

PRICE-FIXING OVERCHARGES:

SECOND EDITION

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Abstract

This paper surveys published economic studies and judicial decisions that contain 1,040 quantitative estimates of overcharges of hard-core cartels. The primary finding is that the *median* long-run overcharge for all types of cartels over all time periods is 25.0%: 18.8% for domestic cartels and 31.0% for international cartels. Cartel overcharges are positively skewed, pushing the *mean* overcharge for all successful cartels to 43.4%. Convicted cartels are on average as equally effective at raising prices as unpunished cartels, but bid-rigging conduct does display somewhat lower mark-ups than price-fixing cartels. These findings suggest that optimal deterrence requires that monetary penalties ought to be increased.

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

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

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PREFACE TO THE SECOND EDITION

The first edition of this working paper was prepared in 2004 and published as a SSRN Working Paper in 2005 [available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=787924]. At that time I had collected 884 overcharge estimates (674 long-run (episodic) and 210 peak) from 332 episodes of 237 cartelized markets. The first edition of the working paper was the basis of several of my publications, such as:

- How High Do Cartels Raise Prices? Implications for Optimal Cartel Fines, *Tulane Law Review* 80 (December 2005): 513-570 [with Robert H. Lande].
- Cartel Overcharges: Survey and Meta-Analysis, *International Journal of Industrial Organization* 24 (Nov. 2006): 1109-1137 [with Yuliya Bolotova].
- Factors Influencing the Magnitude of Cartel Overcharges: An Empirical Analysis of Food-Industry Cartels, *Agribusiness: An International Journal* 23 (Winter 2006-2007): 17-33 [with Yuliya Bolotova and Douglas J. Miller].
- Price-Fixing Overcharges: Legal and Economic Evidence, Chapter 4, pp. 59-153 in John B. Kirkwood (editor), Volume 22 of *Research in Law and Economics*. Oxford, Amsterdam and San Diego: Elsevier (January 2007).
- Cartel Overcharges: Implications for U.S. and EU Fining Policies, *Antitrust Bulletin* 51 (“Winter 2006”/January 2007): 983-1022 [with Robert H. Lande].
- Factors Influencing the Magnitude of Cartel Overcharges: An Empirical Analysis of the US Market. *Journal of Competition Law and Economics* 5 (December? 2008): - . [with Y. Bolotova and D. Miller]

Between late 2004 and 2008, I collected about **XXX** more observations of estimates of cartel overcharges, some of which were the result of tips by interested readers and others that I stumbled across. The tables in this second edition are based on an expanded sample of **884** overcharge estimates (**674** long-run (episodic) and **210** peak) from **332** episodes of **237** cartelized markets.

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INTRODUCTION

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, efficiency, and social welfare effects, but by far the greatest attention has been lavished on market price effects.¹ The increase in transaction prices by a sellers’ cartel is commonly called an overcharge by economists or damages by legal writers. The overcharge rate is calculated by comparing actual cartel-enhanced prices to some competitive benchmark price² (Connor 2004a).

A price-fixing overcharge is a transfer of income or wealth from buyers to the members of the cartel that occurs as a result of a collusive agreement.³ *Ceteris paribus* when a cartel achieves high levels of effectiveness (i.e., longevity, stability, and high overcharges), it tends to generate large customer losses in the form of loss of consumer surplus.⁴ Although there are other negative effects of price fixing, legal scholarship tends to equate antitrust injury with the overcharge. Effective cartels are also viewed as destructive of the competitive process in the sense that they weaken the natural effects of demand and supply in price formation and cause deadweight social losses.⁵ The deadweight losses result from the costs incurred by customers when they are forced to substitute inferior substitutes, if any, the costs incurred by the members of the cartel in managing the collusive enterprise, and rent-seeking behavior by the cartel such as efforts directed at forestalling entry. In this paper I focus on cartel overcharges as the principal type of harm or damages created by price fixing.

