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Abstract: PRICE-FIXING OVERCHARGES: LEGAL AND ECONOMIC EVIDENCE

Author: John M. Connor, Professor, Purdue University; Advisory Board of the AAI

This paper is a survey identified hundreds of published social-science studies of private, hard-core cartels that contained 674 observations of long-run overcharges. The primary finding is that the median cartel overcharge for all types of cartels over all time periods is 25%: 18% for domestic cartels, 32% for international cartels, and 28% for all successful cartels. In addition, a survey of 24 final verdicts in decided U.S. horizontal collusion cases reveals an average median overcharge of 21% and an average mean overcharge of 30%. Outside the United States, 62 decisions of competition commissions cited median average overcharges of 29% and a mean of 49%.

These findings suggest that U.S. and non-U.S. cartel penalties ought to be increased. 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-deterring.

Keywords: cartels, overcharges, international antitrust, penalties and fines.

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Author Contact: John M. Connor, jconnor@purdue.edu

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PRICE-FIXING OVERCHARGES:

LEGAL AND ECONOMIC EVIDENCE

John M. Connor*

Staff Paper No. 04-16,
Purdue University,
Dept. AE

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Summary

This survey identified hundreds of published social-science studies of private, hard-core cartels that contained 674 observations of long-run overcharges. The primary finding is that the median cartel overcharge for all types of cartels over all time periods is 25%: 18% for domestic cartels, 32% for international cartels, and 28% for all successful cartels. Thus, international cartels have historically been about 75% more effective in raising prices than domestic cartels. Cartel overcharges are skewed to the high side, pushing the mean overcharge for all types of cartels over all time periods to 49%. "Peak" cartel overcharges are typically double those of the long-run averages. These results are generally consistent with the few, more limited, previously published works that survey cartel overcharges.[1]

The results of the survey of 24 final verdicts in decided U.S. horizontal collusion cases, only three of which were international cartels, show an average median overcharge of 21% and an average mean overcharge of 30%. Outside the United States, 62 decisions of competition commissions cited median average overcharges of 29% and a mean of 49%.

There are three significant policy implications. First, there is a view among some antitrust writers that there is little evidence that cartels raise prices significantly for a period long enough to justify the height of current U.S. cartel penalties. 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 that U.S. penalties ought to be increased. Mean overcharges are three times as high as the level presumed by the U.S. Sentencing Commission. Surprisingly, bid rigging was no more injurious than other forms of collusion, which suggests that the USSC should amend its Guidelines that currently treat bid rigging more harshly than other forms of collusion.

Second, the principal antitrust authorities abroad also seem to base their typical or maximum fines on a 10% harm presumption. *Average* fines imposed since 1995 by Canada and the EU on identical cartels have been lower than U.S. government fines, yet overcharges generated by cartels discovered outside the United States are higher than North America-centered cartels. Consequently, anticartel laws and fine-setting practices abroad are in even greater need of strengthening.

Third, cartels with multi-continental effects are the most harmful type. 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-deterring. While the recent worldwide trend towards the intensification of cartel penalties has been desirable, 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 sanctions

[1] With rare exceptions, no estimate was ignored because of perceived defects in analytical quality. The authors' professions, types of publications, year of publication, degree of peer review, and analytical estimation methods from which these estimates are derived vary greatly. However, extensive examinations of source reliability give no reason to regard any sub set of the sample as inherently unreliable.

than comparable domestic cartels. Global antitrust sanctions should be higher for global cartels than for other types.

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MOTIVATION

Since at least 1888, hundreds of economists, historians, commissioners, and jurists have labored mightily to assess the "effectiveness" of cartels. Various criteria have been applied to evaluate cartel performance, including longevity, stability, and efficiency, but by far the greatest attention has been lavished on market price effects.[2] The increase in transaction prices by a sellers' cartel is commonly called an overcharge by economists or damages by legal writers. It is the increase in the transfer of income or wealth from buyers to the members of the cartel that occurs as a result of a collusive agreement.[3] The overcharge rate is calculated by comparing actual cartel-enhanced prices to some competitive benchmark (Connor 2004). When a cartel achieves high levels of effectiveness (i.e., longevity, stability, and high overcharges), it generates large customer welfare losses.[4] 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 buyers and sellers to misallocate their spending.

The size of cartel overcharges is an issue at the empirical heart of a number of legal and economic controversies. In the rest of this section, I outline three such issues. First, I demonstrate the importance of knowing the size and distribution of cartel overcharges to justify the underpinnings of the U.S. Sentencing Guidelines for federal criminal violations. Second, I note that similar rules govern the fine-setting criteria employed by other jurisdictions' anticartel sanctions. Third, I present evidence of differences of opinion among experts on the critical legal-economic issue of optimal cartel deterrence.

Other than in economics textbooks, 103 years has passed since the last dedicated survey of the cartel literature (Bullock 1901). To my knowledge no one else has since published a work aimed principally at surveying and analyzing cartel overcharges.

Issue 1: The U.S. Sentencing Guidelines

Twenty years ago the Sentencing Reform Act of 1984 created the U.S. Sentencing Commission (USSC), a judicial-branch unit charged by Congress with devising guidelines for sentencing for the federal judiciary (USSG Advisory Group 2003). The Commission was established because

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[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 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.

[3] The overcharge from a buyers' cartel is similarly defined by a price decrease.

[4] 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 welfare losses.

of Congressional concerns that sentencing was too variable across Circuits and individual judges and that average sentences were too low for certain crimes. The first set of guidelines was promulgated in 1987, and after three years of study and public comment was made law in 1989. The first guidelines were directed primarily at sentencing applicable to individual defendants with one sole exception, the guidelines 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 multilateral restrictive business practices as well as unilateral monopolistic conduct, by long tradition only horizontal price fixing and market-sharing agreements have triggered criminal indictments by the Department of Justice (DOJ).[5]

During 1987-89, the Commission turned its attention to developing "organizational guidelines," which were effective in 1991.[6] Organizations are corporations, partnerships, proprietorships, trusts, or other financial entities. The reason given for the delay in issuing the second set of guidelines was "time constraints and the nonexistence of statistical information" (USSG 1989: 1.12). That is, the USSC apparently believed that, unlike all other corporate crimes, it had prior to 1987 sufficient statistical data on price fixing to set penalties at levels that would deter price fixing.

The issue of how high and for how long cartels raise prices was crucial when the U.S. Sentencing Commission (USSC) established its current fine levels for cartels in 1987. These fine levels are in effect today. The USSC's cartel fine levels followed from its famous conclusion: "It is estimated that the average gain from price-fixing is 10 percent of the selling price."[7]

Origin and Importance of the 10% Presumption

The Commission explained how it used this estimate to establish cartel fines. After noting that fines should be based on consideration of both the gain to the offender and the losses caused by the offender, the USSC noted that it would double the 10% estimate to account for harms "inflicted upon consumers who are unable or for other reasons do not buy the product at the higher price."[8] The Commission added: "The purpose for specifying a percent of the volume of

[5] 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 information-sharing, signaling, refusals to deal, resale minimum-price maintenance, tied sales, exclusive dealing, patent or trademark pooling, mergers, monopolization, and attempts to monopolize are treated as civil matters. More than 90% 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.

[6] The guidelines for criminal price fixing were at that time moved to the new organizational guidelines.

[7] 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. The USSC's use of the word "average" is revealing. It implies that a goal was to design sanctions that would apply to typical infringements, rather than exceptionally effective or ineffective cartels. This criterion may be defended on the basis of simplicity and economy of application because it avoids the necessity of estimating overcharges in specific cases, but it may be fairly described as a "one-size-fits-all" approach. Sanctions are adjusted for each cartel participant by evaluating its culpability, but the size of a cartel's damages is not a culpability factor.

[8] The full quotation reads: "The loss from price-fixing exceeds the gain because, *inter alia*, injury is inflicted upon consumers who are unable or for other reasons do not buy the product at the higher price. Because the loss from price-fixing exceeds the gain, subsection (d) (1) provides that 20 percent of the volume of affected commerce is to be used in lieu of the pecuniary loss under Section 8C2.4 (a) (3)." (*ibid.*)..

commerce is to avoid the time and expense that would be required for the court to determine actual gain or loss."[9]

It is unclear why the Guidelines doubled the assumed 10% loss,[10] although the explanation in the Guidelines' commentary implies that this could be due to such factors as the allocative inefficiency harms of market power, the disruptive effects on victims caused by antitrust violations,[11] or the umbrella effects of market power.[12] Regardless, the Guidelines' approach is consistent with the standard optimal deterrence standard promulgated by William Landes (1983). Landes convincingly 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[13] and proof (Landes 1983:666-68).

The USSC Guidelines therefore start with a *base fine* double the 10% presumed overcharge[14] and use it in conjunction with the assigned base Offence level (of 10) for antitrust offenses. They adjust this offense level by a number of factors, such as whether bid rigging[15] and other aggravating factors were involved, and by mitigating factors as well.[16] This adjustment results a pair of "*culpability multipliers*" that are between 0.75 and 4.0 and are in a 1:2 ratio. 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.[17] 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."[18]

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[9] 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.

[10] Perhaps the doubling can be explained by the Criminal Fine Improvements Act of 1986, which provides an alternative fine: "If any person derives pecuniary gain from the offense, or if the offense results in pecuniary loss to a person other than the defendant, the defendant may be fined not more than the greater of twice the gross gain or twice the gross loss." Pub. L. No. 100-185, 100 Stat. 1280 (codified at 18 U.S.C. § 3571 (1987)) at § 3571(d). Perhaps the 20% figure in § 2R1.1 is a "proxy" for this "twice the gain or loss" provision in the Criminal Fine Improvements Act of 1986.

[11] This should include he corporate time and disruption caused by private suite to recover damages from cartels.

[12] "Umbrella effects" is the name given to higher prices charged by non-cartel members that were permitted or caused by the cartel's supracompetitive prices. The doubling of the 10% presumed overcharge does not, however, given the context, account in any way for the small chances of finding and convicting cartels or the lack of prejudgment interest.

[13] In 1986 the Assistant Attorney General for Antitrust, Douglas Ginsburg, estimated that the enforcers catch less than 10% of all cartels. See USSG (1986: 15). If he is correct, optimal fine for cartels should be tenfold damages! The percentage of cartels that are caught and proven probably is much higher today. See Spratling (2001). There is, however, no evidence that it exceeds 1/3, so there is no reason to believe that the treble damage remedy should be lowered. See also the discussion in Landes (1983: 115 fn. 1).

[14] The Guidelines originally provided that "[t]he fine range for an organization is from 20 to 50 percent of the volume of commerce, but not less than $100,000." 18 U.S.C. Appx. § 2R1.1 (1987).

[15] If bid rigging is involved this increases the Base Offense Level by 1, See 18 U.S.C. Appx. Section 2R1.1 (b). This indicates the USSC's belief that Bid-rigging is worse than other forms of illegal collusion.

[16] See Section 2R1.1 and Application Note 1.

[17] 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 either substantially more or substantially less then 10%" it might not employ the 20% base fine. See Application Note 3. But in practice the DOJ almost always uses the figure of 20% of affected commerce as their starting point in their criminal fine calculations.

[18] 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

The USSC appears to have adopted the 10% presumption because its use was advocated by the (then) head of the Antitrust Division, Douglas Ginsburg. 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).

This in turn raises the question of how Ginsburg arrived at his 10% estimate. A prominent analysis of the issue by Cohen & Scheffman (1989) published shortly after the antitrust sentencing Guidelines were promulgated, states that the economic evaluation of a very small number of price-fixing conspiracies was particularly important in shaping the 1986-87 conclusion of Ginsburg and the Commission that the overcharges from price-fixing conspiracies were 10% on the average. The three cases were: *United States v. Container Corp. of America*[19] and the subsequent civil litigation; the Federal Trade Commission case involving the *Bakers of Washington State*; and a short survey by DOJ economists of empirical studies of bid rigging in the road-building industry in the 1980s (*ibid.* pp. 344-345). Thus, the lynchpin of modern criminal cartel fines -- the USSC's simplifying assumption that cartels raise prices by 10% -- is supported by a surprisingly small amount of evidence.

Critiques of the 10% Guidelines Presumption

The USSC's 10% presumption was attacked as unreliable and overstated almost as soon as it was issued. For example, Cohen and Scheffman (1989) concluded that "…there is little credible statistical evidence that would justify the Commission's assumptions which underlie the Antitrust Guidelines (p. 333)." "At least in price fixing cases involving a substantial volume of commerce, ten percent is almost certainly too high (p. 343)." Moreover, the specific data that the Commission uses was attacked as unreliable: "later research has cast considerable doubt on ... these estimates, concluding that the markups, if they existed, were quite small (p. 345)."

Cohen and Scheffman also argue that the Antitrust Guideline, 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 mandated for antitrust violations and the amount of the economic injuries caused by overt price fixing. During recent years this criticism has been repeated with perhaps even more intensity. These attacks could be due to rising levels of criminal antitrust fines in recent years.

From 1990 to 1999, a series of record corporate fines were imposed for criminal price fixing by U.S. courts; a similar upswing may be noted for fines imposed by the European Commission from 1995 to 2001 (Connor 2003). Civil treble-damages cases in the United States

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consuming to establish. The volume of commerce is an acceptable and more readily measurable substitute... I find nothing other than the following commentary language that indicates that the Sentencing Commission adopted the theory of optimal penalties: "It is estimated that the average additional profit attributable to price-fixing is 10 percent of the selling price."(*ibid.*).

[19] 393 U.S. 333 (1969).

have seen a parallel response in the size of settlements. Not surprisingly, attorneys who have defended companies that have been convicted of collusion in a number of highly publicized international antitrust conspiracies have claimed that the Guidelines have resulted in penalties so large that they have resulted in overdeterrence. 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. After viewing an intensification of this trend for another two years, Adler and Laing (1999) were even more alarmed.

> "What is….troubling is that the company fines...have risen astronomically – to levels far higher than the fines for other serious economic crimes and in amounts that can be unrelated to the economic harm caused by the violations (p.1)."

More recently, 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, which is 20% of the volume of affected commerce (p. 3). This approach, he notes, presumes a pecuniary loss of 10% of sales due to price fixing; unlike all other white-collar federal crimes, the actual degree of direct harm caused does not have to be proven by prosecutors[20]. Denger notes a failure of the economic-legal literature, namely, that "…we have little information on what level of criminal or civil exposure is needed to deter most cartels (p.4)."

Concern about the lack of empirical evidence on the actual harm caused by price fixing is not confined solely to those sympathetic to the increased exposure of corporate defendants. Graubert (2003) notes that the controversy over whether antitrust payments are excessive (which on p. 7 he equates with payouts greater than reasonable damage estimates) is largely attributable to the "…difficulty of gathering useful data." A well known critic of the effectiveness of antitrust enforcement, Klawiter (2001) expresses skepticism as to whether the severe monetary penalties imposed on cartelists in the late 1990s will in fact deter illegal price fixing.

Issue 2: Global Cartel Fines

The majority of the overcharges generated by cartels in the past 15 years have been international, even global in membership and geographic spread (Connor 2001, 2003). Therefore, to assess deterrence non-U.S. monetary sanctions must be considered. U.S. antitrust enforcement has been a model for many other countries that have more recently adopted such laws. In Japan and Germany, U.S. occupation authorities imposed competition laws after World War II (Wells 2000). Germany's revised competition law implemented in 1958 became one of the principal influences on the adoption of such statutes by the original six members of the European Economic Community (Goyder 1999:18-33). After four years of political discussions within the EEC's Commission, Regulation 17 was passed and came into force in march 1962; its Article 15

[20] 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 in this context.

lays out the powers of the Competition Directorate General (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.[21]

Methods of calculating cartel fines are explained in a 1998 Notice and in each price-fixing decision of the EC (Connor 2005:14-15). Yet, authorities on the EU's competition laws are silent on the origins of the 10% rule. Harding and Joshua (2003) state that EU fines are supposed to incorporate both compensatory and punitive components, the latter to serve deterrence (p. 240). EU fines are calculated in six steps. First, the EC considers the "gravity" of the offense. Although a matter of discretion, cartels are usually placed in the "very serious" category, which is the highest of three levels of antitrust infringements. Cartels with large damages that are geographically widespread add to the gravity. The fine calculations base for the most serious infringements start at €20 million. Second, to account for disparities in the power of fines to deter, relatively large companies are fined more than smaller participants: in several global cartels, companies in the upper half of the cartel's size distribution had their fines doubled. Third, fine amounts are increased by 10 percentage points per year for each year the cartel is effective. Fourth, these three factors result in a base fine (called a "basic amount") for each company that is adjusted for culpability; upward for cartel leaders and downwards for various mitigating factors. Fifth, under the EU's Leniency Notice, violators are given 10% to 50% discounts for their degrees of cooperation. In a few cases, amnesty has been granted. Finally, after applying the last four steps, the Commission ensures that fine amount does not exceed 10% of global sales in the year prior to the date of the decision. Rarely does the EC need to worry about reaching the 10% cap (Connor 2003).

Although the fine-setting process is somewhat transparent, why the base fine is €20 million and the basis of the other adjustments is not known. It is clear that for a single-product firm that participates in a cartel with a 10% overcharge for one year, there can be no punitive component to EU fines. For more effective cartels, an EU fine cannot even be compensatory. Moreover, if the probability of detection and conviction is less than 20%, then any specialized member of a one-year cartel with a 2% overcharge or bigger will not be deterred. However, most companies that engage in cartel behavior are large diversified firms; for them, EU fines can come closer to optimal deterrence levels.[22]

Canada is another jurisdiction with relatively tough sentencing for cartels. The Canadian Competition Bureau (CCB) 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).[23] A former Canadian prosecutor comments that "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 discounts, and recently recidivists have paid fines as high as 45% of affected sales. The Canadian 20% rule seems to mimic the base fine

[21] Rule 17 was amended in 2004, but these provisions were unaffected.
[22] If the cartelized product line accounts for 10% of total company sales, then the duration or the overcharge level can be 10 times greater to achieve compensation or deterrence.
[23] 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).

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.

Issue 3: Cartel Deterrence

Concerns about the inadequacy or excessiveness of antitrust sanctions are part of the larger issue of the effectiveness of antitrust interventions. To make any headway in assessing empirically the adequacy of anticartel enforcement, it is necessary to have reliable information about the degree of harm generated by private cartels. Cartel injuries to purchasers are positively related to three economic factors: the size of the cartel's market, the duration of the conspiracy, and the percentage overcharge. Antitrust sanctions should be calibrated to a cartel's affected sales and overcharges; investigation procedures can reduce the probability of cartel formation or the duration of cartels.

Those critical of aggressive antitrust policy have often embraced the comforting notion that cartels are fragile coalitions. When the OPEC cartel began to have an impact on petroleum prices in the early 1970s, several leading economists predicted its imminent demise. Morris Adelman (1972) wrote that

> "Every cartel has in time been destroyed by one and then some members chiseling and cheating…"(p.71).

In 1974, in a now infamous news-magazine article, Milton Freedman predicted OPEC's imminent collapse. However, research by Eckbo (1976) and Suslow (2001) finds that the mean duration of discovered cartels is around five or six years. The (unknown) duration of undiscovered cartels is likely to be longer. OPEC may be less powerful than in the 1970s, but its production decisions continued to roil the petroleum market through at least 2004.

In a provocative essay that quickly drew rebuttals[24], Crandall and Winston (2003) argue that extant empirical evidence demonstrates that antitrust policy has been ineffective in either raising consumer welfare or in deterring anticompetitive conduct:

> "We find little empirical evidence that past [antitrust] interventions have provided much direct benefit to consumers or significantly deterred anticompetitive behavior" (p. 4).

The great majority of their criticisms are directed at monopoly and merger enforcement, but remedies in collusion cases also attract their disfavor. To support their view that the prosecution of overt price 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[25]. While Crandall

[24] 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".

[25] Space constraints do not appear to be responsible for such a skimpy treatment of this topic, for they list 59 references. The choice of two of the articles is unfortunate, because both are methodologically deeply flawed. Newman (1988) is discussed later in this paper; Sproul (1993) is criticized by Werden (2003). Both articles appear in journals managed by University of Chicago economists. Two other studies focus on an odd alleged episode of price fixing, the so-called Overlap group of 23 elite U.S. universities that met regularly to allocate needs-based graduate scholarships; this practice was permitted to continue under a consent decree that limited the degree of detail shared.

and Winston later admit that there are some "examples" of successful collusion, no studies are cited that support the positive effect on prices[26]. As for deterrence, Crandall and Winston rather grudgingly admit that the large DOJ fines meted out to cartels in recent years possibly deterred the most harmful cartels[27]. This concession is immediately tempered by a citation to an entirely theoretical analysis of the dangers of overdeterrence.

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). Kwoka is hardly the first specialist to lament the absence of quantitative estimates of the price effects of overtly collusive arrangements.

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. This is a gap in the literature that I hope this paper will remedy.

OBJECTIVE

The purpose of this paper is to collect and analyze all serious quantitative estimates of the monopoly overcharges generated by private, hard-core cartels from all areas and eras. Estimates will be taken from published social-science studies and from the decisions of competent judicial bodies. Rather than apply a subjective quality filter, the assembled estimates are examined for patterns that might indicate systematic differences in reliability across types of sources. The results of the survey are used to draw lessons about the ability of antitrust policies to deter cartels.

LITERATURE SURVEY

This survey has been prepared by checking more than 500 social-science publications.[28] The major portion of the overcharge estimates included in the present analysis 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

[26] They say that the lysine, citric acid, and vitamins cases are "well known," but provide no citation for this assertion. There appears to be only one publication that covers the price effects of all three of these three cases with a degree of depth, viz., Connor (2001).

[27] Their reasoning is obscure. Perhaps they are referring to international cartels, cartels with absolutely large overcharges, or conspiracies with high percentage overcharges. In any case, why they expect the probability of discovery or relative size of expected sanctions to be greater in such cases is not clear.

[28] The References section below lists about 350 sources with useful information about the private cartels in this paper's sample. Only about 200 contained usable quantitative overcharge estimates (shown in the last column of Appendix Table 2). The remaining studies in the References were consulted to confirm that for some alleged cartel tacit collusion prevailed or government power protected the cartel. See also table 11 below.

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.

Early Monographs on Cartels

Interest in collusive organizations began well before industrial-organization economics was recognized as a distinct discipline. Prior to World War II, relatively few archival articles treat the economics of cartels, but scores of books were published on the economic and political aspects of "pools," "trusts," "combines," "syndicates," and all the other terms that were used at the time to encompass various monopolistic business arrangements. The distinction between these terms was not well understood until the early 20th century. Bullock's (1901) seminal paper tends to regard all of them as roughly equivalent terms for monopolistic business entities with market power over price (p. 183).[29] But by 1916 Ripley could differentiate these phenomena using terms in a manner that has endured.

Pools or corners were contractual joint-profit-increasing agreements by independent sellers over prices or quantities; today these are called cartels (Ripley 1916: xiv).[30] Ripley cites the U.S. cordage cartel, formed in 1860, as the first documented U.S. pool. Other 19th century cartels include cotton bags, distilling, iron pipes, steel, salt (Jenks 1888), wire nails (Edgerton 1997), and a patent pool for porcelain bathtubs. [31] Trusts proper were legal instruments used in the United States from 1882 to 1902 for combining companies under a single board of directors; this legal form was supplanted as a means of industrial merger with the holding company beginning in the late 1890s (Ripley 1916). Thus, trusts, combines, and holding companies refer more to the outcomes of mergers and acquisitions than to cartels. Yet the word "trust" was used loosely and popularly to cover both cartels and mergers intended to increase market power.

Books

Bullock (1901), a professional economist and author of an early American economics textbook, wrote the first 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 outpouring of 34 books and 48 serious articles in 1897-1900.[32] Interest in the subject continued in the early 20th century, with most of the cartel literature from 1900 to 1940 appearing in books. Among the earlier monographs with significant economic content are books

[29] 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.

[30] 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). 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 *comptoirs* was often used to describe a cartel, with a joint sales agency often implied.

[31] 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).

[32] 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* at the time. Bullock includes one book written in French, but none of the large German literature.

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).[33] Some of these works were written by historians and others by some of the earliest practitioners of the emerging field of industrial economics. With the exception of Jenks' books, 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.

Liefmann (1897) published one of the first economic monographs that contained the word *Kartell* in its title.[34] The book appeared in five editions in German from 1897 to 1929. 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." In many ways he was leagues ahead of his contemporaries in the analysis of the cartel phenomenon. Liefmann (1932) devised one of the most cited and pithy definitions of cartels: "free [voluntary] associations of producers for the monopolistic control of the market (p. ix)." By this definition he meant to include only arrangements by independent companies linked by formal of 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.[35] 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 other cartels that were organized before 1929, but with one exception he includes no useful price series that could be used to compute price effects.[36]

Liefmann's positions continued to influence German economists for decades to come. However, 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 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). Indeed, the book contains no price data. However, Beckerath undercuts his agnostic position by noting that most cartels have

[33] Levy (1968), a careful scholar, cites about 30 books on cartels and closely related subjects published before 1927, the great majority in German.

[34] 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.

[35] That is, if two or more national cartels are joined by a government-to-government treaty, 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.

[36] 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)."

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.

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. 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.

Another early European writer who was concerned about the lack of concrete measures of market power is a then young lawyer and economics lecturer, Hirst (1905). His book grew out of an 1899 Oxford essay that attempted to develop price-based indicators of the price effects of cartels. Noting that German cartels frequently exported surplus 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, he applies this method to six German cartels using 1900-1902 prices.

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.[37] 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. 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. His books 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.

Harvard University seems to have been the leading campus for economic and legal studies of cartels in the early 20th century.[38] One indication of its preeminence is the publication of what is probably the first textbook on cartels, mergers, and monopolies in 1905. The revised edition is a huge (872 pages of small print) compilation of reprints from professional journals of law and economics, excerpts from briefs and court decisions, and legal commentary (Ripley 1916).[39] Ripley, himself the author of an important study of the railroads, aimed at applying the case-study method pioneered by Harvard Law School into advanced economics courses.

[37] 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).
[38] Other economists with interests in cartels worked at California, Columbia, Cornell, and Stanford universities.
[39] A similar book was edited by Curtis (1931).

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, a Stanford University economist at the time, 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. Both Jenks and Jones share an interest in organizations that have market power, but like most American and British social scientists writing in the first half of the 20th century, they are vague or inconsistent in distinguishing cartels from other powerful economic groupings. Pools, trusts, combines, monopolies, trade associations, conventions, comptoirs, ententes, syndicates, intergovernmental commodity agreements, and cartels were terms often used interchangeably by those writing in English or French (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. In fact, true trusts as legal vehicles for combining the assets of rival firms for market control lasted from only 1879 to the mid 1890s (Ripley 1916).

