato futures contract	Reading of U.S. court decision	-48.6	--	Appendix Table 4: entry 17 below
267. In <i>United States v. Dynalectric Co.</i> , 859 F.2d 1559 (11 th Cir. 1988) the court found a bid-rigging conspiracy on electrical subcontracting portion of building the Snapfinger Creek Wastewater Treatment Plant in Dekalb County, Georgia; bid made on September 7, 1979 and the final side payment to the loser was made on January 24, 1985	Reading of U.S. court decision	34	--	Appendix Table 4: entry 22 below
268. In <i>U. S. v. Foley</i> , 598 F. 2d 1323,1327 (C.A. Md., 1979) the court found that real estate companies in Montgomery County, MD	Reading of U.S. court decision	16.7	16.7	Appendix Table 4: entry 23 below

agreed Sept. 5, 1975 to raise their sales commissions on houses; ended about April 1977				
269A. In <i>Wall Products v. National Gypsum</i> , 357 F. Supp. 832 (N.D. Calif. 1973) the court found a U.S. conspiracy from December 15, 1965 until January 1, 1968 over price of gypsum wallboard	Reading of U.S. court decision	27	--	Appendix Table 4: entry 25 below
269B. Same as 269A, except an episode lasting from 1968 to 1973; the industry fixed prices solely through information-sharing; the FTC sued in 1973 and won on appeal to the Supreme Court in 1978.	A structural model of supply and demand; monthly prices and quantities fitted to the conspiracy period; author finds that the collusive model fits significantly better than Cournot and competition; implied Lerner Index is 0.4237	--	42.4	Sarkar (1996: 9-16)
270A. The Japanese steel cartel was formed by the major integrated steel manufacturers sometime before 1960 and continued to at least 2002; a precisely observed market-share agreement has been tolerated but not enforced by the Japanese government	Prices of Japanese domestic contracts on cold-rolled sheet steel 1993-1997 are compared to yardstick of contracts for same product in the U.S.	47	--	Tilton (2004:184)
270B. Same as 270A	Same as above for 1993-1997 prices of hot-rolled coil steel	19	--	Tilton (2004:184)
271. In the first of three U.S. trials (<i>Pickett v. Tyson</i>) under the Packers and Stockyards Act Tyson Foods was found liable by a jury for manipulating the purchase prices of fed cattle from Jan. 1994 to August 2002; on appeal in 2005.	The jury was swayed by the plaintiffs' econometric evidence into awarding single damages of \$1.28 billion, which was 60% of the expert's prediction; peak effect in 2002 Q1	3	8.9	Taylor (2003: 20-21)
272. The international polypropylene plastic cartel fixed prices and market shares from June 1979 to December 1983; fined by EC	Price before (1977-early 1979) compared to EU transaction prices in DM given in decision	44.8	--	EC (Aug. 18, 1986:13-22)
273. With the advice of their foreign licensors, the four Japanese manufacturers of heavy electrical equipment formed a cartel in Japan in May 1931; became effective when two more joined in Dec. 1933; rigged bids to achieve agreed quotas; effective in certain more standardized product lines but not high-tech lines until about 1938-39	National Japanese price indexes for all heavy electrical equipment in 1933-1937 relative to base years 1930-32; peak year was 1937	34	50	Hasegawa (1994:252)
274. An international cartel in compressed (industrial and medical) gasses in the Netherlands from Nov. 1989 to Dec. 1997; fined by EU in 2002 and trade assn. cited; expanded from 3 (1989) to 5 (1990-91, 1995-97) to 7 (1994-95) firms over 4 episodes	Price changes set by cartel are adjusted downward by 2% per year for cost inflation for all 4 episodes	30-45	--	EC (7/24/2002: ¶112-154)
274A. 11/1989-11/1990 episode	Actual price change implemented Feb. 1990	5	5	EC (7/24/2002: ¶112)
274B. 11/90-12/92 episode	Actual price changes (2) implemented after Nov. 1990	15-18	15-18	EC (7/24/2002: ¶119)
274C. 12/93-10/95 episode	Actual price changes implemented 2/94 and 12/95	10.5	10.5	EC (7/24/2002: ¶129-137)
274D. 11/95-12/97 episode	Actual price changes	10.5-16	10.5-16	EC (7/24/2002: ¶149-

	implemented 1/96 and early 1997			154)
275. Four to six Chinese manufacturers of vitamin C were alleged to have colluded on the price of exports to the US market; 2 episodes; a civil antitrust suit was filed in 2/2005; the six control over 68% of world supply in 2004-05				
275A. First episode began at a trade assn. (Chamber of Commerce of Medicines and Health Products Importers and Exporters) meeting 12/2001; six firms controlled about 70% of US imports in 2003; a price war began after July 2003 and ended October 2003.	US import prices were flat at \$3.40/kg. from 6/01 to 8/02; average price 8/03 to 10/03 was \$5.77/kg.; peak of \$6.80 reached on 5/03.	70	100	Isaacson (2008: slide 4)
275B. Second episode began at an “emergency meeting” of the trade assn. in Nov. 2003; four firms controlled 77% to 86% of US imports in 2004-05; prices rose for next 3 months, then fell slowly; collusion ended about 2/2005 but price effects lagged through all of 2005.	US import price reached \$3.40 in 12/05 after collusion ended; average price 11/04 to 12/05 was \$4.62/kg.; peak of \$6.05 reached on 2/04.	36	78	Isaacson (2008: slide 4)
275C. Same as 275B	US import price before 2001 meeting was \$2.80/kg.; reached average of \$4.57 in 2004; peak price in 2004 was \$6.05 in 2/04.	63	116	<i>SinoCast</i> (6/24/05)
276. Six Japanese firms fixed the prices of aluminum foil in Japan July 2002-Feb. 2005; JFTC raided firms on 2/8/05	Following a drop of 15% in 2001, prices were raised 5-10% in late 2002 and winter 2003-04	10-20	--	<i>Daily Yomiuri</i> (2/9/05:2)
277A. Three cement makers from France, Switzerland, and Germany were fined by the Romanian Antitrust authority for bid rigging and price fixing from 2000 to 2005	A statement of a spokesperson of the Authority asserted that prices rose from €20 to €50 during the collusive period	75	150	<i>AFX</i> (5/27/05)
277B. Same as 277A	Competition Authority spokesperson used prices in nearby European countries as a yardstick	33-45	--	<i>AFX</i> (5/27/05)
278. Three manufacturers in Korea fixed the prices of construction machinery (excavators and loaders) from May 2001 to Nov. 2004	Estimate of the KFTC	3.5-9.2	--	<i>Asia Pulse</i> (4/6/05)
279A. Three manufacturers in Korea fixed the prices of forklift trucks from Dec. 1999 to Nov. 2004	Estimate of the KFTC is 4% to 5% per year	20-25	--	KFTC Decision (2005), <i>Asia Pulse</i> (4/6/05)
279B. Same as 279A	Same as above, new sales data	4.23	--	Connor (2013), KFTC Decision (2005), <i>Asia Pulse</i> (4/6/05)
280A. Collusion from June 2003 to May 2005 on telephone fees for local land lines, Korea ; fined by the Korean FTC May 2005	Statement of the KFTC Director-General	15-20	--	KFTC Decision (2005), <i>Asia Pulse</i> (9/15/2005)
280B. Same as 280A	Same as above, new sales data	17.1	--	Connor (2013), KFTC Decision (2005), <i>Asia Pulse</i> (9/15/2005)
281. Collusion from June 2003 to May 2005 on connection fees for broadband internet	Statement of the KFTC Director-General	15-20	--	KFTC Decision (2005), <i>Asia Pulse</i>

service, Korea; fined by the Korean FTC May 2005; one firm is US-UK owned				(9/15/2005)
282. Collusion from June 2003 to May 2005 on telephone fees for long-distance land lines, Korea; fined by the Korean FTC May 2005	Statement of the KFTC Director-General	15-20	--	KFTC Decision (2005), <i>Asia Pulse</i> (9/15/2005)
282B. Same as 282A	Same as above, new sales data	17.15	--	Connor (2013), KFTC Decision (2005), <i>Asia Pulse</i> (9/15/2005)
282C. Same as 282A	Same as above, new sales data	3.4	--	Connor (2013), KFTC Decision (2005), <i>Asia Pulse</i> (9/15/2005)
283. Collusion from June 2003 to May 2005 on telephone fees for international land lines, Korea; fined by the Korean FTC May 2005	Statement of the KFTC Director-General	15-20	--	KFTC Decision (2005), <i>Asia Pulse</i> (9/15/2005)on (2005), <i>Asia Pulse</i> (9/15/2005)
283B. Same as 283A	Same as above, new sales data	17.14	--	Connor (2013),
284. The U.S. Supreme Court in 1921 ruled that the American Hardwood Manufacturers Assn. colluded through an information-sharing plan from Dec. 1918 to March 1921 among its 465 members, which represented 30% of output of the 9000 U.S. mills at the time; however, the price effects were sub-national in scope.	Alexander applies an econometric model to national prices in the US hardwood industry and finds no anticompetitive effect on output; thus, one can infer no price effect	0	0	Carlton and Perloff (2004: 383); Alexander (1988); Sjostrom (1991)
285A. The Icelandic Competition Authority in 2005 fined 3 petroleum distribution firms with the whole national market for price fixing 1993-2001; also bid-rigging against the government and fishing ships	Gross margins in the strongest collusive period 1997-2001 are compared to margins in a weaker collusive period (1993-1997) to calculate the cartel's gain	0.01-0.02	0.02	Samkeppniseftirlitid (9/23/2005: 22)
285B. Same as 285A	The Competition Authority report says that in 1998 Icelandic fishing vessels paid 50% less for fuel in the Faeroe Islands, Norway (a yardstick)	100	--	Samkeppniseftirlitid (9/23/2005: 16)
286A. Six multinational drug manufacturers fixed prices and rigged bids on infant and baby formula in Italy from about 1995 to March 2000; fined by the Italian Antitrust Authority in March 2000	Prices in Italy compared to yardstick of prices of identical items in pharmacies in neighboring European countries	100+	--	Italian Competition Authority (3/16/2000)
286B. Same as 286A except only 4 companies colluded from March 2000 to July 2004; companies also prevented sales to Italian supermarkets and blocked parallel imports from DE, FR, and ES; fined a larger amount a second time in October 2005	Prices of infant formula in Italy compared to yardstick of prices of identical items in pharmacies in neighboring European countries	150	300	Italian Competition Authority (10/20/2005)
286C. Same as 286B	Price reductions of infant formula in Italian pharmacies from July 2004 to October 2005	33	--	Italian Competition Authority (10/20/2005)
286D. Same as 286B	From an Italian Competition Authority survey of prices of baby formulas in Italy	100	200	Italian Competition Authority (10/20/2005)

	compared to yardstick of prices of identical items in pharmacies in neighboring European countries			
286E. Same as 286B	Price reductions of baby formulas in Italian pharmacies from July 2004 to October 2005	33	--	Italian Competition Authority (10/20/2005)
286F. Same as 286B	Survey of pharmacy prices of 9 brands infant formula for babies up to 4 months old in 7 large EU nations in 2002; simple average across brands in one country and then simple average of 7 countries; peak is UK	186	280	OECD(2006b:6-7)
286G. Same as 286B	Same as 286F, except survey in 2004; peak is UK comparison	193.3	335	OECD (2006b:6-7)
286H. Same as 286B	Same as 286F for formulas for infants over 4 months old; peak is UK	126.8	240	OECD (2006b:6-7)
286I. Same as 286B	Same as 286F for prices of formulas for infants with special medical conditions; peak is prices in Germany	101.9	142.5	OECD (2006b:6-7)
287A. The Europe-Asia Trades Agreement (EATA) for shipping containers from northern Europe to East Asia had 18 members; it agreed to limit capacity by 31% in Nov. 1992- Dec. 1993 and kept the reduced capacity until disbanded in Sept. 1997; consent decree by the EC in April 1999	Compared to 1992, freight rates rose in 1993, 1994, and 1995 as a result of the capacity reductions in 1993	32.6	48	Drewery (1996: 110), EC Decision (4/30/99: 33)
287B. Same as 287A	Same as above, new sales data	0.3	--	Connor (2013), EC Decision (4/30/99: 33)
288A. Four tobacco processors in Spain began overtly colluding on the <i>maximum procurement</i> prices to pay 5000+ farmers represented by four unions for four types of their " raw " leaf tobacco in March 1996; was ineffective until punishment mechanism adopted in March 1998; failed to agree on prices in 2000-01; ended in Oct. 2001 when processors were raided by European Commission; 4 processors and 4 farmers' unions fined in 2003.	Ineffective episode 3/96- 2/98; prices to farmers actually declined an average of 162% from monopsony period 1993-1995 to marketing year 1997-98	0	0	EC (10/20/04: 13)
288B. Same as 288A, except for effective episode 2/1998-2/2000	Prices of Virginia grade in 1998-2000 compared to 1997-98; peak is 1999-2000	-4.1	-6.0	EC (10/20/04: 13)
288C. Same as 288B	Prices of Virginia grade in 1998-2000 compared to 2000-2001; peak is 1999-2000	-8.4	-10.2	EC (10/20/04: 13)
288D. Same as 288B	Prices of Burley E grade in 1998-2000 compared to 1997-98; peak is 1999-2000	-4.8	-6.0	EC (10/20/04: 13)

288E. Same as 288B	Prices of Burley E grade in 1998-2000 compared to 2000-2001; peak is 1999-2000	-0.1	-1.4	EC (10/20/04: 13)
288F. Same as 288B	Prices of Burley F grade in 1998-2000 compared to 1997-98; peak is 1999-2000	-8.8	-9.1	EC (10/20/04: 13)
288G. Same as 288B	Prices of Burley F grade in 1998-2000 compared to 2000-2001; peak is 1999-2000	0	0	EC (10/20/04: 13)
288H. Same as 288B	Prices of Havana grade in 1998-2000 compared to 1997-98; peak is 1999-2000	-4.3	-4.7	EC (10/20/04: 13)
288I. Same as 288B	Prices of Havana grade in 1998-2000 compared to 2000-2001; peak is 1999-2000	-0.4	-0.8	EC (10/20/04: 13)
289. The "Helsinki Agreement" signed by virtually all W. European national banking associations in May 1983 (effective 12/83) raised the maximum commission to be paid to a group of 703 French banks; also, for the first time a minimum rate was specified on Eurocheque bank commissions ; EU stopped the agreement and fined both groups in 3/92	The maximum percentage commission in 12/83 compared to the 1982 maximum	20-25	28	EC (3/25/92: 1-11)
290. The Society of Price-Regulating Organizations in the Building Trades (SRO), a federation of construction-industry trade associations, began allocating winners and rigging the prices of all tenders in all branches of the construction industry of the Netherlands in 4/1/87; some of its member associations began colluding as early as 10/1980; in 1982-88 the SRO rigged 25-30,000 bids per year; ended 2/92 with large EU fines on the SRO's 28 members	The EC decision cites an independent study that calculates the increased annual costs of the SRO's bid rigging at NGL400 million in 1987-88; sales of tendered construction projects in 1987-88 were NGL12.2 to 12.9 billion.	3.1-3.3	--	EC(2/5/92: 17)
291. At an auction of rare books held at Claygate Estate, Surrey, England over 10 days in October 1919, 81 book sellers formed a bidding ring for 447 of the 641 lots of 13,600 volumes sold; one of the dealers kept a detailed diary of the bidding ring published in 1990; bid rigging was made illegal in the UK in 1927	The ring met secretly later to hold 4 "knockout" auctions among themselves; prices advanced each time; total knockout sales (a yardstick) were £19,696, up from £3714 paid to the estate at the original auction	-81	--	Porter (1992:434)
292A. Five manufacturers cartelized the global market for DRAMs (dynamic random access memory semiconductors) from April 1999 to June 2002; top 4 held 76% world share; U.S. investigation began June 2002 and guilty pleas made in 2004-07	In a DOJ plea agreement of May 11, 2005 with Hynix Semiconductor, the two parties agreed that the company's affected sales was \$839 million and that the <i>minimum proveable</i> U.S. overcharge was more than \$92.5 million	12.4+	--	<i>Korea Herald</i> (8/18/04); DOJ (5/11/2005) Hynix guilty plea [www.usdoj.gov/atr/cases/f209200/209231.pdf]
292B. Same as 292A	In a DOJ plea agreement of March 8, 2006 with Elpida Memory, the two parties agreed that the company's affected sales was \$425 million	11.0+	--	DOJ (3/8/2006) Elpida plea agreement

	and that the <i>minimum proveable</i> U.S. overcharge was more than \$42 million.			
292C. Same as 292A, except world prices	Weekly data from iSuppli on prices of 128MB DRAM shows mean world price \$2.88 from 12/01 to 6/02; prices after collusion were \$1.50 to \$1.70.	69-92	--	WSJ (2/26/04:A1) quoting industry trade publication iSuppli (2004)
292D. Same as 292A	From settlement in <i>DRAM Antitrust Litigation</i> , plaintiff's expert's econometric model found damages of \$362-\$384 mil.; the DOJ plea statements place U.S. affected sales at \$5749 million.	6.3-6.7	--	Lande and Davis (2007: Case 11), Connor (2007a)
292E. Same as 292A, except EU prices	But-for is intra-collusion price war	28.2		Connor (2013), iSuppli (2004)
292F. Same as 292A, except ROW prices	But-for is intra-collusion price war	28.2		Connor (2013), iSuppli (2004)
292G. Same as 292A, except EU prices	But-for is intra-collusion price war	19.2		Connor (2013), iSuppli (2004)
292H. Same as 292A, except U.S. prices and three collusive periods: 9/98-3/99, 4/99-12/00, and 12/01-6/02. The earliest period of collusion is marked by extensive information exchange starting in early 1997 and U.S. antidumping duties on Korean exporters. The eight-month price war in 2001 was an attempt to drive Hynix out of business, foiled only by a \$7 billion Korean Govt. loan.	Noll describes the econometric model of Liu, which uses three time-period dummy indicator variables to capture collusion and many market demand and supply shifters to predict weekly prices; found effects were same across various customer sizes.	32	--	Noll (2014: 275), Liu (2006)
293A. Four manufacturers of polychloroprene synthetic rubber (a/k/a Neoprene) cartelized the global market from Sept. 1999 to April 2002; U.S. guilty pleas	In a public plea agreement of March 29, 2005 with DuPont Dow Elastomers, the two parties mutually agreed that the company's u.s. affected sales was \$410.5 million and its US overcharge was at least \$42 million; latter probably an underestimate	11.4 +	--	DOJ (5/29/2005) [www.usdoj.gov/atr/cases/f209200/209200.pdf]
293B. Same as 293A, except for EU	Price increases in EC Decision	82.2	--	Connor (2013), EC Decision (1/23/2008)
293C. Same as 293A, except for EU	Price before collusion	9.6	--	Connor (2013), International Institute of Synthetic Rubber Producers, Inc. (2004)
293D. Same as 293A, except for ROW	Price before collusion	9.6	--	Connor (2013), Connor (2013), International Institute of Synthetic Rubber Producers, Inc. (2004)
293E. Same as 293A, except for world	Price before collusion	17.8	--	Connor (2013), Connor (2013), International Institute