The last dedicated survey of the cartel literature did not cover overcharges (Bullock 1901, 1905). Today textbooks of economics conventionally devote considerable space to the market price effects of cartels (see, for example, Carlton and Perloff 2004: 128-131, 140-145, 148-150). While empirical studies of cartels routinely survey selected works as a prelude to the study being presented, to my knowledge no one has published a work aimed principally at comprehensively surveying and analyzing cartel overcharges. This paper is aimed principally at filling this gap in the legal-economic literature.

¹ 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.

² The benchmark is referred to as the “but-for price” – the market equilibrium price that would have been observed were it not for the overtly collusive conduct of the sellers. The benchmark may be the purely competitive price, or it may be a somewhat higher price generated by legal tacit collusion. The overcharge rate is similar to the Lerner Index of market power, except that the Lerner Index’s benchmark is the realized market price.

³ The overcharge from a buyers’ cartel is symmetrically defined as 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 buyers’ losses.

⁵ In large markets for manufactured products, the dead-weight loss is typically one-fifth to one-tenth as large as the overcharge, and the two losses are highly correlated (Peterson and Connor 1995).

The size of cartel overcharges is an issue at the empirical heart of a number of legal and economic controversies. First, knowing the size and distribution of cartel overcharges is necessary to justify the underpinnings of U.S. and foreign sanctions for illegal cartel conduct. Many commentators on government fining practices have noted the absence of appropriate empirical data for the rational design of such policies. Second, there is evidence in the economic literature widely varying opinions among experts on the critical legal-economic issue of the size of sanctions needed for optimal deterrence of cartel formation.

Overcharges and Cartel Fines

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 first set of guidelines was promulgated in 1987, and after three years of study and public comment was made law in 1989. The guidelines included sanctions for organizations guilty of horizontal price fixing and bid rigging (Cohen and Scheffman 1989:332). Although the Sherman Act of 1890 is a criminal statute that encompasses other types of restrictive business practices, by long tradition only horizontal price fixing and market-sharing agreements have triggered criminal indictments by the Department of Justice (DOJ).⁶

The issue of how high cartels typically raise prices was crucial when the U.S. Sentencing Commission (USSC) established the fine levels for cartels. 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 The Commission added: "The purpose for specifying a percent of the volume of commerce is to avoid the time and expense that would be required for the court to determine actual gain or loss."⁸ 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."⁹

⁶ 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.

⁷ The USSC Guidelines start with a *base fine* double the 10% presumed overcharge and use it in conjunction with the assigned base Offense level (of 10) for antitrust offenses. They adjust this offense level by a number of factors, such as whether bid rigging and other aggravating factors were involved, and by mitigating factors as well. This adjustment results a pair of "*culpability multipliers*" that are between 0.75 and 4.0. The product of the base fine (20% of the affected commerce) and the culpability multipliers results in the fine range that is to be imposed on a cartel member. Thus, the fine range recommended for convicted cartelists is at its lowest 15% and at its highest 80% of affected sales. These fines usually are adjusted downwards for cooperation or as a part of the Division's leniency program. The USSC's Commentary also notes that "In cases in which the actual monopoly overcharge appears to be either substantially more or substantially less than 10%" it might not employ the 20% base fine. But in practice the DOJ almost always uses the figure of 20% of affected commerce as their starting point in their criminal fine calculations.

⁸ 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.

⁹ See *United States v. Hayter Oil Co.*, 51 F.3d 1265, 1277 (1995). The court noted: "The offense levels are not based directly on the damage caused or profit made by the defendant because damages are difficult and time consuming to establish. The volume of commerce is an acceptable and more readily measurable substitute..."

The USSC appears to have adopted the 10% presumption because its use was advocated by the (then) head of the Antitrust Division, Douglas Ginsburg.¹⁰ The origin of Ginsburg's 10% figure is not publicly known.¹¹ However, 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 only three price-fixing conspiracies was particularly important in shaping Ginsburg's views. If this analysis is correct, a critical assumption in setting cartel in the United States is supported by a surprisingly small amount of evidence.