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 details about their conduct and the degree of government support are lacking. However, Sayous (1902) makes a well documented case for the existence of cartels in the strict sense of the term in 17th century Holland.[40] 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, and by 1622 the States-General of Holland had granted it a long-lasting monopoly for whale-fishing.[41]

[40] Sayous (1902:381) 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. Sayous believes that a cattle-procurement monopoly by butchers of Anvers, France in the 16th century also qualifies as an early European cartel.

[41] However, the government refused repeated appeals by the Company of the North to impose import barriers on whale oil or bone. The Company of the North became weakened by the entry of three other Dutch companies that required a reallocation of market shares and by the growth of the Danish whale-fishing fleet in the 1630s.

Liefmann (1932), also using a modern definition of cartels, believes that the first domestic German cartel was the Neckar Salt Union, a combination of salt mines in three German states. Two others (alum and pig-iron) were formed prior to the 1860s and three more in that decade. However, Liefmann and other writers point to the German depression of the mid 1870s as a peak for cartel formation. Schroeter (1994) calls the 1876 potash cartel one of Germany's first. By 1905 German government surveys found 385 industrial cartels operating; the number rose to 3000 by 1925.[42] As for *international* cartels, he 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) quoted a German book that found 114 international cartels in 1912; by 1920 he could detail 11 international cartels with participation of U.S. companies.

Seagar and Gulick (1929), academics at Columbia University and the University of California, authored a long book that focused primarily on trusts and the first three decades of enforcement of the Sherman Act. They illustrate the ill effects of price fixing by recounting the research of others on several examples of U.S. and European cartels. Like Ripley, they trace the earliest of the U.S. pools to the cordage industry, which began making agreements on prices at least as early as 1861; cordage manufacturers formed a formal association in 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.[43] As good as it is, this book contains only one fleeting reference to price effects.

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), for example, delineates in a modern manner those characteristics that are essential to a cartel and those features that may vary from cartel to cartel. Basically he 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 to control markets or reduce competition.[44] The essential feature 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. The business organizations may be private corporations, state enterprises, or national cartels. If the organizations are registered in at least two countries, then it is an international cartel. The legal organization of cartels ranges from informal committees that meet on no fixed schedule to formal secretariats or administrative units that may hold significant assets. However, Notz specifically excludes trusts, combines, joint ventures, holding companies and the like, because the economically distinctive characteristic of cartels is that its members retain legal independence in production and marketing decisions while at the same time subjugating their decisions for the "common good," that is, an increase in the pool of profits generated by their cooperative actions. While the

[42] Liefmann (1932) notes that these numbers do not count hundreds of local price-fixing agreements among hair dressers, hotels, and other services.

[43] Salt was sold in barrels of 280 pounds at prices of $0.50 to $1.00 per barrel in the 1870s. The National Salt Co., formed to control the salt fields of New York State, purchased the Michigan and Ohio fields in 190, giving it a 73% share of the evaporated salt market east of the Rocky Mountains (Seagar and Gulick 1929: 87).

[44] 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.

Department of Commerce reports are strong in detailing cartel membership and industry supply conditions, they have little to offer by way of price effects.

Cartels, mergers, trade, and foreign direct investment were major concerns of the League of Nations, which sponsored a major conference on the subjects in 1927. Papers prepared by some of the leading European cartel scholars of the day were published as part of the conference proceedings (de Rousiers 1927, MacDonald 1927, Wiedenfeld 1927, Economic and Financial Section 1927)[45]. 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 revealed a deep split between those participants who believed that cartels harmed national economies and international trade and those who believed that cartels stabilized prices, investment, and employment. Perhaps to rectify these ambiguities, the League later sponsored cartel studies with more empirical content (Benni *et al*. 1930, Oualid 1938).

Relatively few books were written about cartels in the 1930s, a period during which antitrust was in eclipse in the United States and cartels took on distinctly political roles as tools of economic planning in Europe. In this decade cartels were often embraced because they were perceived as antidotes to the word wide depression and, in some industries, deflation. From about 1933 to 1937 the U.S. antitrust laws were effectively appealed by federal government industrial planning experiments. Indeed, the Brookings Institution sponsored a series of books during this time to assist policy makers in implementing the National Recovery Act.

One of them was a survey of cartels as instruments for national economic recovery and stabilization (Pribram 1935). However, U.S. Supreme Court decisions quickly restored the antitrust laws by 1938 (Wells 2002). In Europe and Japan, cartels became instruments of government policies to reduce excess capacities, raise prices for certain raw commodities, or extend the power of authoritarian regimes over labor and industrial production. When President Roosevelt and his advisors became apprised of the intimate connections between national socialism and compulsory cartels in Germany in the late 1930s, they rejected using cartels to foster economic recovery.

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, 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. Each cartel study was authored by a different member of the project team. Monographs on cartels published by European economists at this time tended to continue to focus on the internal organization of cartels, but contain little else by way of empirical content.

Academic Papers

Although most books written prior to 1945 lacked empirical analyses of cartel performance, a small number of U.S. economists 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

[45] The United States was not a member of the League of Nations and sent only observers to the 1927 conference.

laws were being debated and first enforced, though none of these works suggested that their approaches had forensic value.[46] Among the most useful papers for overcharges are Jenks (1888), Andrews (1889), Edgerton (1897), Hudson (1900), Walker (1906), Stevens (1912), Tosdal (1916), Ripley (1916), Notz (1920), and Allen (1923).

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.[47] 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. Edgerton's 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 effective manufacturers' cartel which 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; moreover, despite the well publicized nature of the episode, the paper contains no reference to the seven-year-old Sherman Act.[48] 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 bath tub cartel, which used patent licenses on a new machine to achieve effective collusion. Allen's 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.

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) produced the most comprehensive economic study of international cartels yet published. Hexner, a Czech businessman and refugee from the German invasion of his home country, had an insider's knowledge of cartels. He had served as secretary of the Central European group in the international iron and steel cartel (Barjot 1994:65). Louis Marlio (1947), a French economist

[46] 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.
[47] Until World War I, 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; Taylor (1905) has the first reference I can find by an economist in an academic journal. Notz (1920, 1929) helped popularize the term in the United States.
[48] 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.

who wrote a detailed account of the international aluminum cartel, had a similar background. He had been president of one of Europe's largest aluminum manufacturers and had been appointed to represent the views of the International Association of Chambers of Commerce on the Cartels Commission of the League of Nations (*ibid.* p. 66). Both of these authors found much to admire in the effects of international cartels, whereas post-war works by American authors tended 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 toward cartels of North American lawyers and lawmakers and those in Europe:

> "…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 plank 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.

More useful for the purposes of this survey are books and reports that have focused on the effectiveness of international cartels, examining such elements of effectiveness as duration, profitability, or price effects. 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 prosecutions after grand-jury antitrust investigations (Stocking and Watkins 1946, 1948).[49] These books set a new standard for rigor and detail in the economics literature on cartels, and they have provided a dozen or more overcharge estimates for this survey. In my estimation, Stocking and Watkins (1946, 1948) represents a new era in the economic literature on cartels, because they were the first to apply rigorous modern concepts of the emerging field of industrial economics; moreover, because of access to the information spawned by numerous Congressional investigations and the first antitrust prosecutions of international cartels in the 1940s, they were among the first to focus on the market effects of international cartels.[50] Numerous and continuing citations to their books by leading scholars attest to their status as classics in the field.

The 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). The German cartel law, although based on a rule-of reason approach, would prove to be quite effective in purging most of German industry of cartels. The UK had a common-law tradition that disallowed the enforcement of cartel contracts by the courts, but this law did not discourage price fixing by trade associations. Through the early 1950s, a majority of the UK's manufacturing

[49] 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. prosecutions of more than 40 international cartels.

[50] Technically, the 1911 conviction of American Tobacco et al. was the first U.S. prosecution of an international cartel, but the international aspect of the case was a minor aspect of the case.

output was affected by cartels (Symeonidis 2001, Swann 1974). The reconsideration of the benefits of cartels 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. 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 and the UK were the prime movers behind the adoption of tough anticartel provisions in the Treaty of Rome, which solidified the antitrust tradition in the EU and its Member States.

There was a short lived U.S. interest in domestic cartels when the "Great Electrical Equipment Conspiracy" burst onto the Nation's consciousness in 1960-1961.[51] The great electrical equipment conspiracy resulted in the publication 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.[52] 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 1974, Sultan 1975, and Bane 1973). Sultan's books are by far the most quantitative; he was a business-school student at the time of the prosecutions writing case studies of the industry and subsequently consulted for industry. Sultan is perhaps the only writer to accept the defendants' arguments about the ineffectiveness of the conspiracies. Yet, a close reading of Sultan's analysis reveals fairly significant overcharges. In addition to the books, three economic studies were devoted to the cartels (Kuhlman 1967, Finkelstein and Levenbach 1983, and Lean *et al.* 1985). These studies have become staples in textbooks in industrial organization (e.g., Carlton and Perloff 1990).

There was a brief revival of interest in international cartels after 1973 when the Organization of Petroleum Exporting Countries (OPEC) first used its power to raise crude petroleum prices.[53] Many books and articles were written about the cartel, and two economic studies tried to predict OPEC's staying power by surveying the international cartel literature of the time. First, a chapter of a book by Eckbo (1976) has been widely cited. It originated as an MIT Ph.D. dissertation, and came out soon after the OPEC cartel was roiling world petroleum prices for the first time. Eckbo's work 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. In fact, Eckbo depends heavily on the data in Stocking and Watkins (1946) to make these determinations. He defines an effective price effect as a price that is "*three times unit costs*

[51] When the guilty pleas were receive 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.

[52] The conspiracies are notable for their duration (up to 40 years), the as yet unsurpassed 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 size of the fines imposed (over $2 million), the size of the damage awards in three trials and private settlements ($400 to $500 million) from more than 1900 suits, and the imposition for the first time of significant prison sentences for several top executives.

[53] 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.

of production and distribution" (p. 26). It is not clear whether Eckbo refers to total costs or variable costs, so to be conservative I assume he means average variable costs. I have coded Eckbo's 17 effective private cartels as having achieved a 50% overcharge.[54]

The second OPEC-inspired study attempted to use econometric models to predict more precisely the economic performance of international cartels, including many commodity-stabilization schemes that were fostered and enforced by sovereign governments.[55] Even the private cartels were chosen because they were extra-legal. The most comprehensive quantitative study of cartel price effects appears in a chapter by Griffin (1989).[56] 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 Index[57] of market power with three factors: intracartel concentration, the share of cartel market control, and a subjective index of the degree of the cartels' cohesion and monitoring methods. The model was fitted to data on 54 cartel episodes, most of which operated during the interwar period. Each of the three factors is found to be positively significantly related to their Lerner indexes, though the model's fit is modest, probably because of measurement error in the indexes. All but four of the cartel episodes were effective at raising price. Griffin finds that the mean Lerner Index for the 54 cartel episodes is 0.31, which is equivalent to a 44.9% overcharge. Eliminating the 16 episodes that were government-sponsored, the mean overcharge for the 38 private cartels is 45.6% and the median is 43.9%.[58]

Relatively few books were written about cartels from the early 1960s until the revelations about the international lysine, citric acid, and vitamins cartels began in the late 1990s. Four books, only one of which attained large sales, may be traced to high profile U.S. and EU prosecutions that began in late 1996. Three were prompted by a well publicized 1998 criminal trial of three executives involved in the lysine cartel, the record of which provided a degree of testimonial evidence which is unique for international cartels discovered after World War II (Lieber 2000, Eichenwald 2000, and Connor 2001). Harding and Julian (2003) provide a

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[54] This is a conservative assumption. I reason as follows. In the manufacturing industries studied by Eckbo, fixed costs are unlikely to exceed half of average variable costs. Substituting LRMC = FC + AVC = 1.5 AVC into the Lerner index formula yields a value of at least 0.50. Because price is greater than or equal to LRMC, the overcharge is greater than or equal to the Lerner Index of 50%. In fact, Griffin (1989) interprets Eckbo's "effective" cartels as achieving a 100% increase in price (p. 182).

[55] Besides the price effects discussed here, Griffin analyzes the sources of cartel duration.

[56] 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 terms Eckbo's approach subjective.

[57] The Lerner Index is the same as the overcharge, except that it is measured by dividing by the monopoly price instead of the competitive 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, though the difference is 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. Simple algebraic substitution allows one to express MO as a function of L, viz., MO = L/(1-L).

[58] Somewhat surprisingly, government-sponsored cartels in this period had mean overcharges virtually the same as the private schemes.

legal overview of mainly EU cartel enforcement. Only Connor (2001) contains empirical overcharge data.

Quantitative Estimates of Cartel Overcharges

Given the importance of the topic for legal-economic discourse, there have been surprisingly few surveys of the empirical findings of cartel overcharges.[59] I have been unable to find any research that has as its principal aim collecting or analyzing information on the price effects of overt collusion.[60] Indeed, the only work I have been able to locate that purports to survey cartels is a very early paper by Bullock (1901). However, I have found six works that mention a significant number of studies of mark-ups due to overt collusion.[61] The overcharges are cited as a prelude to scholarly research, not as an end in themselves; none claims to be a comprehensive survey. The six studies collect samples of five to 22 estimates. Only one of the six appears in a peer-reviewed journal.

Cohen and Scheffman (1989) recognize that the average size of price-fixing overcharges generated by overt collusion is a critical issue in evaluating the USSGs and assert that there is a sparse economic literature on the topic.[62] Their survey cites only five publications providing such estimates for price-fixing cases not involving bid rigging, one of which is questionable.[63] Cohen and Scheffman defend their decision to limit their survey to a few studies on the grounds that the 1987-89 deliberations of the Commission on the Antitrust Guideline focused on two particularly important cases, *Bakers of Washington State* and *Corrugated Containers.* They cite one short survey of empirical studies of bid rigging in the road-building industry in the 1980s (Werden and Simon 1987). Although supported by that one fairly narrow review, Cohen and Scheffman seem prepared to accept that bid-rigging conspiracies in general generate average mark-ups of around 10% (p. 345). This, in turn, accounts for their support for significantly

[59] 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.

[60] 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. However, neither survey covered the topic of price effects, presumably because of the paucity of such data.

[61] Froeb (1995) constructed a popular internet site for antitrust economics, and four pages contained a partially annotated bibliography of empirical studies of the price effects of conspiracies. The internet page is http://www.antitrust.org/economics/conspiracy effects.html ; it was downloaded on Feb. 24, 1999 but no longer appears on the site with its former content [see http://www.antitrust.org/cgi-bin/showcase.pl?casetype=Collusion]. "Antitrust.org" is now maintained by the graduate business school of Vanderbilt University [http://www.antitrust.org/index.html]. He lists 14 published studies published between 1976 and 1994. Of the 14, nine contain remarks about the studies' findings, and all but one is interpreted as showing a significant relationship between collusive behavior and prices. Froeb does not attempt to provide numerical impacts.

[62] There are several hundred published economic studies that try to measure the degree of market power observed in specific industries, in small of large samples of industries, or attained by a single firm or brand. In most cases these studies are unable to or do not attempt to distinguish whether the measured height of market power is derived from the exercise of unilateral, tacit-collusive, or overt-collusive market power.

[63] 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 a footnote, both the numerator and denominator of this ratio are inappropriate indicators of an overcharge; nevertheless in the text of there article, they persist in quoting with approbation the "suggestion" that price-fixing mark-ups of under 1% of sales are accurate for this industry.

higher fines for bid-rigging conspiracies than for more straightforward price- or quantity-setting conspiracies.

A working paper by Werden (2003) cites 14 studies of cartel overcharges.[64] All of his sampled studies were published since 1991, because he wished to limit the cartels under study to conspiracies that operated after 1974, the first year in which cartels could be prosecuted as felonies; three studies examined international cartels prosecuted by the DOJ in 1996-97. One of the studies is judged to be methodologically flawed (Sproul 1993); another methodologically sound study, while it finds significantly lower collusive prices in rigged bids than in noncollusive bidding, cannot be converted to a numerical price change from the results as published (Pesendorfer 2000). Three of the studies looked at a total of seven distinct instances of price fixing, thus yielding 14 usable observations, some of which are ranges. The mean overcharge was 18.6% to 27.1%.

Posner's (1975, 2001) treatise on antitrust law is an avowedly economic treatment of the subject. An important issue for Posner is the importance of antitrust law to ameliorate the social costs of monopoly in the economy. To 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). In the 2nd edition, seven of his estimates are based on his reading of Stocking and Watkins (1946, 1948), one is an old Supreme Court case, and four are modern quantitative studies of the price effects of market power in major U.S. industries that he assumes are collusive: petroleum, automobiles, cigarettes, and soft drink bottling.[65] Because Posner is an avatar of the Chicago School of economics, it is noteworthy that his estimates are among the highest of the six studies.

Valerie Suslow and Margaret Levenstein are authors and co-authors of a number of important analyses of international cartels. Levenstein's (1997) oft-cited quantitative-historical study of the bromine cartel yields four estimates of mark-ups for its three episodes. Suslow's (2001) paper on the duration of the interwar international cartels also analyses annual prices for 17 products that were cartelized. Levenstein, Suslow and Oswald (2003) profiles three postwar cartels and has usable price data for two of them. Finally, Levenstein and Suslow (2002) focus on the determinants of success for both the interwar and more modern cartels. The paper aims at assessing three dimensions of cartel performance, stability, duration and "profitability," the last equivalent to overcharges. Although the authors are modest about their accomplishment, this paper contains the fullest accounting of overcharges of any source.[66] They collect price-effect information on five cartels (their Table 8) and 16 price increases for 12 international single-episode cartels prosecuted since 1990 (Table 15). Thus, this paper provides a total of 21 estimates of price effects for international cartel episodes. Their sample yields a median cartel price increase of 25% (*ibid.* p.20).

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[64] Irden's paper is a critique of Crandall and Winston (2003). Another critique is by Kwoka (2003). Both comments are unusual in that they were written prior to the publication of Crandall and Winston's paper in December 2003. Baker (2003) is also largely a response to Crandall and Winston.

[65] The authors of the studies make no claim of overt collusion. Posner includes industries that are effectively tacitly colluding.

[66] "I have very little evidence on the excess profits … [from] cartelization. For fifteen cartels … I have anecdotal evidence of price increases…" (p. 20).

The OECD (2003) report on private "hard-core" cartels contains a summary of a 2001-2002 survey of its government-members on the economic harm caused by cartels recently prosecuted by the European Commission and other national antitrust authorities.[67] Presumably, the examples chosen to be included are among the best documented examples of the degree of harm available to the authorities. The 38 responses to the survey are summarized in Annex A of OECD (2003). While not all of them 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.[68] The six surveys just discussed are summarized in Table 1 below.

Table 1. Summary of Six Economic Surveys of Cartel Overcharges

Reference	Number of Cartels	Average Overcharge	
		Mean	Median
		Percent	
1. Cohen and Scheffman (1989)	5-7	7.7-10.8	7.8-14.0
2. Werden (2003)	13	21	18
3. Posner (2001)	12	49	38
4. Levenstein and Suslow (2002)	22	43	44.5
5. Griffin (1989), private cartels	38	46	44
6. OECD (2003), excluding peaks	12	15.75	12.75
Total, simple average	102-104	30.7	28.1
Total, weighted average	102-104	36.7	34.6

The last major source of data is a working paper that attempts to compile data on the price effects of 167 private international cartels that were discovered by antitrust authorities only since 1990 (Connor 2003).[69] The cases covered in that paper include fully prosecuted cartels and

[67] 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.

[68] 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.

[69] The working paper incorporates a series of studies on the same subject that commenced in the mid 1990s (Connor 1997, 1998, 2001a, 2001b, 2004). The author has continued to add cases as they appear.

a few still being investigated of prosecuted as of mid 2004. About 40 of these international cartels yield overcharge estimates. All the overcharges in Connor (2003) are incorporated into this paper.

I have examined hundreds of journal articles, working papers, and other short analyses of cartel price effects. Many were written primarily as historical case studies and mention price effects only in passing; most such papers contain no references to price changes but are valuable because they are based on primary documents that give details about internal organization. The majority of the short cartel studies were written by economists; the focus in these studies is on testing hypotheses or an improved estimation method for overcharges, so much so that they sometimes do not contain enough information to derive point estimates of the overcharge rate.

Nearly all economic articles are written by North American academics using cartel episodes that affected commerce in the United States or Canada.[70] The absence of empirical studies by European or Asian academics is striking. One might speculate as to why this is so. The supply of well trained industrial economists in Europe is unlikely to be an explanation.[71] However, the structure of academic departments at European and Asian universities may explain 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 structural and price data needed to calculate overcharges. Civil 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 likely to expect economists to influence competition policies (Aiginger *et al.* 2001).

DATA SOURCES AND COLLECTION METHODS

I have made every attempt to identify and collect all useful information on *private, hard-core* cartel overcharges available from public sources. A private, hard-core cartel is one that by contemporary U.S. standards could be criminally indicted under the Sherman Act.[72] Classifying these cartels at times requires judgment.

Some cartels operated prior to 1890 when passage of the Sherman Act made participation by U.S. companies illegal, but many cartels headquartered in Europe predate the beginnings of effective antitrust laws there (the late 1950s in the UK, Germany, and the

[70] Several historical studies of cartels were authored by Europeans or Japanese scholars. A few economic studies of cartels were written by UK or Australian economists (Evenett, de Roos).

[71] The principal European organization for industrial economists (EARIE) was more 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.

[72] Criminal indictments for only hard-core cartels is a matter of custom, not law. The 5 to 10% of U.S. DOJ horizontal or vertical conspiracy cases handled through civil indictments could be criminally actionable.

European Economic Community). If these cartels were not formed by means of a legally enforced government monopoly, they are generally considered private schemes.[73] 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. Similarly, if a government-owned national monopoly or commodity association voluntarily joins an international cartel, that too may be 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.

Because of this paper's antitrust orientation, commodity agreements known to have been initiated, actively sponsored, or overtly protected by national sovereignty are not included.[74] In these "public" cartels the active involvement of governments are signaled by the signing of a treaty, government ownership of stocks, 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). In general I will aim to follow procedures that result in conservative overcharge statistics.

Hard-core or "naked" cartels are those that made explicit agreements 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, or production-capacity agreements. Cartels that focused exclusively on advertising, patent pooling, setting technical standards, R & D, and the like are excluded.

The sources fall into two major categories: published estimates contained in studies by economists, historians, or other serious students of the subject and decisions of judges, juries, or commissions in formal criminal or civil proceedings.

Social Science Studies

The first of three major sources consists of books, monographs, reports, and refereed journal articles written by specialists in many fields: economists, historians, political scientists, lawyers, and in a few instances journalists[75]. Newer publications were located by using various

[73] Wallace and Edminster (1930: Appendix A) provide a convenient chronology of most government-sponsored export-control monopolies: 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 cartels.

[74] In some cases particularly in the early 1930s, the earlier phases of an international cartel were controlled by national producers' organizations 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.

[75] 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

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. I examined a number of monograph-length studies that took a cross-sectional approach.[76] There are also several books that study one cartel: for example, Eliott (1937) on nonferrous metals; Marlio (1947) on aluminum; Blair (1976) on oil; Taylor (1979) and Gray (1982) on uranium; and the most heavily studied cartel of all, heavy electrical equipment (Herling 1962, Smith 1963, Bane 1973, Sultan 1975, and Epstein and Newfarmer 1980). Some economists and historians have spent substantial portions of their careers specialized in cartel analysis (Levenstein, Suslow, Barbezat, Griffin, Schroeter, and Connor, among others), but most of the publications quoted herein are by social scientists for whom cartels were just a passing interest. Other sources of information include the Web pages of scores of antitrust agencies, lists of court and commission decisions, and multilateral organizations.

There are varying methods used to derive the effects of cartels on prices. In economics, older studies tended to use a rather informal method of price analysis that now comes under the rubric of the "before-and-after method" (Connor 2004). 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 comparison would be a price war that erupted during the affected period. The collusive prices could be figured two ways, either by averaging prices over the entire collusive period (preferably weighted by the quantities sold in each sub period, but often just a simple average of the available collusive price observations) or by choosing a single, peak price. Averaging revealed how effective a cartel was in controlling prices throughout a conspiracy that normally varied in its degree of cohesiveness, whereas the peak price would reflect how close a cartel had come to achieving the theoretical maximum, the monopoly price. 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 or one day's 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; the trend in cartel prices could then be compared to the trend in the yardstick during the collusive period. Yardstick price

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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).

[76] Liefmann (1897) wrote one of the first; Jenks (1900) and Jones (1921) were early writers. The interwar cartels received a great deal of attention from Pietrowsky (1933), Plummer (1934), Hexner (1946), Edwards (1946), Eckbo (1976), Suslow (2002), and the classic studies by Stocking and Watkins (1946, 1948); the post-World War II studies were more quantitative than their predecessors. More modern studies include Heath (1963), Levy (1968), Maurer and Mirow (1982), Spar (1994), Lanzillotti (1996), Levenstein and Suslow (2002), and Connor (2001).

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.[77] 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. Cost-based estimates are relatively uncommon because detailed internal business records are needed. Both the before-and-after and yardstick methods require expert judgments about the market in question, but both remain the leading 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. Driven by developments in oligopoly theory and the increasing availability of detailed company and market data, increasingly it is econometric models of the alleged collusive market that are specified and fitted to the available data.[78] An essay by Werden (2004) traces the influence of modern oligopoly theory on forensic economic analysis of collusion. Werden considers modern oligopoly theory to be essentially equivalent to game theory, the most useful of which are models based on Cournot and Bertrand games.[79] Game theory has influenced contemporary concepts of collusion, the design of competition policies, and empirical modeling of oligopolies. Modern oligopoly theory has reinforced the importance of small numbers of buyers and sellers as explanations of collusive behavior; it has provided a rational basis for laws that prohibit agreements ("conscious common schemes") between rival sellers and has given more precision to what constitutes tacit agreements and conscious parallelism[80]; and it has overturned some previously influential concepts of collusion.[81] The game-theoretic idea of the prisoners' dilemma has been the basis of highly effective leniency and amnesty programs for cartel participants. Finally, game theory has been used to justify the shape of behavioral models that can be tested statistically.

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[77] 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.

[78] 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.

[79] He notes that Cournot quantity-setting games appear to be different from Bertrand price-setting games. Cournot models are typically thought to apply to homogeneous-product industries; Bertrand models are the basis of models that apply to markets with heterogeneous or differentiated goods and to auctions. However, theorists have proven that under certain reasonable conditions (a two-stage decision process in which firms first choose to invest and later choose output or price levels, the firms have capacity constraints, and consumers with the greatest willingness to pay buy up the low-priced firm's output first), the two models predict exactly the same equilibrium quantities and prices. Infinitely repeated games are not useful in forensic settings, if only because they generally fail to generate unique equilibria.