				of Synthetic Rubber Producers, Inc. (2004)
294 A. The Aviation and Transportation Security Act of 2001 allowed Aloha Airlines and Hawaiian Airlines to obtain temporary antitrust immunity from 9/30/2002 to 10/1/2003 for their agreement to reduce passenger seat capacity on routes between Hawaii's major inter-island airports: prices on Hawaiian air routes rose immediately and a lagged price-adjustment effect until at least December 2004; U.S. average prices are shown to follow airfares in 6 other tourist destinations in Florida, Las Vegas, and Puerto Rico.	ATPI (Average Transportation Price Index) data for entire U.S. supplied by the U.S. Dept. of Transportation shows changes in Kona, Hawaii airfares from 2002Q4 to 2004Q4 compared to US ATPI yardstick in same period; peak price refers to 2003Q4	16.8	24.5	Blair <i>et al.</i> (2007: Figure 3 and Table5)
294 B. Same as 294A, except for Lihue, Hawaii	Average ATPI changes from 2002Q4 to 2004Q4 are compared to US ATPI price changes in same period; peak price refers to 2003Q3	15.8	21.6	Blair <i>et al.</i> (2007: Figure 3 and Table5)
294 C. Same as 294A, except for Kahului, Hawaii	Average ATPI changes from 2002Q4 to 2004Q4 are compared to US ATPI changes in same period; peak price refers to 2003Q4	12.7	18.6	Blair <i>et al.</i> (2007: Figure 3 and Table5)
294 D. Same as 294A, except for Honolulu, Hawaii	Average ATPI changes from 2002Q4 to 2004Q4 are compared to US ATPI changes in same period; peak price refers to 2004Q3	8.3	16.9	Blair <i>et al.</i> (2007: Figure 3 and Table5)
294E. Same as 294A	Regression analysis using dummy variable for period of Hawaii State immunity	10-18	--	Kamita (2010: 258)
294F. Same as 294A, except period for 2.5 years after immunity expired but before a third airline entered	Regression analysis using more time periods and dummy variable for period of Hawaii State immunity	22-43	--	Kamita (2010: 259)
295. The French semi-finished steel cartel of 1932-1939 had 15 members; prices and domestic quotas were managed by the <i>Comptoir Sidurgique de France</i> (CSF); government encouragement but not participation; maximum market control of 52%	Price rise from 1936 to 1939 due to general inflation, labor policies, and devaluation of the franc; highly unstable quotas and inadequate penalties for cheating	0	0	Barbezat (1996: 529-530)
296. The French structural-shapes steel cartel of 1932-1939 had 15 members; prices and domestic quotas were managed by the <i>Comptoir Sidurgique de France</i> (CSF); government encouragement but not participation; maximum market control of 52%	Price rise from 1936 to 1939 due to general inflation, labor policies, and devaluation of the franc; highly unstable quotas and inadequate penalties for cheating	0	0	Barbezat (1996: 529-530)
297. The French merchant-bars steel cartel of 1932-1939 had 15 members; prices and domestic quotas were managed by the <i>Comptoir Sidurgique de France</i> (CSF); government encouragement but not participation; maximum market control of 52%	Price rise from 1936 to 1939 due to general inflation, labor policies, and devaluation of the franc; highly unstable quotas and inadequate penalties for cheating	0	0	Barbezat (1996: 529-530)

298. The French thick plate steel cartel of 1932-1939 had 12 members; prices and domestic quotas were managed by the <i>Comptoir Sidurgique de France</i> (CSF); government encouragement but not participation; maximum market control of 52%	Price rise from 1936 to 1939 due to general inflation, labor policies, and devaluation of the franc; highly unstable quotas and inadequate penalties for cheating	0	0	Barbezat (1996: 529-530)
299. The French thin sheet steel cartel of 1932-1939 had 12 members; prices and domestic quotas were managed by the <i>Comptoir Sidurgique de France</i> (CSF); government encouragement but not participation; maximum market control of 52%	Price rise from 1936 to 1939 due to general inflation, labor policies, and devaluation of the franc; highly unstable quotas and inadequate penalties for cheating	0	0	Barbezat (1996: 529-530)
300 A. Radium was discovered in 1898 and isolated in 1910; a Bohemian monopoly until about 1910 when U.S. mines were opened; from 1912 to 1923 a U.S. cartel dominated world supply (1 st episode ended in 1918)	Prices were held steady 1912-1918 at \$170,000 per gram [sic] when U.S. cost of production was \$70,000	243	243	Canada (1945: 36)
300B. In the early 1920s a Belgian Congo monopoly (Union Minière du Haut-Katanga) developed new radium supplies, causing U.S. cartel to drop its price during 1920-1923 (2 nd episode); "sometime in the mid 1920s" (ca. 1925), the U.S. producers stopped producing and became distributors for the Belgian firm, a world monopoly 1925-1931	Prices were held steady 1920-1923 at \$105,000 to \$120,000 per gram [sic] when U.S. cost of production was \$70,000	50-71	50-71	Canada (1945: 36)
300C. In 1931 a Canadian mine (Eldorado Gold Mining) discovered new, lower-cost radium supplies and prices fell until 1938 when a world market-sharing agreement was concluded (3 rd episode); 40% for Canada, 60% for Congo; for military security the Canadian mine was secretly nationalized in 1942, probably ending duopoly contract.	Price reached \$20,000 to \$25,000 per gram in 1938, but new international duopoly set 1938-1940 prices at \$25,000	0-25	0-25	Canada (1945: 36), Goldsemit (1989:1)
301. Schering-Plough, a US drug maker, paid two other drug makers \$90 million if they agreed not to produce generic versions of a patented drug K-Dur 20 (extended-release potassium chloride supplement) from 6/98 to 9/01; the FTC ordered the practice to stop on 12/03, but lost on appeal when the Supreme Court refused to hear the case (after the Bush II DOJ intervened for the defendants!)	FTC Complaint states that overcharge is at least \$100 million and that patented drug sales are about \$220 mil. annually (which overstates sales had generics entered)	11.4	--	FTC(4/2/2001)
302. In 1928 the Canadian Newsprint Institute export cartel (legal in Canada at the time) was formed with the encouragement of the Premiers of Quebec and Ontario Provinces; members included all non-US newsprint paper companies with a national share of 70% of supply, of which 75% was exported to the US; subsequent Canadian cartel-formation efforts during 1934-1938 seem to have been equally unsuccessful.	Despite the role of governments, the Institute was able to raise prices on only one contract to the Hearst newspapers chain; by 1933 cheating and the Depression had caused prices to fall 24%	0	0	Canada (1945: 37-38)
303. Prices (corrected for the destination of exports) were collected for 83 Swedish manufactured products , some from industries that had export cartels in 1976-1990; if some of	An econometric model regresses the ratio of Swedish prices to EEC prices against a dummy variable (=1 when the	0	0	Fölster and Peltzman (1997: Table 8.8, column 3).

the same products from Swedish cartels with horizontal price agreements are cartelized in the EEC, then the price effects of Swedish cartels are biased toward zero	industry had a legally registered price-fixing cartel); thus, essentially a yardstick method			
304A. This study examines the price and output effects of 64 “ rationalization and specialization ” manufacturing cartels in West Germany during 1973-1986; they are legally exempted from German cartel prohibitions if consumers benefit from lower prices; most are in the non-electrical machinery, non-metallic mineral, food, and transportation equipment industries; the first sample consists of 33 cartels newly legalized	The cartels’ prices during the legal period are divided by the industry’s price 3 years before cartelization, then further divided by the same ratio for the industry group to which the cartel belongs, and finally a before/during difference calculated; a yardstick method	2.2	--	Audretsch (1989: 597)
304B. Same as 204A, except that the sample is 13 cartels that were unexempted during 1976-1983	Same as above, except that relative prices during the legal period are compared to relative changes 3 years after the exemption was nullified	4.5	--	Audretsch (1989: 597)
304C. Same as 204A, except that the sample is 18 cartels that were exempted throughout 1976-1983	Same method as 304A	3.3	--	Audretsch (1989: 597)
305. Six construction firms rigged bids on road projects (worth €83 million) and the price of asphalt in the Seine-Maritime Department of France from 1988 to the end of 1998; by 2005, the six had been acquired by three firms; France imposed fines of €33.6 million in 12/2005.	Studies commissioned by the Conseil found an overcharge to the Department of €24.8 million; method unknown	30	--	Conseil Concurrence, (12/15/2005:2)
306. Six luxury hotels in Paris, France (five foreign-owned) were fined by the Conseil Concurrence in 2005 for fixing prices as early as 1999 to 2003 through detailed information exchanges; price variation among the six five-star “palaces” was extremely low during these years	The <i>Decision</i> shows the ratio of 1999-2001 average prices of rooms at the six “palaces” compared to “Grand luxe” and “Hotels de charme” (1.88); the yardstick is the same ratio calculated for advance-purchase on 10/15/06 for four periods of 3 to 7 days in 11/06-1/07 at 10 four-star Paris hotels (the cheapest double room found on several travel search engines) (1.65)	13.9	37.2	Conseil Concurrence (2005:5,31)
307. Bid rigging in 4/1/2000 to 2/2/2001 by “dozes of firms” of government tenders for construction of agricultural-engineering projects in Shinjo City and Mogami Ward of Yamagata Prefecture, Japan ; Yamagata construction industry association involved; Prefecture officials alleged to have leaked the RCPs to bidders	An internal analysis by the Japan FTC compared the RCP (a yardstick, the buyer’s construction price from engineering estimates) during the collusive period with the RCP during 2/7/2001-12/31/2001.	5.4	--	OECD (2005a:134)
308. Bid rigging by four manufacturers in 4/1/97 to 2/21/2001 of tenders by the District Transport Bureau of the Ministry of Land, Infrastructure and Transport of Japan for Automobile testing machines and equipment	An internal analysis by the Japan FTC compared the RCP (buyer’s estimated price) during the collusive period with the RCP during 2/23/2001-12/31/2001.	41.5	--	OECD (2005a:134)

309A. Three manufacturers of school uniforms in South Korea were found guilty by the KFTC of price fixing and obstructing purchases of uniforms by parents' buying cooperatives from 11/98 to 5/01; overcharges were \$573 million; fines of \$8.8 million were imposed on the three manufacturers and colluding wholesalers and retailers	The KFTC calculated that the manufacturers' prices increased 84 to 100% compared to the price before the cartel was formed	84-100	100	OECD (2005a:140)
309B. Same as 307A	The KFTC compared cartel prices of winter-weight uniforms with prices after the fines	20.7	--	OECD (2005a:140)
309C. Same as 307A	The KFTC compared prices of winter-weight uniforms made by non-members with prices after the fines	24.0	--	OECD (2005a:140)
309D. Same as 307A	The KFTC compared cartel prices of summer-weight uniforms with prices after the fines	25.0	--	OECD (2005a:140)
310A. In 1999 the Korean Omnibus Cartel Repeal Act eliminated the legality of professional associations to set fees for their members; prior to April 1981, Korea had no price-fixing law; the KFTC regularly surveyed those fees following deregulation in 2000, 2001 and 2002	Surveys found the fees of patent lawyers falling from 2000 to late 2001	11.4	--	OECD (2005a:140-41)
310B. Same as 308A, except fees for all lawyers	Fees in 1999 compared to late 2001	12.0	--	OECD (2005a: 140-41)
310C. Same as 308A, except fees of auditing services	Fees in 1998 compared to late 2001	11.0	--	OECD (2005a: 141)
311A. In August 2003 the UK Office of Fair Trade fined a maker and 9 retailers of football replica kits (shirts, shorts, and socks) for price-fixing, a long-time practice formally made illegal in the UK since 1956; the infringement was both a vertical and horizontal restraint	An analysis for the UK Government by the Centre for Competition Policy, University of East Anglia compared prices of adult shirts in 2002 with Nov.-Dec. 2003 retail prices; peak is stores in Boston, UK	16.9	29.0	Davies (2004:73-84), OECD (2006:196)
311B. Same as 311A above	Same as above, except prices of junior-size shirts in 2002 with Nov.-Dec. 2003 retail prices; peak is stores in Norwich, UK	17.3	29.7	Davies (2004:73-84), OECD (2006:196)
311C. Same as 311A above	Price change after the cartel was exposed	43+	--	OECD (2005b: 20)
311D. Same as 311A	In response to a threat of a class-action damages suit, UK sports-clothing retailer JJB offered to compensate victims by giving away free a shirt with retail price £13.49 to all buyers of similar priced-fixed shirts (sold at £40-45)	43-51	--	<i>The Mirror</i> (2/10/07:21)
312A The Competition Commission of Switzerland found 4 construction firms guilty	The Commission invited an expert to estimate the	112.4	112.4	OECD (2006a:3)

of bid-rigging on a March 1999 tender to renovate the façade of the National Library	competitive cost of the project, which was divided into the lowest collusive bid			
312B. Same as 312A	The Commission invited a 5 th firm to make a bid; this yardstick was divided into the lowest collusive bid	47.7	47.7	OECD (2006a:3)
313. Under the cover of the Taxi Service Providers Assn., a cartel with 39 participants was fined by the Lithuanian Antitrust Authority for fixing the prices charged by call taxis in Vilnius from 7/2004 to 12/2004	Prices rose by 33% on October 1, 2004 compared with the price a few months earlier	33.3	33.3	OECD (2006c:3)
314A. In Feb. 2004 the Turkish Antitrust Authority fined several cement producers in the Aegean Region for fixing prices during 2003-2004	The price of bagged cement in Izmir, the largest city in the Region, rose 165% faster than inflation in 2003-2004, and costs were constant	165	--	OECD (2006d:3)
314B. Same as 314A	The price of bagged cement in Izmir, the largest city in the Region, were 65% higher than the Ankara Region (yardstick) in 2003-2004	65	--	OECD (2006d:3)
315. The Korean FTC fined 4 manufacturers of toilet paper for price fixing from 1/1996 to 1/1998; after 1/96 the 4 charged identical prices; however, the Supreme Court overturned the finding of collusion from 1/96 to 7/97	Change in manufacturers' prices from 1996 to 1/98; peak is 12/97-1/98	18.3	21.1	OECD (2006h:6)
316. El Paso Corp. and Sempra (So. Calif. Natural Gas) settled 4 civil damages actions for \$1.6 billion for fixing the price of natural gas sold by pipeline in California from 9/1/1996 to 3/20/2003; El Paso was also convicted for self-dealing and price manipulation in No. Calif.	One illegal act by El Paso was purchasing pipeline capacity in 2/2000 for \$38.5 million that generated \$184 million in illegal profits (p.4 of Court Ruling)	378	378	Lande and Davis (2006:23-28)
317A. Bristol Myers Squibb and Schein Pharmaceutical colluded to prevent entry into the US market for the anti-anxiety drug bupirone from 11/21/00 to April 2001; after being sued, the two firms settled damages to direct purchasers (\$220 mil.) and to indirectly overcharged consumers (\$93 million)	Probably by econometrics, plaintiff's expert estimated direct overcharges at \$232 million for the period 11/00 to 2006; sales of drug estimated to be \$2.2 billion	10.4	--	Lande and Davis (2006:10-14), Connor (2007a)
317B. Same as 317A.	???	69.9	--	Connor (2013)
318A. From May 1, 1998 to May 24, 1994, 37 Nasdaq market makers fixed the prices of securities , namely, the buy-sell spreads (i.e., the traders' fees) by avoiding "odd-eighth quotes" on the stocks of four large companies; a class action representing 1.25 million plaintiffs recovered \$1.027 billion in damages in 1997-98; the SEC and DOJ imposed a consent decree in 1996	A law review analyzing the case quotes an academic affidavit affirming that the settlement was 100% of damages; the DOJ press release of 7/17/96 mentions affected sales of securities of about \$10 trillion (but trader's fees, which are the better measure of sales, are much smaller)	3.3	--	Lande and Davis (2006:45-47)
318B. Same as 318A.	Comparison of bid/offer spreads on four stocks before and after 5/27/94 (i.e., "after")	50	--	Christie <i>et al.</i> (1994)

	price)			
319. During 10/92-6/93, 7 manufacturers of polypropylene carpets fixed US prices; one firm was criminally fined by the DOJ, seven paid a civil settlement in 1998	The class-action Court decision (p. 1360) cites the plaintiffs' expert's study (probably econometric)	8.3	--	Lande and Davis (2006:64-66)
320. In 1992 a US federal government task force discovered a 22-year (1966-1988) bid-rigging scheme by 32 manufacturers and distributors of specialty steel (stainless, nickel, and other alloys) piping purchased by the Washington State Public Power Supply System and other utilities and refineries; the ringleader and his company were criminally prosecuted and convicted at trial in 1990; a 1988 class action with 6000 plaintiffs and 31 defendants settled in 1992 for \$50 million.	A decision of the 5 th Circuit Court of Appeals filed 5/28/92 affirmed the criminal convictions of 6 pipe distributors and cites the price effects as facts on p. 5	20	75	Lande and Davis (2006:94-96); 962 F.2nd 465
321A. Collusion between Abbott Laboratories and Sandoz (a Novartis subsidiary) from 4/1/98 to 8/99 raised the price of the drug terazosin hydrochloride (Hytrin brand) and prevented the launch of competing generic equivalents; a class action was settled in Feb. 2005 for \$72.5 million	The Court decision approving the settlement filed 4/6/05 cites the plaintiffs' expert's calculation of damages (probably econometric) with approval on p. 15; sales from a newspaper article	43-63	--	Lande and Davis (2006:89-93); <i>WSJ</i> (2/7/00:B20); MDL 1317
321B. Same as 321A.	Same as above, but new sales data	63.3	--	Connor (2013), Lande and Davis (2006:89-93)
322A. In 10/2004 the Japan FTC discovered 70 firms involved in bid rigging 180 contracts for construction of public bridges in 2003-04; 45 firms paid \$110 mil. in civil surcharges and 23 others paid \$55 mil. in criminal fines, both Japanese records; 8 men received prison sentences	The Tokyo High Court ruled that overcharges totaled \$78.9 million on projects costing the government \$634 mil.	14.2	--	<i>Daily Yomiuri</i> 11/11/06:2; <i>Jiji</i> 11/10/06; <i>AP</i> (11/10/06)
322B. Same as 322A	The ratio of winning bids to engineering estimates declined from 90% in 2003-04 to 60% after 2004	50	--	<i>Daily Yomiuri</i> 11/11/06:2)
323A. The first episode of the Nord-Pas-de-Calais (NPC) coal cartel in 16 Départments of northern France lasted from 1901 to 1919; 10 firms controlled 87% of the cartel's area of dominance	No information; historical study	--	--	Montant (2001:301)
323B. In 1922 a private NPC cartel was reformed but without an punishment mechanism (cheaters' identities were kept secret); 10 firms controlled 87% of the cartel's area of dominance; apparently price wars were frequent; external competition came from Belgium, Germany, and the UK	Judged ineffective	0	0	Montant (2001:301-303), Caron (1988), Sauvy and Hirsch (1984), Kemp (1972)
323C. The third episode began in 1927 when a recession caused the cartel to implement a 3-zone supply-control scheme with a more effective punishment mechanism; a 1932 agreement with the other two French coal cartels reinforced collusion; the NPC cartel lasted	Judged "effective," but no numerical estimates	1 +	--	Montant (2001:303-306), Heaulme (1948)