The USSC's 10% presumption was attacked as unreliable and overstated almost as soon as it was issued. For example, Cohen and Scheffman (1989) 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 characterized as exaggerated: "later research has cast considerable doubt on ... these estimates, concluding that the markups, if they existed, were quite small (p. 345)."

From 1990 to 1999, a series of record corporate fines were imposed for criminal price fixing by U.S. courts, most of which can be attributed to prosecutions of international cartels; a similar upswing may be noted for fines imposed by Canada and the European Commission from 1995 to 2001 (Connor 2004c).¹² In 1990-1994, U.S. fines on international cartels were practically zero; in 1996-97, fines averaged \$69 million per year; and in 1998-99, fines were 12 times higher (*ibid.* Figure 3). Civil treble-damages cases in the United States have seen a parallel response in the size of settlements (*ibid.* pp. 263-64). Besides corporate penalties, a full assessment of optimal deterrence requires a consideration of corporate reputational effects of conviction and individual sanctions (Connor 2005).

Attorneys engaged in cases involving international antitrust conspiracies have argued that the Guidelines have resulted in excessive penalties. For example, just as the DOJ's campaign against international cartels was gathering steam, Adler and Laing (1997) assert that "the fines being imposed against corporate members of international cartels are staggering (p.1)", placing the blame on the "uniquely punitive" requirements of the U.S. Sentencing Guidelines.¹³ After viewing an intensification of this trend for another two years, Adler and Laing (1999) were even more alarmed.

¹⁰ 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).

¹¹ A common procedure for preparing testimony for the Assistant Secretary would include the preparation of a confidential "white paper" by the Antitrust Division's economists.

¹² Cartel fines in the United States and Canada peaked in 1999 and peaked in the EU in 2001 (Connor 2004c).

¹³ Adler and Laing are correct that the fining standards of the DOJ do not compute fines simply as a function of damages, but rather as a function of the company's affected commerce, which is loosely related to damages (see note 7 *supra*). However, these authors do not document their claim that antitrust fines are harsher than other corporate crimes.

“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 harm¹⁴ 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 (p. 3). This approach, he notes, unlike all other white-collar federal crimes, means that the actual degree of direct harm caused does not have to be proven by prosecutors.¹⁵ Denger blames this state of affairs on a gap in the economic-legal literature: “...we have little information on what level of criminal or civil exposure is needed to deter most cartels (p.4).”

Concern about the lack of empirical evidence on the size of overcharges caused by price fixing is not confined solely to those sympathetic to the increased exposure of corporate defendants. DOJ official Graubert (2003) notes that the controversy over whether antitrust payments are excessive (which on p. 7 he equates with payouts greater than reasonable damage estimates) is largely attributable to the “...difficulty of gathering useful data.” In a law-review article noting the sharp increase in U.S. criminal fines on international cartels in the late 1990s, Klawiter (2001) believes that these fines and other related antitrust penalties “...have substantially increased the level of deterrence in antitrust criminal cases” (*ibid.* p. 756).¹⁶ Yet, he laments the paucity of information needed to make a more sweeping conclusion. “There are no known applicable empirical studies on the adequacy of the present mix of criminal and civil antitrust sanctions from the standpoint of deterrence” (*ibid.* note 79).

U.S. antitrust enforcement has been a model for many other countries that have more recently adopted such laws (Wells 2002). 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 1998:18-33). After four years of confidential political discussions within the EEC’s Commission, Regulation 17 was passed; it 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.¹⁷

¹⁴ In the case of injuries from naked price fixing, most legal scholars agree that the appropriate rule for damages is a multiple of the overcharge plus the deadweight loss, where the multiple is the inverse of the probability of detection (Hovenkamp 1999: 645-649). However, the difficulties of calculating the probability of detection and of the deadweight loss have encouraged U.S. courts to equate price-fixing damages with the direct-purchaser overcharge (*ibid.* pp. 651-56). Therefore, in most legal writings, if not otherwise specified, harm can be presumed to be the overcharge.