[80] Werden asserts that actionable collusion may be either *spoken* (classic overt communication) or *unspoken* (communications effected purely by means of marketplace actions). "Tacit" collusion is an ambiguous term because it may refer either to unspoken agreements (e.g., the sudden, simultaneous adoption of basing-point pricing) or to conduct unrelated to any kind of agreement (e.g., barometric price leadership). Similarly, developments in game theory have supported making illegal consciously parallel behavior *if* it is accompanied by certain "plus factors" (a close correspondence between meetings and bids; a pattern of close advanced price announcements; conduct that is multilaterally rational but unilaterally irrational; and certain facilitating practices such as detailed information sharing, best-price policies, meeting-the-competition clauses, and basing-point pricing.

[81] Werden argues that Chamberlin's small-numbers case, which predicts a "spontaneous" (tacit) shift to monopoly prices when the number of sellers contracts, is inconsistent with noncooperative oligopoly models that predict prices lower than monopoly.

In a sense, econometric modeling is an elaboration of the before-and-after method. These models usually specify the demand and supply conditions in the relevant market, and then investigate through statistical tests whether and to what extent changes in prices or output fail to respond to normal, competitive market forces. Because these models can simultaneously incorporate multitudinous factors, economists tend to regard overcharge estimates from such models as more credible than analyses that depend on more informal ways of accounting for such factors. 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 fancy econometric models and the more traditional methods will yield the same overcharges. For durable cartels, constancy of all these factors is unlikely.

In short, the economics literature on overcharges has evolved in many ways since the first cartel studies first appeared in the very late 19th century. This evolution might affect the way that readers regard the reliability of the overcharge estimates assembled for the present paper. Therefore, this study tries to be careful to annotate the type of study, the method of analysis (if known), the data available to the author, and whether the estimate is an average one or a peak overcharge (see Appendix Table 1). Differences in overcharges may be related to method. Moreover, alternative estimates are sometimes available for the same cartels; the differences will be analyzed.

Consistent with most previous studies of cartel effectiveness, each cartel episode is treated as a unique observation. Most cartels are organized and fall apart only once; not counting brief disciplinary price wars, this describes one episode. However, many cartels are formed, disband, reform, and disband several times; each cycle is an episode. The reasons for analyzing episodes rather than one cartelized market over time are fairly straightforward. Each time a new collusive episode begins, chances are that the methods and membership composition have changed; pauses between episodes are often quite lengthy. Because the agreement and the players are different, a new cartel is launched.

U.S. Antitrust Court Verdicts

In theory one should be able to determine how high cartels raise prices by a straight-forward examination of a statistically significant sample of the many antitrust cases that involved cartels. However, the amount that prices changed, or even whether prices were affected at all, is not relevant to the issue of whether a cartel violated the antitrust laws.[82] It therefore is unnecessary for a U.S. court in criminal antitrust cases to calculate the extent of any overcharges or undercharges.[83] In civil cases, however, the damages awarded to a successful plaintiff are

[82] 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.

[83] Normally the government simply relies upon the 10% overcharge presumption. On this basis the prosecutors and the defendants typically settle upon a criminal fine without calculating the actual overcharges involved.

The first time in which the federal government attempted to prove the size of cartel overcharges was in the sentencing phase of *United States v. Andreas*, in which defendants were convicted of conspiring to fix the price and allocate the sales of lysine. The Department of Justice ("DOJ") recommended that the court apply the alternative sentencing provisions of 18 U.S.C. § 3571(d). The court conditionally denied the defendants' motion to reject the

equal to three times the overcharges,[84] so in these cases plaintiff must demonstrate how much prices increased or decreased due to the actions of the cartel.

The necessary research has proven to be extremely difficult to undertake, however, 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[85] calculated an overcharge are surprisingly rare. As an example of their scarcity, there apparently has never been even a single final verdict in a damages case involving indirect purchasers, even though this is a very actively litigated area of antitrust law where more than 100 cases have been filed against a single defendant.[86]

The reasons for this high settlement rate are not completely clear.[87] One reason is because the litigation is so risky and expensive that settlement often is the most logical alternative for both parties.[88] Rather than incurring substantial litigation expenses,[89] risking personal and corporate time, expenses, and disruption for clients,[90] and face an uncertain

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sentencing provisions, and granted the parties' motion for an evidentiary hearing to present economic evidence regarding the gains or losses attributable to the conspiracy.

The DOJ retained the expert opinion of an economist, who based his estimate of the defendants' gains on a hypothetical "but-for" price. When the defendants requested more time to research and respond to the expert's opinion, the court ordered DOJ to assist the defendants to obtain the necessary sales, price, and volume information from other lysine producers. The court later opined that DOJ's production of economic data was insufficient, and therefore granted the defendants' motion to bar imposition of the alternative fine provision.

[84] 15 U.S.C. Section 15 (Supp 1992). The Statute also provides that successful plaintiff will recover reasonable attorney's fees and expenses.

[85] Although there have been cases where its staff entered into agreements with defendants over the size of the illegal overcharges, I know of no cases where the Federal Trade Commission calculated the actual size of a cartel overcharge.

[86] See Lande (2004). For example, a reliable source reported that in recent years at least 137 antitrust cases alleging overcharges were filed against Microsoft alone, involving both Sherman Act Section 1 and Sherman Act Section 2 allegations (Groner 2004). As of July 2004 almost all had been dismissed or settled, and there have been no final verdicts.

[87] Most civil cases of all types settle or are dismissed. I have no information as to whether cartel cases are more likely to settle or be dismissed than are other types of antitrust or non-antitrust cases. However, the fact that so few final cartel verdicts can be found suggests that it may be lower. Unfortunately, these settlements virtually always provide little useful public information. Bentson in Salop and White (1988: 318) notes that the most ambitious empirical study of private antitrust cases yielded too little publicly available information on settlement amounts to justify analysis.

[88] This type of complex litigation that goes to final judgment has sometimes colloquially been termed a "mutual suicide pact" because of the ardor involved for all concerned.

[89] Salop and White (1988) calculated that attorneys' fees average 30-50% of the overcharge amount. Elzinga and Wood (1988) calculate attorneys fees as being 58%-102% of the overcharge.

[90] The cost of this disruption to the affected firms can be tremendous. See the discussion in Lande (2004: 142-144) in which James T. Halverson was reported to have recommended "that a defendant take exhaustive discovery, particularly if it has an advantage over the plaintiff in terms of resources. Halverson also suggested that any defendant show the plaintiff that it is not costless to sue. Thus a defendant should counterclaim. Halverson bluntly suggested that private plaintiffs look at their pocketbooks rather than the so-called "public interest," so defendants should make plaintiffs worry about their pocketbooks. He also suggested that if more than one private suit is filed, the defendant should get the weak suit to trial first....[after] the plaintiff's board of directors has seen months of attorneys' fees and corporate disruption, the plaintiff's board will work in the defendant's favor and nudge its lawyers toward a compromise.... In sum, he stated, settle strong cases and try the weak cases, always while delaying the Government."

probability of an uncertain magnitude of gains (or a total loss[91]), counsel for all parties often recommend and negotiate a compromise.

It might instead be useful to ask why some cartel cases do not settle. One possibility is that the non-settling cases are most likely to be those where the parties have different beliefs as to the likelihood of victory. Settlement is very difficult if plaintiffs are optimistic that they will prevail and the award will be large, while defendants believe the opposite. For this reason non-settling cases might be those in which liability and damages are least susceptible to prediction, and in which the expected likelihood or magnitude of liability cannot be predicted with even a small amount of confidence.[92]

Since most cartel cases settle, it might be desirable to survey settlements as one way of determining the size of the cartel overcharges.[93] However, settlement amounts are too frequently an extremely unreliable guide as to the size of the underlying cases' overcharges. Settlements are by no means likely to be compromises for half of the overcharges.[94] A risk-averse plaintiff with a strong case might settle for very little if it needs the money quickly and consequently is in a weak bargaining position.[95] Conversely, a risk-averse defendant with a strong case might settle for what might seem like a overly generous amount to avoid even a small probability that an

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[91] Both parties have a special incentive to settle cases that, if plaintiff prevails, would bankrupt defendant.

[92] Other factors could include lawyer or client stubbornness, irrationality or denial of the likely impending reality of the court's verdict. Another possibility is the unethical resistance by counsel to accept a settlement that would be good for their clients but would generate fewer legal fees than litigation. This could be especially likely to occur in class action cases since class members cannot effectively supervise their attorneys. It also is possible that as a case develops, plaintiffs are more likely to settle to the extent they come to believe that its potential rewards are likely to be less than the expected payoff. However, since the costs of litigation are automatically recovered by prevailing plaintiffs (See 15 USC Section 15 (1992)) this factor is less important than in other fields.

[93] One might believe, for example, that a settlement represents the lower bound on the expected recovery if the case would go to trial (the present value of three times the overcharge plus attorneys' fees) since a risk-neutral defendant would be unlikely to settle for the entire expected verdict.

One might also believe the supposed rule of thumb that good antitrust cases usually settle for single damages, perhaps on the dubious theory that the trebling (which produces a higher number) and the lack of prejudgment interest (which produces a lowe number) would roughly usually cancel one another. I have no evidence as to whether this is the way that plaintiff and defendants, or their attorneys, typically behave. I have, however, heard trustworthy plaintiff and defendant attorneys tell us, anecdotally, they have settled cartel cases for single damages.

[94] If plaintiff and defendant each had, and knew that they had, a 50% chance of winning, then the settlement might Ill be for 50% of the present value of the automatically trebled overcharges. But this would not be true if plaintiff's chance of prevailing was not 50%, if one party was a better bargainer, or if parties were unduly optimistic or pessimistic about their chances of prevailing. Suppose, for example, that difficult class action certification problems reduced plaintiffs' chances of winning to 25%. And, even if defendants really did raise prices by 30%, this often can be very difficult for plaintiff to prove. If plaintiff only has a 25% chance of obtaining class certification and subsequently proving the damages, a settlement should be at far below the level of 50% of the discounted present value of three times the overcharges. Moreover, publicly available settlements typically contain very little usable data. Often they do not even include the size of the affected commerce, making the calculation of the overcharge percentage highly speculative.

[95] Plaintiffs' counsel typically asserts that defense counsel are able to find barely ethical ways to delay meritorious claims for years. Since antitrust awards do not contain pre-judgment interest (15 USC Section 15), and plaintiffs often need the money in the short term, these delays harm plaintiffs' bargaining position significantly. Plaintiffs' counsel also asserts that defendants often are able to unreasonably prevent the necessary class certifications, and otherwise to make litigation so burdensome that plaintiffs have to settle for only a small fraction of the actual overcharges.

irrational judge or jury will award an amount large enough to cripple the company.[96] Legal writings are replete with such a wide variety of claims from both plaintiffs and defendants[97] as to settlement motivations that it appears that an analysis based upon average settlements would not be very meaningful.[98]

Data collection aimed at obtaining the largest possible sample of verdicts in collusion cases, namely, final decisions in United States antitrust cases involving horizontal collusion, broadly defined to include bid rigging and related practices, where a judge, jury, or commission calculated the damages.[99] Three sources were explored: computer assisted searches of data bases,[100] reading through a large number of articles and treatises on cartels and on antitrust damages, and messages to groups of knowledgeable antitrust professionals.[101] Every qualifying final collusion verdict is included.[102]

One example will illustrate the difficulties of engaging in this type of research. United States v. Anderson[103] involved a conviction for bid rigging USAID contracts. The Circuit Court Opinion said that the winning bid on the wastewater treatment facility was $107,017,000, the engineers estimated the cost would be $60,000,000, and the defendant's profit was $50,639,000. Thus, the illegal overcharge might have been 47%. The problem with using this figure is that the winning bidder certainly might have made some profit in a competitive market.[104] So 47%

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[96] There are many variations on this theme. Attorneys for defendants in cases that have settled for millions of dollars appear to believe, Ill after the cases were over and after there was any threat of further liability, that their clients never affected prices. Defendant attorneys often assert that their clients (who were found by a court to have agreed to fix prices) were prevented by market forces from affecting prices significantly. HoIver, rather than take the risk of having a judge or jury not believe them, they settle for a large sum. Another factor that can make defendants want to settle even if they did not raise prices is the antitrust law's joint-and-several-liability doctrine, which makes every member of a cartel liable for the overcharges of the entire cartel. See Denger, (2003: 10). This can lead to extremely large potential damages, and even a small risk of a huge payout can, from the defendant's perspective, overshadow a weak liability case. A defendant might be forced to settle for a significant amount even if it did not cause prices to be elevated.

[97] Interestingly, defendants sometimes assert that unscrupulous plaintiff attorneys often only have an interest in the size of their legal fees, rather then the amount they recover for their clients. If true, this gives rise to the possibility that plaintiff attorneys, especially in consumer class action cases, might settle for unduly low amounts solely to secure generous legal fees for themselves. The Courts are supposed to prevent this from happening, but judges sometimes are too busy to do so optimally.

[98] It may be possible, though difficult to derive insights from an analysis of settlements. One could imagine, for example, a study of settlements based upon candid interviews with participants. Anonymous questionnaires about past cases are another possible research method.

[99] I excluded cases that were overturned on appeal.

[100] Computerized searches were not, with only a few exceptions, particularly helpful. Most searches turned up hundreds of useless citations, including searches for "price fixing" or "bid rigging" and "verdict", "amount of overcharge", "overcharge" and "percent", "auction" and "conspiracy" w/in "antitrust", "collusion" and "dollars" or "cents". I never were able to design a successful focused computerized case search.

[101] For example, inquiries were made on the antitrust listserves of the ABA Antitrust Section, the National Association of Attorneys' General, and of the American Antitrust Institute.

[102] However, many of the verdicts that I did find were only expressed in dollar amounts which I was unable to translate into percentages, so I reluctantly had to omit these cases See, e.g., Bigelow v. RKO Radio Pictures, Inc., 150 F.2d 877, 884, 327 US 251, *Chattanooga Foundry & Pipe Works v. Atlanta*, 203 U.S. 390 (1906), Transnor (Bermuda) Ltd. v. B.P. North America Petroleum, 736 F. Supp. 511 (S.D.N.Y. 1990), Phillips v. Crown Cent. Petroleum Corp., 602 F.2d 616 (1979).

[103] 326 F.3d 1319 (11th Cir. 2003).

[104] Economists often define "cost" to include a normal rate of return or a normal profit, but I are unsure whether the Court was using the term this way. Moreover, in a competitive market risky construction projects sometimes make a considerable profit, but sometimes result in a loss.

represents something like the maximum possible illegal overcharge. However, the Opinion also said that the winning bidder agreed to pay two co-conspirators $5.35 million and $2.2 million for bidding so high that they would not be awarded the contract.[105] This totals 7.1% of the contract price, and means that the overcharge must have been at least this much. Since the true overcharge probably was between 7.1% and 47%, I used 7.1% when computing the overall average.

The vast majority of the cases either settled or were dismissed. This left a disappointingly small sample size to analyze. However, I know of no reason to believe that the sample is biased in any particular direction. Moreover, the sample of 24 observations is roughly as large as the sample size of those in the prior surveys reported in Table 1. Nevertheless, this sample is disappointingly small compared to the number of social science observations. Due to its small size these results should be interpreted with caution. They should be considered only as additional data worthy of analysis and discussion, not as definitive material.

Decisions of Other Antitrust Authorities

Table 1 summarizes 16 percentage overcharge estimates[106] of hard-core cartels that were reported to the OECD (2003) by nine antitrust authorities: U.S. Department of Justice (DOJ), the European Commission (EC), the Korean Fair Trade Commission (KFTC), the Australian Competition and Consumer Commission (ACCC), the Canadian Competition Bureau (CCB), the German Bundeskartellampt (BKA), the Danish Competition Authority, the Norwegian Competition Authority, and the Spanish Competition Authority. 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.

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.[107] However, in some jurisdictions a detailed report is released a year or two after the decision, and some of these reports have prices that can yield useful overcharge information.[108] I read about 80 EC decisions that imposed fines on cartels (Burnside 2003: Annex 1). Additionally, commission decisions can be appealed to a court that renders a decision with a recitation of the facts of the case. In this paper, the UK and EC decisions afforded enough data to make several estimates.[109]

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[105] Defendant also agreed to give them other considerations, such as a $25 million subcontract, which probably had a substantial profit built into it, and the designation to win another contract (*ibid.*).

[106] Four were judged to be peak estimates. Some other estimates were total damages that could not be converted to a rate.

[107] 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).

[108] The UK Monopolies Commission also operated in this fashion.

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

GENERAL DESCRIPTION OF THE SOCIAL SCIENCE DATA [110]

The data analyzed in this paper are drawn from two major sources, published social-science studies broadly defined and the decisions of courts and commissions entrusted with the enforcement of antitrust laws. With very few exceptions, I have attempted to report on every scholarly or serious social science study that contained quantitative information on the price effects of hard-core private cartels.[111] While no time limit was placed on the literature search, the majority of the sources consulted were written after 1945.[112]

In general, I aimed at collecting the largest possible body of quantitative estimates of monopoly overcharges, and avoided applying some sort of 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; the bases for my inferences are briefly outlined in Appendix Table 2.[113] Few overcharge claims appearing in newspapers, magazines, and newsletters are included 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.[114] In some cases, overcharge estimates may originate from articles 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. We did include estimates appearing in a few book-length cartel studies by journalists, public servants, or other professional writers of nonfiction.

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

[110] The subsequent tables in this report are constructed from spreadsheets that incorporate data collected as of October 10, 2004. Appendix Tables 1 and 2 contain a few observations added after that date.

[111] See Appendix Table 5 for a list of excluded studies and the reason for their exclusion. I am indebted to dozens of colleagues who responded to appeals for information useful for this study.

[112] Unless available in translation, I have mostly confined this survey to English language sources. Many antitrust authorities now translate their press releases 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. Although theoretical concepts of competition and monopoly go back at least to Adam Smith, the field is generally regarded as having developed a separate identity only in the 1930s. The first textbook of industrial organization was published in 1958.

[113] 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" are not tabulated in the quantitative summaries.

[114] Some scholars may have relied on what they judged to be credible journalistic reports of overcharges.

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. 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.

The data may be 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. *Markets* are precisely self-identified by the participants in the conspiracy, though occasionally there are alternative names for the same market.[115] The name of the market is eponymous for the cartel. *Episodes,* discussed more fully below, are distinct periods of collusion separated by price wars, temporary lapses in agreements, or changes in cartel membership or methods. Episodes may be adjacent in time or may be separated by significant gaps of time.[116] The markets marked by adjacent multiple episodes will typically be regarded by antitrust law as one infraction, but as economic phenomena as multiple cartels. Most of the analyses in this paper will use *overcharges* as the units of observation. Each episode will in principle have one true "average" (episode-long) overcharge and one "peak" overcharge.[117] However, 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.

Markets

Publications from economists, historians, and related sources yielded useful overcharge or undercharge information on cartels that operated in 237 markets (Table 2). If one group of sellers decided to fix prices of a product in one geographical region and another group colluded on the same product in a separate geographical region, these will be viewed as two markets. Of the 237 markets, 39% 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 both senses. National cartels account for the remaining 61% of the cartelized markets[118]. In this category I count some purely national cartels that were formed for the sole purpose of controlling a nation's export sales; in the United States, these are called Webb-Pomerene Associations. In addition, some domestic cartels had

[115] 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.

[116] 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.*

[117] In the rare instances where a cartel kept the market price absolutely constant for the whole episode, the two overcharge concepts will be the same number.

[118] 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 potash mines in Lorraine became part of France a joint Franco-German scheme was established.

agreements with international cartels that often protected their domestic market from exports from the international cartel's members.

Table 2. Number of Cartel Markets, by Type

Type	Number	Percent
International membership	88	37.1
National or regional	149	62.9
Bid-rigging schemes	73	30.4
Classic cartels	164	69.6
Cartel found guilty or liable	140	59.1
Currently under investigation (presumed "illegal")	6	2.5
Known to have been operating legally	54	22.8
No record of sanctions (presumed "legal")	37	15.6
Total	237	100.0

Source: Appendix Table 1 (version of 10/14/04)

Almost one-third of the sample consists of markets affected by bid-rigging cartels.[119] Although most cartels have some sales to government entities or industrial customers that purchase by tenders, these cartels are explicitly indicated by the authors to have substantially or exclusively engaged in bid rigging. This proportion is certainly an underestimate because the sources did not always provide enough detail on the cartels to be certain of the degree of bid rigging. It is widely believed that bid rigging leads to higher overcharges than otherwise identical conspiracies. The remaining 70% of the cartelized markets may be called "classic" cartels, those that set market selling prices and/or market quotas for each or its members.[120]

Three-fifths of the cartels were found to be in violation of antitrust laws by at least one legal body.[121] Sometimes these are called "discovered" cartels. The determination of guilt or liability may take the form of guilty pleas (or *nolo contendere* in U.S. courts up until the 1960s), of a decision at trial by judge or jury, of a commission decision to impose fines or other sanctions, of the payments of civil penalties, or of negotiated settlements by defendants in a suit. The remaining 39% of the 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 extra-legal, because they were never discovered by an antitrust authority. Other legal cartels were organized and registered under antitrust exemptions, such as export cartels or ocean shipping conferences.

Episodes

[119] In Europe, bid rigging is generally referred to as collusion involving "tenders."
[120] Only a couple of cartels were oligopsonies.
[121] 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. Also a few unfinished probes by antitrust authorities are placed in this category.

Although I have collected data on 237 cartelized markets, there are multiple overcharge estimates for a large minority of the markets. There are more estimates than cartelized markets for three reasons. First, about half of the markets experienced multiple phases or "episodes" for which the price effects differed.[122] The sources have distinguished a total of at least 512 episodes (Table 3). This term, which might better be called an observational time period, requires some additional explanation.

If a cartel had more than one episode, then each episode is marked by changes in membership composition, the terms of the collusive agreement, method of management, geographic focus, or other major change. In other words, when a cartel is re-formed, it enters a new phase. Between episodes, pricing discipline often breaks down; in some of the earlier cartels the interregnum is a period of contract renegotiation The aluminum market (code number 18), for example, went through six distinct phases that sometimes were adjacent in time and sometimes were several years apart. This heavily researched cartel has 28 overcharge observations.

One study from which I obtained a dozen observations summarized the results of 109 price-fixing convictions in the fluid milk markets of the Southeastern United States within a few years (Lanzillotti 1996). I count each conviction as an episode.[123] If one prefers to count the Lanzillotti summary and two other "group studies" as a three episodes, then the total becomes 332. However, some studies that I count as one episode incorporate multiple temporal phases (e.g., Ellison's study of the Joint Executive Committee). Thus, there are reasons to believe that the number of episodes is an undercount. Second, for a few episodes, more than one study has been published. For example, for the various aluminum cartels I drew on nine studies written by eight authors. Third, for a given episode, alternative methods of estimation are sometimes available, in a few instances by the same author writing in the same publication.

In general the distribution of episodes across types of cartels (Table 3) is quite similar to the distribution of cartelized markets (cf., Table 2). The major difference is that international cartels tended to have a larger number of multiple episodes than did domestic ones. The 88 international markets in the sample that were cartelized had on average 1.6 episodes, whereas national cartels had only 1.3 episodes on average. As a result, a larger share (44%) of the cartel episodes had international membership. The number of episodes per market does not vary significantly across other type categories.

[122] Each overcharge estimate is identified in Appendix Table 1 by capital letters following the code numbers that I have arbitrarily assigned for each cartel. If 100B says "Same as 100A," then they belong to the *same* episode. (Single-episode cartels have numeric coding only.) The cartels with multiple episodes have the time spans of the episodes identified by the studies' authors.

[123] However, I was able to extract only eight of these episodes' price effects, plus one overall estimate, from this source. One other study of UK national cartels provided a summary mark-up estimate for 40 cartels. Otherwise, all the other episodes are counted in the manner described.

Table 3. Number of Cartel Episodes, by Type

Type	Number	Percent
International membership	145	43.7
National or regional	187	56.3
Bid-rigging schemes	98	29.5
Classic cartels	234	70.5
Cartel found guilty or liable [a]	196	59.0
Known to have been operating legally	84	25.3
No record of sanctions (presumed "legal")	52	15.6
Total	332 [b]	100.0

Source: Appendix Table 1 (version of 10/26/04).
[a] Episodes that were sanctioned by a court or commission or through a settlement.
[b] Counts three "group" observations of 206 cartels (numbers 15, 38, and 55) as single episodes.

Overcharges

Two kinds of cartel mark-up data are available. First, researchers usually report the *average* price increases over the whole episode (Table 4). This is the measure most relevant for forensic purposes and is the one that will be the focus of most analyses in this paper. I have collected 635 of these estimates; 94% of all episodes report average overcharges. In some cases, the averages 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. This is the sort of datum of most interest in an antitrust damage suit. Some of the overcharge estimates are said to be *minimum* estimates, and these are shown in the "Average" column of Appendix Table 2 with "+" signs. To be conservative, all such minimum estimates are counted as averages. Some averages are given as ranges, and I have preserved these ranges in the appendix tables, but have used the midpoints of the ranges for others.

Second, 210, one-fourth of the 845 overcharge figures that were assembled, are *peak* price effects. Thirty-one percent of the episodes have peak estimates. In some cases the peak price was reached for only one day during a cartel period of several years; in other cases, the peak may be the highest one of several years. Peak price changes indicate the potential for maximum harm when a cartel is at its most disciplined. 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 maximum. I report the peak estimates separately from the average estimates.

Table 4. Number of Average Overcharge Observations, by Type of Cartel

Type	Number	Percent
International membership	365	54.2
National or regional	309	45.8
Bid-rigging schemes	185	27.4
Classic cartels	489	72.6
Cartels found guilty or liable [a]	384	57.0
No record of sanctions ("legal")	290	43.0
Total	674	100.0

Source: Appendix Table 1 (spreadsheet dated 10-14-04).
[a] Included are six cartels still being investigated by authorities.

SOCIAL SCIENCE STUDIES: RESULTS

Number of Overcharge Observations

The number of average overcharge estimates is shown in Table 5 arranged by the cartel episode's end year and three types. To summarize the main types, there are total of 845 useful estimates of overcharges[124] and undercharges drawn from nearly 200 publications.[125] The overcharges refer to at least 674 episodes of cartels that were organized in 237 separate markets. Of these episodes or markets, 36% were characterized by international agreements (including 12 intra-EU cartels), while the remaining 64% were national in membership. Almost one-third of the markets were affected by bid-rigging schemes. Finally, roughly 60% of the cartels were found guilty or liable for penalties by a court or commission.