without price wars until government price controls were imposed in Aug. 1936				
324A. The interwar UK coal cartel operated from 1930 to 1939 with 17 production districts; organized by statute but operated by the mine owners; 1 st episode (prior to 1936) dumping across districts was common, each district set its own minimum prices, and quotas were exchanged among owners at a few pence per ton.	Judged to be ineffective during 1930-1935	0	0	Fine (1990:445); Kirby (1973:280), Marlio (1930:842)
324B. From 1936 to 1939 a national council allocated quotas to each district, eliminating dumping	Henley compares the mark-up on direct costs during 1936-39 with the mark-up before 1936	13-24	--	Henley (1988)
325. Five airlines raised the prices on the Rio de Janeiro to Sao Paulo, Brazil route in August 1999; ended sometime before Sept. 2004; fined 1% of their revenues by CADE, the Brazil antitrust authority	Simple before-and-during price comparison	10	10	UNCTAD (2005:4), OECD 2005c:22)
326. From 4/2001 to 11/2002 two college bookstores on the campus of Indiana University-Purdue University at Indianapolis (IUPUI) fixed the prices of textbooks by eliminating discounts on books sold to students; One of the store managers was criminally convicted by the DOJ	Plea Agreement states the profit margins rose from 25 to 27% during the conspiracy	8	--	DOJ (5/10/04:3)
327A. Virtually all cement makers (100+) in Egypt fixed prices in 2002, affecting sales of \$630 million; indictments of 20 company officials by new Egyptian Competition Authority 1/08 and convicted in 2008	Price rise from 2001 (before cartel agreement in 2002)	37	40	Jenny (2005:16), <i>Financial Express</i> (7/5/07)
327B. Same as above, except cartels were fined illegal price fixing from 2002 to 2006.	From the decision of the court in Egypt's first antitrust trial of executives of 8 cartel participants; cost-based method for years 2003-04	20.9	--	Decision reported by <i>Daily News Egypt</i> (2008)
327C. Same as above, except cartels were fined for illegal price fixing from 2002 to 2006.	From the decision of the court in Egypt's first antitrust trial of executives of 8 cartel participants; cost-based method for 2006	17.5	--	Decision reported by <i>Daily News Egypt</i> (2008)
327d. Same as 327C.	???	38.5	--	Connor (2013)
328. From July 2003 to Dec. 2005, 4 asphalt paving contractors rigged bids against Suffolk County and Brookhaven Town, New York; all four pleaded guilty and paid fines in 1/07	DOJ press release cites contract revenues and "restitution" (i.e., overcharge) amounts, price increase and selling price ranges	16.5	29	DOJ (12/22/2006)
329A. A large number of cement producers in Turkey colluded from 1993 to 2005, in three episodes; four investigations and two decisions to fine the cartel by the Turkish Competition Authority; first episode 1993-June 1999 when the first fine was imposed	Simple econometric model fitted to 1993-2005 data incorporates U.S. cement prices as a yardstick; year 2000 assumed to be competitive	24.6-33.6	--	Dalkir (2006:19 and 29), Dalkir (2007)
329B. Same as 329A	Econometric model above is corrected for mild autocorrelation	19.8-25.2	--	Dalkir (2007)

330A. A cartel composed of five multinational drug firms rigged one bid in Jan 2001 on a tender for diabetes (blood glucose) testing reagent strips by Coimbra Hospital in Portugal; fined by PT competition authority (PCA)	Five identical bids of €20 per package were submitted, which were increases on bids from the same firms for the identical product one year earlier	34-76	76	OECD (2005b: 24), PCA (1/11/05)
330B. Same as 330A, except the same cartel rigged 36 bids during 7/01-12/04 on tenders for diabetes (blood glucose) testing reagent strips by 22 hospitals in Portugal; fined a much higher amount by PCA	Four mostly identical bids received by Hospital de Santa Maria in Lisbon, compared to early 2001 bids for the identical product	49-91	91	PCA (10/13/05)
330C. Same as 330B.	Same as above, new sales data	49-114	114	Connor (2013), PCA (10/13/05)
331. The Swedish asphalt paving cartel of 11 Swedish, Finnish, and Norwegian companies rigged bids 1995-2002 on tenders by the National Road Administration (NRA) and several municipalities; the NRA was held complicit; fined by the national antitrust authority	A survey of road-services procurement officials found a significant drop in prices of asphalt paving following the end of the cartel	25	--	OECD (2005b: 24)
332. From 2000 to 2004, 10 flour millers in Korea fixed prices; 8 of the 10 were fined by the KFTC	Appears to be the peak increase from about 1999	--	40	<i>Yonhap</i> (3/3/06)
333. From 2001 to 2004 102 members of the Portuguese Assn. of Shipping Agents set "maximum" (i.e., target prices for shipping-agent services ; Assn. fined by PCA in 2005	PCA decision reports "one case" (may not be typical) of a price impact from 2001 to 2002 for "assistance to the crew outside port limits"	--	2,024	PCA (2006)
334. In 1989 the house of a Washington, DC schoolteacher was sold at public real estate auction by her court-appointed conservator; a bid-rigging ring was later convicted for lowering the house price.	The designated winner of the bid paid \$22,000 for the house that was soon sold for \$36,500; market sale is a yardstick	-39.7	--	Stucke (2006: 504), DOJ (1990)
335. Four companies were convicted and fined in Norway for fixing the prices of corrugated cardboard paper from 1983 to 1990; total affected sales was NOK 5.3 billion (\$842 million); decision sustained on appeal to the Supreme Court	The chief economist of the Competition Authority cites an expert opinion (used by the Court?) that the overcharge was NOK70 to 80 million and the deadweight loss 30-40 million; probably econometrics	8.3-9.5	--	Sølgard (2007:14-15), Sunnevåg (2007)
336A. As many as 40 insurance companies and insurance brokers in the US and UK conspired to rig bids on commercial insurance brokers' contingent fees paid by buyers of insurance from 1/2001 to 10/2004; civil suits by many of the state attorneys general (initiated by New York) obtained more than \$3 billion in restitution and civil penalties by early 2007; fees were 0.3% to 0.4% of the insurance premiums	Several settlements mentioned the agreed restitution (single damages) and the size of the companies contingent fees	-2.9 to -6.1	--	<i>AP</i> (2006-07), <i>Insurance Business</i> (2006-07)
336B. Same as 336A	Same as above method for Prudential Ins. Co. settlement	-27.5	--	<i>AP</i> (12/12/06)
336C. Same as 336A	One winner of a bid had a contract to pay a side payment to a loser of 10% to 15.75%; I assumed that the two divided these yardstick profits equally	-20 to -31.5	--	New York State Attorney General (2006: 2)

336D. Same as 336A	Client A charged 19.6% more than target price (price with normal profits)	-19.6	--	New York State Attorney General (2006: 5)
336E. Same as 336A	After bid rigging, Client B charged 111% more in 8/2002 than year before	-111	--	New York State Attorney General (2006: 5-6)
336F. Same as 336A	After bid rigging, Client C charged 65% more in 10/2002 than year before	-65	--	New York State Attorney General (2006: 7)
336G. Same as 336A	Client G charged 65% more than target price (price with normal profits) for lower quality insurance with more exclusions	-20+	--	New York State Attorney General (2006: 8)
337. Three Korean and one US petroleum company were criminally convicted and fined for fixing the prices of light oil products (Gasoline, diesel, kerosene) in Korea , 4/1/2004 to 6/10/04;	The KFTC decision estimated customer damages at \$255 million on sales of \$1701 million	15.0	--	<i>Yonhap</i> (2/23/2007)
338. Four ice cream manufacturers were fined in Korea for price fixing from May 2005 to March 2007; the 4 controlled 80% of the Korean market	The KFTC decision calculated the increase on major items from 5/05 to early 2007	--	42.9	<i>Yonhap</i> (3/18/2007)
339. Two French cement manufacturers colluded on prices and entry with two local distributors and two wholesale trade associations in the Haut-Corse region of Corsica from 1977 to 2007; all six entities were fined	The decision of the Conseil de la Concurrence compared prices in Corsica with prices in the nearest Italian and Greek production areas	25	--	Conseil de Concurrence press release (3/12/07)
340A. The authors surveyed a random sample of 495 lots at auctions of basmati rice during the Oct.-Nov.1999 season in Panipat, Hariyana, India . The auctions are oral ascending (English) bids managed by an auctioneer in a regulated market. There are many small farmers that sold lots to one large local miller and three large distant millers (CR4=55%) and to 5 to 10 additional small local millers; the 3 distant millers are represented by commission agents that (perversely) make larger fees when the large local miller withdraws from bidding on a lot and when the 3 collude on lowering the procurement price.	Controlling for quality (7 characteristics) and weeks, an econometric monopsony model of asymmetric overt collusion by bid rotation between the largest buyer and the next 3 buyers predicts the winning bid price best; numerical analysis is used to calculate the <i>undercharge</i> for the largest buyer when the other 3 large millers don't bid; peak is when only 6 buyers bid	-7.1	-8.4	Banerji and Meenakshi (2004b: Table 5)
340B. Same as 340A.	Same as 340A, except numerical analysis is used to calculate the undercharge for the the 2 nd , 3 rd , and 4th largest millers when the largest doesn't bid; peak is when 13 buyers bid	-0.16	-0.23	Banerji and Meenakshi (2004b: Table 5)
341. The authors surveyed a random sample of 421 lots at auctions of wheat during the April-May.1999 season in Nerala, Punjab, India . The auctions are oral ascending bids managed by an auctioneer in a regulated market. Many	Controlling for quality (4 characteristics) and weeks, an econometric asymmetric <i>monopsony</i> model of overt collusion by bid rotation	-2.2 to -2.9	-3.25	Banerji and Meenakshi (2004a: Table 7)

small farmers sold lots to one large local miller or two large distant millers (buyer CR4=45%) and to 6 to 13 additional small local millers; the authors compare winning prices in a bid-rotation model of overt collusion with a competitive model in which all 3 large buyers bid simultaneously.	among the 3 largest buyers; numerical analysis is used to calculate the undercharge when 2 of the 3 large millers don't bid; mean is when there are 9 or 10 small buyers bidding; peak is when only 7 buyers bid			
342A. The French Conseil de la Concurrence fined six groups the maximum possible for bid rigging on 88 tenders for construction of high schools in Ile-de-France region during 1989-1996	The Decision gives several examples of increases in profit rates from the normal industry rate; for the school at Coulommieres, France	11-15	--	Conseil de la Concurrence (5/9/2007: 130)
342B. Same as A, except a high school at La Courneuvre, France	Same method (constant-profit-margin) as in 342A	11-14	--	Conseil de la Concurrence (5/9/2007: 130)
342C. Same as A, except a high school at Chatenay Malabry, France	Same method (constant-profit-margin) as in 342A	11-14	--	Conseil de la Concurrence (5/9/2007: 130)
342D. Same as A, except a high school at Sartrouville, France	Same method (constant-profit-margin) as in 342A	12-15	--	Conseil de la Concurrence (5/9/2007: 130)
343A. Four manufacturers of acrylic glass (or polymethyl methacrylate/PMMA) were fined by the EU for price fixing from 1/1995 to 8/2005; in 2006 a U.S. class action alleged that the three largest of those four companies had fixed U.S. prices of both PMMA and the main input MMA (acetone) from 1/1995 to 12/2003	The simple mean 1995-2002 ('03-'05 NA) EU transaction price of \$1.302 per kg. was divided by the 1993 and 1994 "before" prices; peak is 1995	17.3-26.4	79-93	Connor (2013) from Bizzari (2003: 41-43)
343B. Same as 343A, except for the U.S. domestic market	The simple mean US market price 1995-2003 was \$0.61 per lb., up from \$0.52-\$0.55 in 1993-94; peak year is 1997	17.3-19.6	29-40	Connor (2013) from Bizzari (2003: 41-43)
343C. Same as 343A, except refers to 1995-2002 US exports	Mean export price \$0.534 per lb., up from \$0.45-\$0.47 1993-94; peak is 1996	13.6-18.7	28-33	Connor (2013) from Bizzari (2003: 41-43)
344A. In early 1888 U.S. manufacturers formed a national jute textile cartel and immediately made side payments to 8 small members to cease production; despite a partially successful boycott by cotton farmers, prices remained high for two seasons (fall 1888 and fall 1889); prices fell 32% in 1889 because of new entry; by 1890 cartel members controlled only 52% of the market.	But-for price is average of Jan. 1886-June 1888	71.2	71.2	(Holmes 1994)
344B. Same as 344A.	But-for price is average of fall 1890 to fall 1892	76.1	76.1	(Holmes 1994)
345A. 65+ airlines raised prices of US-UK air cargo services from "as early as" 3/2002 (actually 1/2000) to 2/14/2006 by colluding on fuel surcharges, which rose 1000%, much faster than fuel costs; US guilty pleas began in July 2007	From British Airway's fine, the minimum provable overcharge is \$200 mil. on sales of \$488.7 mil.	20.5+	--	DOJ (7/31/2007) guilty plea
345B. 65+ airlines raised prices of US-Korea air cargo services from 1/1/2000 to 2/14/2006 by	From Korean Air's fine, the minimum provable overcharge	12.4+	--	DOJ (8/31/2007) guilty plea

colluding on fuel surcharges, post 9/11 security surcharges, and the base rates; fuel surcharges alone rose 500%; US convictions began 8/2007.	on cargo and passenger sales is \$150; total sales are \$1214 mil.			
345C. Same as 345A, except ROW prices	Same as above, but new sales data	20.17	--	Connor (2013)
345D. Same as 345A, except EU prices	Same as above, but new sales data	18.6	--	Connor (2013)
345E. Same as 345A, except US & CA	Same as above, but new sales data	12.3	--	Connor (2013)
345F. Same as 345A, except world prices	Same as above, but new sales data	20.46	--	Connor (2013)
347A. Two+ airlines raised prices of US-UK Transatlantic air passenger services from 8/2004 to 2/14/2006 by colluding on fuel surcharges, post 9/11 security surcharges, and the base rates; US convictions began 8/2007.	From Korean Air's plea agreement, the fine of \$100 mil. is not based on the alternative sentencing provision, so no minimum overcharge can be inferred	10	--	DOJ (7/31/2007) guilty plea
347B. Same as 347A, but refers to fuel surcharge only	DOJ reports fuel surcharge rose from \$10/ticket to \$110 from 5/04 to 2/06 ; spot jet fuel prices rose from ca. \$41.40/bbl. in 3/04-4/04 to \$85/bbl. in late 2006; peak is early 2006	470	893	Antitrust Division (2008: 38), Factiva search
347C. Same as 347A, refers to ticket prices	Cost-based analysis, airfare prices	14-26.7	--	Connor (2013), DOJ Report of Congress (2013)
348A. Two+ airlines raised prices of US-Korean Transpacific air passenger services from 8/2004 to 7/16/2006 by colluding on fuel surcharges;	From Korean Air's fine, the minimum provable overcharge on cargo and passenger sales is \$150; total sales are \$1214 mil.	12.4+	--	DOJ (8/31/2007) guilty plea
348B. Same as 347A, but refers to fuel surcharge only	DOJ reports fuel surcharge rose from \$0.10/kg. to \$0.60/kg. from 5/04 to 2/06 ; spot jet fuel prices rose from ca. \$29/bbl. in 2002 to \$85/bbl. in late 2006; peak is early 2006	50	300	Antitrust Division (2008: 38), Factiva search
348C. Same as 348A	New affected commerce data	14.2	--	Connor (2013), DOJ (8/31/2007) guilty plea
349A. From 1/1994 to at least 7/1996, four Israeli household liquid propane (LPG) gas distributors controlling 92% of the market fixed prices; in 2004-2007 the companies and 15 executives were fined or imprisoned.	Estimate of post-restructuring price decreases made by the Israeli Finance Ministry	25	--	Wrobel (2007:17)
349B. Same as 349A	Estimate of post-restructuring price decreases made by the Federation of Israeli Chambers of Commerce	40-45	--	Wrobel (2007:17)
350. The author studies several true private, hard-core raw materials cartels active in Germany in 1919-1931; products include anthracite coal, iron, steel, basic steel products, glass, and cement; all were protected by high tariffs	Author compares price indexes of protected cartelized raw materials for the years 1929-31 to a yardstick of unprotected raw materials sold primarily as exports; peak is 1931	30.1	52.5	Bloch (1932: Table 1)