¹⁵ 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.

¹⁶ Klawiter contrasts enforcement powers in the late 1990s with the clearly suboptimal maximum fine of \$10 million available to the DOJ in the 1970s and 1980s.

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

Methods of calculating EU cartel fines are explained in a 1998 Notice (Connor 2004c:14-15). Harding and Joshua (2003) state that EU fines are supposed to incorporate both compensatory and punitive components, the latter meant to serve deterrence (p. 240). The EC considers the “gravity” of the offense. EU cartel fines are loosely related to overcharges because cartels with large damages that are geographically widespread add to the gravity. Also, 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. After applying a number of other factors, 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).

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).¹⁸ 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 leniency discounts, and recently recidivists have paid fines as high as 45% of affected sales, yet the large majority of convicted cartelists pay fines equal to 20% of Canadian affected sales. The Canadian 20% rule seems to mimic the base fine of the USSGs. If Canada intends to punish cartels, then the presumed overcharge may also be 10%; if only compensation is the aim, then a 20% overcharge is assumed.

Overcharges and Cartel Deterrence

Concerns about the inadequacy or excessiveness of antitrust sanctions are part of the larger issue of the effectiveness of antitrust interventions. 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 total overcharge; investigation procedures can reduce the probability of cartel formation or the duration of cartels.

The U.S. Sentencing Guidelines’ are consistent with the standard optimal deterrence standard promulgated by William Landes (1983). Landes showed that to achieve optimal deterrence the damages from an antitrust violation should be equal to the violation’s “net harm to others”, divided by the probability of detection and proof¹⁹ (Landes 1983:666-68). Cohen and Scheffman (1989) argue that fines based on the U.S. sentencing guidelines, when coupled with civil and marketplace sanctions will cause “a serious overdeterrence problem” (p. 334). That is, they and other critics of the Guidelines believe that there is a disparity between the size of the corporate fines mandated for antitrust violations and the amount of the economic injuries caused by overt price fixing.²⁰ Specifically, Cohen and Scheffman argue

¹⁸ 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).

¹⁹ 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 fines for cartels should be tenfold damages! The percentage of cartels that are caught and proven is probably much higher today. See Spratling (2001). There is, however, neither evidence nor speculation that it exceeds 33%, 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).

²⁰ Those critical of aggressive antitrust policy have often embraced the notion that cartels are fragile coalitions. However, empirical studies of discovered cartels from the 1920s to the early 2000s find that the average duration is

that actual overcharges are well below the 10% level assumed in the Guidelines (pp. 343-347).²¹ During recent years their criticism has been repeated with perhaps even more intensity.

For example, in a provocative essay that quickly drew rebuttals²², Crandall and Winston (2003) argue that extant empirical evidence demonstrates that U.S. antitrust policy has been ineffective in deterring anticompetitive conduct. To support their view that the prosecution of overt price 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.²³ 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).

The majority of the overcharges generated by cartels in the past 15 years have been international in membership and global in their geographic impact (Connor 2001, 2003). To assess deterrence in the context of international schemes, non-U.S. monetary sanctions must be considered. Optimal deterrence requires cartel sanctions to be somewhat punitive. 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 solely with EU fines.²⁴ EU and Canadian fines together are usually less than those imposed by U.S. courts for the same violations, and penalties in other parts of the world are practically zero. In general, global monetary sanctions have amounted to less than 10% of estimated global overcharges (Connor 2003). Thus, punitive sanctions are the exception not the rule for illegal international price fixing.

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. A secondary objective of this paper is to provide a firm factual foundation for dialogs on optimal deterrence and anticartel policies.

OBJECTIVE

between four and seven years (Zimmerman 2005). Legal U.S. export cartels – a sample unaffected by possible bias inherent in studies of prosecuted conspiracies – endured an average of 5.3 years (Dick 1996).