The six periods distinguished in this and subsequent tables were selected to represent different antitrust regimes in the United States and abroad.[126] In addition, the periods correspond roughly to the major changes in the relationship of antitrust jurisprudence to economics Kovacic and Shapiro (2000). The era up to 1890 is an obvious choice because of the enactment of the Sherman Act in the United States and the 1889 Anti-Combines Act in Canada[127]. 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 business persons (Wells 2002). By and large, economists and other social scientists stood on the sidelines of antitrust-

[124] As explained in more detail below, 587 of the overcharges are "average" or long-run mark-ups, while the remaining 187 estimates are "peak" or short-run price effects. I analyze the former more often than the latter.
[125] The same estimates sometimes appear in multiple publications. Here I count only the total number of books, articles, and reports that contain one or more original estimates. The very few undercharges are entered as positive numbers.
[126] They are also convenient to chart changes in the historical views toward cartels or in methods of analysis.
[127] 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.

law developments before the 1920s.[128] The year 1919 is chosen as a break point because it represents the end of a period of U.S. antitrust activism and, because of World War I, a date by which nearly all international cartels, many of them with U.S. corporate members, had 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 in price- or quota-setting. The years 1945-1946 are another logical break point. Again during 1939-1945, nearly all of the interwar international cartels were disbanded. Scores of U.S. criminal prosecutions of international cartels during 1940-1945 clarified the illegality of many more subtle forms of cartel participation, such as patent pools and cross-licensing of technologies. The pace of social-science publications on cartels quickened.

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 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 modeling (particularly after 1980) and related empirical testing on collusion.[129] 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.

The post-war era is divided into three sub periods. The transition years 1945-1973 correspond with three 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. 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 at the end of this period.

Beginning around 1961, the DOJ began seeking guilty pleas from most price-fixing defendants, rather than allowing them to plea *nolo contendere,* which eased the burden of proof for plaintiffs in civil treble-damage suits. Private federal antitrust suits peaked in 1962 as a result of the huge electrical-equipment conspiracy (White 1998: Table 1.1). The number of private cases per year was five times higher in the mid 1960s than the number in the 1940s, and in the 1970s the number tripled from the level in the mid 1960s (*ibid.).* 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.

[128] The first time the Supreme Court took notice of economists was in the 1925 *Maple Flooring* decision (Kovacic and Shapiro 2000:47).

[129] Even in recent decades, 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.

Another milestone 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. 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). 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.

Table 5. Number of Average Overcharge Observations by Year and Type

Cartel Episode End Date	Membership		Legal Status		Bid Rigging	
	National	Inter-national[a]	Found Guilty[b]	Legal or Unknown	Primary Conduct	Classic Cartel
			Number			
1770- 1890	59	5	9	55	4	60
1891 -1919	61	36	38	59	9	88
1920 - 1945	9	147	45	111	1	155
1946- 1973	72	20	63	29	39	53
1974- 1990	59	20 (1 EU)	60	19	40	39
1991- 2004	49	137(11 EU)	169	17	92	94
Total	309	365	384	290	185	489

Source: Appendix Tables 1 and 2 (spreadsheet dated 10-7-04)

[a] The companies in the cartel were headquartered in two or more countries.

[b] One or more members of the cartels pleaded guilty, were fined or otherwise sanctioned by an antirust authority or a parliamentary committee, agreed to payments to settle a private antitrust suit, or (in a very few cases) were in 2003 currently under price-fixing investigation by a government agency.

[c] The earliest cartel is the Newcastle Vend, an English coal cartel that was formed in 1699 and first collapsed in 1770. Although highly unstable, it persisted until 1845.

By 1990 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[130]. 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 certain criteria (1993), and a demonstrated ability since 1994

[130] Raised to $100 million in April 2004; maximum prison sentences rose from 3 to 10 years.

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. After 1990 the influence of the Chicago School of Economics waned.

Several features of the data set are apparent in Table 5. The number of observations per year has generally grown over time, and the primary factor that explains the trend is the growth in the number international cartels with usable data[131]. The first cartel for which price effects can be found is the Coal Gild of northeastern England (also known as the "Newcastle Vend"), which made its first collusive agreement in 1699. Up until 1890 when price-fixing was legal everywhere in the world, only one estimate is available about every six months on average. There were large numbers of cartels extant in the late 19th century; but the small size of the fledgling economics profession, a literary approach to writing in economics, and inevitable destruction of most business records over time doubtless accounts for the fewness of quantitative overcharge observations for 19th century cartels. 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.

From 1891 to 1945 most of these data are drawn from studies of international cartels. The proportion of international schemes is especially high during the interwar period and after 1990 and especially low during 1946-1990. 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[132]. The increasing awareness of the illegality of price fixing in the United States may also account 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. Private suits, where such data is essential to determining damages, were relatively few in the United States until the early 1960s but grew rapidly through the late 1970s (White 1988:Table 1.1).

During 1891-1919, there are 3.1 price observations per year; the rate rises to about 6.2 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 75% of the observations are drawn from international cartels. One reason is the international cartels mostly were based in Europe, where they operated with legal impunity.[133] Many of the interwar international cartels were organized as federations of national cartels and were aimed primarily at controlling export sales.[134] As nearly all of them were believed by their members to be legal

[131] Although there is a dip in 1946-1990, the correlation between the number of observations per year and a linear time trend is r = +0.98.

[132] I know that when the UK, Germany, and the EEC began requiring registration of cartels in the 1950s, hundreds came forth in each jurisdiction.

[133] That is, they had freedom to set prices. In Weimar Germany for a few years after 1923, cartels were regulated. In a few European countries, cartels were required to register with the government.

[134] 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. However, I do include a few international cartels with one or more members consisting in part of government-appointed committee members, government-owned

at the time, their activities often were openly reported by the business press.[135] 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 achieved increases in 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 covers 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 of 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 after 1945. Few international cartels were discovered or prosecuted until the early 1990s -- less than one international cartel episode every two years.

Several explanations have been offered for the hiatus in international cartel formation in the decades following the War. 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. The large number of overcharges available for the data set after 1990 is attributed to the launching of an historically high number of international cartels since the early 1980s; most of these cartels could not have been contemplated without the direct participation or passive cooperation of leading U.S. companies that still tend to be among the leaders in most markets with internationally traded goods. The number of overcharge observations exceeds 14 per year, which is more than double the rate of the interwar period.

A second important trend is that most cartel data now arise from prosecuted cartels. Prior to 1946, although a higher proportion of the agreements was illegal, less than 5% of the

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corporations, or government-sanctioned national cartels, if they were formed by a voluntary 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.

[135] U.S. companies apparently believed that patent pooling with foreign firms was legal; others joined cartels indirectly through controlled overseas subsidiaries. These and other subterfuges were judged illegal by U.S. courts.

observations refer to cartels known to have been prosecuted. Prior to the 1940s, U.S. anticartel sanctions were weak by today's standards, but increasingly after 1911 or so 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 the EEC after 1960)[136]. 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 harsher, 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 studied after they were prosecuted or fined by one or more antitrust authority. This pattern does not necessarily mean that the probability of discovery by prosecuting bodies has gone up, but it probably does represent a heightened aggressiveness in anticartel enforcement as well as a shift in research methods by social scientists[137].

A third trend manifest in Table 5 is the prominence of estimates derived from bid-rigging conspiracies since 1945. From few recorded examples prior to 1946, in the post-War era almost half of all the overcharge observations in the sample were primarily bid-rigging conspiracies. The large majority of national cartels, most of them local milk or construction conspiracies in the United States, rigged bids. The immediate victims of most bid-rigging conspiracies were governments. Relatively few international cartels rely primarily on rigging auctions or tenders for public projects. What may seem like a surge in this practice may in fact be a reflection of changes in data availability. 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 at the state and municipal levels similar to the federal Freedom of Information Act.

[136] 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.

[137] 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.

Table 5A. Number of Zero Average Overcharge Observations by Year and Type

Cartel Episode End Date	Membership		Legal Status		Bid Rigging	
	National	International[a]	Found Guilty[b]	Legal or Unknown	Primary Conduct	Other
	Number					
Before 1891	7	1	3	5	0	8
1891 - 1919	2	3	2	3	0	5
1920 - 1945	1	13	1	13	0	14
1946 - 1973	6	2	4	4	3	5
1974 - 1990	1	3	3	1	0	4
1991 - 2003	2	0	1	1	0	2
Total	20	21	15	26	3	38

Source: Appendix Tables 1 and 2 (spreadsheet dated 10-23-04).

[a] Cartels with corporate members from two or more countries. Those with all members from the EU shown separately.

[b] At least one member of the cartel pleaded guilty, was found guilty at trial, paid civil antitrust fines, or made a monetary settlement with plaintiffs in a private suit.

Table 5A displays the number of observations of overcharge observations for what will be termed "unsuccessful" cartels – those with zero average overcharges. About 6% of the average-overcharge data collected indicate that a cartel episode was unsuccessful in controlling prices. These zero-effect estimates will be eliminated from some of the analyses below. One reason is that studies of allegedly unsuccessful cartels were published almost entirely prior to 1945. Fewer than 1% of the most recent cartels are judged to be unsuccessful. It appears that the skepticism of earlier analysts about the power of cartels has nearly disappeared in the last 50 years or so.

Trends in Average Overcharges over Time

Table 6 displays the medians of all average overcharges reported, distinguished by the same time periods and types shown in Table 5. Table 6A eliminates the episodes with zero price effects; nearly all of these observations come from classic cartels that ended before 1973 and from studies written before that time. Median percentages are displayed because nearly all the cells contain positively skewed prices. 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 are not allowed to fall below zero. In such situations the means are larger than the medians, and the median is a better representation of central tendency.

The median cartel overcharge for all types and time periods is 25.0% and for successful cartels 27.5%. There is a strong downward trend in overcharges by international and sanctioned cartels, but there is a weaker downtrend for the other types.[138] The downward time trends are similar but slightly stronger among the successful cartels (Table 6A). Mark-ups are above average for all types of cartels that were formed in the pre-modern era of antitrust (i.e., before about 1911 in the United States and before World War II in other parts of the world). In the period after 1990 when anticartel sanctions were the highest, the overcharges of discovered cartels are below the all-period averages for each type. The distinct decline in average overcharges of cartels that ended after 1990 is most evident among international cartels.[139] Somewhat surprisingly, it appears that the interwar cartels, nearly all of them Eurocentric international legal agreements, attained only slightly higher than average levels of price effectiveness. Perhaps the steadiest overcharges may be seen in the column of legal cartels where the average overcharges hover near the 30% to 35% range in all but the most recent period. [140]

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[138] The correlation of median overcharges of international cartels to a linear time trend is r = -0.57; similarly, among cartels found guilty, the coefficient is r = -0.38; for all cartels r= -0.20. Data from Table 6; time is the midpoint year.

[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 may have been 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.

[140] This last observation should be ignored because there is only one legal cartel formed after 1990.

It is difficult to know what to make of 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 have declined as an effect of globalization, 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. 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.

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Table 6. Median Average Overcharges, by Year and Type

Cartel Episode End Date	Membership		Legal Status		Bid-Rigging		All Types
	National	Inter-national	Found Guilty	Legal	Primary Conduct	Other	
			Median percent [a]				
1780-1891	22	41	32	22	16	24	23.5
1891-1919	21	48	25	35	37	28	30.4
1920-1945	18	36-37	45	32	34	34	34.0
1946-1973	14	26	13	23	13	15	15.0
1974-1990	18-20	40-43	22	25	21	25-26	24.0
1991-2004	17-18	25	24-25	20	22	25	24.0
ALL YEARS	17-19	30-33	23-25	28	21	25-29	25.0

Source: Appendix Table 2 (spreadsheet dated 10-21-04).
[a] Medians of the lower bounds or the upper bounds of ranges, where appropriate. Includes many zero estimates. See Table 5 for the numbers of observations in each cell.

Table 6A. Median Average Overcharges of Successful Cartels, by Year and Type

Cartel Episode End Date	Membership		Legal Status		Bid Rigging	
	National	International	Found Guilty	Legal or Unknown	Primary Conduct	Other
	Median percent [a]					
1780 - 1891	25	41	36	25	16	28
1891 - 1919	23	50	25	39	37	32
1920 - 1945	23	40	45	37	34 [b]	39
1946 - 1973	15	31-34	14	25-27	13	20
1974 - 1990	19-20	40-44	25	26	21	26-31
1991 - 2003	17-19	25	25	21	22	25-26
All dates	19-21	33-35	24-25	30	21	30-31

Source: Appendix Table 2 (spreadsheet dated 11-02-04).
[a] Medians or ranges of median estimates. The median for all observations is 28%.
[b] Cell contains only one observation. See Tables 5 and 5A for numbers of observations.
-- = Not available

Average Overcharges across Types

A second pattern that emerges in Tables 6 and 6A is that in every period since 1890 international cartels have been more injurious than domestic (mostly U.S.-based) cartels. In general, international cartels are roughly 50% more effective in raising prices than "national" cartels (cartels that fixed prices in one country and export cartels comprised of firms from single countries). Indeed, from 1891 to 1990, international cartels are twice as effective as domestic ones (Table 6A). This is not so surprising in the pre-World War II era because international cartels were formed without concern about prosecution, and even in the interwar period U.S. companies may have believed that they had structured their participation in ways that would not run afoul the Sherman Act. But the fact that the differences persisted in the postwar period is somewhat unexpected. The clearly greater effectiveness 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, homogeneous producer intermediates with relatively low long-distance transportation costs

A third pattern noted in Table 6 is the inferior price effects of bid-rigging cartels compared to conventional conspiracies that set selling prices or allocate market shares. Bid rigging cartels often were organized to exploit tenders for government public-works projects. Relatively few international cartels engage in bid rigging, whereas bid rigging occurs mostly in national or local conspiracies, so this distinction may be confounded with the geographic types just discussed above. Nevertheless, this finding directly contradicts Cohen and Scheffman (1989), the prior beliefs of many economists, and the U.S. Sentencing Guidelines that impose higher penalties for bid rigging. It also challenges a rationale of the U.S. Government's policy shift in the 1980s that overtly targeted bid rigging against governments.

Finally, it is worth noting that there are 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. I do not wish to make too much of this result, because it may represent selection bias by the authors of the studies relied upon. Injurious cartels may be inherently more interesting or publishable than incompetent cartels.

Distribution of Overcharges

Given the interest in the factual foundations of the U.S. Sentencing Guidelines applied to cartel sanctions, it is logical to examine the size distribution of the estimates. Table 7 classifies the average estimates into nine size categories. Because the Guidelines are predicated on the assumption that the average cartel has a 10% overcharge, that break point is of special interest.

Because of the interest in prosecutable cartels, the discussion of Table 7 will focus on the effective cartels (non-zero overcharges). Perhaps the most striking result is that 62% of the cartel episodes have overcharges above 20%.[141] The mean overcharge of the 38% of the episodes in the two lowest size ranges (0.1 to 19.9) is 10.3%. *These are the cartels imagined to be typical by the creators of the U.S. Sentencing Guidelines.* The 62% of the cartel episodes with overcharges of 20% or higher have a mean overcharge of 55.3%, more than five times the level assumed by the Guidelines' authors. If the Guidelines were truly designed to deter recidivism, even if the probability of detection is 100% five-eighths of the cartels will be under-deterred.

[141] Note that from a legal perspective, each episode is an actionable offense.

Table 7. Mean Average Overcharges by Size Category

Percentage Range [a]	Number of Observations	Distribution of Observations		
		Mean	Total	Non-Zero
	Number		*Percent*	
Zero or less [b]	46	0	7	0
0.1-9.9	90[c]	6.3	14	15
10.0-19.9	122	14.1	19	21
20.0-39.9	182	28.6	29	31
40.0-59.9	99[d]	47.9	16	17
60.0-79.9	39	67.8	6	7
80.0-99.9	13	88.6	2	2
100.0-199.9	25	129.0	4	4
200 or greater	19	429.8	3	3
Total	635	49.4[e]	100	100

Source: Appendix Table 2 (spreadsheet dated 10/7/04).
[a] Overcharges of 10% or higher are rounded to the nearest whole number. Midpoints of ranges.
[b] Four negative numbers are converted to zero.
[c] Four estimates of "weak cartels" are assumed to be 1% overcharges.
[d] Fifteen estimates of 50% are from Eckbo (1976).
[e] Excluding zeros, the mean is 78.4%.

Peak Overcharges

So far only the "average" overcharges have been examined – those that refer to the mean price change over all or most of an episode. Tables 8 and 9 explore the peak price effects attained by cartels – the maximum mark-ups observed for one week, one month, one quarter, or one year of an episode, depending on the price series available.[142] It is well known that oligopolistic 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 mark-ups above but closer to competitive

[142] There is no need to examine effective cartels separately, because nearly all of the peak price effects are non-zero.

levels than monopoly levels. While overt collusion may be somewhat more effective 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 discipline of the members is at its most cohesive.[143] Thus, the peak price effects are instructive about the potential harm that cartels can cause when they are unfettered by coordination problems.

Table 8 shows the median peak overcharge over time and across types of cartels. Compared with the data available for the average overcharges in Table 5, these data are over-weighted by observations taken from the interwar period. Approximately one-fourth of the 210 observations available for Table 8 refer to interwar cartels, which have been well studied by economic historians who often had available public commodity-exchange prices. Almost 30% of the observations on peak prices are for the period since 1991.

Unlike the average overcharges discussed above, there are few notable trends in peak effectiveness over time. Ignoring cells with few observations, the only temporal pattern is a decline in peak overcharges by international cartels. The pattern of peak overcharges across cartel types is similar to that for the average overcharges. In all time periods, international cartels were able to reach higher levels of peak price effectiveness than the "national" cartels – on average 100% higher. Peak mark-ups were not consistently related to whether the cartel was prosecuted. And, consistent with the earlier findings, cartels that fixed prices or production levels were significantly more harmful than bid-rigging agreements.

Table 9 provides calculations of how *much* higher peak overcharges were compared the longer run averages for given episodes. Unlike Table 8, Table 9 calculates ratios for the 173 pairs of median overcharges for which *both* an average and a peak estimate are available. Generally speaking, the peaks were about 50% higher than the longer run average mark-ups. A high peak/average ratio is a rough indicator of price stability during a conspiracy; low ratios may be interpreted as cartels that achieved few operational problems. There are few strong trends in these ratios over time, but classic international cartels that were not sanctioned are the types that displayed greater stability in fixing prices.

[143] Peak price changes may Ill 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 Ill financed cartel felt free to announce a new agreement that buyers perceived as likely to be effective, "panic buying" often ensued, which leveraged the purely collusive effect on prices.

Table 8. Peak Cartel Overcharges, by Year and Type

Cartel Episode End Date	Membership		Legal Status		Bid Rigging	
	National	International	Found Guilty	Legal	Primary Conduct	Other
			Median percent			
1770 - 1891	51	100 [b]	77[b]	56	19[b]	80
1891 - 1919	20	78	34	40	--	34
1920 - 1945	45	69	53	67	50 [b]	67
1946 - 1973	38	38 [b]	43	21	43	37
1974 - 1990	35	64 [b]	35	39 [b]	35	46
1991 - 2003	25	57	53	25 [b]	49	56
ALL YEARS	33	61	50	53	40	55

Source: Appendix Table 2 (spreadsheet dated 10-23-04)
[b] Fewer than four observations.

Table 9. Peak/Average Ratios of Cartel Overcharges, by Year and Type

Cartel Episode End Date	Membership		Legal Status		Bid Rigging	
	National	International	Found Guilty	Legal	Primary Conduct	Other
			Ratio of Medians [a]			
Before 1891	1.30	2.58	1.10	1.80	1.46	1.56
1891 - 1919	2.24	1.94	1.93	2.32	--	2.11
1920 - 1945	1.75	1.22	1.05	1.66	1.47	1.23
1946 - 1973	1.55	1.43	1.58	1.43	1.58	1.46
1974 - 1990	1.82	1.72	1.80	1.25	1.93	1.66
1991 - 2003	1.48	1.82	1.78	2.30	1.82	1.69
ALL YEARS	1.72	1.45	1.40	1.75	1.77	1.42

Source: Appendix Table 2 (spreadsheet dated 10-30-04)
-- = Not available
[a] The ratio of the median peak overcharges to the median full-period overcharge for those cases when both are known and positive.

These data are relevant for assessing whether cartels intended to maximize price increases or to control *variation* in their collusive prices. Apologists for cartels, particularly those writing about them during the Great Depression, tended to assert that

cartels did not aim to raise prices so much as stabilize prices.[144] Given the manner in which these ratios were computed, a high number indicates that overcharges were quite variable during the episode being observed. A ratio close to one reveals a cartel that was successful in holding its collusive price *flat* or steady for the affected period. For example, although the difference is not large, international cartels that ended between 1920 and World War II achieved greater price stability than those before and after. This result is consistent with the positions of Marlio (1947), Pyndyck (1979), and some other scholars about cartel objectives.

Overcharges by Location of Cartel

Law-makers and antitrust enforcement officials may be interested in the locus of decision-making by the cartels in the sample. Table 10 classifies the cartels according to the location of the cartel's headquarters or the place of residence of the great majority of the cartel's managers, not necessarily the cartel's field of operations because export cartels are categorized in their country of origin. If a cartel was composed of member companies with headquarters in only one country or one continent, while others have established secretariats with professional staffs in London, Zurich, or similar locations. 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 in North America, Western Europe, or Asia, the cartel is categorized under the appropriate row. Global cartels are those with a diverse mixture of participants from two or more continents.

There are some significant differences in average cartel overcharges across geographic regions. Those managed in single European countries have the highest overcharges, but curiously those organized across national boundaries in Western Europe were as a group the least successful. North American conspiracies were also quite low. Median overcharges for global conspiracies were relatively high.

Overcharges and Market Size

A commentary in the USSGs asserts that there is an inverse relationship between the size of affected sales and the height of the overcharges achieved by cartels. No conceptual or empirical justification is provided for this assertion. Studies of cartels available to the Commission analyze neither factor (e.g., Hay and Kelly 1974, Asch and Seneca 1975, Fraas and Greer 1977, Posner 1970). Eckbo's (1976) and Griffin's (1989) studies have information on price effects but do not link them to cartel size. Finally, it is unclear how this alleged relationship ought to affect the design of appropriate sanctions for cartel violations.

[144] As prices were generally falling, "stabilization" may in fact have been equivalent to preventing weak demand from causing prices to decline. See, for example Plummer (1934).

Table 10. Average Overcharges by Cartel Headquarters Location

Principal Location of Cartel Managers	Number of Estimates	Average Overcharge	
		Median percent	*Mean percent*
USA and Canada	242	21.0	28.7
Single nations in W. Europe	132	43.0	55.8
Multiple nations in W. Europe	107	16.3	37.0
Asia	34	30.0	76.5
Global	136	27.5	55.8
Australia, Africa, So. America, E. Eur.	22	21.5	23.9

Source: Appendix table 2 (spreadsheet dated 10-12-04).

Nevertheless, I decided to try to examine whether this curious hypothesis might be valid. The only appropriate data of which I am aware are those contained in Connor (2003: Tables A.1 - A.12). This working paper has developed affected sales and overcharge data for a minority 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.[145] The first sample of 50 cartels examined the largest geographic market for each cartel; the coefficient 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.

There is no empirical support for the market size-overcharge connection. The policy implication is that there is no justification for going proportionately easy when sanctioning the largest cartels.

[145] The simple correlation coefficient r takes a value of unity when pairs of numbers are perfectly aligned positively or negatively and a value of zero when unrelated.

THE RELIABILITY ISSUE

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 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 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. Among legal scholars, many will regard criminal trials or guilty pleas as the gold standard of fact-finding, relegating civil commission hearings and other processes with skepticism.

The task in the remainder of this section is to learn whether the various overcharge estimates are sensitive to the methods, data sources, time period, or disciplines of the authors. To do so, three approaches are taken.

Sources of the Estimates

Confidence in the estimates may be judged in part by the sources from which the estimates were derived. A single source often provides multiple estimates (e.g., Stocking and Watkins 1946). I mentioned earlier in this paper that the single most common type of source is peer-review journals, 82 articles in all. Nearly all of these journals are in the discipline of economics, law and economics, or economic history. Social scientists typically accord a high degree of credibility to peer-review outlets. The second most frequent source of estimates is 55 books or chapters in books. Some have a degree of peer review, but this varies by publisher and author; a few began as university essays or dissertations. The great majority of the books were authored by academics, but a couple of books were written by parties to a suit (e.g., Bane 1973, Sultan 1974), and a few were written by investigative journalists (Gray 1982). A high but unknown share of the more recent articles and books were written by economists who served as experts in litigation.

Minor sources include 21 government reports (several by the League of Nations and the UK Monopolies Commission), nine economic working papers, and five magazine articles[146]. Many of these sources are subject to internal reviews by department supervisors or senior editors, but the reviews are not usually blind ones. Some of the working papers are subject to rigorous review, but most are the authors' responsibilities.

[146] Only three magazine articles selected to be cited by experts are included.

Table 11 shows the types of ultimate sources for each of the estimates. By "ultimate source" is meant the original study from which the estimate was quoted or derived; for example, if a book chapter cites or interprets a legal decision, the latter is the ultimate source. The units of observation are the estimates, not the sources.

Table 11. Social-Science Sources of Overcharge Estimates

Source Type	Estimates Number	Percent
Peer-reviewed academic journals:	**170**	**25.2**
1. Economics, economic history	149	22.1
2. Other social science	14	2.0
3. Law	7	1.0
Books and monographs:	**233**	**34.6**
1. Academic authors and editors	205	30.4
2. Journalists	2	0.3
3. Interested parties or unknown	26	3.9
Chapters in edited books:	**60**	**8.9**
Government reports	**24**	**3.6**
Court or commission decisions	**82**	**12.2**
Economists' working papers	**101**	**14.8**
Newspapers, magazines, speeches	**4**	**0.6**
Total	**674**	**100.0**

Source: Appendix Table 2 (spreadsheet dated 10-12-04). Includes both average and peak overcharge estimates; those with both are not double counted.

The 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. In addition, 15% of the estimates were taken from economist' working papers, most of which were distributed in the last few years, examined modern international cartels, and appear to be intermediate versions of book chapters and journal manuscripts.[147] The majority of the government reports were authored by civil servants with specialized training in economics, and some were written

[147] Several of them have notes to that effect.

by academics commissioned by the agency; typically these reports would be vetted by a panel of experts. Similarly, 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 the Congressional committee reports on cartels. In sum, four-fifths of the estimates are drawn from the formal or informal writings of academic social scientists, and most of the remainder was the product of professionally trained individuals subject to the checks and balances of internal reviews.

Sensitivity to Publication Dates

Here the hypothesis examined is whether there are systematic differences between the average 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[148]. 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; moreover, there is a trend away from evaluating cartels from the point of view of the theory of pure monopoly to a more sophisticated and nuanced view informed by game theory and other conceptual advances in industrial economics. Because in previous sections above differences in average overcharges were found over time, I also disaggregate the data by the cartels' termination dates.