351. A global cartel convicted by the EU in isostatic graphite blocks involved 9 firms from 7/1993 to 2/1998; meetings began in fall 1988.	The price in the EU in 1/1997 compared to the price in 1/1994.	--	52.7	EC (12/17/2002), Harrington (2007:91)
352A. Potash Export Cartel based in Saskatchewan, Canada (Canpotex), Russia , and Belarus consisted of six mining firms with 100% of Canadian exports and two Eastern European national monopolies (comprising 82% of world supply in 2010) to world markets; first episode began mid 1987 and ended 1993; sued by US buyers and settlement paid in 2013. This cartel is unrelated to Cartel #73.	Class action by US fertilizer makers. Author states that the 60 to 75% increase in prices in 1987-93 entirely explained by anti-dumping tariffs imposed by the US Intl. Trade Commission in 8/87	0	0	Scherer (2007: 4-5), Jenny (2010)
352B. Same as 352A, except examines second episode, roughly 1/2005 to 12/2011.	Simulation of industry; Scenario 2 assumes that the Canadian company Potash Corp. will transition to a full production mode during 2012-13; predicted 2014-15 prices are the competitive benchmark; peak decline is in 2015	190	196	Conference Board of Canada (2010: Table 21)
352C. Same as 352B.	Simulation of industry; Scenario 2 assumes that the Canadian company will transition to a full production mode during 2012-13; predicted 2016 prices are the competitive benchmark	32	--	Conference Board of Canada (2010: Table 21)
352D. Same as 352C, except examines part of second episode, roughly 1/2008 to 11/2010.	Article uses average 1980-2004 prices (\$100-\$150/t) as the benchmark; peak year is 2009.	259-438	483-775	Jenny (2010)
352E. Same as 352C.	Econometric model using an estimated supply relationship; "The dynamic Lerner index averaged about 0.4 over 2010-2012"	40	--	Taylor (2013: 50)
353A. Collusive (i.e., significantly supra-Cournot) pricing conduct is inferred for the Brazilian cement industry in 1988-2000 from plant-level data: 57 plants owned by 12 firms operating in 17 states; mean local CR2=83%, CR4=97% and HHI=4494.	Econometric model finds 40% of all possible time-plant-pairs had competitive prices, 33% are 20% above Cournot, another 20% above 10%, and another 8% above zero; assume mean collusive price effects are 30%, 15%, and 5%, respectively	14.8-21.8	--	Salvo (2007: 28)
353B. Same as 353A.	???	4.5	--	Connor (2013)
354. In 9/1996 33,000 travel agents and their counsel were paid \$86 million for allegations in Airline Ticket Commission Antitrust Litigation of collusion beginning 2/1995 by 7 U.S. airlines with 85% of industry sales; affected commission revenues were about \$7.98 billion	An industry analyst in CSFB Bank calculated that one airline saved \$25-\$35 mil. of \$510 mil. paid in commissions in 1997	4.9-6.9	--	<i>Houston Chronicle</i> (9/4/1996: 1D), Lande and Davis (2007: Case 1)
355. In Lease Oil Antitrust Litigation 31 large petroleum companies (some foreign) paid \$164	Plaintiffs' expert's econometric model found	-1.62	--	Lande and Davis (2007: Case 24),

million for undercharging royalty recipients by depressing the price of crude oil from 1/1986 to 1993	damages of \$359 million; total royalties from <i>Statistical Abstract of US</i>			Connor (2007a)
356A. In <i>Microcrystalline cellulose Antitrust Litigation</i> US plaintiffs got a settlement from the 2 members of this 1984-95 global cartel ; medical grade US prices	Plaintiffs' expert's econometric model for the Pharma class	22.1	--	Lande and Davis (2007: Case 20)
356B. Same as 356A, except food grade	Plaintiffs' expert's econometric model for the food-processing class	18.5	--	Lande and Davis (2007: Case 20)
356C. Same as 356A, except both grades' world prices	Used before price	35	--	Connor (2013)
357. Covers loan markets in the Honk Kong banking sector 1991-2002	Econometric conjectural-variations model	0	0	Hong Kong Monetary Authority (2007)
358. Report of a decision of the Pakistan Monopoly Control Authority of a cement cartel of 16 local firms that raised prices from 10/16/98 to 2/9/99; the Ministry of Commerce intervened to cancel the restitution, allowing the cartel to continue until at least 7/2007	The Authority calculated the market overcharge of 4 billion rupees and the overcharge for each company for restitution using selling price before cartel	74	74	Mehmood (1999)
359A. The Indian jute yarn and bag industry, which dates from 1855, began restricting output as early as Feb. 1886 through late 1891 because of excess capacity. Excess capacity again developed in the early 1920s, reaching 30% by 1929, and prices fell 40% to 50% from 1925-29 to 1930-1931. The 18 members of the Indian Jute Manufacturers Assn., which controlled 90 to 97% of supply in the 1930s, reduced hours in 1930-31 by 33% compared with non-members. Fringe producers' share rose from 3% to 9%.	The cartel had cheating and internal dissention about how to handle the fringe producers; the "doves" in the IJMA wanted to accommodate the fringe and avoid a price war; but industry output rose about 45% from 1931-32 season to 1936-37, much of it going to the fringe. Cartel ineffective in slowing price declines.	0	0	Gupta (2005)
359B. In 1933-37, the profits per loom for the "hawks" in the IJMA declined to 83% of 1929 levels and were half the levels of non-members. In March 1937, the output restrictions were lifted and prices fell to new lows in Dec. 1937-Feb. 1938. With the encouragement of the Bengal government later in 1938, the enlarged IJMA reimposed output limits in Jan. 1939	Prices in 1939 are compared to the 1937-38 price war year; the onset of WWII in 9/39 prevents an assessment of the cartel's long-term effects.	19	--	Gupta (2005)
360. In Feb. 2000, the retail gasoline stations in Florianopolis, Brazil , through their local owners' association, agreed to raise prices through 12/2000; companies and owners fined by CADE	An analysis of prices in the second half of 2000 by the Brazilian antitrust authority (CADE), compared to Jan. 2000 prices	20	20	Pfeiffer (2005: 3)
361A. In early August 1996, Brazil's three largest and dominant steel manufacturers agreed to raise their prices of hot-rolled steel sheets and announced their decision to the Ministry of Finance in advance; they were fined by CADE in 1999.	An analysis by CADE ruled out changes in costs; before-and-after	3.6-4.1	--	Pfeiffer (2005: 3)
361B. Same as above, but for cold-rolled steel sheets	An analysis by CADE ruled out changes in costs; before-and-after	4.3-4.5	--	Pfeiffer (2005: 3)
362. From 2005 to 2006, at least five US, UK,	An estimate of the German	5	5	BKT (2008)

and German manufacturers of toiletries (liquid hand soap, shower gel, and toothpaste) in Germany colluded on the 2005-06 price increase; the firms and their sales executives were fined in 2/2008	Federal Cartel Office developed from direct (internal historical records) evidence			
363. Nine cement companies were found guilty of bid rigging in the Jalalpur, India market from 11/24/2000 to 1/19/2001	From the decision of the Indian Monopolies and Restrictive Trade Practices Commission, apparently the before price being used	20	56	<i>Indian Express</i> (March 3, 2008)
364. Four pharmaceuticals distributors in South Africa were accused of bid rigging against hospitals from 1998 to 2007; fines recommended to Tribunal	Report of the Competition Commission estimated price effects from 2001, during a brief non-collusive period	10-15	--	Barbeau (2008)
365. The Korean Fair Trade Commission imposed large fines on 3 sugar refiners with 100% of the national market for colluding 1991-9/2005	KFTC staff compared the increase in 2004-05 sugar prices with a yardstick of other comparable industrial goods	20	--	KFTC (2008: 58)
366. Restitution was paid by two of 13 distributors of food in New York City who rigged bids to supply schools in the NYC Board of Education from 5/1996 to 4/1999	Total restitution sought is over \$20 million on contracts worth over \$200 million	10	--	DOJ (8/9/2001)
367. Procurement of many goods and services by the U.S. Defense Department in 1960s	Author compares bid prices of identical products with several versus only one bidder (sole source contracts)	50	--	Yuspeh (1976)
368. Two firms out of 4 were convicted of bid rigging tenders in construction of sewers in Klaipeda, Lithuania in 2000 worth \$4.43 million;	Commission decision cites price increase based on yardstick of normal prices charged by two guilty parties and other rivals in market	22.3	22.3	OECD (2003a: 2)
369A. River boat operators between Phnom Penh and Siem Reap, Cambodia colluded on prices during ca. 2005.	Immediate increase in prices for Cambodian nationals from USD 5 to USD 10.	100	100	Bhatia (2006: 5).
369 B. Same as 369A. Note price discrimination.	Immediate increase in prices for non-Cambodian nationals from USD 5 to USD 25.	400	400	Bhatia (2006: 5).
370. "Mylan Laboratories, Inc., the nation's second largest generic drug manufacturer, and three other companies, were charged [in 12/98] ... by the Federal Trade Commission with restraint of trade, monopolization and conspiracy to monopolize the markets for two widely-prescribed anti-anxiety drugs , lorazepam and clorazepate." Later convicted and required to disgorge profits. Span 1/98-12/98.	Report of FTC estimates average annual increase from 1997 in range of 1400% to 2200%.	1400-2200	3000	FTC (1998)
371A. A knockout-auction bidding ring of 11 dealers from US, UK, France colluded against other buyers in stamp auctions from about 1980 to July 1997, mostly in New York City auction houses, but also in the UK; world prices.	A structural econometric model estimates true damages (less than half of "naïve damages," i.e., side payments by winner) from data on 1781 lots auctioned during 6/1996-6/1997	-3.4 to -4.2	--	Asker (2008: Tables 6 and 7)
371B. Same as 371A.	mean damages to sellers plus to non-bidders/mean lot value	10.1-10.4	--	Asker (2008)

372. Four manufacturers of chocolate candy are accused of fixing prices in the EU and North America from December 2002 to Dec. 2007. Prosecuted by Eur. Commission, Germany, and private plaintiffs in No. America	Plaintiffs allege effective price increases of 10% (12/02), 6% (12/04), and 5% (4/07) after 11/2002. Enter this obs only if conviction occurs after 4/09.	15.9	22.4	Duffy (2009: 1)
373. Drug-gang cartel , operated illegally in 12 square blocks (later 24 blocks) of a poor urban neighborhood of Chicago; had a strong local monopoly internally (30% of sales) and on sales to outsiders buying on bordering thoroughfares (70% of sales); created by violent enforcement methods; employed 500 to 690 persons, of which about 440 to 490 were full time; uniquely detailed internal records of drug-gang cartel; dates unknown, approx. 1992-96.				Levitt and Venkatesh (1998), Levitt and Venkatesh (2000)
373A. During peaceful pre-expansion phase (12 blocks of territory) when city-wide prices were relatively high	Mean mark-up over variable costs (cast-based method)	144	--	Levitt and Venkatesh (1998: Table 4)
373B. Same as 373A, except months of open warfare with a gang bordering to the North	Mean mark-up over variable costs (cast-based method)	-7.4	--	Levitt and Venkatesh (1998: Table 4)
373C. During peaceful post-expansion phase (24 blocks of territory): labor costs doubled and city-wide prices fell 40% from earlier period	Mean mark-up over variable costs (cast-based method)	27	--	Levitt and Venkatesh (1998: Table 4)
373D. Same as 373A, except post-expansion phase (24 blocks of territory) during months of open warfare with a gang bordering to the North, which ended with territorial expansion	Mean mark-up over variable costs (cast-based method)	28	--	Levitt and Venkatesh (1998: Table 4)
373E. Covers all 4 episodes (373 A, B, C, and D)	Regression analysis explaining variation in the monthly Lerner analysis; omits city-wide drug prices; mean of all periods	88.7	--	Levitt and Venkatesh (1998: Table 6)
373F. Same as 373A, except 5 months before new territory was integrated; unclear, but may be period of open warfare with the drug gang bordering to the North	Regression analysis explaining variation in the monthly Lerner analysis; omits city-wide drug prices; effect on mean level of "transition" period	14.9	--	Levitt and Venkatesh (1998: Table 6)
373G. Same as 373 B.	Regression analysis explaining variation in the monthly Lerner analysis; omits city-wide drug prices; effect on mean level of "price war" periods	-4.8		Levitt and Venkatesh (1998: Table 6)
373H. Same as 373 E.	Regression analysis explaining variation in the monthly price of drugs sold; omits city-wide drug prices; mean price compared to "price war" periods	30.9		Levitt and Venkatesh (2000: Table V)
373I. Same as 373 E.	Regression analysis explaining variation in the monthly price of drugs sold; omits city-wide drug prices; mean price compared to "transition" or possible war period	22.7		Levitt and Venkatesh (2000: Table V)

374. The Italian antitrust authority fined 6 manufacturers (1 from US) and their “mandatory consortium” that recycled batteries to extract lead; collusion occurred 2002-07	Report of the authority compared 2002-04 prices of recycled lead in IT with yardstick of same prices in UK and DE	31.8	--	AGCM (2009)
375. Lamp oil (a/k/a Illumination oil or kerosene) began to be extracted from crude petroleum in the 1850s, eventually replacing whale oil; export prices were collected starting in 1879 and domestic prices from 1885; the Standard Oil Trust was formed in 1882; though formally “dissolved” in 1892 after the Sherman Act was passed in 1890, it was found guilty of monopolization in 1911.				Jenks (1900: 150-157)
375A. In 1896-97, the Standard Oil monopoly was challenged in New York City by the entry of Pure Oil Co., which built a more efficient plant than previous independents.	The decline in the NYC price of standard-grade illuminating oil in barrels fell from \$8-10 in 1895 to about \$6.50 in 1896-97; trough was \$5.50 in 12/1897.	19-35	31-45	Jenks (1900: 150-152 and chart)
375B. In 1899-1900, the price-cost margin between crude oil and refined oil in New York City “decidedly” increased from \$4 in 1896-97 to \$5 in 1899; the Trust increased its dividends 30% in each of the past 3 years; these trends are also seen in Chicago and Cincinnati.	Much of the increase in the gross margin in 1899 can be explained by the added costs of refining a broader range of products and by higher input costs, but higher profits seem to account for at least half of the margin increase since 1896-97; peak is Dec. 1899.	10	18.8	Jenks (1900: 153-155 and chart)
376A. The U.S. tin plated steel cartel (American Tin-Plate Co.), joined by all 6 to 8 major producers, began in January 1899 after a two-year period of declining profits (up to 50% by Oct. 1888); prices of imported tin plate remained about \$0.40 to 0.70 above the Pittsburg price to end of 1899.	The gross margin in the industry, using the price of “American coke tin plate” in Pittsburg rose to about \$1.15 to \$1.20 in 1899-1900, up from \$0.60-\$0.85 in June-Oct. 1898; peak in Mar. 1899.	35-100	117	Jenks (1900: 157-164 and chart)
376B. Author shows that tin-plate-industry-cartel prices are by mark-ups over import price + tariff -- almost exactly -- as tariffs change; pricing began before cartel officially formed.	Compares actual NY wholesale prices/lb. 1891-99 of 14x20 tin plated sheets with pre-tariff import prices as yardstick; peak is 1884	52	81	U.S. Industrial Commission (1901: 557-59)
377A. In January 1899, the the Am. Steel and Wire Co. trust was formed, which controlled 65 to 95% of the US market for barbed steel wire . The gross margin increased from about \$1.00 in 1898 to \$1.50 to \$2.00 in 1899, in part because of the ownership of patents; peak was \$2.00 in Oct. 1899; ended 12/1899.	The price increased from about \$1.60 to \$1.70 in 1898 to \$2.50 to \$3.00 in 1899; peak was \$3.00 in Oct. 1899.	47-88	88	Jenks (1900:165-170 and chart)
377B. Same as 377A, except that 2 nd episode began when, in response to rapidly falling prices in early 1900 (about 25%), the Wire Trust closed several of its mills; producers outside the Trust followed with closures of their own; gross margins rose well above 1897-98 levels and remained high until mid 1915.	Prices of barbed wire stabilized in 4/1900, declining very slowly until the end of 1914; competitive bench mark is 1897-98 prices; peak is 1/1991-8/1902.	233	287	Jenks and Clark (1929: 119-122 and chart)

378. In January 1899, the the Am. Steel and Wire Co. trust was formed, which controlled 65 to 95% of the US market for smooth steel wire . The gross margin increased from about \$0.50 in 1898 to \$1.50 to \$2.00 in 1899; peak was \$2.00 in Oct. 1899.	The price increased from about \$1.12 in 1898 to \$2.00 to \$2.95 in 1899; peak was \$2.95 in Oct. 1899.	79-163	163	Jenks (1900:165-170 and chart)
379. A European centered global borax cartel was formed in 1878-79 and operated until Jan. 1899. Fitfull collusion occurred in the US from 1878; a US monopoly (Pacific Borax a/k/a the Borax Trust) was formed about 1888. Prior to 1894, U.S. producers had an understanding with the European cartels: a US monopoly for Pacific Borax and the rest of the world for the Europeans. In 1894, a US tariff reduction sparked aggressive warfare by Pacific Borax on the European cartel. In June 1896, a joint US-UK borax company was formed by Pacific Borax. The Europeans capitulated in Jan. 1899, selling all their assets to the Borax Consolidated Works trust (a UK company) of 12 companies, a global near monopoly that collapsed in 1913, but came out of bankruptcy as a public UK company. By 1980, U.S. Borax had become part of Rio Tinto Group.	To obtain a competitive price, one can chart changes in the delivered New York price of refined borax as the US import tariff varied from 5¢ (9/1890 to 8/27/1894), to 2¢ (8/28/1894 to 8/1997), to 5¢ (9/1897 to late 1999). After a few months of adjustment and near the end of these three periods, the US price settled down to 8.25¢, 5.25¢, and 7.25¢, respectively. Pacific Borax was known to mark up to the import price (the yardstick) plus the tariff. Thus, the competitive price ranged from 2.25¢ to 3.25¢ and was falling during the 1890s. Pierce and Holt also conclude that 2.25 to 3¢ is the competitive price.			U.S. Industrial Commission (1901: 567-570), Holt (1907: 223- 224), Pierce (1913: 63-65), Rothwell (1893-1921)
379A. For the period 9/1890 - 8/27/1894	Same as above; peak 10/1890	165-282	322	U.S. Industrial Commission (1901: 567-570), Rothwell (1893-1921)
379B. For the period 8/28/1894 -8/1897	Same as above; peak 9/1894	77-156	211	U.S. Industrial Commission (1901: 567-570), Rothwell (1893-1921)
379C. For the period 9/1897- 12/1899	Same as above; peak is 1999	115-211	222	U.S. Industrial Commission (1901: 567-570), Rothwell (1893-1921)
380A. The U.S. window glass cartel began in 1880-1892 (1 st episode) as the Window Glass Manufacturers' Assn.; set prices, plant output, and wages; fell apart 1893-95	No prices, but deemed "very effective"	--	--	U.S. Industrial Commission (1901: 564-566)
380B. Am. Glass Co. trust re-formed 1895; a selling pool for 85% of US production until Oct. 1999 when succeeded by Am. Window Glass Co.; pool made very high profits 1896-98; ended 1899; import duties 80-100% of import price.	Price of glass in 1893 relative to 1896-99	100	100	U.S. Industrial Commission (1901: 564-566)
381. Two South Korean manufacturers (one and affiliate of St. Gobain of France) of flat glass with 84% of the national market fixed prices from 11/2006 to 3/2009	KFTC decision uses before method	40-50	--	Yoon (2009)
382A. Nine companies with with extensive, hidden cross-ownership colluded on mobile telephone service rates in Indonesia from 2003	The KPPU compared actual rates on purchases by consumers with a yardstick:	119-207	--	KPPU Decision (2007), Jarkarta Post (2007)