The results of this temporal analysis are displayed in Tables 12 and 12A; the discussion will focus on the successful cartels. The publications are classified according to four periods that correspond roughly to milestones in social-science analysis of cartels. The era prior to 1946 is marked by studies that betray a relatively undeveloped understanding of oligopoly theory, some confusion about essential nature of private cartels, and the absence of statistical methods of analysis. Various authors would confuse cartels with "combinations" (mergers and acquisitions), unified firms with monopoly power, or large diversified or multinational corporations – categories now viewed as distinct economic phenomena. In the earlier years when
antitrust enforcement was weak or nonexistent, many writers failed to see the necessity of distinguishing voluntary agreements to restrict trade from wholly compulsory arrangements. In 1946, with the appearance of the landmark studies of Stocking and Watkins (1946, 1948) cartel studies moved to a higher level of analytical rigor. These studies and those that followed had the advantage of at least a decade of rapid developments in oligopoly theories that loosened economists from their sole dependence on the twin concepts of pure competition and pure monopoly, thereby sharpening the understanding of collusive behavior in general and the distinctions between overt and

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

tacit collusion.[149] By the 1970s and 1980s, further advances in oligopoly theory were being made (though had not yet been integrated into the consciousness of most empirically oriented economists), the "Chicago School" of economics was having an impact on the field, and quantitative statistical methods first came into widespread use by economists and economic historians.[150] By about 1990 or so, knowledge of game theory pervaded the modeling efforts and empirical research of professional economists; moreover, a reassessment of the Chicago-School challenge had asserted itself.

Table 12. Average Overcharge Estimates by Publication Dates

Cartel Episode End Date	Publication Date of Study			
	Before 1945	1945-1970	1971-1989	1990-2004
Before 1891				
Median	22.6 [35]	25.1 [4]	22.3 [7]	30.0 [14]
Mean	25.4	39.4	30.7	29.6
1891-1945				
Median	26.0 [87]	39.5 [88]	39.0 [34]	29.0 [30]
Mean	47.4	74.6	42.4	39.0
1946-1990				
Median	–	12.5 [24]	19.5 [92]	23.0 [48]
Mean	–	21.6	28.3	49.2
1991-2003				
Median	–	–	–	24.5 [172]
Mean	–	–	–	40.2

Source: Appendix Table 2 (spreadsheet dated 10-7-04).
Note: Superscripts indicate sample size in cell. The second cell of the first row is omitted because only two observations are available.

[149] Two books on oligopoly published in 1933 are often cited as the beginning of industrial-organization economics as a distinct field.
[150] Although an article published by Joe Bain in 1951 is usually credited as the first statistical study in industrial economics, such methods were uncommon in cartel studies until the very late 1960s.

Table 12A demonstrates some interesting trends, but provides no evidence for concluding that overcharges vary systematically over time. Looking initially at cartels that ended in the pre-antitrust era, one sees that both contemporary and early writers arrived at moderate estimates of cartel price effects – median estimates of 22 to 30%. Studies published prior to 1990 tended to calculate relatively low median price effects.[151] However, as the methods of scholarship presumably improved, the estimated price effects of cartels active in the most laissez-faire of economic environments actually rose to a median of 30%.[152]

Table 12A. Average Overcharge Estimates by Publication Dates, Successful Cartels

Cartel Episode End Date	Publication Date of Study			
	Before 1945	1945 - 1970	1971 - 1989	1990 - 2003
	Median percent *Mean percent*			
1770-1890	25 [32] 28	25 [4] 39	22 [7] 31	30 [14] 46
1891-1945	31 [74] 56	43 [83] 79	48 [28] 52	29 [30] 39
1946-1990	– –	13 [24] 22	22 [76] 33	23 [47] 50
1991-2003	– –	– –	– –	25 [170] 41

Source: Appendix Table 2 (spreadsheet dated 11-02-04).
Note: Superscripts indicate sample size in cell. "Successful" means non-zero overcharge.

A pattern of high and rising median estimates is evident for the cartels that were active after the Sherman Act became law but ended before 1945; however, there is a dip in median estimates among studies published in the past decade or so. The 1891-1945 category is dominated by the international albeit Eurocentric "interwar" cartels, many of the which were revivals of similar legal export cartels operating before World War I. Again one sees that contemporary chroniclers of these interwar cartels were generally moderate in their evaluation of price effects. However, for the relatively ineffective

[151] The samples of cartels in each time period overlap, but are not identical. I will correct for changes in the sample immediately below.
[152] Note that the mean does not fluctuate over time for the earliest group of cartels, but I regard the mean as less indicative of central tendency than the median.

cartels ending between 1946 and 1990 (many of them bid-rigging agreements), there appears to be a tendency for median price effects associated with cartel behavior to rise as publication dates become more contemporary.

The analysis presented in Tables 12 and 12A is suggestive but has many shortcomings, principally because many other things could be changing over time besides the analytical approaches of various writers. Averaging could mislead because the samples of cartels (even those ending in the same broad periods) change as the publication periods change. To remedy these defects I present a second analysis of the sensitivity of overcharge estimates to analytical approach.

Publication-Type Comparisons

Table 13 examines whether median overcharges vary by type of publication and prosecution status. Using peer-review journals as the basis of comparison, estimates of overcharges tended to be lower in other types of publications for cartels that ended prior to 1946. However, for more contemporary cartels, journals tended to produce lower estimates than other outlets.

Table 13. Median Average Overcharges by Publication and Cartel Type

	Guilty	Legal	Guilty	Legal	Guilty	Legal
			Percent			
Peer-reviewed journal	--	28	21*	43	19	21
Book	25	28	33	31	22	20
Book chapter	--	3*	50*	28*	50	25
Government report	21*	10	--	27*	21*	50*
Official decision	37	--	12	245*	26	--
Other	--	--	7*	--	15	28*
	1888-1945		1946-1973		1974-2004	
Publication Type	Cartel Year and Cartel Prosecution Status					

Source: Appendix Table 2 (spreadsheet dated 10-11-04).
- - = Not available
* = May be unreliable because fewer than 7 observations.

Intra-Episode Comparisons

The third check on reliability of estimates across various analytical methods controls for changes in the composition of the sample by focusing on one cartel episode at a time. Recall that a cartel episode refers to a single market, time period, and form of cartel organization. This check on reliability requires us to examine only those episodes that have two or more estimates derived from at least two of seven different methods.[153] Only 91 episodes (about one-third of the total) are available, because the majority of the cartel episodes have only one study using a uniform method of overcharge estimation.

There are 291 pairs of observations available for this analysis of reliability. I have identified six general methods of estimation. In the full sample of 674 average overcharges, the most widely used (45% of the total) 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 benchmark prices refer to periods before the cartel began its operation, after the cartel ceased its activity, or a period during the affected period when there was a brief breakdown (a disciplinary price war perhaps) in full collusion. The base periods require judgment on the part of the analyst, because the but-for period ought to be as free from demand or supply conditions not observed during the collusive period as possible. 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%). These five methods have been sanctioned by U.S. courts for determining damages in price-fixing trials (Connor 2004). Sixth, approximately 10% of this study's estimates are quotes from or interpretations of decisions made by antitrust authorities. Finally, about 10% of the estimates are given by writers who did not explain their methods; these unspecified estimates are mostly from archival sources studied by economic historians, from legal-economic studies by antitrust specialists, or from books written by journalists that summarize estimates provided by anonymous sources close to a lawsuit involving a cartel. In general, these unspecified estimates are produced by non-economists writing without the benefit of anonymous peer review, whereas the other five methods are studies written by professional economists.[154] One may speculate that most of the unspecified estimates are before-and-after comparisons.

In Table 14 each entry in a cell is constructed by taking the median estimate of the method listed in the first column and dividing that number by the corresponding median estimate that used the method in the heading of the table. All possible ratios are calculated with the median ratio shown. A median ratio of one indicates that there is no difference between methods on average. Several of the median ratios are drawn from such small sub samples that I refrain from drawing any conclusions.

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[153] In a small number of cases, a particular study may offer more than one approach to the study of a cartel episode, but in the vast majority of cases the estimate being compared are taken from studies by different authors typically writing at widely separated times.

[154] There are several notable exceptions to this dichotomy. Eckbo, a Ph.D. economist, did not in explain his method; several estimates of overcharges by economic historians use state-of-the-art analytical methods; and some of the aluminum cartel's "economic" estimates were drawn from a businessman's memoir (Marlio)

A general comment about the ratios is that nearly all of them lie between 0.5 and 1.5 and most are close to unity. This demonstrates that 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 methods is quite close.[155] Therefore, in Table 14A all of the before-and-after methods are treated as one method.[156] In this table, all the ratios are between 0.5 and 2.0. Nevertheless there are three differences worth commenting on.

First, the eclectic estimates that termed "unspecified" are on average quite close to the before-and-after price method. There are 38 pairs of observations, and the median unspecified estimate is only 8% lower than the median before-and-after estimate for the same cartel episodes. Moreover, when the top row of unspecified estimates are compared to the three other estimation methods (cost, yardstick, and econometric), the pattern is quite similar to the pattern in the second row of table 14A. This confirms a guess made earlier that most of the unspecified estimates probably employ the before-or-after method.

Second, another somewhat surprising result is that the before-and-after method produces cartel-overcharge estimates that are quite a bit *higher* than econometric model applied to the same data. To be specific, the pre-cartel but-for prices are typically double estimates derived from econometric models and post-cartel prices are triple. In principal, econometric models are simply more formal and precise ways of applying the before-and-after method. 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.

[155] But not perfect. The overcharge estimates developed by comparing the cartel-affected price with a *pre-cartel* price are lower than those constructed from a *post-cartel* price. The ratio of 46 paired comparisons is 0.70. This result is unexpected, because it implies that post-cartel prices are lower than pre-cartel prices. Post-cartel real prices are sometimes observed to be higher than the pre-cartel price; speculation as to why has centered on institutional features of markets (e.g., long-term supply contracts) that cause price declines to lag or on the possibility that the learning involved in cartel cooperation translates into more effective tacit cooperation after a cartel is dissolved (Connor 2001). Other scholars have noted the incentive that former cartelists have to keep their prices high during the post-conspiracy period when they are negotiating a settlement for private damages (Harrington 2004). On the other hand, post-cartel prices have sometimes been lower than pre-cartel prices because the cartel was preceded by a sharp price decline and because exposed cartel members may try to repair customer relations with favorable prices. It appears that the latter forces outweigh the former.

[156] This approach increases the number of paired observations slightly.

Table 14. Median Rates of Estimates for Same Episodes by Different Methods

Numerator Method	Denominator Method						
	Unspec-ified	Before and After			Cost Based	Yard-stick	Econo-metric
		Price Before	Price During	Price After			
	Ratio of medians [a]						
Unspecified	1.00	0.89 [30]	- -	1.16 [7]	0.74 [3]	0.73 [20]	1.86 [21]
Price before cartel	0.99 [30]	1.00	1.09 [5]	0.70 [46]	0.72 [11]	1.29 [21]	1.95 [45]
Price during cartel	- -	0.92 [5]	1.00	0.75 [2]	0.45 [3]	0.15 [10]	- -
Price after cartel	0.86 [7]	1.43 [46]	1.35 [2]	1.00	- -	- -	3.16 [11]
Cost or profit	1.34 [3]	1.38 [11]	2.22 [3]	- -	1.00	- -	0.60 [7]
Yardstick	1.36 [20]	0.77 [21]	6.70 [10]	- -	- -	1.00	0.57 [4]
Econometric model	0.54 [21]	0.51 [45]	- -	0.32 [11]	1.66 [7]	1.76 [4]	1.00

Source: Appendix Table 6 (spreadsheet dated 10-28-04).
- - = Fewer than three pairs available
[a] Ratio of median overcharges using method in left column to medians based on method above.
Superscripts indicate numbers of pairs.

Table 14A. Median Ratios of Estimates for Same Episodes but Different Methods (Simplified)

Numerator Method	Denominator Method				
	Unspecified	Before and After [a]	Cost Based	Yardstick	Econometric Model
	Ratio of medians [b]				
Unspecified method	1.00	0.93 [38]	0.74 [2]	0.72 [20]	1.86 [21]
Before and after	1.08 [38]	1.00	0.78 [15]	0.68 [33]	2.01 [66]
Cost based	1.34 [2]	1.29 [15]	1.00	2.10 [1]	0.60 [7]
Yardstick	1.39 [20]	1.48 [33]	0.48 [1]	1.00	0.57 [4]
Econome-tric model	0.54 [21]	0.50 [66]	1.66 [7]	1.76 [4]	1.00

Source: Appendix Table 2 (spreadsheet dated 10-28-04).
- - = No pairs available
[a] Ratio of median overcharges using method in left column to medians based on method above.
Superscripts indicate numbers of pairs.

An example of such a situation is when a cartel's formation is preceded by a predatory price war that forces the pre-cartel price to unsustainably low, sub competitive levels (Connor 2004). The before-and-after method does not lend itself easily to adjustments for such subtle influences as seasonal demand and currency exchange rates.

Third, compared with the before-and-after, the cost-based and yardstick techniques yield relatively high overcharge estimates.[157] 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 most of the yardsticks are prices in regions in which the cartel did not attempt to fix prices, this result suggests that indirect geographic spillovers from cartel activity may be more common than most analysts anticipate. If the yardsticks are product substitutes, analysts may have underestimated quality differences.

Sensitivity to Peer Review

As one further test of reliability, I examine whether the average overcharge estimates are sensitive to type of review given to a particular study. One might expect peer review to rein in exaggerated or unsubstantiated overcharge estimates. In the "peer-review" category I include academic journals, dissertations, explicit court and commission decisions, and reports issued by the OECD. This is a restrictive concept of peer review, because doubtless some of the books and chapters from conference proceedings were also peer reviewed. Furthermore, to allow for improvements in analytical rigor over time, I distinguish three time periods separated by the years 1946 and 1974. Finally, I divide the observations into those cartels that are known to have been legally sanctioned and those not sanctioned.

The results are shown in Table 15. Peer review does not systematically produce lower estimates of overcharges. Among cartels that operated unafraid of prosecution, peer review tends to result in slightly higher estimate than other sorts of studies. In the cases of convicted cartels, peer-reviewed studies display slightly lower average overcharges; for example, the median overcharge of convicted cartels from peer-reviewed publications since 1973 was 22%; from other type of publications, the median was 25%. In general, studies have detected a rise in average overcharges over time among both sanctioned and unsanctioned cartels. Improved analytical techniques have not whittled down median overcharges of discovered cartels.

Looking only at peer-reviewed studies of discovered cartels, there is one finding that is either a bizarre coincidence or a highly revealing suggestion about the source of the "10% rule." Among the 27 estimates drawn from peer-reviewed publications in 1946-1973, the median overcharge is exactly 10%. If the USSG was based upon a these studies, it could be construed as having a rational foundation. However, after 1974, peer-

[157] These two methods seem to be conservative relative to statistical modeling, but the number of pair-wise observations is quite limited.

reviewed studies of discovered cartels tended to have average overcharges 120% higher. It is likely that the sample of studies published during 1946-1973 were biased toward bid-rigging cartels, which were shown to have less destructive schemes than the ordinary and international cartels that would be studied after 1973.

Perhaps the strongest finding is the contrast between convicted and other cartels. No matter which type of study and the time period of publication, the undiscovered and presumptively legal cartels generated consistently higher price mark-ups. With one exception, the price effects were from 100% to 400% higher for the unsanctioned cartels compared to the sanctioned ones[158]. This finding has significant implications for anticartel policy, because it suggests that *ceteris paribus* less effective cartels are the most likely to be caught and sanctioned. It also suggests that there is a large social payoff from increasing the probability of cartel detection.

Table 15. Average Percentage Cartel Overcharges, by Legal Status and Type of Study

Date of Publication	Convicted Cartels [a]							Legal and Undiscovered Cartels						
	Peer Reviewed			Other				Peer Reviewed			Other			
	J	G	D	B	C	W	O	J	G	D	B	C	W	O
	median													
	mean													
Before 1946	--	21^{3}	37^{8}	25^{29}	--	--	--	28^{12}	10^{12}	--	28^{57}	8^{2}	--	--
	--	19	33	69	--	--	--	32	21	--	37	8	--	--
1946-1973	21^{2}	--	12^{20}	33^{25}	50^{1}	--	7^{1}	43^{9}	27^{1}	245^{6}	31^{58}	28^{2}	--	--
	21	--	68	71	50	--	7	40	27	225	41	28	--	--
1974-2004	19^{92}	2^{6}	29^{45}	22^{25}	50^{15}	24^{92}	63^{2}	21^{51}	50^{4}	--	20^{21}	25^{38}	13^{2}	28^{1}
	27	150	49	28	60	34	63	48	150	--	25	41	13	28

Source: Appendix Table 2 (spreadsheet dated 10-27-04).

[a] At least one closely related episode was subject to an adverse decision of a court or antitrust authority.

Note: J=Peer reviewed academic journals, G=government publications, and D=court and commission decisions (including those reported to the OECD). B=books, C=chapters, W=working papers by academics, and O=other (journalistic, speeches, etc.). Superscripts are number of observations.

[158] The publications from before 1946 find a much smaller but still positive difference.

U.S. COURT VERDICTS

Results

The results of the survey of final verdicts in collusion cases are that the 25 collusion episodes had a median average overcharge of 21.6% and a mean average overcharge of 30.0% (Appendix Table 4).[159] The 9 cases that reported peak overcharges produce a median peak overcharge of 71.4% and a mean peak overcharge of 130%. All but 5 found that the cartel had raised prices by more than the USSC's 10% benchmark. Due to the small number of final verdicts it would not be meaningful to analyze these verdicts in even smaller groups, e.g., there were only find 8 final verdicts involving bid rigging episodes, so it does not seem worthwhile for this article separately to report the median or mean figures for bid rigging cartels.

Reliability

How useful are the decisions of judges and juries in answering the question of how high cartels raise prices? Their verdicts are of course based on the opinions of the competing expert witnesses, who come to radically different conclusions about the size of the damages involved.[160] Both sides make their presentations and the finders of fact decide which expert is more believable on particular issues (with plaintiff having the burden of proof).[161]

This may or may not be the best way to determine which expert witness's conclusions are more accurate since many skills besides facts and economic reasoning can play a role in the judge or jury determination. While the common law system of jury and judge verdicts is far from perfect, it is the system the nation has chosen to use in a wide variety of life and death decisions affecting society.[162] Since the United States long has continued to use this system,[163] our nation has made an implicit decision that judges and juries are the best way to arrive at the truth the largest percentage of the time. I know of no way to prove whether judges or juries achieve results better than those of the economists who publish studies in journals and books. Neither sample is perfect: each has it strong and weak points. But since the question of how high cartels raise prices is an

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[159] For a discussion of the merits of examining only final verdicts, see Connor and Lande (2004).

[160] It is extremely unlikely that there has ever been even a single antitrust case where experts for opposing sides agreed upon the amount of damages. Similarly, although there is no evidence for the allegation, the economic studies reported elsewhere in this article are open to the charge that some of the authors' and their methodology are biased. Occasionally, judges appoint special masters to advise them on the damages.

[161] Moreover, the likelihood and size of damages also will depend upon the absolute and relative abilities of the defending and prosecuting counsel. It is an open question whether defendants or plaintiff are likely to have the best legal representation on average.

[162] While it may be true that some juries and trial or appellate judges juries are not objective, the burden of proof should be on those who would assert that the overall system, including its appeals, has a systematic bias, or that an alternative approach to answering the question of how high cartels raise prices would be superior.

[163] In other nations with admirable judicial systems, judges or judicial panels are the vehicles of decision making in antitrust cases, which are typically are civil matters.

important one that deserves as reliable an answer as can be ascertained, this method deserves consideration. And, since our two major approaches reinforce one another, the credibility of both is strengthened.

Further, since such a large percentage of cases settle, one reasonably might ask whether the few that do not settle are in some manner different from those that do. Since the motivations for settling and not settling are so varied, one can only speculate as to the biases involved.

Are there likely to be any significant systematic differences between cases that settle and those that do not? Is there reason to believe that classes of cases for which settlement will be less likely - such as in cases where the parties have different expectations as to what the outcome is likely to be - when the overcharge percentage is especially high? As examples I will present two contrasting possibilities. First, it certainly is possible that for cases when the cartel overcharged by a large percentage the defendants might reason that plaintiff is likely to be able to prove at least some overcharges to the fact finder's satisfaction. Defendant might be more likely to settle these cases.[164] Alternatively, it could be true that a small overcharge percentage -- less than 5% -- might be too small for plaintiff successfully to distinguish from purely random movements in prices. If plaintiffs believed that defendant had increased price by 4%, but knew that it would be extremely difficult to prove this, they would be less likely to sue.[165] As these examples illustrate, one can speculate as to why a survey of verdicts could be biased in either direction. While one should certainly acknowledge this method's potential flaws, I know of no reason to believe that it is either systematically biased or unreliable, or why this unreliability would shift the results in a particular direction.

[164] Some cases with large overcharges settle, while some smaller ones do go to trial.

[165] Further, it might be less likely that plaintiff would even file a civil case unless it believed that damages were likely to be high. However, this article is examining overcharge percentages, not total recoveries, and it focuses on medial percentages. Aren't plaintiffs likely to file cases with large expected total payoffs, regardless what overcharge percentage that constitutes? What difference does it make to plaintiffs or their attorneys if they prove a 1% overcharge on $1 Billion in sales, 10% on $100 million, or 100% on $10 million? In all three examples the amount of the expected overcharge would be identical.

DECISIONS OF OTHER ANTITRUST AUTHORITIES

Table 16 assembles overcharge data from the "social science" data set that originated from cartel decisions by authorities other than U.S. courts. There are 62 such observations – almost three times the number of observations that were available from U.S. courts.

The median overcharge is almost 29%, and the mean is 49%; both of these figures are well above the averages from U.S. court decisions. Half of the observations come from decisions about mostly domestic schemes made by the UK Monopolies Commission in the 1950s and 1960s, whereas the remaining decisions are from other commissions that mostly fined international cartels discovered since 1990. The estimated overcharges from decisions of the EU, Taiwanese, and Korean authorities are relatively high.

Table 16. Cartel Overcharges from Decisions of Other Antitrust Authorities

Antitrust Authority	Number of Observations	Median Percentage	Mean Percentage
UK	31	20	64.1
EU	17	33.3	36.8
Japan FTC	6	28.4	26.3
Taiwan FTC	3	238	237.7
Korea FTC	3	38.4	39.5
Other	2	49.4	49.4
Total	62	28.5	49.1

Source: Appendix Table 2.

CONCLUSIONS

Empirical Findings on Cartel Overcharges

This survey identified hundreds of social-science studies of cartels that contained 674 observations of "average" overcharges.[166] The primary finding is that the median[167] cartel overcharge for all types of cartels over all time periods is 25%: 18% for domestic cartels, 32% for international cartels, and 28% for all successful cartels.[168] Thus, in general international cartels have been about 75% more effective in raising prices than domestic cartels. Cartel overcharges are skewed to the high side, pushing the mean overcharge for all types of cartels over all time periods to 49%. "Peak" cartel overcharges are typically double those of the long-run averages.[169] These results are generally consistent with the few, more limited, previously published works that survey cartel overcharges. Six economic studies that exhibited high standards of scholarship report samples with simple average median overcharges of 28% and simple average mean overcharges of 31% of affected sales.

The results of the survey of final verdicts in decided U.S. horizontal collusion cases, only three of which were international cartels, show an average median overcharge of 21% and an average mean overcharge of 30%.[170] Thus, the 24 U.S. decisions produce average overcharges that are quite comparable to the results of the much larger set of economic estimates. All but five of the reported decisions found that the cartel had raised prices by more than the USSC's 10% benchmark.[171] Outside the United States, 62 decisions of competition commissions cited median average overcharges of 29% and a mean of 49%. Except for the UK Monopolies Commission (median of 20%), all other jurisdictions reported higher overcharges.

The authors' professions, types of publications, year of publication, degree of peer review, and analytical estimation methods from which these estimates are derived vary greatly. However, extensive examinations of source reliability give no reason to regard any sub set of the sample as inherently unreliable.

The results of the survey have significant policy implications.

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[166] Average overcharges are those calculated from an entire cartel episode, not just a peak or isolated result.

[167] All figures presented in this section incorporate all relevant zero estimates and omit peak results.

[168] This study has a majority of episodes and estimates taken from international cartels.

[169] 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 average 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 in studies that measure the degree of monopoly power.

[170] In addition, the 9 cases that reported peak overcharges produce a median peak overcharge of 71.4% and a mean peak overcharge of 130%.

[171] Because of the relatively small number of verdicts (sample of 23), it is improper to place much weight on sub-groups of these data.

Issue 1: the USSGs

In the sample of 674 social-science overcharges, 79% were higher than the 10% presumption contained in the U.S. Sentencing Guidelines; 60% were above 20%. This paper's introduction noted that there is a view among some antitrust writers that there is little evidence that cartels raise prices significantly for a period long enough to justify extant anticartel laws and, especially, extant cartel penalties. Consequently, they argue for the repeal or scaling back of the fines or damages that result from collusion. Even some who recognize that a significant number of cartels are harmful believe that the U.S. Sentencing Commission's presumption that cartels raise prices by 10% is too large. 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. Median overcharges are two or three times as high as the level presumed by the U.S. Sentencing Commission. Moreover, the great majority of the overcharge estimates – those with overcharges above 20% -- have a mean overcharge of 55.3%, more than five times the Guidelines' presumption.

The Guideline's 10% overcharge presumption was, moreover, based upon the estimate that "the average gain from price-fixing is 10 percent of the selling price."[172] The Guidelines "average" is the equivalent of the mean, not the median.[173] The correct comparisons are therefore not between the Guideline's figure of 10% and the medians of 27% for the economic studies and 22% for the case verdicts. Rather, the truer comparison would be to the mean figures of 36% and 27% respectively. One must be agnostic on the question of whether, from the perspective of optimal deterrence, mean or median figures should be used as the basis of the U.S. Sentencing Commission's presumption. However, the decision to focus on the median figures has been a conservative one.

Surprisingly, bid rigging was no more injurious than other forms of collusion. If anything, the data suggests that bid rigging is slightly less injurious. These results suggest that the USSC should amend its Guidelines, which currently treat bid rigging more harshly than other forms of collusion. Nor is there any empirical basis for the Guideline's statement that cartels are less dangerous when they are formed in larger markets.

There is another respect in which this paper has been conservative: it focuses solely on the public injury that arises from the transfer of income or wealth from purchasers to the cartel. However, cartels also can lead to allocative inefficiency, umbrella effects, less innovation, managerial slack, and to non-price harms to quality and variety, etc. Yet, these factors have not taken these harms into account. Nor have the figures been adjusted for inflation. While the Guidelines seem to have doubled the 10%

[172] 15 U.S.C. 1 Application Note 3.

[173] The inclusion of a few highly successful cartels in a sample implies that the sample's mean is significantly higher than its median. The mean will also be higher than the median because overcharges cannot be less than zero.

presumption to account for its omission of these factors, I believe that doubling is insufficient.

For all of these reasons, if the U.S. Sentencing Commission decides to re-examine whether 10% is the right overcharge presumption,[174] Connor and Lande (2004) propose raising the presumption to 15% for domestic cartels and 25% for international cartels.[175] 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 harms presumed by the current Sentencing Guidelines.

Issue 2: Global Sanctions

The principal antitrust authorities abroad also seem to base their typical or maximum fines on a 10% harm presumption.[176] Many jurisdictions follow the EU's lead in limiting their cartel fines to at most 10% of a guilty company's annual sales.[177] This self-imposed restriction will not, under a wide range of conditions,[178] result in fines that reach or exceed a cartelist's monopoly profits. *Average* fines imposed since 1995 by Canada and the EU on identical cartels have been lower than U.S. government fines (Connor 2005). 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.

The survey results suggest that overcharges generated by cartels discovered outside the United States are higher than North America-centered cartels. Moreover, contemporary international cartels have a majority of their members drawn from Europe and Asia, and these cartels as a group are more harmful than geographically localized conspiracies. Consequently, anticartel laws and fine-setting practices abroad are in even greater need of strengthening.

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[174] This article's introduction observed that it was possible that *Blakely v.Washington* could mean that the 10% presumption will be declared unconstitutional or employed less often. Instead, defendants may litigate the actual overcharges. If this happens, most of the 79% of cartels that overcharged more than 10% should acquiesce to the government's use of the 10% presumption. Only the 21% of cartels that overcharged less than 10% should be likely to contest this. However, these fines have no prejudgment interest, so defendants benefit from the delay that comes from litigation.

However, a key issue is whether cartels usually know in advance of litigation roughly how much they overcharged. Could most cartels predict in advance of litigation, for example, that a Court will find that it overcharged 5%, as opposed to 15%? How risk-averse are they, in light of the probability that lengthy, protracted litigation could result in a much higher result? I believe that cartels often are risk seekers and often will be able to make this prediction with a fair degree of accuracy.

[175] If the policymakers decide that it would be unwise to make this differentiation, however, a 20% overall presumption would be appropriate. The doubling of the base fine and the 0.75 to 4.0 culpability multipliers are not affected by this proposal.

[176] Is there something particularly alluring about the fingers of two human hands that impels decision makers to fixate on ten or multiples of ten when designing numerate sanctions' standards?

[177] Canada centers its fines around 20% of affected Canadian sales, but has no culpability multipliers other than leniency discounts. Brazil permits 30% of affected sales.

[178] The conditions are that the targeted company is fairly specialized, has most of its sales inside the jurisdiction's borders, and joins a highly durable international conspiracy with a low probability of detection (Connor 2003).

Issue 3: Cartel Deterrence

Global cartels are the most harmful type. 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 deterring (Bush *et al.* 2004, Connor 2005).

For most types of cartels, there are modest downtrends in cartel mark-ups over time.[179] Since 1990 the average overcharges of discovered cartels fell to 15-16% for domestic cartels, and to 25% for international cartels.[180] 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 been desirable. 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.

Global cartels are difficult to detect, have less fear from entry of rivals, achieve higher levels of sales and profitability, and systematically receive weaker corporate sanctions than comparable domestic cartels. Base fines of 20% of cartelists' affected commerce, even when adjusted by significant culpability multipliers,[181] will do little to deter most of these cartels.

[179] The fact that cartel overcharge estimates do not change systematically over the past century (except as noted above) provides a rough indication that progress in theories and empirical methods has not totally invalidated cartel case studies published in the early years of cartel scholarship. I also ascertained that median overcharges are not sensitive to whether or not a study was subject to formal peer review. However, in an analysis of finely matched cartel episodes, I did find that econometric approaches typically produced lower estimates than did application of the before-and after method.

[180] This period also has the highest proportion of cartels that are international.

[181] 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 for a variety of reasons.

References

Adams, Richard F. and George M. Bock. Damages in Horizontal Price Fixing Cases. *Antitrust Law Journal* 49 (1980): 141-152.

Adelman, Morris A. Is the Oil Shortage Real? *Foreign Policy* (Winter 1972-73): 71.

Adler, Howard. and David J. Laing. Explosion of International Criminal Antitrust Enforcement. *The Corporate Counselor* 11 (March 1997): 1- .

_____. As Corporate Fines Skyrocket. *Business Crimes Bulletin* 6 (1999): 1- .

Aiginger, Karl *et al.* Do American and European Industrial Organization Economists Differ? *Review of Industrial Organization* 19 (2001): 383-405.

Aiginger, Karl and Michael Pfaffermayr. Looking at the Cost Side of "Monopoly. *The Journal of Industrial Economics* 45 (1997): 245-267.

Albaek, Svend, *et al*. Government-Assisted Oligopoly Coordination? A *Concrete* Case. *Journal of Industrial Economics* 45 (1997): 429-443.

Alexander, Barbara. The Impact of the National Industrial recovery Act on Cartel Formation and Maintenance Costs. *Review of Economics and Statistics* 76 (1994): 245-254.

_____. Failed Cooperation in Heterogeneous Industries Under the National Recovery Administration. *Journal of Economic History* 57 (1997): 322-344.

Allen, G.C. An Eighteenth Century Combination in the Copper-Mining Industry. *Economic Journal* 33 (1923):74-85.

Andrews, E. Benjamin. The Late Copper Syndicate. *Quarterly Journal of Economics* 3 (1889): 508-516.

Appelbaum, Elie. Testing Price Taking Behavior. *Journal of Econometrics* 9 (1979): 283-294.

Arnold, Thurman W. *Cartels or Free Enterprise? Pamphlet No. 103*. Washington, DC: U.S. Public Affairs Committee (1946).

Asch, Peter and Joseph J. Seneca. Characteristics of Collusive Firms. *Journal of Industrial Economics 23 1975): 223-237.*

Ashenfelter, Orley C. and Kathryn Graddy. *Art Auctions: A Survey of Empirical Studies, Discussion Paper 3387.* Center for Economic Policy Research (May 2002) [www.cepr.org].

Baldwin, Laura H., *et al*. Bidder Collusion at Forest Service Timber Sales. *Journal of Political Economy* 105 (1997): 657-695.

Baker, Jonathan B. Identifying Cartel Policy Under Uncertainty: The U.S. Steel Industry, 1933-1939. *Journal of Law and Economics* 32 (1989): S47-S76.

_____. The Case for Antitrust Enforcement. *Journal of Economic Perspectives* 17 (Fall 2003):27-50.

Baker, Jonathan B. and Daniel L. Rubinfeld. Empirical Methods in Antitrust Litigation. *American Law and Economics Review* 1 (1999):386-435.

Baker, Wayne E. and Robert P. Faulkner. The Social Organization of Conspiracy: Illegal Networks in the Heavy electrical Equipment Industry. *American Sociological Review* 58 (1993): 837-860.

Bajari, Patrick and Lixin Ye. Deciding between Competition and Collusion. *Review of Economics and Statistics* 85 (2003): 971-989

Bane, Charles A. *The Electrical Equipment Conspiracies: The Treble Damage Actions.* New York: Federal Legal Publications (1973).

Barbezat, Daniel. Competition and Rivalry in the International Steel Cartel, 1926-1933. *Journal of Economic History* 49 (1989): 435-447.

_____. International Cooperation and Domestic Cartel Control: The International Steel Cartel, 1926-1932. *Business and economic history: Papers presented at the thirty-sixth annual meeting of the Business History Conference* Baltimore, Maryland, pp. 14-16, Second Series, vol. 19. Williamsburg, Va.: College of William and Mary, Department of Economics Business History Conference (March 23-25, 1990).

_____. Structural Rigidity and the Severity of the German depression: The AVI and the German Steel Cartels, 1925-1932. *Explorations in Economic History* 31 (1994): 479-500.

Barjot, Dominique (editor). *International Cartels Revisited (1880-1980).* Caen, France: Edition-Diffusion du Lys (1994).

Barnett, Paul G., *et al*. Oligopoly Structure and the Incidence of Cigarette Excise Taxes. *Journal of Public Economics* 57 (1995): 457-470.

Becker, Gary. Crime and Punishment: An Economic Approach. *Journal of Political Economy* 76 (1968): 169- .

Beckerath, Herbert von. *Modern Industrial Organization: An Economic Interpretation*. New York: McGraw-Hill (1930, translated 1933).

Beckmann, Michael. Art Auctions and Bidding Rings: Empirical Evidence from German Auction Data. *Journal of Cultural Economics* 28 (2004): 125-141.

Benni, M.C.L., *et al. Review of the Economic Aspects of Several International Agreements.* Geneva: League of Nations (1930).

Berge, Wendell. *Cartels: Challenge to a Free World (1st ed., 2nd printing)*. Washington, DC: Public Affairs Press (1944).

Berry, Steven and Hugh Briggs. A Non-Parametric Test of a First-Order Markov Process for Regimes in a Non-Cooperatively Collusive Industry. *Economics Letters* 27 (1988): 73-77.

Besanko, David and Daniel F. Sperber. Are Treble Damages Neutral? *American Economic Review* 80 (1990): 870-887.

Bhuhan, Sanjib and Rigoberto Lopez. Oligopoly Power in the Food and Tobacco Industries. *American Journal of Agricultural Economics* 79 (1997): 1035-1049.

Blair, John M. *The Control of Oil.* New York: Pantheon (1976).

Block, Michael Kent and Frederick Carl Nold. The Deterrent Effect of Antitrust Enforcement. *Journal of Political Economy* 89 (1981): 429-445.

Bosch, J. and E.W. Eckard. The Profitability of Price Fixing: Evidence from Stock-Market Reactions to Federal Indictments. Review of Economics and Statistics 73 (1991): 309-317.

Brännlund, Runar. The Social Loss from Imperfect Competition – The Case of the Swedish Pulpwood Market. *Scandinavian Journal of Economics* 91 (1989): 689-704.

Bruland, Kristine and Patrick O'Brien (editors). *From Family Firms to Corporate Capitalism.* Oxford: Clarendon Press (1998).

Bullock, Charles J. Trust Literature: A Survey and Criticism. *Quarterly Journal of Economics* 15 (1901): 167-217.
_____. *Pools, Trusts and Corporations.* Boston: Ginn & Co. (1905).

Burnside, Alec. European Cartel Enforcement and Investigations. Speech at the annual spring meeting of the Antitrust Section of the American Bar Association (April 2-4, 2003).

Buschena, D. E. and J. M. Perloff. The Creation of Dominant Firm Market Power in the Coconut Oil Export Market. *American Journal of Agricultural Economics* 73 (1985): 1000 – 1008.

Bush, Darren *et al. Brief Amici Curiae No. 03-724 in the Supreme Court of the United States, F. Hoffmann-LaRoche et al. v. Empagran et al.* (March 15, 2004).

Calvert, Albert F. *A History of the Salt Union.* London: Effingham Wilson (1913).

Carlton, Dennis W., Gustavo E. Bamberger, and Roy J. Epstein. Antitrust and Higher Education: Was There a Conspiracy to Restrict Financial Aid? *Rand Journal of Economics* 26 (1995): 131-147.

Carlton, Dennis W. and Jeffrey M. Perloff. *Modern Industrial Organization*. Glenview, Illinois: Scott Foresman (1990).

Carmen, Hoy F. and Daniel H. Pick. Orderly marketing for lemons: Who Benefits? *American Journal of Agricultural Economics* 72 (1990): 347 – 357.

Cawson, A. *Organized Interests and the State.* London: Sage (1985).

Christie, William G., Jeffery Harris, and Paul Schultz. Why did NASDAQ Market Makers Stop Avoiding Odd-Eighth Quotes? *Journal of Finance* 49 (1994): 1841-1860.

Clabault, James M. and M. Block. Sherman Act Indictments, 1955-1980, unpublished statistical compilation of fines as proportions of volume of commerce (1981). [From Cohen and Scheffman 1989, note 12].

Clarke, Julian L. and Simon J. Evenett. *The Deterrent Effects of National Anti-Cartel laws: Evidence from the International Vitamins Cartel: Working Paper 02-13.* Washington, DC: AEI-Brookings Joint Center for Regulatory Studies (December 2002).

_____. The Deterrent Effects of National Anticartel Laws: Evidence from the International Vitamins Cartel. *Antitrust Bulletin* 48 (2003): 289-726.

Clay, Karen and Werner Troesken. Further Tests of Static Oligopolistic Models: Whiskey, 1882 – 1898. *Journal of Industrial Economics* 51 (2003) : 151-166.

Cohen, Mark A. The Role of Criminal Sanctions in Antitrust Enforcement. *Contemporary Policy Issues* 7 (1989a): 36-46.

_____. Corporate Crime and Punishment: A Study of Social Harm and Sentencing Practices in the Federal Courts, 1984-1987. *American Criminal Law Review* 26 (1989b): 605-660.

Cohen, Mark A. *et al*. Organizations as Defendants in Federal Court: A Preliminary Analysis of Prosecutions, Convictions and Sanctions, 1984-1987. *Whittier Law Review* 10 (1988): 103-124.

Cohen, Mark A. and David T. Scheffman. The Antitrust Sentencing Guideline: Is the Punishment Worth the Costs? *Journal of Criminal Law* 27 (1989): 331-366.

Coleman, D.C. International Consortia (1969), in Jones (1993):51-78.

Comanor, W.S. and M.A. Schankerman. Identical Bids and Cartel Behavior. *Bell Journal of Economics* 7 (1976): 281-286.

Connor, John M. The Global Citric Acid Conspiracy: Legal-Economic Lessons. *Agribusiness:An International Journal* 14 (1998): 253-259.

_____. *Global Price Fixing: "Our Customers are the Enemy*." Boston: Kluwer Academic (2001a).

_____. "Our Customers Are Our Enemies:" The Lysine Cartel of 1992-1995. *Review of Industrial Organization* 18 (2001b): 5-21.

_____. *Private International Cartels: Effectiveness, Welfare, and Anticartel Enforcement, Staff Paper 03-12*. W. Lafayette, IN: Dept. of Agricultural Economics, Purdue University (November 2003).

_____. Global Cartels Redux: The Amino Acid Lysine Antitrust Litigation (1996), in John E. Kwoka and Lawrence White (eds), *The Antitrust Revolution (Fourth Edition).* Oxford: Oxford University Press (2004).

_____. Global Antitrust Prosecutions of Modern International Cartels. *Journal of International Competition and Trade*. (forthcoming 2005), 50 pp.

Connor, John M. and Robert H. Lande. How High Do Cartels Raise Prices? Implications for Reform Of Antitrust Sentencing Guidelines. Proposed law review article (October 18, 2004), 91 pp.

Crampton, Peter and Thomas Palfry. Collusive Bidding: Lessons from the FCC Spectrum Auctions. *Journal of Regulatory Economics* 17 (2000): 229-252.

Crandall, Robert W. and Clifford Winston. Does Antitrust Policy Improve Consumer Welfare? Assessing the Evidence. *Journal of Economic Perspectives* 17 (Fall 2003):1-26.

Crespi, John M. and Adriana Chacon-Cascante. Do U.S. Marketing Orders Have Much Market Power? An Examination of the Almond Board of California. *Agribusiness: An International Journal* 21 (2004): 1-16.

Curtis, Roy Emerson. *Trusts and Economic Control: A Book of Materials.* New York: McGraw-Hill (1931).

Daggett, R. S. and D.A. Freedman. Econometrics and the Law: A Case Study in the Proof of Antitrust Damages, in Lucien M. Le Cam and Richard A. Olshen (eds.), *Proceedings of the Berkeley Conference in Honor of Jerzy Neyman and Jack Kiefer, Vol. 1.* New York: Wadsworth (1985).

Dana, Durand E. Jones' the Trust Problem in the United States. *Quarterly Journal of Economics* 28 (Nov. 1922): 175-182.

Davidow, Joel. Proof of Purchases and Damages by Public Buyers of Price-Fixed Goods. *The Antitrust Bulletin* 17 (1972): 363-378.

Denger, Michael L. Too Much or Too Little, a summary of discussion, American Bar Association's Antitrust Remedies Forum, Washington, DC (April 2003).

Demaree, Allen T. How Judgment Came for the Plumbing Conspirators. *Fortune* (December 1969): 96-99 and 175-182.

De Rousiers, Paul. *Cartels Trusts and Their Development.* Geneva: League of Nations (1927).

Devos, Greta. International Cartel Agreements in the Zinc Industry, pp.143-151 in Dominique Bardot (ed), *International Cartels Revisited, 1880-1980.* Caen, France: Editions-diffusion du Lys (1994).

Dick, Andrew R. Are Export Cartels Efficiency-Enhancing or Monopoly-Promoting? *Research Law and Economics.* 15 (1992a): 89-127.

_____. The Competitive Consequences of Japan's Export Cartel Associations. *Journal of Japanese and International Economics* 6 (1992b): 275-298.

_____. When Are Stable Cartels Stable? *Journal of Law and Economics* 39 (1996): 241-283.

Domeratzky, Louis. *The International Cartel Movement: Trade Information Bulletin No. 556.* Washington, DC: U.S. Department of Commerce (1928).

Duggan, James E. and Gorti V. L. Narasimham. Price Fixing in the Titanium Industry: A Time Series Analysis. *Proceedings of the Business and Economic Statistics Section, American Statistical Association.* Washington, DC: American Statistical Association (1981).

Eckbo, Paul L. *The Future of World Oil*. Cambridge, Mass: Ballinger (1976).

Economic and Financial Section. *Electrical Industry*. Geneva: League of Nations (1927).

Edwards, Corwin. *Cartelization in Western Europe.* Washington, DC: Bureau of Intelligence and Research, U.S. Department of State (1946).

Edgerton, Charles E. The Wire-Nail Association of 1895-96. *Political Science Quarterly* 12 (1897): 246-272.

Eichenwald, Kurt. *The Informant: A True Story.* New York: Broadway Books (2000).

Elliott, William.Yandell, *et al*. *International Control in the Non-Ferrous Metals.* New York: Macmillan (1937).

Ellison, Glenn. Theories of Cartel Stability and the Joint Executive Committee. *RAND Journal of Economics* 25 (1994): 37-57.

_____. Personal communication to J. M. Connor about Ellison's 1994 JEC study, dated November 12, 2003.

Elzinga, Kenneth G. Predatory Pricing: The Case of the Gunpowder Trust. *The Journal of Law and Economics* 13 (1970): 223-240.

_____. New Developments on the Cartel Front. *Antitrust Bulletin* 29 (Spring 1984): 3-26.

Elzinga, Kenneth G. and William C. Wood. The Costs of the Legal System in Private Antitrust Enforcement, in White, Lawrence J. (ed.). *Private Antitrust Litigation: New Evidence, New Learning.* Cambridge, MA: MIT Press (1988).

Epstein, Barbara. *Politics of Trade in Power Plants.* London: Trade Policy Research Center (1971).

Epstein, Barbara and Richard S. Newfarmer. *International Electric Association: A Continuing Cartel,* Report to the Subcommittee on Oversight and Investigations, House Committee on Interstate and Foreign Commerce, U. S. Congress. Washington, DC: USGPO (1980).

Erickson, W. Bruce. Price-Fixing Conspiracies: Their Long-Term Impact. *Journal of Industrial Economics* 24 (1976): 189-202.

Evenett, Simon J., Margaret C. Levenstein, and Valerie Y. Suslow. International Cartel Enforcement: Lessons from the 1990s. *World Economy* 24 (2001): 1221-1246.

Eswaran, Mukesh. Cartel Unity over the Business Cycle. *Canadian Journal of Economics* 30 (1997): 644-672.

Fallenius, Christer. A Swedish Example – the Petrol case, in *Fighting Cartels – Why and How?: Proceedings of a conference sponsored by the Konkurrensverket.* Stockholm: Elanders Graphic Systems (2001).

Feinstein, Jonathan S., Michael Block, and Frederick Nold. Asymmetric Information and Collusive Behavior in Auction Markets. *American Economic Review* 75 (1985): 441-460.

Fejø, Jens. Deterrent Effect of Competition Law on Hard Core Cartels, in *Fighting Cartels – Why and How?* Stockholm: Konkurrensverket (2001).

Fetter, Frank A. *The Masquerade of Monopoly.* New York: Harcourt Brace (1931).

Filson, D. *et al.* Market Power and Cartel Formation: Theory and Empirical Test. *Journal of Law and Economics* 44 (2001): 465-480.

Finkelstein, M. and H. Levenback. Regression Estimates of Damages in Price-Fixing Cases. *Law and Contemporary Problems* 46 (1983): 145-169.

Fisher, Franklin. Multiple Regression in Legal proceedings. *Columbia Law Review* 80 (1980): 702- .

Fisher, Franklin M. and Paul H. Cootner. An Econometric Model of the World Copper Industry. *Bell Journal of Economics and Management Science 3* (1972): 570-591.

Fisher, L.A. and A.D. Owen. An Econometric Model of the U.S. Aluminum Market. *Resources Policy* (1981): 150-160.

Fleming, Grant. Collusion and Price Wars in the Australian Coal Industry during the Late Nineteenth Century. *Business History* 42 (2000): 47-70.

Fourie, F. C. and A. Smith. The South African Cement Cartel: An Economic Evaluation.. *South African Journal of Economics* 62 (1994): 123-143.

_____. The South African Cement Cartel: Reply. *South African Journal of Economics* 63 (1995): 91-102.

Fog, Bjarke. How Are Cartel Prices Determined? *Journal of Industrial Economics* 5 (1956): 16-23.

Fraas, Arthur G. and Douglas F. Greer. Market Structure and Price Collusion: An Empirical Analysis. *Journal of Industrial Economics* 26 (1977): 21-44.

French, B. C. and C. F. Nuckton. An Empirical Analysis of Economic Performance under the Marketing Order for Raisins. *American Journal of Agricultural Economics* 64 (1982): 581-593.

Friedman, Milton. FEO and the Gas Line. *Newsweek (*Mach 4, 1974):71.

Froeb, Luke M., Robert A. Koyak, and Gregory J. Werden. What Is the Effect of Bid-Rigging on Prices? *Economic Letters* 42 (1993): 419-423.

_____. Bid Rigging against the Government. *Owen Manager* (1994).

_____. Effects of Price-Fixing and Bid-Rigging Conspiracies (1995, downloaded 2/24/99) (www.antitrust.org/economics/conspiracy effects.html)

_____. Japan's Price-Fixing and Bid-Rigging Conspiracies (1995). (www.antitrust.org/economics/conspiracyeffects.html).

FTC. *Report of the Federal Trade Commission on International Electrical Equipment Cartels.* Washington, DC: U.S. Federal Trade Commission (1948).

Fugate, Wilbur L. *Foreign Commerce and the Antitrust Laws, 2nd ed.* Boston: Little Brown (1973).

Funderburk, Dale R. Price Fixing in the Liquid Asphalt Industry: Economic Analysis versus the "Hot Document." *Antitrust Law & Economic Review* 7 (1974): 61-74.

Gallet, Craig A. Cyclical Fluctuations and Coordination in the US Steel Industry. *Applied Economics* 29 (1997): 279-285.

Gately, Dermot. A Ten-Year Retrospective: OPEC and the World Oil Market. *Journal of Economic Literature* 22 (1984): 1100-1114.

Gavin, Andrew. Email to John M. Connor dated October 7, 2004.

Genesove, David and Wallace P. Mullin. Testing Static Oligopoly Models: Conduct and Cost in the Sugar Industry, 1890-1914. *Rand Journal of Economics* 29 (1998): 355-77.

Genesove, David and Wallace P. Mullin. Rules, Communication, and Collusion: Narrative Evidence from the Sugar Institute Case. *American Economic Review* 91 (2001): 379-398.

Gerber, David. *Law and Competition in Twentieth Century Europe: Protecting Prometheus.* Oxford: Clarendon Press (1998).

Gillingham, John. An Ill-Fitting Jacket: The United States and the International Steel Cartel, pp. 129-142 in Dominique Bardot (ed), *International Cartels Revisited, 1880-1980.* Caen, France: Editions-diffusion du Lys (1994).

Ginsberg, Douglas H. Statement of the Assistant Attorney General for Antitrust, U.S. Department of Justice to the U.S. Sentencing Commission. (July 15, 1986).

Goldberg, Victor P. The International Salt Puzzle. *Research in Law and Economics* 14 (1991): 39-41.

Gommesen, Henrik. Cartels in Denmark, personal communication. (December 3, 2003).

Goyder, D. G. *EC Competition Law: Third Edition.* Oxford: Clarendon (1998).

Graubert, John D. Too Much or Too Little, a summary of discussion, American Bar Association's Antitrust Remedies Forum, Washington, DC (April 2003).

Graebner, William. Great Expectations: The Search for Order in Bituminous Coal, 1890-1917. *Business History Review* 48 (1973):49-72.

Gray, Earle. *The Great Uranium Cartel*. Toronto: McClelland & Stewart (1982).

Granitz, Elizabeth and Benjamin Klein. Monopolization by "Raising Rivals' Costs": The Standard Oil Case. *Journal of Law and Economics* 39 (1996): 1-47.

Grant, Hugh and Henry Thille. Tariffs, Strategy and Structure: Competition and Collusion in the Ontario Petroleum Industry, 1870-1880. *Journal of Economic History* 61 (2001): 390-413.

Greer, Douglas F. *Industrial Organization and Public Policy, 2nd edition*. New York: Macmillan (1984).

Griffin, James M. Previous Cartel Experience: Any Lessons for OPEC?, in Lawrence R. Klein and J. Marquez (eds), *Economics in Theory and Practice: An Eclectic Approach.* Boston: Kluwer Academic (1989).

Griffin, James M. and William S. Neilson. The Oil Price Collapse and Afterwards: What Does Game Theory Add? *Economic Inquiry* 32 (1994): 543-561.

Groner, Jonathan. Chalk up a Few Wins for Microsoft. *The National Law Journal* (October 2, 2000): A4.

Grossman, Peter Z. The Dynamics of a Stable Cartel: The Railroad Express, 1851-1913. *Economic Inquiry* 34 (1996): 220-236.

Guersent, Oliver (editor). *The Fight against International Cartels of the European Commission: 19 Decisions in 19 Months between July 2001 and December 2003.* Brussels: EC Directorate-General for Competition (2001). [http://europa.eu.int/comm/competition/antitrust, downloaded March 2004].

Guilfoil, John D. Damage Determination in Private Antitrust Suits. *Notre Dame Lawyer* 42 (June 1967): 647-679.

Gupta, Srabana. The Effect of Bid-Rigging on Prices: A Study of the Highway Construction Industry. *Review of Industrial Organization* 19 (2001): 453-467.