to 2006; the Indonesian antitrust authority KPPU fined all 9 the maximum possible in November 2007.	average prices of the same services in nearby countries in Southeast Asia.			
382B. Same as 382A.	Same as above, but re-decided after adverse Court decision	11.1	--	KPPU Decision (8/20/2010)
383. The UK bleaching powder industry was centered in Lancashire in the 19 th cent.; major input was mined salt, converted to chlorine with the LeBlanc process; exports to US were only source of bleach until 1897 when two US chemical firms (Dow Chemical and Mathieson Alkali) began production using a new low-cost electrolytic production method; two more US producers entered industry in 1906 and 1908.				Barker and Harris (1993), McCrosty (1907), Levenstein (1995: 595-601)
383A. In response to falling prices, Lancashire Bleaching Powder Manufactures' Assn. formed in 1883, dissolved in Dec. 1889; aggressively bought or drove entrants out of business.	Prices rose to £7 per ton in 1884 from £3 7s. 6d. in 1883	--	107	Barker and Harris (1993: 440-444)
383B. In Feb. 1891 UK manufacturers merged to form the United Alkali (predecessor of ICI) cartel; cartel ceased to be effective around 1897-98	Prices rose during October from £5 to £6 per ton	20	20	McCrosty (1907: 187-188)
383C. Same as 383B	In 1898, German producers adopted the electrolytic method and exported to UK; prices fell from £6.35 in 1897 to £4 in 1903-05	59	--	McCrosty (1907: 192)
383D. In late 1899 or early 1900 a new unnamed syndicate was formed that lasted until at least 1905; colluded with German cartel on exports to US (possibly combining German manufacture with UK cartel's US distributors)	Prices in late 1900 to 1902, compared to 1898-99 when no cartels existed	26	--	McCrosty (1907: 141-143), Levenstein (1995: 597-98)
383E. Same as 383D	US prices declined from \$1.75 in 1901 to \$1.50 in 1911	17	--	Levenstein (1995: 595 fn. 67)
384. When the Lancashire bleaching powder cartel operated (1883-1889), a US distribution monopoly was given to New York's James Lee & Co.	The US price in 1881 was \$1.07/cwt., but rose to \$2.25 in 1891	111	--	Levenstein (1995: 595 fn. 67)
385A. Three manufacturers of the chemical intermediate MCAA (monochloroacetic acid) held a 53-55% global share (and 90%+ EU share) operated several episodes of a global cartel from the late 1970s to May 1999; this first episode in EU began about Jan. 1984, ended Dec. 1992.	After constant 1984-89 prices, there was a decline in EU prices in 1/91-12/92 (1993 after price) due to a new plant opening; peak is 1984-89.	15.2	18.1	EC Decision (1/19/2005: §2.3.3)
385B. Same as 385A, except a 4 th company joined the EU cartel and the cartel began improved monitoring of sales data; episode is 1/1994-5/1999	There was a low price in EU in 1993 (before price) due to a new plant opening; peak is 1997	15.6	21.2	EC Decision (1/19/2005: §2.3.3)
385C. Same as 385A+B for world	Econometric trade model of short-run (1 to 2 years) price effects after cartel collapses.	12.2-31.1	--	Levenstein et al. (2011: Table 4 and 5)
385D. Same as 385C	Econometric trade model of long-run (3 to 4 years) price effects after cartel collapses.	25.4-30.1	--	Levenstein et al. (2011: Table 4 and 5)

385E. Same as 385C	Authors calculate the mean price changes with and after collusion and show significant changes in mean and dispersion.	33.7	--	von Blanckenburg <i>et al.</i> (2010: Table 2)
385F. Same as 385C	Econometric trade model of short-run (1 to 2 years) price effects after cartel collapses.	6.8	--	Connor (2013), Levenstein <i>et al.</i> (2011)
385G. Same as 385C, except for US & CA prices	Econometric trade model of short-run (1 to 2 years) price effects after cartel collapses.	48.2	--	Connor (2013), Levenstein <i>et al.</i> (2011)
386A. From 4/1994 to 10/2002, 8 refiners (100% of market) and 6 large road construction builders (45% of mkt.) colluded on the Dutch bitumen market; fined by EC 9/2006.	Difference in rebates for largest builders and for fringe builders during 4/2000-7/2001; peak is 3/01-4/01	8.6	12.3	EC (9/13/2006: 42-45)
386B. Same as 386A	NL prices of bitumen compared to yardstick of BE, DE, and FR prices 4/2000-10/2002; peak is 7/01-10/01	27.2	28.2	EC (9/13/2006: 42-45)
387A. Two card-issuing consortia of banks, Visa and Mastercard , bank associations with 6000+ members, were successfully sued in US court for colluding on the size of transactions fees charged to retail merchants; the 2004 settlement of \$3.05 billion in compensation (and \$25 billion in injunctive relief) was the largest in antitrust history; dates are 1980? – 2002?	Statement of the judge that as a result of the antitrust case, card interchange fees were reduced by about one-third.	50	50	US District Court in Brooklyn, NY decisions (2003-04)
387B. Same as 387A	Author quotes with approval an overcharge of at least \$40 billion. Estimated affected sales are \$285 billion.	14	--	Schinkel (2010: 2)
388. The seven manufacturers who held rights to the 1894 patent that started the calcium carbide industry formed a cartel in early 1910, after the patent expired; they signed agreements with new entrants in other countries of Europe to create a French market hegemony; after a brief price war in 2/1914, an 8 th manufacturer joined; in Dec. 1915, the government introduced price controls ending the cartel	In 1910, prices rose from 250 to 290 francs, where they held steady through 1914	16	16	Paxton (1992:156-157)
389. Two Indonesian manufacturers/importers of Pharmaceuticals, antihypertensive colluded on prices and were fined by the Indonesian antitrust authority in Sept. 2010.	The KPPU used the yardstick of the usual ratio of local/international prices (2.5:1) and compared it to actual local prices	150-185.7	--	<i>Jakarta Post</i> (9/28/10: 10)
390. Five manufacturers of personal care products in Spain were fined on 5/4/2010 by the Spanish antitrust authority for colluding on reducing the sizes of consumer containers without reducing prices from 2005 to Feb. 2008.	The average reduction in container sizes	15	15	<i>Procurement News</i> (5/4/2010)
391A. More than 13 owners of retail gasoline stations overtly raised prices in Sherbrooke, Canada from 4/1/2005 to 4/18/2006; criminal fines and prison sentences imposed.	Econometric model that used Montreal price changes as a yardstick (Quebec City was closer but not a good yardstick)..	2.8	--	Erutku and Hildebrand (2010):

391B. Same as 391A, except authors employ station-level price data and focus on the role of telephonic communication in four towns in Quebec (Sherbrooke included); these estimates refer to the Bilodeau-led cartel.	Econometric model estimates the absolute value of the decline in margins (2.73 cents per liter) after the announcement of a federal investigation; base is avg. price in Sherbrooke "before" 9 successful episodes	2.8	--	Clark and Houde (2011: 20, 40, and 43)
391C. Same as 391A, except authors employ station-level price data and focus on the role of telephonic communication in four towns in Quebec (Sherbrooke included); these estimates refer to the Bourassa-led cartel.	Econometric model estimates the decline in margins (0.67 cents per liter) after the announcement of a fed base is avg. price in Sherbrooke "before" 9 successful episodes	0.7	--	Clark and Houde (2011: 20, 40, and 43)
392. A farmers' marketing cooperative, United Fresh Potato Growers of Idaho, was formed in Nov. 2004 and controls 85% of fresh Idaho potato supply.	Econometric models (ARCH and GARCH) predict price increases after 1994 and after production cost increases	56-60	--	Bolotova (2009), Bolotova et al. (2008, 2010)
393. In 1995 a cartel of chicken producers was formed in the Lima-Callao region of Peru ; in Jan. 1997 the national competition authority FCC fined 21 firms for illegal supply reduction.	Econometric model with many food substitutes underpredicts the actual price during the collusive period; result from the most conservative model shown	2	--	Pirola (2003: 420)
394A. Three manufacturers of roasted coffee in Germany are alleged to have colluded from 1/1976 to 6/2008; large fines imposed by the Federal Cartel Office in 2010	Authors calculate the mean price changes with and after collusion and show significant changes in dispersion, though not in mean.	4.5	--	von Blanckenburg <i>et al.</i> (2010: Table 2)
394B. Same as 394A	Direct estimate of FCO officials	35.4	--	Federal Cartel Office (12/23/2009)
395. Eight manufacturers of copper plumbing tubes and fittings in EU colluded from 5/1988 to 3/2001; large fines imposed by the EC	Authors calculate the mean price changes with and after collusion and show significant changes in dispersion, though not in mean.	91.5	--	von Blanckenburg <i>et al.</i> (2010: Table 2)
396. Ten manufacturers of gas-insulated electric power switchgear colluded globally from 1988 to 2004; large fines imposed by the EC	Authors calculate the mean price changes with and after collusion and show significant changes in dispersion, though not in mean.	6.1	--	von Blanckenburg <i>et al.</i> (2010: Table 2)
397A. Eight manufacturers of hydrogen peroxide colluded globally from 1/1994 to 12/2000; large fines imposed by the EC	Authors calculate the mean price changes with and after collusion and show significant changes in mean and dispersion.	35.2	--	von Blanckenburg <i>et al.</i> (2010: Table 2)
397B. Same as 397A	Probably same as above	50.0	--	Connor (2013)
398. Six manufacturers of marine plastic hoses colluded globally from 1986 to 2007; large fines imposed by the EC and US; price effects for EU.	Authors calculate the mean price changes with and after collusion and find no significant changes in dispersion.	0	--	von Blankenburg <i>et al.</i> (2010: Table 2)
399. Four manufacturers of plasterboard in EU colluded from 1992 to 1998; large fines imposed	Authors calculate the mean price changes with and without	0	--	von Blanckenburg <i>et al.</i> (2010: Table 2)

by the EC	collusion and show significant changes in dispersion, though not in mean.			
400. Thirteen manufacturers of plastic industrial bags in EU colluded from 1/1982 to 6/2002; large fines imposed by the EC	Authors calculate the mean price changes with and without collusion and show significant changes in dispersion, though not in mean.	0	--	von Blanckenburg <i>et al.</i> (2010: Table 2)
401A. Seven manufacturers of nitrile synthetic rubber colluded globally from 1/2004 to 10/2007; large fines imposed by the US & EC	IISR survey of members' prices, relative to before price	15.2	--	International Institute of Synthetic Rubber Producers, Inc. (2004)
401B. Same as 401A, except No. America	IISR survey of members' prices, relative to before price	26.0	--	International Institute of Synthetic Rubber Producers, Inc. (2004)
401C. Same as 401A, except EU	IISR survey of members' prices, relative to before price	81.4	--	International Institute of Synthetic Rubber Producers, Inc. (2004)
401D. Same as 401A, except ROW	IISR survey of members' prices, relative to before price	4.1	--	International Institute of Synthetic Rubber Producers, Inc. (2004)
402. seven manufacturers of synthetic rubbers (nitrile and polychlorene) in EU colluded from 5/1996 to 11/2002; large fines imposed by the EC	Authors calculate the mean price changes with and without collusion and show significant changes in dispersion, though not in mean.	24.9	--	von Blanckenburg <i>et al.</i> (2010: Table 2)
403. From Jan. 1993 to Dec. 2000, five manufacturers (with 90%+ of market) of Automotive refinishing paints, US colluded on paints sold to thousands of small auto repair shops; they did not collude on paint sold to Original Equipment Manufacturers (OEMs); US DOJ investigated but did not fine; cartel members settled civil case in 2003-04	US Producer Price index for other auto paints is compared to yardstick of PPI for auto paints sold to OEMs; cartel ineffective in raising prices from 1993-96; average effect during 1996-2000, peak is 1999-2000.	17.8	40	Connor (2007)
404. During the First World War, the Australian government established the Commonwealth Line to combat the high prices of several British cartels ("The Conference Combine") in Shipping, Europe-Australian wheat ; it operated independently during 1919-1921, but eventually after predatory boycotts, in 1922 the Line was forced to join the Conference Combine.	In 1919, the Commonwealth Line charged much less than the British Conference Combine for wheat shipped from Australia to the UK	53.3	--	Tsokhas (1997 : 361)
405A. After the EC instituted anti-dumping measures to protect the EU's chemical industries from Japanese imports, 17 firms and their subsidiaries colluded on EU prices of low density polyethylene plastic (ldPE) from 1976 to 1985, but Messerlin focuses on the 6/1983 to 9/1984 episode during which share agreements were reached; EC fines were imposed in 1988	The minimum estimate; compares EU market prices with benchmark of 6/1981 to 5/1982 avg. prices, before anti-dumping proceedings public; peak is 12/83-3/84	3.0	3.5	Messerlin (1990: Table 6)

405B. Same as 404A, except a preferred scenario in which cartel is aided by EC antidumping tariffs imposed late 1982	Compares EU market prices with benchmark of Nov. 1980 to two yardstick prices: Japan export prices and US export prices ; peak is 5/84-11/84	11.6	13.4	Messerlin (1990: Table 6)
406A. The Air Route from Seoul, Korea to Ulan Bator, Mongolia was by two airlines cartelized from 1999 to Oct. 2010; fined by the Korean FTC in Jan. 2011.	The KR FTC estimated the competitive price from comparable Korean air routes (yardstick)	3	--	Decision of Korean FTC (1/31/2011)
406B. Same as 406A.	Newspaper's survey of airfares of comparable distance	30	--	<i>Korea Times</i> 1/31/11
407. The Spanish antitrust authority CNC fined 47 companies for bid rigging of 14 public tenders for road construction and repair , 2008-2009; the public authorities publish a benchmark budget for each project and bidders offer discounts from that base budget.	Report of the CNC states that discounts ranged from 1% to 6% instead of the yardstick (normal discounts) of 15% to 30%.	14-24	--	CNC (2011: 1)
408A. The U.S. Forest Service sells timber cutting rights to loggers and wood mills through both open bidding and sealed bidding procedures. These data are from California open bids sales in 1982-1990.	Econometric model predicts prices <i>under</i> pure competition and collusion, without entry allowed	-47	--	Athey et al. (2011: Table V)
408B. Same as 408A	Econometric model predicts prices <i>under</i> pure competition and collusion, with entry allowed	-41	--	Athey et al. (2011: Table V)
408C. Same as 408A, except Idaho, and Montana open bids	Econometric model predicts prices under pure competition and collusion, without entry allowed	-35	--	Athey et al. (2011: Table V)
408D. Same as 408C	Econometric model predicts prices under pure competition and collusion, with entry allowed	-35	--	Athey et al. (2011: Table V)
409. More than 17 competition authorities opened investigations of bank credit-card interchange fees set by Visa, MasterCard and similar bank consortia, 10/02-6/03. Many have alleged collusion between these entities or between banks issuing credit cards; some were rulings after the industry requested an exemption. A few competition authorities fined Visa, MC, etc., but most have issued consent decrees requiring reductions in fees. (In 11 other cases not listed here, central banks, legislatures, or government ministries have mandated reductions). The EC decision was followed by similar national actions by competition-law authorizes of the Hungary, Spain, Austria, Portugal, UK, Norway, Germany, Finland, Chile, and Poland.				Hayashi (2010), OECD (2007)
409 A. European Commission reached a settlement in 2002 with Visa to reduce interchange fees by 12/2007, but Visa reduced them after 2010. The EC charged MC with	MC agreed to reduce credit card fees to 0.3% and Visa to 0.2%; data on previous fee rates are mostly confidential,	133-250	--	Hayashi (2010: 2), Evans and Mateus (2011: 19-20)

illegal price fixing in 12/2007, but while it was under appeal, they settled in 4/2009.	but industry insiders said that they averaged about 0.7%.			
409 B. Same as 409A. European Commission reached a settlement in 2002 with Visa to reduce interchange fees by 12/2007, but Visa reduced them after 2010. The EC charged MC with illegal price fixing in 12/2007, but while it was under appeal, they settled in 4/2009.	Evans and Mateus state that the average EU reduction in fees was 60% (“after” price)	133	--	Hayashi (2010: 2), Evans and Mateus (2011: 19-20)
409 C. Same as 409A, except Australia . The Australian antitrust authority (ACCC) began investigating these fees as a competition-law violation, but relinquished it to the Reserve Bank of Australia in 2003, which imposed a cost-based fee in that year	Evans and Mateus report that the average fee fell from 0.95% to 0.55% (“after” price)	172	--	Hayashi (2010: 1), Bos (2006), Evans and Mateus (2011: 28)
409 D. Same as 409A, except Israel . In 2001 the Antitrust Authority investigated a restrictive agreement in Israel’s highly concentrated credit card industry; seems to have been a civil action; in 2006 a settlement was reached to lower fees.	Interchange fees were reduced through a settlement negotiation from 1.25% to 0.875%	42.9	--	Hayashi (2010: 3), Gilo and Spiegel (2005)
409 E. Same as 409A, except Spain . In 2005 the Antitrust Authority (CNC) investigated a restrictive agreement in Spain’s highly concentrated credit card industry; seems to have been a civil action; in 12/2005 a settlement was reached to lower fees by the end of 2008.	Interchange fees were reduced through a settlement negotiation from 2.32% maximum to 1.1%	111	--	Hayashi (2010: 4)
409F. US, “Wal-Mart” case, U.S. , 10/1992-6/2003; U.S. settlement; refers to change in total banking revenues	Fees during collusion compared to after conviction	3.53	---	Affected sales from Connor (2013), <i>Packaged Facts</i> (Jan. 2008)
409G. US; “AMEX-Discover” case; U.S. , 10/1992-6/2003; refers to change in total banking revenues	Fees during collusion compared to after conviction	3.53	--	Affected sales from Connor (2013), <i>Packaged Facts</i> (Jan. 2008)
409H. US; “Merchant Discount” case; U.S. , 2004-2011; settlement; refers to change in total banking revenues	Fees during collusion compared to after conviction	1.6	---	Affected sales from Connor (2013), <i>Packaged Facts</i> (Jan. 2008)
409I. Korea 1; 1990-12/2005; fines	KFTC analysis	0.94	--	KFTC Decision (3/14/01)
409J. Korea 3; 2004-2011; fines	KFTC analysis	25	---	KFTC Decision (11/20/11)
409K. Australia ; 4/2004-3/2005; consent agreement; changes in fees	Reporting on action of RBA (AU central bank)	72.7	--	Hayashi (2010)
409L. Spain ; 1990-12/2005; changes in fees	Antitrust Authority mandate	52.6	---	Hayashi (2010)
409M. Israel ; 1998-2006; changes in fees	Antitrust Authority mandate	24.5	--	Hayashi (2010)
409N. EU ; 1985-4/2010	EC mandate	57.7-73.2	---	Evans and Mateus (2011)
409 O. Same as 409 E (Spain).	Interchange fees were reduced using a competitive costs approach through a mandate from 1.40% in 1/2006 to 0.35% in 12/2009	200	--	Carbó-Valverde et al (2011)
409 P. Same as 409A, except Switzerland . In 2005 the Antitrust Authority investigated a restrictive agreement in Switzerland’s highly	Interchange fees were reduced through a settlement negotiation from 1.65 to 1.70%	22-31	--	Hayashi (2010: 4), OECD (2013: 117-118)