Haber, L. F. *The Chemical Industry 1990-1930.* Oxford: Clarendon press (1971).

Hajivassilou, Vassilis A. Testing Game-Theoretic Models of Price-Fixing Behavior: Discussion Paper No. 935. New Haven: Cowles Foundation for Research in Economics (1989).

Haney, Lewis H. Price Fixing in the United States during the War I. *Political Science Quarterly* 34 (March 1919a): 104-126.

_____. Price Fixing in the United States during the War II. *Political Science Quarterly* 34 (June 1919b): 262-289.

_____. Price Fixing in the United States during the War III. *Political Science Quarterly* 34 (September 1919b): 434-453.

Hansen, Robert G. Empirical Testing of Auction Theory. *American Economic Review* 75 (1985): 156-159.

Harding, Christopher and Julian Joshua. *Regulating Cartels in Europe: A Study of Legal Control of Corporate Delinquency.* Oxford: Oxford University Press (2003).

Harrington, Joseph E. Post-Cartel Pricing during Litigation. *Journal of industrial Economics* (forthcoming 2004).

Hasagawa, Shin. International Cartels and the Japanese Electrical Machinery Industry, pp. 243-252 in Dominique Bardot (ed), *International Cartels Revisited, 1880-1980.* Caen, France: Editions-diffusion du Lys (1994).

Hausfeld, Michael D. *Class Plaintiffs' Motion for Preliminary Approval of Settlement Between Class Plaintiffs and Defendants Mitsui & Co., Mitsui & Co. (U.S.A.), Inc., and Bioproducts, Inc*. Washington, DC: U.S. District Court for the District of Columbia (October 31, 2003).

Hausman, William J. A Model of the London Coal Trade in the Eighteenth Century. *Quarterly Journal of Economics* 94 (1980): 1-14.

_____. Cheap Coals or Limitation of the Vend? The London Coal Trade, 1770-1845. *Journal of Economic History* 44(1984): 321-328.

Hay, George A. and Daniel Kelley. An Empirical Survey of Price-Fixing Conspiracies. *Journal of Law and Economics* 17 (1974): 13-38.

Heath, John. *Still Not enough Competition? Restrictive Business Practices Re-examined.* London: Institute of Economic Affairs Ltd. (1963).

Henley, Andrew. Price Formation and Market Structure: The Inter-War Coal Industry. *Oxford Bulletin of Economics and Statistics 50 (1988):263-278.*

Herfindahl, Oris C. *Copper Costs and Prices: 1870-1957.* Baltimore: Johns Hopkins University Press (1959).

Herling, John. *The Great Price Conspiracy: The Story of the Antitrust Violations of the Electrical Industry*. Washington, DC: Robert D. Luce (1962).

Hendricks, Kenneth and Robert H. Porter. Collusion in Auctions. *Annales d'Economie et de Statistique* 15/16 (1989): 217-230.

_____. An Empirical Study of an Auction with Asymmetric Information. *American Economic Review* 78 (1988): 865-883.

Hexner, Ervin (with the assistance of Adelaide Walters). *International Cartels*. Chapel Hill, NC: University of North Carolina Press (1946).

Hirst, Francis W. *Monopolies,Trusts, and Kartells.* London: Methuen (1905).

Holloway, Steven K. *The Aluminum Multinationals and the Bauxite Cartel*. New York: St. Martin's (1988).

Hovenkamp, Herbert. *Federal Antitrust Policy: Second Edition.* St. paul: WestGroup (1999).

Hoxby, Caroline M. *Benevolent Colluders?: Working Paper No. 7754.* Cambridge, MA: NBER (2000).

Hudson, Henry. The Southern Railway and Steamship Association. *Quarterly Journal of Economics* 5 (1890): 70-94.

Howard, Jeffery H. and David Kaserman. Proof of Damages in Construction Industry Bid-Rigging Cases. *Antitrust Bulletin* 34 (1989): 359-393.

Ippolito, R. A. and R. T. Masson. The Social Cost of Government Regulation of Milk. *Journal of Law and Economics* 21 (1978): 33-65.

Jacquemin, Alexis, Tsuruhiko Nambu, and Isabelle Dewez. A Dynamic Analysis of Export Cartels: The Japanese Case. *The Economic Journal* 91 (1981): 685-696.

Jacquemin, Alexis and Margaret E. Slade. Cartels, Collusion, and Horizontal Merger, in *Richard* Schmalensee and Robert D. Willig (editors.), *Handbook of Industrial Organization, Volume 1.* Amsterdam: Elsevier (1989).

Jenks, Jeremiah W. The Michigan Salt Association. *Political Science Quarterly* 3 (1888): 78-98.

_____. *The Trust Problem.* Garden City, NY: Doubleday, Page (three editions 1900, 1901, 1903).

Jenks, Jeremiah W. and Walter E. Clark. *The Trust Problem.* Garden City, NY: Doubleday, Doran (4th and 5th editions 1917, 1929).

JFTC. *Basic Idea behind the Planned Major Revision of the Antimonopoly Law.* Tokyo: Fair Trade Commission (May 19, 2004) [www2.jftc.go.jp/kaisei.htm, downloaded Aug. 2004]

Jenny, Frederic. A Tale of Three Cartels, presentation at the 2003 Forum on International Competition Law, Section of Antitrust Law, American Bar Association, New York (February 7, 2003)

Johnsen, D. Bruce. Property Rights to Cartel Rents: The Socony-Vacuum Story. *Journal of Law and Economics* 34 (1991): 177-203.

Jones, Elliot. *The Anthracite Coal Combination in the United States.* Cambridge: Harvard (1914).

_____. *The Trust Problem in the United States.* New York: Macmillan (1921).

Jones, Geoffrey (editor). *Coalitions and Collaboration in International Business.* Aldershot, UK: Edward Elgar (1993).

Josephson, Matthew. *The Robber Barons.* San Diego: Harcourt Brace (1962).

Joskow, Paul. Commercial Impossibility, the Uranium Market and the Westinghouse Case. *Journal of Legal Studies 6* (1976): 119-176.

Just, Richard E. and Wen S. Chern. Tomatoes, Technology, and Oligopsony. *Bell Journal of Economics* 11 (1980): 584-602.

Kamerschen, David R. and J.E. Morgan. Collusion Analysis of the Alabama Asphalt Market. *Applied Economics 36 (2004):690.*

KFTC. The KFTC Imposes Surcharges on the International Cartel of Vitamin Companies, Press Release. Seoul: Korea Fair Trade Commission (April 25, 2003).

_____. Harms of Cartels and Sanctions against Them: Report to the OECD. Seoul: Republic of Korea (June 7, 2001).

Kikkawa, Takkeo. International Cartel and Domestic Cartel in Japan: The Case of the 1932 Gasoline Agreement, pp. 233-241 in Dominique Bardot (ed), *International Cartels Revisited, 1880-1980.* Caen, France: Editions-diffusion du Lys (1994).

Kishi, Nobuko. Translation of JFTC (2004) (August 2004)

Kleinwächter, Fritz. *Die Kartelle.* Innsbruck, Austria (1883).

Kovacic, William E. and Carl Shapiro. Antitrust policy: A Century of Economic and Legal Thinking. *Journal of Economic Perspectives* 14(2000):43-60.

Kronstein, Heinrich. *The Law of International Cartels.* Ithaca: Cornell University Press (1973).

Kudo, Akira. The Japanese Strategy of the International Dyestuffs Cartel, pp. 215-222 in Dominique Bardot (ed.), *International Cartels Revisited, 1880-1980.* Caen, France: Editions-diffusion du Lys (1994).

Kuhlman, John M. Theoretical Issues in the Estimation of Damages in Private Antitrust Actions. *Antitrust Bulletin* 17 (1972): 548-558.

Kwoka, John E. Pricing under Federal Milk Market Regulation. *Economic Inquiry* 5 (1977): 367–384.

_____. *The Attack on Antitrust Policy and Consumer Welfare: A Response to Crandall and Winston*, Working Paper 03-008. Boston: Department of Economics, Northeastern University (March 2003).

_____. The Price Effect of Bidding Conspiracies: Evidence from Real Estate "Knockouts." *Antitrust Bulletin* 42 (1997): 503-516.

Labys, W.C. and J.F. Hewheler. *Survey of Commodity Demand and Supply Elasticities: Memorandum No. 48.* Geneva: Research Division, UNCTAD (1974).

Lande, Robert H. Are Antitrust "Treble" Damages Really Single Damages? *Ohio State Law Journal* 54 (1993):115- .

_____. Why Antitrust Damage Levels Should Be Raised. *Loyola Consumer Law Review* 16 (2004):326-

Landes, William H. Optimal Sanctions for Antitrust Violations. *University of Chicago Law Review* 50 (1983): 652-678.

Lanzillotti, Robert F. The Great School Milk Conspiracies of the 1980s. *Review of Industrial Organization* 11 (1996): 413-458.

_____. Great School Milk Conspiracies Revisited: Rejoinder. *Review of Industrial Organization* 17 (2000): 343-353.

Leach, D.F. The South African Cement Cartel: A Critique of Fourie and Smith. *South African Journal of Economics* 62 (1994): 254-279.

Lean, David F., Jonathan D. Ogur, and Robert P. Rodgers. Does Collusion Pay… Does Antitrust Work? *Southern Economic Journal* 51 (1985): 828-841.

LeCraw, D.J. The Uranium Cartel. *Business Quarterly* (1977): 77-83.

Lee, In Kwon. Non-Cooperative Tactic Collusion, Complementary Bidding and Incumbency Premium. *Review Industrial Organization* 15 (1999): 115-134.

Lee, In Kwon and Kyungdong Hahn. Bid-Rigging in Auctions for Korean Public-Works Contracts and Potential Damage. *Review of Industrial Organization* 21 (2002): 73-88.

Leiden University, Historical Institute. *Interwar Cartel Database.* [http://www.let.leidenuniv.nl/history/rtg/cartels/bal2.html].

Leitzinger, J. Regression Analysis in Antitrust Cases: Opening the Black Box. *The Philadelphia Lawyer* 20 (1983): 1- .

Levenstein, Margaret C. Price Wars and the Stability of Collusion: A Study of the Pre-World War I Bromine Industry. *Journal of Industrial Economics* 45 (1997): 117-137.

_____. Strategic Consumer Behavior and Cartel Stability: The Potash Industry 1870-1914. Ann Arbor, MI: mimeo (2000).

Levenstein, Margaret and Valerie Suslow. *What Determines Cartel Success? Working Paper 02-001.* University of Michigan Business School (January 2002).

Levenstein, Margaret, Valerie Suslow, and Lynda Oswald. *International Price-Fixing Cartels and Developing Countries: A Discussion of Effects and Policy Remedies,* Working Paper 9511. Cambridge, Massachusetts. National Bureau of Economic Research (February 2003).

Levy, Hermann. *Monopoly, Cartels and Trusts in British Industry, 2nd edition*. London: Cass & Co. (1927, reprinted 1968).

Lieber, James B. *Rats in the Grain: The Dirty Tricks and Trials of Archer Daniel Midland.* New York: Four Walls Eight Windows (2000).

Liefmann, Robert. *Die Unternehmerverbande, Konventionen, Kartelle.* (1897).

_____. *Cartels, Concerns and Trusts.* New York: Dutton (1932).

Lister, Louis. Coal: Concerted Practices, in *Europe's Coal and Steel Community: An Experiment in Economic Union.* New York: Twentieth Century Fund (1960): 251-281.

Loescher, Samuel M. Economic Collusion, Civil Conspiracy, and Treble-Damage Deterrents: The Sherman Act Breakthrough with Southern Plywood. *Quarterly Review of Economics and Business* 20 (Winter 1980): 6-35.

Lord, Richard A. and W. Ken Farr. Collusion and Financial Leverage: An Analysis of the Integrated Steel Mill Industry. *Financial Management* (Spring 2003): 127-148.

Low, D. Martin. Cartel Enforcement, Immunity, and Jurisdiction: Some Recent Canadian Developments, speech at the International Bar Association, Rome, Italy (May 17-18, 2004).

Lozowick, Arnold H. *et al*. Law and Quantitative Multivariate Analysis: An Encounter. *Michigan Law Review* 66 (1968): 1641-1678.

MacAvoy, Paul W. The Economic Effects of Regulation. Cambridge, MA: MIT Press (1965).

MacKie-Mason, Jeffrey K. and Robert S. Pindyck. Cartel Theory and Cartel Experience in International Minerals Markets, in Gordon, Richard L., Henry D. Jacoby, and Martin B. Zimmerman (eds), *Energy: Markets and Regulation* Cambridge: MIT Press (1987).

Madhavan, Ananth N., et al. Cooperation for Monopolization? An Empirical Analysis of Cartelization. *Review of Economics and Statistics* 76 (1994): 161-175.

Marlio, Louis. *The Aluminum Cartel*. Washington, DC: Brookings Institution (1947).

Markham, Jesse W. *Competition in the Rayon Industry.* Cambridge: Harvard University Press (1952).

Marvel, Jeffrey M., *et al.* Price Fixing and Civil damages: An Economic Analysis. *Stanford Law Review* (1988):561-575.

Maurer, Harry and Kurt Mirow. *Webs of Power: International Cartels and the World Economy*. Boston: Houghton Mifflin (1982).

McClave, J.,P. Rothrock, and J.P. Ailstock. Computerized Statistical Investigation of the Florida Bread Market. *Southeastern Anti-Trust Review* 1 (1978):13-54.

McGee, John S. Ocean Freight Rate Conferences and the American Merchant Marine. *University of Chicago Law Review* 27 (1960): 191-314.

MacGregor, David H. *International Cartels.* Geneva: League of Nations (1927).

McMillan John. Dango: Japan's Price-Fixing Conspiracies. *Economic and Politics* 3 (1991): 201-218.

_____. *Reinventing the Bazaar: A Natural History of Markets.* New York: W. W. Norton (2002).

Mailmath, George J. and Peter Zemsky. Collusion in Second Price Auctions with Homogeneous Bidders. *Games and Economic Behavior* 3 (1991): 467-486.

Merchant, E.O. The Government and the Newsprint Manufacturers. *Quarterly Journal of Economics* 34 (1920): 313-328.

Michels, Rudolf K. *Cartels, Combines and Trusts in Post-War Germany*. New York: Columbia University Press (1928).

Miyajima, Hideaki. Strategic Intervention against International cartels: The Case of the Japanese Chemical Industries in the Interwar Period, pp. 223-232 in Dominique Bardot (ed), *International Cartels Revisited, 1880-1980.* Caen, France: Editions-diffusion du Lys (1994).

Morrison, Catherine J. *Market Power, Economic Profitability, and Productivity Growth Measurement: An Integrated Structural Approach*, NBER Working Paper No. 3355 (1990).

_____. Productive and Financial Performance in U.S. Manufacturing Industries: An Integrated Structural Approach. *Southern Economic Journal* 69 (1993): 376-392.

Morrison, Steven A. and Clifford Winston. Causes and Consequences of Airline Fare Wars. *Brookings Papers on Economic Activity* (Microeconomics 1996): 85-123.

Morse, Adair B. and Jeffery Hyde. *Estimation of Cartel Overcharges: The Case of Archer Daniels Midland and the Market for Lysine*, Staff Paper 00-8. West Lafayette, Indiana: Department of Agricultural Economics, Purdue University (2000). (revised version presented at the 1st International Industrial Organization Conference, Boston, Mass., April 2003).

Mund, Vernon. Identical Bid Prices. *Journal of Political Economy* 68 (1960): 150-169.

Mueller, Willard F. and Russell C. Parker. Bakers of Washington Cartel: Twenty-Five Years Later. *Review of Industrial Organization* 7 (1992): 75-82.

Nelson, Jon P. Comparative Antitrust Damages in Bid-Rigging Cases: Some Findings from a Used Vehicle Auction. *Antitrust Bulletin* 38 (1993): 369-394.

Newell, Edmund. "The Irremediable Evil": British Copper Smelters' Collusion and the Cornish Mining Industry, 1725-1865, in Bruland and O'Brien (1998).

Newfarmer, Richard S. *The International Market Power of TNCs (UNCTAD/ST/MD/13).* New York: United Nations (1978).

Newman, Philip C. Key German Cartels under the Nazi Regime. *Quarterly Journal of Economics* 62 (1948): 576-595.

Newmark, Craig M. Does Horizontal Price Fixing Raise Price? A Look at the Bakers of Washington. *Journal of Law and Economics* 31 (1988): 469-484.

Notz, William F. International Private Agreements in the Form of Cartels, Syndicates, and Other Combinations . *Journal of Political Economy* 28 (1920): 658-679.

_____. *Representative International Cartels, Combines, and Trusts: Trade Promotion Series No. 81.* Washington, DC: U.S. Department of Commerce (1929).

OECD. *Collusive Tendering.* Paris: Organization of Economic Cooperation and Development (1976).

_____. *Export Cartels.* Paris: Organization of Economic Co-Operation and Economic Development (1974).

_____. *Summary of Cartel Cases Described by Invitees (CCNM/GF/COMP(2001)4).* Paris: (OECD October 2001).

_____. *Report on the Nature and Impact of Hard Core Cartels and Sanctions against Cartels under National Competition Laws (DAFFE/COMP (2002) 7*). Paris: Organization of Economic Co-Operation and Development (April 9, 2002).

_____. *Competition Law and Policy: 2002-2003 Annual Reports.* [http://www.oecd.org/document/49/0,2340,en_2649_34715_2509617_1_1_1_1,00.html] (National antitrust authorities' annual reports appended; site goes back to 1994-1995)

Osiatynski, Jerzy (ed.). *Collected Works of Michael Kalecki: Volume VI.* Oxford: Clarendon (1996).

Oualid, W. *International Raw Commodity Price Control.* Paris: International Studies Conference, League of Nations (1938).

Page, William. Antitrust Damages and Economic Efficiency: A Study in Law and Economics. *University of Chicago Law Review* 47 (1980): 1539-???

Parker, Alfred A. Measuring Damages in Federal Treble Damages Actions. *Antitrust Bulletin* 17 (1972): 497-517.

Passer, Harold C. *The Electrical Manufacturers 1897-1900: A Study in Competition, Entrepreneurship, Technical Change, and Economic Growth.* Cambridge: Harvard University Press (1953).

Peck, M.J. *Competition in the Aluminum Industry 1945-1958.* Cambridge: Harvard University Press (1961).

Pesendorfer, Martin. A Study of Collusion in First-Price Auctions. *Review of Economic Studies* 67 (2000): 381-411.

Peterman, John L. The International Salt Case. *The Journal of Law and Economics.* 22 (1979): 351-364.

Phillips, Almarin. Price Fixing in UK Manufacturing Industries 1953-1956, in *Market Structure and Corporate Behaviour,* Kieth Cowling (ed.). London: Gray-Mills (1972).

Pierce, Richard J. Essay: Antidumping Law as a Means of Facilitating Cartelization. *Antitrust Law Journal* 76 (2000): 725.

Piotrowski, Roman. *Cartels and Trusts*. London: George Allen & Unwin (1933).

Pirrong, Stephen C. An Application of Core Theory to the Analysis of Ocean Shipping Markets. *Journal of Law and Economics* 35 (1992): 89-131.

Plummer, Alfred. *International Combines in Modern Industry.* London: Pittman (1934, 1951).

Porter, Robert H. A Study of Cartel Stability: The Joint Executive Committee, 1880-1886. *Bell Journal of Economics and Management* 14 (1983): 301-314.

Porter, Robert H. and J. Douglas Zona. Bidding, Bid Rigging, and School Milk Prices: *Ohio v.Trauth (1994)* in John E. Kwoka and Lawrence J. White (eds.), *The Antitrust Revolution : Fourth Edition.* New York: Oxford University press (2004).

_____. Detection of Bid Rigging in Procurement Markets. *Journal of Political Economy* 101 (1993): 518-538.

_____. Ohio School Milk Markets: An Analysis of Bidding. *RAND Journal of Economics* 30 (1999): 263-288.

_____. Detecting Collusion among Bidders in Auction Markets, in *Fighting Cartels – Why and How?* Stockholm: Konkurrensverket (2001).

Posner, Richard A. *Antitrust Law: An Economic Perspective*. Chicago: University of Chicago Press (1976)

_____. *Antitrust Law: (Second Edition)*. Chicago: University of Chicago Press (2001).

_____. Personal Communication to John M. Connor dated February 4, 2004.

_____. The Social Costs of Monopoly and Regulation. *Journal of Political Economy* 83 (1975): 807-828.

Powers, Nicholas J. Marketing Order Impacts on Farm-Retail Price Spreads: Comment. *American Journal of Agricultural Economics* 73 (1991): 507-510.

Prain, R. *Copper: Anatomy of an Industry.* London: Mining Journal Books Limited (1976).

Prais, Sigmund.J. The Electric Lamp Monopoly and the Life of Electric Lamps. *Journal of Industrial Economics* 23 (Dec. 1974): 153-58.

Pribram, Karl. *Cartel Problems.* Washington, DC: Brookings (1935).

Price, Robert M. and Douglas G. Bonett. Distribution-Free Confidence Intervals for Difference and Ratio of Medians. *Journal of Statistical Computational Simulation* 72 (2002): 119-124.

Pyndyck, Robert S. The Cartelization of World Commodity Markets. *American Economic Review* 69 (1979): 154-158.

Read, Robert. Cartels and Internalization in the Eighteenth-Century Copper Industry, in *Entrepreneurship, Networks and Modern Business,* Jonathan Brown and Mary B. Rose (editors). Manchester: Manchester University Press (1993).

Reader, W.J. *Imperial Chemical Industries: A History* (1975), in Jones (1993):283-316.

Rees, Ray. Collusive Equilibrium in the Great salt Duopoly. *Economic Journal* 103 (1993):833-848.

Reuter, peter. The Cartage Industry in New York. *Crime and Justice* 18 (1993): 149-201.

Richardson, G.B. Pricing of Heavy Electrical Equipment. *Bulletin of the Oxford University Institute of Economics and Statistics* 73 (1966): 73-92.

Rieber, M. International Commodity Agreements. *Resources Policy* (1985): 87-98.

Ripley, William Z. (editor). *Trusts, Pools and Corporations: Revised Edition* . Boston: Ginn (1916).

Röller, Lars-Hendrik and Frode Steen. *On the Workings of a Cartel: Evidence from the Norwegian Cement Industry: Discussion Paper No. 25/03*. Bergen, Norway: Norwegian School of Economics and Business Administration (2003).

De Roos, Nicolas. A Model of Collusion Timing. *International Journal of Industrial Organization* (2004 forthcoming).

_____. Collusion with a Competitive Fringe: An Application to Vitamin C, unpublished manuscript, Dept. of Economics, Yale University, 30pp. (October 2001).

Rowe, J.W.F. *Markets and Men.* New York: Macmillan (1936).

Rubinfeld, Daniel L. and Peter O. Steiner. Regression Estimates of damages in Price-Fixing Cases. *Journal of Law and Contemporary Problems* 46 (1983): 68-144.

Salop, Steven C. and Lawrence J. White, Private Antitrust Litigation: Introduction and Framework, in *Private Antitrust Litigation* (Lawrence White ed.) (1988)

Sarkar, G.K. *The World Tea Economy.* Bombay: Oxford University Press (1972).

Sayous, Andre E. Cartels and Trusts in Holland in the Seventeenth Century. *Political Science Quarterly* 17 (1902): 381-393.

Scherer, F.M. *Industry Structure, Strategy, and Public Policy.* New York: HarperCollins (1996).

Schaub, Alexander. Cartel Enforcement by the European Commission, in *Fighting Cartels – why and how?* Stockholm: Konkurrensverket (2001).

Schmitt, Nicolas and Rolf Weder. Sunk Costs and Cartel Formation: Theory and Application to the Dyestuff Industry. *Journal of Economic Behavior & Organization* 36 (1998): 197-220.

Schröter, Harm G. Cartels as a Form of Concentration in Industry: The Example of the International Dyestuffs Cartel from 1927 to 1939 (1988), reprinted in Jones (1993): 109-140.

_____. The International Potash Syndicate, in Dominique Bardot (ed), *International Cartels Revisited, 1880-1980.* Caen, France: Editions-diffusion du Lys (1994).

_____. Cartelization and Decartelisation in Europe, 1870-1995: Rise and Decline of an Economic Institution. *Journal of Economic History* 25 (1999): 129-153.

Scott, Frank A. Great School Milk Conspiracies Revisited. *Review of Industrial Organization* 17 (2000): 325-341.

Scott Morton, Fiona M. Entry and Predation: British Shipping cartels 1879-1929. *Journal of Economics and Management Strategy* 6 (1997): 679-724.

Seager, Henry R and Charles Adam Gulick. *Trust and Corporation Problems (Second Printing).* New York: Harper (1929).

Sheer, A. and C. Ho. Preliminary Review of Sentences Imposed on Organizations in 1988, memorandum to the U.S. Sentencing Commission (August 16, 1989).

Shepard, Lawrence. Cartelization of the California-Arizona Orange Industry, 1934 – 1981. *Journal of Law and Economics* 29 (1986): 83-123.

Shepard, William G. *The Economics of Industrial Organization (7th Edition)*. Homewood, Illinois: Richard O. Irwin (1985).

Shin, Kwangshik. The Treatment of Market Power in Korea. *Review of Industrial Organization* 21 (2002): 113-128.

Sjostrom, William. Collusion in Ocean Shipping: A Test of Monopoly and Empty Core Models. *Journal of Political Economy* 75 (1989): 1160-1179.

_____. An Empirical Test of Monopoly Behavior: An Application to the Hardwood Case: A Comment. *Applied Economics* 23 (1991): 339-341.

Smith, Richard Austin. *Corporations in Crisis*. Garden City, N.Y.: Doubleday (1963).

Smith, David C. *History of Papermaking in the United States (1691-1969).* New York: Lockwood (1970).

Spar, Deborah. *Cooperative Edge: The Internal Politics of International Cartels*. Ithaca: Cornell University Press (1994).

Spratling, Gary R. Detection and Deterrence. *George Washington Law Review* 69 (2001): 817-823.

Sproul, Michael F. Antitrust and Prices. *Journal of Political Economy* 101 (1993): 741-754.

Staley, Eugene. *Raw Materials in Peace and War.* New York: Council on foreign Relations (1937).

Steen, Frode and Lars Sørgard. Semicollusion in the Norwegian Cement Market. *European Economic Review* 43 (`999): 1775-1796.

Stevens, William S. A Group of Trusts and Combinations. *Quarterly Journal of Economics* 26 (1912c): 593-644.

_____. The Powder Trust, 1872-1912. *Quarterly Journal of Economics* 26 (1912a):444-481.

_____. The Dissolution of the Powder Trust. *Quarterly Journal of Economics* 27 (1912b): 202-207.

Stewart, James B. Bidding War. *The New Yorker* (Oct. 15, 2001):158.