concentrated credit card industry; seems to have been a civil action; in 2005 a settlement was reached to lower fees.	range to 1.30-1.35%			
409 Q. Same as 409A; refers to fees	Fees during collusion compared to after conviction	172	--	Bos (2006)
410. More than 9 competition authorities opened investigations of bank debit-card interchange fees set by Visa, MasterCard and similar bank consortia, 1990-2005. Many have alleged collusion between these entities or between banks issuing credit cards. A few competition authorities fined Visa, MC, etc., but most have issued consent decrees requiring reductions in fees. (In other cases not listed here, central banks, legislatures, or government ministries have mandated reductions)				Hayashi (2010)
410 A. European Commission reached a settlement in 2002 with Visa to reduce interchange fees in EU by 12/2007, but Visa delayed reducing them until after 2010. The EC charged MC with illegal price fixing in 12/2007 and MC settled in 4/2009.	MC and Visa agreed to reduce debit card fees to 0.2%; data on previous fee rates are mostly confidential, but industry insiders said that they averaged about 0.5%.	150	--	Hayashi (2010: 2), Evans and Mateus (2011: 19-20)
410 B. European Commission reached a settlement in 2002 with Visa to reduce interchange fees in EU by 12/2007, but Visa reduced them after 2010. The EC charged MC with illegal price fixing in 12/2007 and they settle in 4/2009.	Evans and Mateus state that the average EU reduction in fees was 57%	132.6	--	Hayashi (2010: 2), Evans and Mateus (2011: 19-20)
410 C. In mid 1990s, the Canadian Bureau of Competition issued a consent order reducing fees to zero, i.e, the LR Marginal Cost was judged by the Bureau to be zero (\$0.00).	Reduction to zero from any positive collusive level to zero implies an infinite mark-up.	Infinity	infinity	Hayashi (2010: 1), OECD (2013: 9-13)
410D. Same as 410, except Spain , beginning date unknown; consent agreement 12/2005	Probably after-decree decline in rates.	51.4	--	Hayashi (2010) or Carbo-Valverde et al. (2011)
411 A. At least eight and possibly 12 manufacturers of large liquid crystal display panels (LCDs) , located in Japan, Korea, and Taiwan, colluded worldwide on the selling prices of panels used in computer monitors, notebook computers, and possibly TV screens from at least April 2001 to September 2006; bid rigging of purchasers that assembled computers, monitors, and large TVs was a common form of conduct.	The jury accepted the testimony of the U.S. Government's expert economist when it rendered a guilty verdict against AU Optronics in March 2012. He calculated that U.S. overcharges of the six largest cartel members were much greater than \$500 million and later says "The overcharges are certainly in excess of \$2 billion." AUO's affected U.S. commerce was \$23.5 billion.	8.5+	--	Leffler (2012: 3282, 3378, 3380)
411 B. Same as 411 A, except that Leffler refers only to the first and last 6 months of the conspiracy. Trade magazines say the industry was growing at 15% to 20% per year, which implies US affected commerce of about \$3.4 to \$4.3 billion.	He calculated that U.S. overcharges of the six largest cartel members were greater than \$500 million. In that 12-month period	11.6-14.7	--	Leffler (2012: 3282, 3378, 3380)

411 C. Same as 411 A.	"I have reached the opinions that the Crystal Meeting conspiracy was effective in raising prices above the competitive levels; that, as a result, the Crystal Meeting participants overcharged purchasers by over \$12 billion."	51.1 +	--	Leffler (2012: 3263)
412. A study of all Maritime Shipping liner-conferences imports into the US , for the year 1998 (the year TACA was fined by the EC), excluding tramp and tanker services. Authors found that national trade restrictions raised import prices by only 8%.	Econometric estimation of a sub-sample 99,000 shipments (\$8.325 billion) with a dummy variable for liner-conference shipments	24	--	Fink et al. (2002: 101)
413. In 328-326 BC, during wartime, several Athenian wholesale grain merchants formed a trade association to collude on bids made to importers of grain at Athen's port (a buyers' cartel). In 326 they were convicted of price fixing by a jury at a public trial and sentenced to death. The prosecutor's famous speech survived. Undrchrgrge shown as a positive percentage.	The prosecutor charged, and the defendants did not dispute, that their gross margins (monopoly profits) increased 500% during the collusive period compared to pre-cartel times. Based on grain-marketing conditions in low-income countries today, Connor assumes that normal gross margins were 5% to 33% of costs of grain purchased.	24 to 49	--	Connor (2007c: 2-6)
414. In antitrust litigation in a U.S. court, the judge cites evidence that supports certifying the plaintiff's contention that high fructose corn syrup may have been overpriced due to a five-firm cartel during 1989-1995.	Price "was up \$3/cwt...." during the conspiracy and fell to \$13.40/cwt. in 1996 after the cartel ceased.	22.4	--	Mihm (2003:24)
415. Evidence of at least three episodes of nationwide collusion in the Indian cement market by major producers from 2/1994 to 12/2009. India Competition Commission levied historic fines on 11 firms with 70%+ of market in 2012.				Sylwester Beyger (2012), CCI (2012)
415 A. From as early as 4/1999 to 6/1996.	Using the approximate avg. weekly wholesale price index for cement during collusion relative to the competitive period after (2001-2002).	0	--	Bejger (2012: Fig 1 and p. 14)
415 B. From 1/2000 to 7/2001.	Using the approximate avg. weekly wholesale price index for cement during collusion relative to the competitive period before (2001-2002).	20	--	Bejger (2012: Fig 1 and p. 14)
415 C. From 7/2006 to at least as late as 12/2009.	Using the approximate avg. weekly wholesale price index for cement during collusion relative to the competitive period before (2006).	50	--	Bejger (2012: Fig 1 and p. 14)
415 D. From 12/2005 to at least 12/2006, part of 415C.	Using the approximate avg. national wholesale price	45-84	--	CCI (2012: 2)

	increase for cement during collusion relative, and evidence that costs were constant.			
416. A bidding ring of five dealers at a UK Antiques Auction in Leamington near London in 1964 suppressed the price of an antique mohogany Chippendale commode. No legal action mentioned or likely.	The object sold at auction for £750 and was resold the same evening at a dealers-only Knockout sale for £4350; it later sold to at retail for £10,000	480	--	Cassaday (1967: 181)
417A. Two suppliers (1 US, 1DE) of rock salt , the sole owners of rock salt mine in Ohio, were accused of rigging bids in the Northern 54 counties of Ohio during the winters of 2004-05 to 2007-08. State and cities sued for damages.	Used the profit margins of the two suppliers in northern New York State during period (27% average) as a yardstick	68	--	Ohio OIG (2010: iii)
417B. Same as 417A.	Used the profit margins of the two suppliers in southern Ohio during period (27% average) as a yardstick	15.3	68	Ohio OIG (2010: 29-30)
417C. Same as 417A.	Used the constant-margin method: compared margins in year 2000 before collusion with margins during collusion	19.2	68	Ohio OIG (2010: 29-30)
417D. Same as 417A, except longer collusion, winters of 2000-2010	Yardstick method	50	--	Ohio OIG (2010: 29-30)
418. In 1993 to May 1996 (and perhaps much earlier) the head trader at Sumitomo Corp. colluded with two other traders and a U.S. metals wholesaler to corner the market for physical copper to manipulate the London Metal Exchange (therefore world) prices; the 4 firms paid fines to the US CFTC and the UK regulator as well as private settlements over 1999-2001.	The US CFTC Order placing a fine on Sumitomo states that peak prices declined from \$2899/t to \$2000/t for several months after May 1996	--	40	CFTC (1999)
419A. The nationwide Finnish asphalt paving cartel of seven Finnish and Swedish companies rigged bids in 1994–2002 on tenders by the Finnish Road Authority (FRA), municipalities and private parties; cartel fined by the Supreme Administrative Court; a 2012-13 trial over private damages claims filed by the Finnish State and numerous counties and municipalities.	Econometric evidence on 1994-2009 bids presented in court prepared by plaintiffs' experts at an independent research organization; compares county and municipal bids during collusion with bids after collusion	20	--	Pursiainen, et al. (2011, 2012)
419B. Same as 419A, except bids made on tenders by the national government for paving of national roads. It is interesting that the government unit most likely to have the capability to detect bid rigging incurred a lower overcharge rate.	Econometric evidence presented in court prepared by plaintiffs' experts at an independent research organization; compares FRA bids during collusion with bids after collusion	15	--	Saxell, Tukiainen & Siikanen (2011)
419C. Same as 419A, except bids made by one defendant on tenders.	Econometric models using bids submitted by Lemminkäinen, the cartel's ringleader, to municipalities or to the FRA in 1993–2009, comparing prices	0	--	Riipinen & Toivanen/Tempo Economics (2010); Helsinki District Court, case ID L

	during the cartel and after the cartel.			08/16883 (joint cases), evidence DT 12
419D. Same as 419A, except bids made by one defendant on tenders.	Econometric models using bids submitted by Skanska, the cartel's ringleader, to the FRA in 1993–2009, comparing prices during the cartel and after the cartel.	0	--	Hyytinen/Spillover Economics (2011); Helsinki District Court, case ID L 08/16883 (joint cases), evidence DT 18
420. In January 1980, a Canadian auto repair firm circulated a letter stating that 14 repair shops in Fort Erie, Ontario, Canada had met and agreed to raise labor rates by 10%; in January 1981 another 13.6% increase was announced, effective for another year. The Bureau of Competition sued, and a trial ensued in 1986; the authors believe guilty, but case was dismissed by the judge because of a few arithmetic errors by the prosecutor's expert.	The authors are convinced that this cartel was effective in raising prices from the 1979 labor rate of C\$20 per hour for at least two years, Jan. 1980 to Dec. 1981.	17.5	25	Low and Halladay (2011: 84-85)
421A. In 1997, the Canadian Bureau of Competition prosecuted land surveyors in Edmonton, Canada colluded at a meeting in Nov. 1, 1994 to raise the price of surveying a residential property from C\$225 to C\$325 effective immediately;	Testimony at trial revealed that prices rose to the agreed higher price and held steady all over the city compared to before Nov. 1 1994.	44.4	44.4	Low and Halladay (2011: 89-90)
421B. Same as 421A.	Testimony at trial revealed that prices rose to the agreed higher price and held steady all over the city compared to after the Bureau's investigation began	11-47	--	Low and Halladay (2011: 89-90)
422A. From Jan. 1999 (some plaintiffs claim 1993) to Dec. 2003, six urethane plastics manufacturers colluded on prices in the huge US market, and very likely in the rest of the world; plaintiffs won 3 settlements and one judgment in a jury trial against one of the largest defendants, Dow Chemical in Feb. 2013.	Econometric model presented by plaintiff's economist at trial	13	--	Report of trial outcome in <i>Kansas City Business Journal</i> (Feb. 19, 2013)
422B. Same as 422A	Jury decides that damages were only 33% of what plaintiffs' claimed and for 4 years, not 5.	5.4	--	<i>Kansas City Business Journal</i> (Feb. 20 2013)
423A. Telephone service in New York City circa 1908 before rates were state-regulated in New York; home service prices by Bell Telephone Co. compared in two similar cities; not clear if Bell had any competition at this time; unlike NYC, Bell paid a 5% tax to City of Toronto.	Yardstick is prices in Toronto, Canada (\$180 per year in NYC vs. \$25)	620	--	Demarest (1910: 187-88)
423B. Same as 423A, except for office rates (note price discrimination by Bell Telephone).	Yardstick is prices in Toronto, Canada (\$240 per year vs. \$45)	433	--	Demarest (1910: 187-88)
424. Aggregate (crushed stone), Sao Paulo, BRAZIL 10/2000-7/2003	Compares collusive prices to prices before cartel	14.1	--	Martinez (2007)
425. Air route, Latvia , 8/1998-1/1999	Compares collusive prices to	4.0	--	OECD Competition

	prices before cartel			Policy Report (2002)
426. Airlines, passenger, Indonesia, 2006-2009	Statement by the antitrust authority, no method mentioned	1.8-5.0	--	Indonesia antitrust authority decision (5/6/10)
427. Automobiles, Canadian imports, US, 1/2001-3/2006	No explanation of method	15-24	--	<i>Toronto Star</i> 2/19/03
428. Baby Equipment, US, 1/1999-12/2011	Statement by the antitrust authority, no method mentioned	20.7	--	US Court decision (1/16/12)
429. Bank interbank check fee, FRANCE, 1/2002-7/2007, convictions and fines by French antitrust authority.	Overcharges €220 milion.and affected sales €766.8 mil.from internal records of the banks.	28.5	--	Autorite de la Concurrence (9/20/2010: ¶667-¶668)
430. Banks, interchange fees, Latvia, 12/2002-1/2011	Statement by the antitrust authority, no method mentioned	2.7	--	Latvia Antitrust authority decision (3/8/2011)
431. Beer, Belgian, HORECA channel, 1/1993-1/1998	Compares collusive prices to prices before cartel	15.0	--	EC Decision (2001)
432. Beer, Belgian, Retail Private Label, 10/1997-7/1998	Compares collusive prices to prices before cartel	14.7	--	EC Decision (2001)
433. Beer, France, HORECA, 3/1996-4/1996	Statement by the antitrust authority, no method mentioned	0.0	--	EC Decision (2004)
434. Bicycles, NETHERLANDS, 1998-11/2002	Statement by the antitrust authority and Appeals Ct., no method mentioned	0.0	--	Dutch Court of Appeals (10/5/11)
435. Bread and flour 1, SOUTH AFRICA, 1994-12/2006	Statement by the antitrust authority, no method mentioned	6.4	--	So Af. Competition Commission press release (11/2/10)
436. Carbon and Graphite Electrical and Mechanical Products, world, 1970-5/2000	Probably U.S. wholesale price index, relative to before price	9.0	--	Connor (2013)
437. Carbon Cathode Block, world, 6/1995-12/1997	Statement by the antitrust authority that fine equals overcharge	14.0	--	Canada Bur. of Competition Decision (2013)
438. Cardboard boxes, AUSTRALIA + NEW ZEALAND , 1993-2004	Compares collusive prices to prices before cartel	18.2	--	Beaton-Wells and Brydges (2008)
439. Cement 1, Pakistan, 3/2008-9/2009	Compares collusive prices to prices before cartel	33.3	--	Pakistan Competition Commission decision (2009)
440. Cement, Poland, 1/1995-5/2006	Statement by the antitrust authority, no method mentioned	28.0	--	Polish antitrust authority report on cartels (2008)
441. Cement, Taiwan, 6/2001-12/2005	Statement by the antitrust authority, no method mentioned	35.9	--	TWFTC Decision (12/15/05)
444. Compact discs, prerecorded, US, 2/1995-8/2000	Statement by the AG's Complaint, accepted by Court	1.5	--	State AG s Complaint (2000)
445. Compressors, refrigeration, US+EU+BRAZIL, 1/1996-2/2007	Statement by the antitrust authority, no method mentioned	11.3	--	Brazil's CADE estimate (10/1/2009)
446. Concrete poles, electric power, Pakistan, ? – 4/2209	Compares collusive prices to prices before cartel	24.2	--	Pakistan Competition Commission decision (2009)
447. Concrete, precast pipes, culverts, manholes, & sleepers, SOUTH AFRICA,	Compares collusive prices to prices after cartel fell apart	36.7	--	So Af. Competition press release

1973- 2007				(11/29/10)
448. Concrete, ready mix, Northwest Iowa, US, 1/2006- 12/2009	Statement in Decision, no method mentioned	91.1	--	US Court decision (2010)
449. Concrete, ready-mix, central Indiana, US, 7/2000-5/2004	Prediction from econometric model	8.8	--	Expert testimony at Court Hearing (2009)
450. Construction of athletic tracks, NETHERLANDS, 1/1998-2000	No explanation of method	12.5	--	Zembla (2009)
453. Construction, D-1 Highway, Slovakia, 1/2005-12/2005	Yardstick method	24.0	2	Slovakia antitrust authority decision (1/06)
454. Construction, Hibernia oil platform, CANADA, 1992-3/1999	Constant cost method	6.6	--	Stipulated facts, Fed. Court Canada (2001)
455. Construction, installation engineering, NETHERLANDS, 1/1998-2001	No explanation of method	12.5	--	Zembla (2009)
456. Construction, landscaping, NETHERLANDS , 1/1998-2001	No explanation of method	12.5	--	Zembla (2009)
457. Construction,liquid natural gas plants, Nigeria, 1995-2004	Statement by the antitrust authority that fine exceeds overcharge	10.7	--	Criminal Division DOJ statement (4/22/11)
458. Construction, pipes & cables, NETHERLANDS, 1/1998-2001	No explanation of method	12.5	--	Zembla (2009)
459. Construction, public works 4, FRANCE, 1988-1990	Statement in Decision, no method mentioned	15.3	--	Autorite de la Concurrence (12/16/94)
460. Construction, public works 8, Meuse, France, 1996-1998	Statement in Decision, no method mentioned	33.1	--	Autorite de la Concurrence (6/13/05)
461. Construction, public works 9, asphalt, Seine-Maritime, FRANCE, 1991-1998	Statement in Decision, no method mentioned	42.9	--	Autorite de la Concurrence (12/15/05)
463. Construction, SRO, Netherlands, 10/1980-2/1992	Statement in Decision, no method mentioned	3.1-3.3	--	EC Decision (2/5/1992)
465. Paper, copy paper imports, SOUTH KOREA, 2/2001-2/2004	Statement in Decision, no method mentioned	14.0	--	KFTC Decision (2009)
466A. Corn Glucose Syrup, US, 1/1989-6/1995	Compares collusive prices to prices before cartel	24	--	USDA wholesale prices (2000)
466B. Corn Glucose Syrup, US, 1/1989-6/1995	Compares collusive prices to prices before cartel	31.1	--	USDA wholesale prices (2000)
467. Currency conversion fees, charge cards, US, 2/1996-11/2005	Compares collusive prices to prices after cartel	200	--	Complaint (1/22/2002)
469. Detergent manufacturing, SOUTH KOREA, 1998-2006	Statement in Decision, no method mentioned	20.9	--	KFTC Decision (10/19/06)
470. Detergent, laundry, FRANCE, 1996-2006	Compares collusive prices to prices before cartel	19.0	--	Autorite de la Concurrence (11/12/11)
472. Distribution, bananas, 8 northern EU states, 1/2000-12-2002	Compares collusive prices to prices before cartel	24.4	--	Euromonitor prices (2013)
473. DVD, "3C" technology Patent Pool, world, 6/2000-7/2004	Yardstick method	6.6	16.7	Plaintiffs' expert testimony, US court (2005)
474. Electricity and gas utilities, US, dates unknown	Mentioned in Statement, no method mentioned	40.5	--	US Govt. Competitive Impact Statement (2/23/10)
475. Electricity, green certificates, Belgium, dates unknown	Statement in Decision, no method mentioned	21.0	--	Belgium Competition Commission

				(10/6/11)
476 -481. About 8 firms from W. Europe, Austria, Finland, and U.S. colluded by bid rigging on the prices and territories for elevators and escalators , new and service contracts in most parts of the world from May 1992 to late 1997 or early 1998; costs of production were declining during collusion, but benchmarks usually not adjusted; convicted in EU and Korea				
476A. Elevators & escalators in Belgium , 1995-2004, fined by EC.	Compares collusive prices to prices before cartel	29.6	--	Levenstein and Suslow (2003)
476B. Elevators & escalators in Belgium , 1995-2004, fined by EC.	Compares collusive prices to prices after cartel fell apart	10	--	Levenstein and Suslow (2003)
477A. Elevators and escalators in Austria , 8/1995-6/2004, fined by EC.	Compares collusive prices to prices before cartel	29.6	--	Levenstein and Suslow (2003)
477B. Elevators and escalators in Austria , 8/1995-6/2004, fined by EC.	Compares collusive prices to prices after cartel fell apart	10	--	Levenstein and Suslow (2003)
478A. Elevators and escalators in Germany , 8/1995-3/2002, fined by EC.	Compares collusive prices to prices before cartel	29.6	--	Levenstein and Suslow (2003)
478B. Elevators and escalators in Germany , 8/1995-3/2002, fined by EC.	Compares collusive prices to prices after cartel fell apart	10	--	Levenstein and Suslow (2003)
479A. Elevators and escalators in Luxembourg , 8/1995-3/2002, fined by EC.	Compares collusive prices to prices before cartel	29.6	--	Levenstein and Suslow (2003)
479B. Elevators and escalators in Luxembourg , 8/1995-3/2002, fined by EC.	Compares collusive prices to prices after cartel fell apart	10	--	Levenstein and Suslow (2003)
480A. Elevators and escalators in Netherlands , 8/1995-3/2002, fined by EC.	Compares collusive prices to prices before cartel	29.6	--	Levenstein and Suslow (2003)
480B. Elevators and escalators in Netherlands , 8/1995-3/2002, fined by EC	Compares collusive prices to prices after cartel fell apart	10	--	Levenstein and Suslow (2003)
481. Elevators and escalators in Korea , 4/1996-4/2006, fined by KFTC.	Compares collusive prices to prices before cartel	25.1	--	KFTC Decision reported in <i>Korea Times</i> 8/16/09
482. EPDM synthetic rubber, world , 1/1996-10/2002	Compares collusive prices to prices before cartel	9.2	--	International Institute of Synthetic Rubber Producers, Inc. (2004)
483. E-Rate federal Internet program, 8 states , 11/1998-11/2003	Compares collusive prices to prices before cartel	53.0	--	Connor (2012)
485. Gases, industrial, Japan , 1/2008-12/2009	Statement in Decision, no method mentioned	20.0	--	JFTC Decision (11/22/2012)
486. Hydro-Electric power equipment, Norway , 1990-2007	Statement in Decision, no method mentioned	26.9	39.0	Sorgard (2007)
487. Insurance, Auto, Vietnam , 10/2008-12/2008	Statement in Decision, no method mentioned	20.0	--	Vietnam antitrust authority Decision (11/26/08)
488. Insurance, industrial property, Germany , 6/1999-7/2002	Statement in Decision, no method mentioned	5.3	--	Federal Cartel Office estimate (2013)
489. LCDs, TFT Type, sold to Apple , 9/2005-12/2006	Statement by the antitrust authority, no method mentioned	23.5	--	Connor (2013)
490. LCDs, TFT Type, sold to Dell , 4/2001-4/2004	Statement by the antitrust authority, no method mentioned	11.8	--	Plaintiffs' Complaint (2007)
491. LCDs, TFT Type, sold to Motorola ,	Statement by the antitrust	13.8	--	Connor (2013)

9/2005-7/2006	authority, no method mentioned			
493. Lipitor, "Pay-for-delay," US, 8/2011-5/2012	Yardstick method, generic prices	78.0	--	Connor (2013)
494. Mobile phone operators in FRANCE, 1997-2003	Compares collusive prices to prices before cartel	2.9	--	UFC-Que Choisir report (2005)
495. Mobile phone service, Italy, dates unknown	Statement in Decision, no method mentioned	10.6	--	Italian antitrust authority (10/1/99)
496. Mobile phone service, Pakistan, 9/2009-1/2010	Compares collusive prices to prices before cartel	0.0	--	Pakistan Competition Commission (1/26/10)
497. Motors, large-medium industrial, SOUTH KOREA, 1998-2006	Statement in Decision, no method mentioned	19.6	--	KFTC Decision (9/22/2007)
499. Movie tickets, SOUTH KOREA, 3/2007-7/2007	Statement in Decision, no method mentioned	57.0	--	KFTC Decision (4/20/2008)
500. Moving and storage services, (intl freight forwarding), DE-US, 5/2000	Statement in Decision, no method mentioned	18.3-22.0	--	US DOJ statement (7/31/07)
501. MSG and Nucleotides (IMP, GMP), world, 7/1992	Compares collusive prices to prices before cartel	27.5	--	Connor (2013)
503A. Paper, Adhesive lable Stock, CANADA, 1/1996	Mediated settlement is 30-67% of damages	5.4	--	US Court decision (10/22/2009)
503B. Paper, Adhesive lable Stock, US1/1996,	Mediated settlement is 30-67% of damages	4.9	--	US Court decision (10/22/2009)
504. Parcel Tankers, Chemical Shipping, 8/1998	Statement in Decision, no method mentioned	5-25	--	Wall St. Journal 2/20
505. Pharmaceutical wholesale distribution, SOUTH AFRICA, 1998	Statement in Decision, no method mentioned	10-15	--	So Af. Competition press release (2/17/2008)
506. Plastic Additives, epoxidized soybean esthers, world, 1/1990	Compares collusive prices to prices before cartel	15.6-19.5	--	<i>Modern Plastics</i> (8/2001)
507A. Polyester staple, CANADA, 9/1991-7/2001	Compares collusive prices to prices before cartel	46.0	--	<i>Business and Industry</i> (1999)
507B. Polyester staple, US, 9/1991-7/2001	Compares collusive prices to prices before cartel	24-30	--	Lande and Davis (2006)
508. Polyols, polyester aliphatic, US+CANADA, 1998-2002	Bayer admits minimum amount of ocercharge in plea	7.8	--	DOJ plea agreement with Bayer (5/24/05)
509. Polypropylene, high density polyethylene, SOUTH KOREA, 4/1994-4/2005	Statement in Decision, no method mentioned	18.7	--	KFTC Decision (2/20/2007)
510. Polystryol plastic, Hungary, 2005-1/2008	Statement in Decision, no method mentioned	10-15	--	Hungary antitrust authority Decision (1/25/2008)
511. Polyurethane foam, AUSTRALIA, 1985	Constant cost method	0.4	--	ACCC Decision (11/27/1998)
512. Poultry, SOUTH AFRICA, 2005-2009	Statement in Decision, no method mentioned	25.0	--	Soputh Africa Competition Commission report (11/22/2010)
513. Power transmission equipment, Pakistan, 4/2009-12/2010	Compares collusive prices to prices before cartel	13.5-19.5	--	Pakistan Competition Commission (4/4/12)
514. Printing check pads, UK , ?-2006	Compares collusive prices to prices before cartel	22.5	--	UK OFTdecision (3/31/06)
515A. Private equity buyouts, US , 2003-2007	Statement by the antitrust authority, no method mentioned	8.1-10.5	--	Officer et al. (2010)

515B. Private equity buyouts, US , 2003-2007	Statement by the antitrust authority, no method mentioned	13.5-16.8	--	Officer et al.(2010)
516. PVC (polyvinyl-chloride) plastic, EU, 10/1980-7/1984	Target prices less customary 15% discounts, compared with before prices; peak 12/83	55.9	70	EC Decision (12/21/1998)
518. Roof tiles (clay), Germany, 7/2006-12/2008	Statement in Decision, no method mentioned	5.0	--	Federal Cartel Office estimate (12/22/2008)
519. Salt, Portugal, 1997-2005	Statement in Decision, no method mentioned	6.1	--	Portugal antitrust authority decision (11/14/07)
520. School books in Indonesia, IBRD, 1999-2000	Restitution amount divided by donation value	18.9	--	IBRD Fraud Office demand (10/2/2004)
521. Shipping (marine freight lines) US-Puerto Rico, 5/2002-4/2008	Compares collusive prices to prices before cartel	6.8	--	Court Complaint (2010: 82)
522. Shipping TACA (Trans-Atlantic Conference Agreement), world, 1/1994-12/1998	Compares collusive prices to prices before cartel	80	--	EC press release (9/16/98)
523. Soft drink bottling, SOUTH KOREA, 1999-2/2009	Compares collusive prices to prices before cartel	21	--	KFTC Decision reported in <i>Korea Times</i> (8/16/09)
524. Steel beams (structural steel), EU, 1/1984-12/1990	Compares collusive prices to prices after cartel fell apart	25-43	--	<i>The Independent</i> (1/14/93)
525. Steel, flat, SOUTH AFRICA, 1999-6/2008	Compares collusive prices to prices before cartel	20.0	--	<i>Africa News</i> (7/18/2008)
526. Text message service (SMS), Indonesia, 1/2004-4/2008	Statement in Decision, no method mentioned	73.4	--	Indonesia antitrust authority decision (6/19/2008)
527. Tobacco, leaf, procurement, Italy, 1995-2/2002	Yardstick method	210-212	--	EC Decision (10/20/2005)
528. Transformers, power & distn, E. AUSTRALIA, 1993-1999	Decision says profits from bid rigging were A\$169 mil, bids worth \$900 mil.	18.8	--	Australian Fed Ct. decision 2003)
529. Vegetable oils, Spain, 2001-2005	Statement in Decision, no method mentioned	25	--	Spain antitrust authority report (6/29/07)
530A. Elevators & escalators in Canada, 1995-2004, no fines	Change in prices compared to price after collusion stops	59	--	Levenstein and Suslow (2003: 826-843)
530B. Same as 53A	Compares collusive prices to prices after cartel fell apart	13.5	--	Levenstein and Suslow (2003: 826-843)
531A. Elevators & escalators in US, 1995-2004, no fines	Change in prices compared to price after collusion stops	39	--	Levenstein and Suslow (2003: 826-843)
531B. Same as 53A	Change in prices compared to price before collusion starts	9	--	Levenstein and Suslow (2003: 826-843)
532A. Elevators & escalators, world, 1995-2004, no fines	Change in prices compared to price after collusion stops	26.9	--	Levenstein and Suslow (2003: 826-843)
532B. Same as 53A	Change in prices compared to price before collusion starts	10	--	Levenstein and Suslow (2003: 826-843)

533. Mobile phone operators in Netherlands , 7/2001-12/2002, fined by Dutch antitrust authority (NMa)	Prices fell 45% in 2 years after conviction	108	--	MNa 2004 Annual Report, p.60.
534. Banks, debit-card interchange fees , 1990?-2011, ES	Compares collusive prices to prices after cartel fell apart	51.4	--	Chakravorti (2010)
535. Beer , 2/1998-5/1999, Korea	Statement in Decision, no method mentioned	10	--	<i>KFTC Decision (5/29/1999)</i>
536. British Sugar , 6/1986-7/1990, UK	Statement in Decision, no method mentioned	49.9	--	EC Decision (10/14/1998)
537. Cipro, Pay-for-Delay , 1997-2004, US	Bayer's profits during delay period plus side payment to Barr	92	--	Class action complaint (2012)
538. Circuit plates, copper-plated phenolic paper laminate , 6/1987-1989, Japan	Statement in Decision, no method mentioned	10-15	--	JFTC Decision 1989; High Court Appeal (9/25/1995)
539. Construction, buildings , 1/1998-12/2001, NL	Statement in Report to Parliament, no method mentioned	8.8	--	Netherlands Parliament Committee investigation & report (12/02)
540. Construction, buildings , 2000-2006, UK	Statement in Decision, no method mentioned	9.9	--	UK OFT Decision (9/22/2009)
541. Construction, heavy-lift marine , 1990/1/2007, global	Constant cost method	37	--	<i>Platt's Oilgram News (3/29/200)</i>
542. Construction, public bridge project , 1994-2000, Norway	Statement in Decision, no method mentioned	37.5	--	Norwegian Antitrust Authority, in OECD Report (2003)
543. Diamonds, Industrial , 11/1987-5/1994, world	Class action settlement used as lower bound of compensation value	3	--	US Court decision (11/1/2000)
544. Movie distributors , 2000-2006, ES	Statement in Decision, agreeing with buyers' claims	15	--	Decision of Spanish Competition Authority (5/12/06)
545A. Municipal Bond Derivatives , 1/1992-8/2011, US	Based on details of effect on fees made from fees before one representative bid rig	11.8	--	DOJ Criminal charging document (7/12)
545B. Municipal Bond Derivatives , 1/1992-8/2011, US	Based on details of effect on rates compared with before presented as evidence	0.8	--	DOJ Criminal trial testimony (4/12)
546. Telephone fees, long distance , 2/2003-12/2005, Philippines-US	Based on details of effect on rates compared with before presented as evidence	6.5	--	<i>Business World (Philippines) (1/20/2004)</i>
547. Tomatoes, processed , 1/2004-4/2008, US	Quality dilution of tomato paste	39	--	Class action complaint (2010)
548. Waste collection , 9/2000-9/2003, Germany	Price effect in tendering areas (about half) where cartel arranged for only one bidder versus areas with no collusion	70	--	<i>Financial Times (London) (9/12/2003) Interview of BKA Official</i>
549. Window coverings, PVC , 4/2002-7/2002, US + CA	Statement in Decision, no method mentioned	8	--	DOJ press release (6/27/07)
550A. Apple Corp. conspired with five large book publishers to raise the prices of electronic books ("eBooks") from late 2009 to early 2010 to prevent Amazon from selling most popular new releases at \$9.99. the publishers paid civil	The US DOJ won the criminal bench trial and presented evidence accepted by the judge that the average price increase due to collusion by the five	18	50	<i>Reuters Business & Financial News (7/10/2013, 4:11 PM: p. 2), Bear (2014: 8)</i>

finer.	publishers was 18% compared to the \$9.99 price <i>before</i> collusion began.			
550B. Same as 550A	A statement by the Antitrust Division of the DOJ of the average price of the 25 best-selling eBooks several months <i>before</i> the prosecution (\$9.99) compared to range of prices for similar eBooks during collusion (\$12.99 to \$14.99)	30-50	50	Bear (2014: 8)
550C. Same as 550A	An analysis by the Antitrust Division of the DOJ of the average price of the 25 best-selling eBooks several months <i>after</i> the prosecution (\$6.47) compared to range of prices for similar eBooks during collusion (\$12.99 to \$14.99)	101-132	132	Bear (2014: 8)
551. Thirty auto insurance companies in Italy began colluding on rates as soon as the industry was liberalized, from 1994 to about 1999; fines and overcharge upheld by Supreme Court; moreover, double damages awarded to provide increased deterrence.	Before and after method and yardstick of other EU prices.	20	--	Komninos et al. (2009: 6 and 94).
552. For two months around 2004, five driver-training schools in Graz, Austria colluded on the fees charged to students for the most popular type of training course; prices fell immediately after an investigation began; upheld by the Graz Court of Appeal.	Students charged identical fees of €1140; fell to €900. [Source erroneously calculates a 22% overcharge]	26.7	--	Komninos et al. (2009: 53).
553A. In 2007, the Italian antitrust authority (AGCM) discovered a cartel from 10/2006 to 3/2008 among the leading brands of pasta sold to supermarkets , many manufacturers (some foreign-owned) accounting for 76% of supply were fined; prices rose 15% on average from Sept. 2006 and peaked about 53% in March 2008. Fined by AGCM.	Notaro's focus is on showing that the simple "before price" econometric method fails to account for costs of inputs. Model 2 uses the before approach, but allows for cost changes interacted with the cartel dummy variable (i.e., the cartel passed on costs faster during collusion).	11.0	--	Notaro (2013: 11)
553B. Same as 553A; implies an overcharge of €147 million on affected sales of €1441 million.	Model 2 is non-stationary. A dynamic econometric model 3 predicts a higher average but-for price; the peak collusive price increase in March 2008	10.2	40	Notaro (2013: 15 and Figure 4)
<p>a) If the dates of the cartel's effective period of operation are different from its formal existence, the former dates are given if known.</p> <p>b) If a source states that a collusive episode "failed" or was "unsuccessful" (or similar terms), the overcharge is zero; if the descriptor is "small," "slight," "weak," or similar, then an arbitrary value of 1% is coded.</p> <p>c) A complete list of the publications can be found in the References above. In addition, the <i>Wall Street Journal (WST)</i>, <i>New York</i></p>				

Times (NYT), Financial Times, and other newspapers or news wires (AP, APX, Jiji, Yonhap, Asia Pulse, etc.) are sometimes cited as sources for summaries of legal decisions.

d) The first number is from the first edition of Posner, the second from the second (2001) edition.

Note: Occasionally, a source gives a percentage decline (P%) in prices from during to after a cartel episode; in these cases the overcharge should be converted to using the formula $P\%/(1-P)$.

The citation Connor (2011) is simply an earlier version of Connor (2013); the latter often has more accurate measures of affected sales and, therefore, better overcharge estimates.