Stigler, George J. and James K. Kindahl. *The Behavior of Industrial Prices.* New York: Columbia University Press (1970).

Stiglitz, Joseph. *Globalization and Its Discontent.* New York: New Press (1998).

Stocking, George W. and Myron W. Watkins. *Cartels in Action*. New York: Twentieth Century Fund (1946).

_____. *Cartels or Competition?* New York: Twentieth Century Fund (1948).

Suslow, Valerie Y. Estimating Monopoly Behavior with Competitive Recycling: An Application to Alcoa. *RAND Journal of Economics* 17 (1986).

_____. Cartel Contract Duration: Empirical Evidence from International Cartels, unpublished manuscript that updates a 1988 Hoover Institution Working Paper, University of Michigan Business School (October 2001).

Swann, Dennis, *et al*. *Competition in British Industry: Restrictive Practices Legislation in Theory and Practice*. London: Allen & Unwin (1974).

Sweezy, Paul M. *Monopoly and Competition in the English Coal Trade 1550-1850*. Cambridge: Harvard University Press (1938).

Sultan, Ralph G.M. *Pricing in the Electrical Oligopoly, Vols. I and II.* Boston: Harvard Business School (1974,1975).

Symeonidis, George. *The Effects of Competition: Cartel Policy and the Evolution of Strategy and Structure in British Industry.* Cambridge: MIT Press (2002).

Taylor, June H. and Michael D. Yokell. *Yellowcake: The International Uranium Cartel*. New York: Pergamon (1979).

Taylor, W. G. Langworthy. The World's Prosperity in the Year 1903. *Journal of Political Economy* 13 (1905): 217-236.

Teece, David J. *et al.* Natural Resource Cartels, in Allen V. Kneese and James L. Sweeney (eds), *Handbook of Natural Resource and Energy Economics, Vol. 3.* Amsterdam: North-Holland (1993).

TFTC. Decisions of the Taiwan Fair Trade Commission. Taipei, Taiwan (date of decision).

TFTC-OECD. *OECD Global Forem on Competition: Contribution on Competition (CCNM/GF/WD(2001)16).* Paris: OECD (2001).

Thompson, G. D. and C.C. Lyon. Marketing Order Impacts of Farm-Retail Price Spreads: The Suspension of Prorates on California-Arizona Navel Oranges. *American Journal of Agricultural Economics* 71 (1989): 647-660.

Thompson, John S. and David L. Kaserman. After the Fall: Stock price movements and the Deterrent Effect of Antitrust Enforcement. *Review of Industrial Organization.* 19 (2001): 329-334.

Timberlake, E. Compton. The Legal Injury Requirements and Proof of Damages in Treble Damage Actions under the Antitrust Law. *The George Washington Law Review* 30 (1961): 231-284.

Tosdal, H.R. The German Potash Syndicate, pp. 795-832 in Ripley, William Z. (editor). *Trusts, Pools and Corporations: Revised Edition* . Boston: Ginn (1916).

Tsokhas, Kosmas. The Rise and Decline of an International Zinc and Lead Cartel. *Australian Economic History Review* 40 (2000): 263-286.

UK Monopolies Commission[182]. *Chlordiazepoxide and Diazapam: A Report on the Supply of Chlordiazepoxide and Diazapam.* London: HMSO (1973a).

_____. *Concrete Roofing Tiles*. London: HMSO (1981).

_____. *Flat Glass: A Report on the Supply of Flat Glass.* London: HMSO (1968a).

_____. *Man-made Cellulosic Fibres: A Report on the Supply of man-made cellulosic fibres.* London: HMSO (1968b).

_____. *Metal Containers*. London: HMSO (1970).

_____. *Opium Derivatives*. London: HMSO (1989).

_____. *Plasterboard*. London: HMSO (1990).

_____. *Report on the Supply and Export of certain Semi-Manufactures of Copper and Copper-Based Alloys.* London: HMSO (1955).

_____. *Report on the Supply and Export of Electrical and Allied Machinery and Plant.* London: HMSO (1957a).

_____. *Report on the Supply and Export of Matches and the Supply of Match-Making Machinery.* London: HMSO (1953).

_____. *Report on the Supply of Chemical Fertilizers*. London: HMSO (1959).

_____. *Report on the Supply of Electric Lamps*. London: HMSO (1951).

_____. *Report on the Supply of Hard Fibre Cordage.* London: HMSO (1956a).

_____. *Report on the Supply of Insulated Electric Wires and Cables.* London: HMSO (1952a).

_____. *Report on the Supply of Linoleum.* London: HMSO (1956b).

_____. *Report on the Supply of Certain Industrial and Medical Gases.* London: HSMO (1956a).

[182] Includes the Monopolies and Restrictive Practices Commission and the Monopolies and Mergers Commission.

_____. *Report on the Supply of Electrical Equipment for Mechanically Propelled Land Vehicles.* London: HMSO (1963).

_____. *Report on the Supply of Electronic Valves and Cathode Ray Tubes.* London: HMSO (1957b).

_____. *Report on the Supply of Insulin.* London: HMSO (1952b).

_____. *Report on the Supply of Wallpaper*. London: HMSO (1964).

_____. *Starch, Glucoses, and Modified Starches.* London: HMSO (1971).

_____. White Salt. London: HMSO (1986).

U.S. Congress. *Hearings of the Temporary National Economic Committee, Vols. 1-11.* Washington, DC: U.S. Government Printing Office (1938-1940).

_____. *Staff Study of Income Tax Treatment of treble Damages Payments under the Antitrust Laws.* Washington, DC: Joint Committee on Taxation, U.S. Government Printing Office (1965).

_____. *Hearings on Prices of Quinine and Quinidine,* Subcommittee on Antitrust, U.S. Senate Committee on the Judiciary. Washington, DC: U.S. Government Printing Office (1966-1967).

_____. *Hearings on the International Uranium Cartel,* Subcommittee on Oversight and Investigations, Committee on Interstate and Foreign Commerce, U.S. House of Representatives. Washington, DC: U.S. Government Printing Office (1977).

Uctum, Merih. Why Have Corporate Profits Declined? An International Comparison. *Review of International Economics* 6 (1998): 234-251.

USSG. Unpublished Public Hearings. Washington, DC: United States Sentencing Commission (July 15, 1986)

USSG Advisory Group. *Report of the ad hoc Advisory Group on the Organizational Guidelines.* Washington, DC: U.S. Sentencing Commission (October 7 2003).

Van Eden, Holger. *Fighting Hard-Core Cartels: Harm, Effective Sanctions and Leniency Programmes*. Paris: OECD (2002).

Von Beckerath, Herbert. *Modern Industrial Organization.* New York: McGraw-Hill (1933).

Von Hirsch, Andrew. Federal Sentencing Guidelines: Do They Provide Principled Guidance? *American Criminal Law Review* 27 (1989): 367-390.

Wallace, B.B. and L.R. Edminster. *International Control of Raw Materials.* Washington: Brookings (1930).

Walker, Francis. The German Steel Syndicate. *Quarterly Journal of Economics* 20 (1906): 353-398). [reprinted as pp. 833-868 in Ripley, William Z. (editor). *Trusts, Pools and Corporations: Revised Edition.* Boston: Ginn (1916)].

Walters, Adelaide. The International Copper Cartel. *Southern Economic Journal* 11 (1944): 133-156.

Wang, Xuezheng. *OECD Global Forum on Competition: Contribution from China (CCNM/COMP/WD(2001)10).* Paris: OECD (2001).

Weder, Rolf. The Swiss Dyestuffs Industry, in *Studies in Swiss Competitive Advantage,* Michael J. Enright and Rolf Weder (eds.). Bern: Peter Lang (1995).

Wells, Wyatt. . *Antitrust and the Formation of the Postwar World.* New York: Columbia University Press (2002).

Werden, Gregory J. Price-Fixing and Civil Damages: Setting the Record Straight. *Antitrust Bulletin* (Summer 1989): 307-335.

_____. Economic Evidence on the Existence of Collusion: Reconciling Antitrust Law with Oligopoly Theory. *Antitrust Law Journal* 71 (2004):719-800.

_____. *The Effect of Antitrust Policy on Consumer Welfare: What Crandall and Winston Overlook, EAG 03-2.* Washington, DC: Economic Analysis Group, Antitrust Division, U.S. Department of Justice (January 2003).

Wiedenfeld, Kurt. *Cartels and Combines*. Geneva: League of Nations (1927).

Werden, Gregory J. and Mailan J. Simon. Why Price Fixers Should Go to Prison. *Antitrust Bulletin* 32 (1965): 924-.

White, Lawrence J. (ed.). *Private Antitrust Litigation: New Evidence, New Learning.* Cambridge, MA: MIT Press (1988).

Whitney, E. B. Brief submitted to the 6th Circuit Court of Appeals in *U.S. v. Addyston Pipe and Steel Co.* (1896).

Wiggins, Steven N. and Gary D. Libecap. Firm Heterogeneities and cartelization Efforts in Domestic Crude Oil. *Journal of Law, Economics, and Organization* 3 (1987):1-25.

Wood, Fiona. Fuelling the Local Economy: The Fenland Coal Trade, 1760-1850, in Bruland and O'Brien (1998).

Woodall, Brian. *Japan Under Construction: Corruption, politics, and Public Works*. Berkeley, CA: University of California Press (1996).

Wurm, Clemens A. International Industrial Cartels, the State and Politics (1989), in Jones (1993):234-245.

Appendix Table 1. Alphabetic List of Cartelized Markets

Name	Code No.	Characteristics				Number of	
		Interna-Tional	Loca-tion	Bid Rig-ging	Found Guilty, Liable for Civil Penalties, or Extralegal [c]	Epi-sodes	Average Obser-vations
Airlines, US passenger	172		US			1+	1
Air Routes, Danish	235	X	EUR		EC fines	2	2
Almonds, US and export	205		US		Legal cartel	1	2
Aluminum, metal (interwar)	18	X	EUR		U.S. consent decree	6	28
Aluminum, metal (1990s)	199	X	INTL			1	1
Aluminum phosphide, US	82		US		U.S. guilty pleas	1	2
Asphalt, Alabama, US	204		US	X	US settlement	1	1
Asphalt, Oklahoma, US	7		US	X	Jury trial decision	1	1
Auction houses, fine art	42	X	US+UK		U.S. pleas, EU fines	1	5
Auctions, houses in DC, US	53		US	X	U.S. trial	1	1
Auctions, used police cars, NY City	52		US	X	Civil settlement	1	2
Automobile manufacture, US	25		US			1	2
Ball & roller bearings, France	115	X	FR		France, fines	1	1
Banks, Euro-Zone fees, DE & NL	216	X	DE		EU fines	9	9
Basic materials, JP	214		JP		JFTC actions	1+	1
Bath tubs, iron, UK	63		UK		Legal cartel	1	1
Bath tubs, enameled, US	239		US		US trial	1	1
Bedsteads, metal, UK	167		UK		Legal cartel	1	1
Beef, US	45		US		US trial		
Bond underwriting, US	153		US	X		1	1
Bread, white pan, US	37		US		U.S. Appeals Court	1	1
Bromine	6	X	US		U.S. guilty pleas	3	4
Cable, rubber & plastic, UK	59		UK		Legal cartel	1	1
Cable, power, Germany	124		DE	X	Germany, fines	1	1
Carbon, arc lighting, US	188		US		Legal cartel	2	2
Carbon black, US exports	152		US		Legal export cartel	1	1
Carbon dioxide, US	202		US		US civil settlement	1	1
Carbon fiber, US	198		US		US investigation	1	1
Cardizem heart medicine, US	203		US		US civil trial	1	1
Carton board, EU	39		EUR		EU fines	1	1
Cartons, corrugated, US	142		UK		US trials	1	6
Carpets, woven, UK	62		UK		Legal cartel	1	1
Cathode ray tubes (see electronic radio & TV tubes)							
Cell phones (see telephone)							

Cement, Norway	212		NO		Legal cartel	1	1
Cement, South Africa	70		ZA	X		1	2
Cement, Germany	106	X	DE	X	Germany, fines	1	1
Chicken, US	144		US		US trial, consent decree	1	1
Cigarettes, U.S.	26		US			1	1
Citric acid	76	X	INTL		U.S. pleas, EU fines	1	6
Choline chloride	81	X	US		US jury trial	1	4
Coal, Ruhr, Germany	155		DE		Legal cartel	1	2
Coal, anthracite, eastern US	160		US		US trial	10	16
Coal, black, Australia	179		AU			6	9
Coal, Newcastle, England	166		UK		Parliamentary inquiry	5	17
Coconut oil, Philippines	206		PL		Legal cartel	1	1
Coke	147	X	EUR		Legal export cartel	1	2
Concrete, Denmark	51		DK	X		1	1
Concrete, Germany	114	X	DE	X	Germany, fines	1	1
Construction & procurement, JP	213		JP	X	JFTC actions	5+	5
Construction, 8000 buildings, Germany	177		DE	X	Germany fines	1	1
Construction, electric wiring, Denmark	122		DK	X	Denmark, fines	1	1
Construction, electrical, France	175		FR	X	France consent decree	1	1
Construction, university, France	176		FR	X	France consent decree	1	1
Construction, roads, Colorado, US	222		US	X	Civil settlement	1	2
Construction, roads, France	177		FR	X	France consent decree	1	1
Construction, roads, Korea	193		KO	X	Korea FTC fines	1	1
Construction, roads, seal coating, US	211		US	X		1	2
Construction, kitchen, Japan	163		JP	X	Japan trial	1	1
Construction, US Navy shipyard, Japan	162		JP	X	JFTC fines	1	1
Construction, Netherlands	108	X	NL	X	Netherlands, fines	1+	1
Construction, Norway	107	X	NO	X	Norway, probe	1+	1
Construction, public, Japan	161		JP	X	A few civil actions	1+	2
Construction projects, Korea	32		KO	X	Korea, fines	1+	1
Construction, USAID in Egypt	101	X	EGY	X	U.S. trial	1	1
Construction, roads, Florida	1		US	X	Trials, settlements	1+	1
Construction, roads, Germany	123		DE	X	Germany, fines	1+	1
Construction, roads, SD & NC, US	34		US	X	Trials, settlements	1+	2
Construction, roads, US	195		US	X	Trials, settlements	1+	1
Construction, sewers, US	33		US	X	Trial	1+	3
Copper metal	22		X US+INTL			9	30
Copper concentrate	88	X	INTL		US, EU Probes	1	1
Copper smelters, UK	225		UK	X		4	4

Dairy processing, US	54		US		US consent decree	1	1
Diamonds, gem, So. Africa	71	X	ZA		Legal cartel	1	1
Distributors, natural gas, TW	229		TW		TFTC fines	2	2
Dredging, river, Japan	164		JP	X	Japan trial	1	1
Drugs (see pharmaceuticals)							
Dyestuffs	159	X	EUR		Legal cartel	1	2
Electric light bulbs	21	X	EUR			1	15
Electric light bulbs, US	189		US			1	1
Electric light bulbs, UK	184		UK		UK Commission	1	2
Electric meters, UK	61		UK	X	Legal cartel	1	1
Electric motors, UK	60		UK		Legal cartel	1	1
Electric power equip. U.S.	48		US	X	US pleas, settlements	5	18
Electric power equip., Nor.	116	X	NO	X	Norway, fines	1+	1
Electric power equipment	129	X	EUR	X	US conviction	2	3
Electric power equip., UK	183		UK	X	UK Commission	1	4
Electronic radio & TV tubes, UK	192	X	UK		UK Commission	1	5
Explosives, US	98	X	US	X	U.S. guilty pleas	1	1
Fertilizer (see nitrogen, phosphate, potash)	--						
Fire protection installation, Australia	121		AU		Australia, fines	1	1
Ferrosilicon, US	100	X	US		U.S. pleas	1	1
Flour imports, Taiwan	234		TW	X	TW FTC fines	1	1
Ferry services, English Channel	41	X	EUR		EU, fines	1	1
Frozen foods, Australia	120		AU		Australia, fines	1	1
Frozen fish, US	36		US	X	US guilty pleas	1	3
Fuels, military, Korea	112	X	KO	X	Korea, fines	1	1
Games & toys, UK	104	X	UK		UK, fines	1	1
Garbage collection, NY & NJ	233		US	X	NYC convictions	2	2
Gasoline, retail, Italy	109	X	IT		Italy, fines	1	1
Gasoline, retail, France	110	X	FR		France, fines	1	1
Gasoline, retail, Sweden	111	X	SE		Swedish court, fines	1	1
Gasses, compressed, Canada	102	X	CA	X	Canada, fines	1	2
Glass, flat, Benelux	237	X	EUR		EU fines	1	1
Glass, flat, US	113	X	US		US settlement	1	1
Graphite electrodes	84	X	INTL		US, EU, Korea, fines	1	8
Gunpowder, US	158		US		First episode legal	2	2
Gymnasium seats, US	2		US	X	US settlements	1	1
High fructose corn syrup, US	197		US		US settlements	1	1
Hotel association, Spain	125		ES		Spain, fines	1	1

Insecticide, forest, Canada	83	X	CA	X	Canada pleas	1	1
Iron & steel rolls, cast, EU	227	X	EUR	X	EU fines	1	1
Iodine	40	X	EUR		Legal export cartel	1	1
Lead	69	X	INTL		Legal export cartel	4	4
Lemons, California	210		US		Legal cartel	1	2
Linerboard, US	201		US		US civil settlement	1	1
Linoleum exports	137	X	EUR		Legal export cartel	1	1
Linoleum, UK	180		UK		UK Commission	1	2
Lysine	75	X	INTL		US pleas, EU fines	1	11
Manufacturing, UK	55		UK		Legal cartels	40	1
Manufacturing, U.S.	38		US		US pleas, fines	57	1
Magnesium metal	28	X	US		US pleas, fines	2	4
Magnesite	94	X	EUR		US prosecution	1	1
Market makers, NASDAQ, US	31		US		U.S. settlements	1	1
Mercury	72	X	EUR		Legal cartel	3	6
Methionine	78	X	INTL		EU fines, US settlements	1	2
Methyl glucamine	85	X	INTL		EC, Canada fines	1	1
Milk, 3 counties, Kentucky	9		US	X	U.S. state convictions	1	1
Milk, 2 counties, Florida	10		US	X	U.S. state convictions	1	1
Milk, 3 counties, Florida	11		US	X	U.S. state convictions	1	1
Milk, Danville, Kentucky	12		US	X	U.S. state convictions	1	1
Milk, Owensboro, KY	13		US	X	U.S. state convictions	1	1
Milk, core area, Kentucky	14		US	X	U.S. state convictions	1+	1
Milk, Southeastern U.S.	15		US	X	U.S. state convictions	109	1
Milk, Dallas, Texas	19		US	X	U.S. settlement	1	1
Milk, Cincinnati, Ohio	30		US	X	U.S. trial	1	1
Milk, AMPI cooperative	226		US		U.S. trial	1	1
Milk, U.S. marketing orders	207		US		Legal cartel	1	2
Mobile/cell phones (see telephone)							
Mushrooms, canned , Germany	230	X	INTL		EC fines	1	1
Nails, Germany	186		DE		Legal cartel	1	1
Nitrogen (sodium nitrate) fertilizer	16	X	INTL			2	7
Nonferrous metals, UK	181		UK		UK Commission	1	2
Oil (see petroleum)							
Oranges, California navel	209		US		Legal cartel	1	3
Paper, carbonless, EEC	89	X	EUR		EC fines	1	1
Paper pulp, bleached sulphate	228	X	INTL		EC fines	2	4
Paper pulp, mechanical sulfite	138	X	EUR			1	1

Paper, thermal fax, US	99	X	US		U.S. pleas & trial	1	1
Paints, export, Japan	157		JP		Legal cartel	1	1
Petroleum, US	24	X	US			1	1
Petroleum, TX & Okla.	190		US		Legal cartel	1	1
Petrol., offshore leases, US	154		US	X		1	1
Petroleum refining, Midwest	35		US		U.S. trial	1	1
Petroleum, lamp oil, Ontario	134		CA		Legal cartel	3	3
Pharmaceuticals, UK	105	X	UK	X	UK probe	1	1
Pharmaceuticals, US	141		US		US trial	1	1
Pharmaceuticals, respiratory, Italy	118	X	IT	X	Italy, fines	1	1
Pharmaceuticals, cholesterol, Italy	119	X	IT	X	Italy, fines	1	1
Phosphate rock exports, US	135	X	US		U.S. indictment	2	2
Phosphorus, red	132	X	EUR			1	1
Pipes, cast iron, SE US	23		US		U.S. trial	1	1
Pipes, concrete, US	143		US	X	US trials	1	2
Platinum	47	X	EUR			3	7
Plumbing fixtures, US	156		US		US trial	1	1
Plywood, US	145		US		US trial	1	1
Plywood, Japan	178		JP	X	JFTC fines	1	1
Polyvinyl chloride plastic	232	X	EUR		EC fines	1	1
Porcelain, sanitary, UK	57		UK		Legal cartel	1	1
Potash	73	X	EUR			4	19
Quebracho extract	50	X	ARG		U.S. conviction	3	8
Quinine	131	X	EUR		U.S. pleas, fines	1	2
Railroad, Chicago to East, US	49		US		Legal U.S. cartel	1+	7
Railroad, U.S. South	133		US		Legal U.S. cartel	1	1
Raisins, US	208		US		Legal US cartel	1	1
Rayon	136	X	EUR			1	1
Roundwood buying, Sweden	236		SW	X		2	2
Rubber, crude	20	X	EUR		Legal export cartel	2	4
Salt, Michigan	194		US			2	4
Salt, rock, US	3		US	X	U.S. convictions	1	1
Salt, white, Salt Union, UK	168		UK		Legal cartel	4	9
Salt, white, duopoly, UK	215		UK		Commission decision	1	1
Scholarships, graduate, US	173		US		DOJ consent decree	1	1
Shipping, France-Africa	43	X	EUR		EU fines	1	1
Shipping, 3 conferences	171	X	EUR		Legal cartels	6	2
Shipping, chemical tankers	86	X	EUR		U.S. pleas	1	1
Shipping, express packages, US	127		US		Legal U.S. cartel	1	2
Soil & gravel, Japan	165		JP	X		1	1
Soft drinks, US	27		US			1	1
Sodium chlorate	79	X	EUR			1	1

Sorbates	77	X	INTL		US and EU fines	1	5
Steel, bulk metal, European	74	X	EUR		Legal cartel	2	6
Steel drums, UK	64		UK		Legal UK cartel	1	1
Steel girders, Germany	187		DE		Legal cartel	1	1
Steel and iron, Germany	238		DE		Legal cartel	4	5
Steel pipes, sewage, UK	58		UK		Legal UK cartel	1	1
Steel pipes, insulated, EU	93	X	EUR		EU fines	1	2
Steel rails, US	150		US		First episode legal	1	1
Steel rails, Europe	169	X	EUR		Legal cartel	1	3
Steel, seamless tubes, EU	91	X	EUR		EU fines	1	2
Steel tubes, US	151		US		Legal cartel	1	1
Steel, flat stainless, EU	92	X	EUR		EU fines	1	3
Steel, structural, buildings, US	4		US	X	U.S. convictions	1	2
Steel, structural, bridges, US	5		US	X	U.S. convictions	2	4
Steel, structural, EU	95	X	EUR		EU fines	1	1
Sulfur, international	87	X	INTL			3	4
Sulfur, crude, US exports	191		US		Legal export cartel	2	1
Sulfuric acid, US & Canada	103	X	US+CA		DOJ probe	1	1
Sugar beets, US	44		US		U.S. trial	1	1
Sugar, cane	17	X	INTL		Legal export cartel	2	3
Sugar refining, US	67		US		U.S. trial	2	8
Sugar, Spain	126		ES		Spain, fines	1	1
Sugar refining, UK	96		UK		EU, fines	1	1
Tea	128	X	EUR		Legal cartel	1	1
Tetracycline, US	223		US		Civil settlement	1	1
Thorium nitrate, Germany	170		DE		Legal cartel	1	1
Timber, US auctions	29		US	X		1	1
Tin	146	X	INTL		Legal export cartel	1	4
Titanium metal, US	139		US	X	US trial	1	1
Telephone fees, UK & Germany	97	X	IT		EC probe	1	1
Telephone fees, Italy	117	X	IT		Italy, fines	1	1
Tobacco leaf, US	200		US	X	US settlement	1	1
Transformers, large, UK	65		UK	X	Legal UK cartel	1	1
Transformers, system, UK	66		UK	X	Legal UK cartel	1	1
Tungsten carbide	8	X	INTL		U.S. trial	2	4
Uranium metal	130	X	INTL		U.S. pleas, settlements	1	6
Vanadium ore, US	46		US		U.S. jury trial	1	1
Vitamins and Carotenoids, bulk [a]	80	X	INTL	X	U.S. & EU fines	14[a]	55
Vitamin D, US	140		US		Patent abuse trial	1	1
Vitamin B4 (see choline)							
Wallpaper manufacturing, BL	231		BL		EC fines	1	1

Wire, Germany	185		DE		Legal cartel	1	1
Wire nails, US	149	X	US		Legal cartel	1	2
Wire rope, non-marine, UK	56		UK		Legal UK cartel	1	1
Whiskey alcohol, US	148		US		First episode legal	5	6
Wire and cable, UK	182		UK		UK Commission	3	3
Zinc metal [f]	68	X	INTL		Legal export cartel	5+	8
Zinc phosphate	90	X	EUR		Fined by EC	1	2
Total 245 markets	--	90	International	79	153 guilty/liable [d]	560 [b]	664 average
					55 known "legal"		216 peak
					37 presumed legal [e]		886 total

Source: Appendix Table 2 and References.

[a] One for all vitamins, one for the three Carotenoids, and twelve individual vitamins.

[b] This total counts three multiple cartel summaries (see cartel numbers 15, 38, and 55 above) as 206 episodes. Counting these entries as one episode reduces the total to 353. In addition, most bid-rigging cartels could in principle count each contract as an episode, but are treated as one here; for example, in cartel #211 more than 3500 contracts were overtly collusive bids.

[c] Fines, trials, consent decrees, settlements, commission decisions, parliamentary inquiries, and known official investigations are all considered adverse sanctions for cartels. Adverse parliamentary and commission decisions resulted in changes in conduct similar to consent decrees.

[d] Includes six markets (88, 97, 103, 105, 107, and 198) that in 2004 were being investigated by antitrust authorities; a high proportion will be legally sanctioned.

[e] Counts blank entries in column above. Blank entries are cases without information about any criminal sanctions or adverse civil proceedings and are presumptively legal or extralegal.

[f] This cartel was fined at the end of its life by the EC (8/6/1984) but operated openly in the belief that it was legal for most of its existence.

NB. Appendix Tables 2 to 5 can be found at:

http://www.agecon.purdue.edu/directory/details.asp?username=jconnor