Appendix Table 3. Rejected Estimates and Reasons

Episode Number ^a	Source	Reasons for Concern
23	Bittlingmayer (1982)	Analysis contradicted by Williams (1986), Taylor (2002)
74A	Gallet (1997)	Study cannot distinguish overt from tacit collusion.
74A	Baker (1989)	Refers to US data, whereas case is a European cartel
74B	Barbezat (1989)	Covers a period in which cartel was government-directed
84	Jeon and Shin (2005)	Regression analysis assumes that Korean steel production affected global demand and the Korean import price; annual data used when quarterly preferred.
None	Sproul (1993)	BLS data employed are inappropriate (see Werden 2003)
None	Block <i>et al.</i> (1981)	Settlements in the bread industry are a poor guide to overcharges, and dividing them by 3 worsens the problem
37	Newmark (1988)	Ten other economists have cited the FTC analysis of prices with approval; moreover, an Appeals court upheld the conviction; and Mueller and Parker (1992) provide a devastating critique of Newmark's article.
None	Pesendorfer (2000)	Author would not supply data necessary for calculation.
190	Wiggins and Libecap (1987)	Repeated assertions by authors that cartel was ineffective are not supported by (an entirely feasible) quantitative analysis.
9	Scott (2000)	A critique of Lanzilloti (1996), who appears to defend ably his original conclusions in his 2000 rejoinder.
284	Sjostrom (1991)	Finds no evidence of national collusion in the <i>Hardwood</i> decision of 1921, but most authorities have agreed on this point for some time.
155	Kinghorn and Nielson (2004)	Find that the prices of the German coal and iron and steel cartels were below the yardstick prices in the UK; however, one of their major sources (Webb 1980) shows that during the cartel periods productivity change was higher in Germany than in the UK.

284	Alexander (1988)	An interesting study, but the Hardwood Association did not engage in explicit price fixing on a national basis.
None	Hendricks and Porter (1988)	The authors find that federal government auctions of oil “drainage leases” on tracts on the Outer Continental Shelf return 14.3% lower prices per acre than “wildcat tracts”; they attribute the difference to collusion, but not necessarily explicit collusion.

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- a) “None” means that this study is the only one about a potential cartel market; therefore, no cartel observation number was created for listing in Appendix Tables 1 or 2.

Appendix Table 4. Final Court Decisions with Overcharges Data

Name and Type of Case	Overcharge	
	Average	Peak
1. Addyston Pipe & Steel Co. v. U. S., 175 U.S. 211 (1899) (conspiracy allocate customers via secret bidding pool)(Court provided a typical res but not an average figure ²⁷²)	34.7-42.6%+	
2. Armco Steel Corp. v. North Dakota, 376 F.2d 206 (U.S. App. 1967) (highway construction bidding conspiracy. ²⁷³) (period of injury involve was from 1957 to June 17, 1960)	18.5%	
3. Armco Steel Corp. v. Adams County, 376F. 2d 212 (1967)(highway construction bidding conspiracy) (same defendants as previous case but different victims) (corrugated culverts for local road-work purposes during the years 1957-1960)	17.3-20.3%	
4. Colorado ex rel. Woodard v. Goodell Bros., 1987-1 Trade Cas. (CCH) P67,476 ²⁷⁴ (road building projects bid in 1978 and 1980)	9.6%	
5. FTC v. Superior Court Trial Lawyers Association, 493 U.S. 411 (1990) (legal aid attorneys conspired to raise fees ²⁷⁵) (began September 6, 1983 and ended Sept. 20, 1983)	16.7% ²⁷⁶	75%

²⁷² “The cost of producing pipe at Chattanooga, together with a reasonable profit, did not exceed \$ 15 a ton. It could have been delivered at Atlanta at \$ 17 to \$ 18 a ton, and yet the lowest price which that foundry was permitted by the rules of the association to bid was \$ 24.25. The same thing was true all through 'pay' territory to a greater or less degree, and especially at 'reserved' cities.”

This means that the typical price increase was at least $\$24.25 - 18 = 6.25/18 = 34.7\%$ And, $24.25 - 17 = 7.25/17 = 42.6\%$

²⁷³ “We have no difficulty whatever in holding that there was adequate basis... proximate injury in the amount of \$258,355, on the extent of the artificiality involved in the fixed prices and its ingrediency in the \$1,396,500 list-price aggregate ... which had entered into the construction projects let during the conspiracy period, and in the \$2,000 quantity of direct purchases made by the State.” If \$258,355 of the \$1,396,500 was an overcharge, then the overcharge would have been 22.7% of the base figure of \$1,138,145.

²⁷⁴ The court found that plaintiff has reliably proved the overcharges on two of the three contracts at issue; competitive prices of \$333,253 and \$343,051 were increases by \$35,381 and \$29,732. Colorado ex rel. Woodard v. Goodell Bros., 1987-1 Trade Cas. (CCH) P67,476 Id at 7.

²⁷⁵ Legal aid attorney conspired to raise fees. Cartel/boycott by Washington DC lawyers (public defenders) that demanded (& received) a price increase from \$30 hr court time and \$20 hr non court time to \$35 hr for both in the span of a week. They would later seek and obtain a price increase to \$55 hr court time & \$45 hr non court time (without a boycott).

²⁷⁶ The increase was 16.7% for in court time and 75% for out of court time, but it was not possible to compute the average.

6. Freeman v. San Diego Ass'n. of Retailers, 322 F. 3d 1133 (2003)(conspiracy to standardize subscription charges ²⁷⁷) (from 1992 to March 2003)		150%
7. Greenhaw v. Lubbock County Beverage Ass'n., 721 F. 2d 1019 (5 th Cir. 1983)(conspiracy to fix retail price of liquor for 4 ½ years ²⁷⁸) (during the period June, 1970 to December, 1974)	7.74%	
8. Homewood Theatre v. Loew's, 110 F. Supp. 398 (D. Minn. 1952) (conspiracy in Minneapolis, MN from Jan. 1935 to Sept. 1948 involving first run films ²⁷⁹)	6.3%	
9. Kruman v. Christies' Intern. PLC, 284 F. 3d 384, 390 (C.A. 2 2002) ²⁸⁰ (global fine art auction cartel 1992-2000)	50 %	150%
10. New York v. Hendrickson Bros. 840 F.2d 1065 (2d. Cir. 1988 ²⁸¹) (bid rigging on state highway construction contracts - three distinct episodes in 1977, 1978, and 1979)	49.2% 32.1%	

²⁷⁷ Group of realtor associations combined and standardized their charges. Some raised subscription price from \$10 up to \$25, others lowered them. Although it was not a simple price fixing conspiracy, Judge Kozinski called it "price fixing". However, since he did not state how much the average charge increased, we did not include it in our median or average estimates.

²⁷⁸ Jury decided amount of overcharge and appellate court upheld. Id at 1026-27.

²⁷⁹ \$39,432.67 loss on sales of \$625,763.78.

²⁸⁰ "On November 2, 1992, Sotheby's announced it would increase its buyer's premiums from 10% to 15% for the first \$ 50,000.00 of the purchase price. On December 22, 1992, Christie's declared an identical increase in its buyer's premiums. The defendants allegedly agreed not to reduce these premiums. The defendants also agreed to set their seller's commissions at identical levels. Prior to March 1995, the defendants would permit clients to negotiate smaller seller's commissions. On or about March 10, 1995, Christie's announced it would implement a fixed schedule of non-negotiable seller's commissions ranging between 2% and 10% depending on the value of the item to be sold. On April 13, 1995, Sotheby's stated it would implement a fixed schedule of non-negotiable seller's commissions substantially identical to the schedule set by Christie's." Id at 390.

For the items covered by the agreement, buyers' commissions rose by 50%, from 10% to 15%. In addition, the new sellers' commissions means that total commissions had increased from 10% up to as much as 25% - a 150% increase.

²⁸¹ Jury determined that contract overcharges were \$590,000 on what should have been a \$1.2 million contract (49.2%: page 1070), \$644,000 on what should have been a \$2,004,000 contract (32.1%: page 1071-72), and \$1,113,000 on what should have been a \$8,187,000 contract (13.6%). The Court also noted: "Amfar was advised not to 'get too greedy,' *i.e.*, it was to limit the excess profit included in its bid to 20-25% and was not to seek excess profits of 40-50%. Later review by Ambrosio of bids submitted by other coconspirators led him to the conclusion that most of them were submitting bids that included excess profits higher than the 20-25 % benchmark." Id at 1070.

Most of the economic analyses we surveyed would have called these different episodes and analyzed them separately, even though legally they were treated together. This clearly is a judgment call upon which reasonable people could differ. If they were treated as one larger conspiracy, the overcharges would total \$2,347,000 on a base of \$11,391,000, or 20.6% overall. Alternatively the average of the three computed overcharges is 31.6%. In addition, the Court found that a subcontract that should have been bid at \$512,000 was given to a fellow conspirator,

	13.6%	
11. New York v. Cedar Park Concrete Corp, 85 Civ 1887 (2001) (concrete superstructure construction bid rigging during 7 year period 1978-1985 ²⁸²)	5.87%	
12. North Texas Producers Ass'n v. Young, 308 F. 2d. 235 (5 th Cir. 1962) (conspiracy from Nov. 1956 to Feb. 1961 to exclude low cost milk seller ²⁸³)	36%	
13. Ohio Valley Electric Corp. v. General Electric Co., 244 F. Supp. 914 (SDNY 1965) (bid rigging against U.S. electric utilities, began in 1930s but data available only for 1950-1959, in purchases of electric power generating and transmission equipment ²⁸⁴)	10.9%	
14. Palmer v BRG of Georgia, 498 U.S. 46,47 (1990)(naked division of market by two providers of Bar Review courses, from 1980 to approximately Nov. 1990 ²⁸⁵)	167%	
15. Pease v. Jasper Wyman & Son, 2004 ME 29 (2004) (conspiracy during August 1996 to October 1999 by four processors to suppress prices paid for wild blueberries ²⁸⁶)	21.6%	32.8% ²⁸⁷
16. Story Parchment Co. v Patterson Parchment Paper Co., 282 U.S. 555 (1931) (conspiracy by three manufacturers to monopolize and destroy	27.7%	

in return for not bidding, for an additional \$338,000, a 66% overcharge. This was not included as a separate overcharge figure, however, since is subsumed in the conspiracy for its prime contract.

²⁸² The conspiracy was organized personally by Paul Castellano, on behalf of "the governing body of New York's five organized crime families". Yet the Court only found that it raised prices by 5.87%.

²⁸³ This involved a horizontal conspiracy to exclude a low-priced milk seller that would have sold milk for 69 cents instead of 96 cents. He was awarded \$100,000 in lost profit damages for the period at issues. The important point for our study, however, is the Court's conclusion that that the horizontal competitors caused the price of the milk that plaintiff would have sold to consumers at 69 cents to be sold to them at 96 cents instead. The conspiracy prevented a 36% price drop. Id at 237.

²⁸⁴ "This overcharge of \$5,624,401 is slightly under eleven per cent of the total final order price for all units (\$52,027,785) and slightly under ten per cent of the total final billed price, including escalation (\$57,116,819). Page 947 This totals 10.92% of the pre-collusive amount.

²⁸⁵ This case involved an agreement by the only 2 Bar Review preparation companies in Georgia. They entered into a naked division of markets, after which the price of a Bar Review course in Georgia went from \$150 to "over \$400." Id. at 47. We will conservatively assume that the price only went up to \$400, an increase of \$167%.

²⁸⁶ This was a four year average, calculated from Solow exhibit 10, "Underpayment to Growers", whose figures were accepted by the jury. A \$56 million judgment was upheld.

²⁸⁷ For 1997.

plaintiff's business by predatory pricing in the market for vegetable parchment from Nov. 1927 to at least the bankruptcy of Aug. 1928²⁸⁸)

17. Strobl v. N. Y. Mercantile Exchange, 582 F. Supp. 770 (1984) (conspiracy from about Jan. 1976 to May 1976 by two processors to lower the price of a Maine potato futures contract on the NY Mercantile Exchange ²⁸⁹)	48.6%	
18. Union Carbide & Carbon Corp. v. Nisley, 300 F.2d 561 (10 th Cir. 1961) (for recovery period Oct. 1938- March 1948 on a conspiracy that began 1933 by smelters to reduce prices paid for vanadium-bearing ore on the Colorado Plateau ²⁹⁰)	22.5%	38- 47.5%
19. United Nuclear Corp. v. General Atomic Co., 629 P. 2d 231 (N.M./ 1980)(global uranium cartel established 1972 but effective from about June 1974 to Dec. 1975 ²⁹¹)		567%
20. U.S. v. Anderson, 326 F.3d 1319 11 th Cir. 2003) (bid rigging on USAID contracts on construction of waste-water treatment plants in Egypt 1988-1996 ²⁹²)	16.4-39.2%	
21. United States v. Andreas, 216 F.3d 645 (2000) (global conspiracy 6/92-7/95 to raise lysine prices ²⁹³)		71.4%

²⁸⁸ Conspiracy to monopolize and destroy plaintiff's business. Jury verdict of \$65,000, before trebling. Property that cost \$235,000 allegedly reduced in value to \$75,000. So damages must have been $65/235 = 27.7\%$.

²⁸⁹ Strobl v. New York Mercantile Exchange, 582 F. Supp. 770 (S.D.N.Y. 1984), motion to reduce award denied 590 F. Supp. 875 (S.D.N.Y. 1984), aff'd 768 F.2d 22 (2d Cir. 1985). "The \$460,000 figure reached by the jury, therefore, was the equivalent of a finding that the price of the May potato futures contract would have been approximately \$18.00, instead of \$9.25, had the market been operating solely on the basis of supply and demand...The jury could have concluded from the evidence of low supply that the price of Maine potato futures was artificially low during the conspiracy period." Id. at 779. Price therefore was depressed 48.6%.

²⁹⁰ "In these circumstances, we cannot say that the jury's finding to the effect that the free market price of 2 percent vanadium ore for the period October 1938 through March 1948 was 40 cents per pound instead of 31 cents was clearly erroneous."

²⁹¹ United Nuclear Corp. v. General Atomic Co., 629 P.2d 231, 242 (N.M. 1980) "Fourth, between 1972, when the cartel apparently began, and 1975, when this suit was filed, the price of uranium in the United States increased from approximately \$6.00 per pound to approximately \$ 40.00 per pound." The Court concluded that the price of Uranium had increased by 567% during the period of the conspiracy but did not say that all of this increase was due to the activity of the cartel. For this reason this cartel's increase has been put in the maximum column, not the average column.

²⁹² Exhibits 16 and 24 say that the winning bids on the three contracts at issue were \$283.984 million On page 77 of the Transcript of Sentencing Before The Honorable Robert B. Propst, May 20, 2002, the judge found that the total overcharges for these three contracts were "greater than 40 and less than 80" million dollars. Using the \$40 m loss figure -- this would mean that the three jobs together should have cost \$244 million, so $40/244$ is 16.4%. For the higher overcharge finding, the contracts should have totaled \$204 million, so $80/204 = 39.2\%$.

22. United States v. Dynalectric Co., 859 F.2d 1559 (11 th Cir. 1988) (Bid Rigging on electrical subcontracting portion of at the Snapfinger Creek Wastewater Treatment Plant in Dekalb County, Georgia ; bid made on September 7, 1979 and the final payment to the loser was made on January 24, 1985. ²⁹⁴)	34%	
23. U. S. v. Foley, 598 F. 2d 1323,1327 (C.A. Md., 1979 ²⁹⁵) (real estate companies in Montgomery County, MD agreed Sept. 5, 1975 to raise their sales commissions on houses; ended about April 1977)	16.7%	16.7%
24. In Re Vitamins Antitrust Litigation, Animal Science Products v. Chinook Group, Misc. No. 99-0197 TFA, M.D.L. No. 1285 (choline chloride global cartel jury verdict ²⁹⁶)	38%	
25. Wall Products v. National Gypsum, 357 F. Supp. 832 (N.D. Calif. 1973) (U.S. conspiracy from December 15, 1965 until January 1, 1968 over price of gypsum wallboard ²⁹⁷)	27%	
26. Webb v. Utah Tour Brokers Ass., 568 F. 2d 670 (1977) (conspiracy by tour brokers to deny plaintiffs entry, boycott, etc. ²⁹⁸)	5%	

²⁹³ "The meeting ended without a sales volume allocation agreement, but two months later, at the recommendation of Whitacre, the cartel raised prices anyway, and prices rose from \$.70 to \$ 1.05 per pound. ... [Much later] The producers also agreed on a new price of \$ 1.20 for the United States market." *Id* at 652-53

The Court inferred that at least one sale took place at \$1.20, so its maximum increase was $(1.20-.70)/.70 = 71.4\%$. As is typical, this Court was not perfectly clear as to what caused the price to rise. But the plain meaning of the quotation is that the Court found that, as a maximum, the cartel raised the price of Lysine by 71.4%.

In fact this would be a modest conclusion because the Court also wrote: "Together, the three parent companies produced all of the world's lysine until the 1990s, presenting an obvious opportunity for collusive behavior. Indeed the Asian cartel periodically agreed to fix prices, which at times reached as high as \$3.00 per pound." This would mean that the maximum increase was roughly $(3.00-.70)/.70 = 329\%$

²⁹⁴ 7. United States v. Dynalectric Co., 859 F.2d 1559 A \$1.7 million profit on a \$5 million contract is a profit of 34%.

²⁹⁵ On Sept. 5, 1975, competing real estate executives agreed to raise their commission from 6% to 7%. "Within the following months each of the corporate defendants substantially adopted a seven percent commission rate." *Id*. at 1327. Since almost all, but not 100% of the sales were at a 7% Commission, 16.7% actually overstates the average actual rise somewhat.

²⁹⁶ The jury verdict was \$49.54 million "before trebling and credit for prior settlements". On page 6 Plaintiff's expert gives total U.S. sales in the industry of \$130.85 million. So this one jury verdict was 38% of total industry sales, which means that the markup by defendant had to be significantly more than 38%. Surely 38% is a conservative estimate of the markup involved, despite the fact that the total industry sales came from the plaintiff's expert.

²⁹⁷ Wall Products Co. v. National Gypsum Co., 357 F. Supp. 832 conspired among themselves and with others, to stabilize and maintain the price level of gypsum wallboard 27%

Source: Lande and Davis (2006), Davis and Lande (2006, 2007, 2008, 2011).

²⁹⁸ Webb v. Utah Tour Brokers Assn., 568 F. 2d 670, 676-77 (1977). “They had been able to obtain the same transportation service for 70 cents per mile from the other licensed brokers. However, with Greyhound they were obliged to pay a Special Operations Bus Order tariff of three and one-half cents per person per mile. Of the eleven tours operated they had to pay this higher rate for eight tours. Plaintiffs calculated that they suffered a total loss of \$10,165 as a result of having to pay the higher tariff for the tours that they took.” $3.5/70$ equals 5%.