²¹ For larger price-fixed markets “...ten percent is almost certainly too high” (p. 343). In part, they rely on evidence of price-fixing *settlements* rather than awards. They assert that there is “a sparse amount of economics literature” on cartel mark-ups; my reading of their article turns up seven to ten observations with a median range of 8% to 14% (see Table 1 below).

²² 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”.

²³ Space constraints do not appear to be responsible for such a skimpy treatment of this topic, for they list 59 references. Somewhat inconsistently, Crandall and Winston do admit that the large DOJ fines meted out to cartels in the 1990s possibly deterred the most harmful cartels. They appear to refer to the lysine, citric acid, and vitamins cartels --international cartels with overcharges in the 15% to 40% range.

²⁴ For diversified companies for which a cartelized product is a small share of its total sales, EU fines can come closer to optimal deterrence levels. However, given a low probability of detection, durable cartels with average overcharges are difficult to deter with EU fines alone (Wils 2005).

The principal 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 are taken from published social-science studies and from the decisions of competent judicial bodies. There are two secondary objectives. First, rather than apply a subjective quality filter during the collection phase, the assembled estimates are examined for patterns that might indicate systematic differences in reliability across types of sources. Second, the results of the survey are used to draw lessons about the ability of current antitrust policies to deter cartels.

LITERATURE SURVEY

This paper was prepared by checking more than 500 social-science publications.²⁵ The major portion of the overcharge estimates included in this paper is taken from books, book chapters, conference proceedings, or papers published in economic, historical, and legal journals whose readers and contributors are mainly academics. The great majority of these publications are peer reviewed. A minority of the estimates are taken indirectly from newspapers, magazines, and similar journalistic outlets; from reports issued by governments; from academic working papers; and from decisions rendered by courts or antitrust commissions. This section focuses on the evolution of social-science concepts about cartels and their price effects.

Early Cartel Studies

The social-science literature on cartels prior to 1945 is characterized by a groping towards a conceptual understanding of the nature of private cartels and the first tentative steps toward quantitative evaluation of the market effects of overt collusion (see Appendix).

Economic studies of cartels were dominated through the 1920s by books written in German. Especially influential was the German economist Liefmann (1897, 1932). His concept of a cartel as a voluntary, contractual association of independent firms intent on profit maximization²⁶ and monopolistic control of a market became the accepted definition by the late 1930s. Acceptance of the idea was assisted by the simultaneous development of oligopoly theories, which freed economists from their dependence on only two market models: pure monopoly and pure competition.

An unfortunate legacy of the German school of cartel studies was its view that gauging price effects was nearly impossible, a presumption that discouraged European economists from attempting to estimate overcharges until the late 20th century.²⁷ However, U.S. social scientists inherited a more

²⁵ The References section of Connor (2004 b) lists about 350 sources with useful information about the private cartels in this paper's sample. **Only about 200** contained usable quantitative overcharge estimates.

²⁶ An issue among economists up to the 1940s was whether cartels raised average prices in a manner consistent with monopolies or whether cartels simply stabilize price movements with no net increase in prices. Liefmann was in the minority that accepted profit maximization as the goal of a cartel.

²⁷ Liefmann accepted that raw-materials cartels typically did raise prices, but considered the price effects of industrial cartels an open question (see Appendix). While most of his contemporaries considered such calculations impossible, Liefmann took the position that precision was difficult because of simultaneous changes in demand and supply. The lack of attention to empirical estimates of price effects may also have resulted from an absence of cartel suits in German courts.

pragmatic tradition driven by an awareness of the country's new antitrust law. As a result, most quantitative estimates of overcharges made prior to 1945 were produced by American social scientists. Some highlights include Jenks' (1888) path-breaking analysis of the Midwest salt cartel; Jones' (1914) book on the anthracite coal industry; Edgerton's (1897) paper on the U.S. Wire Nail Association is a superb analysis of price effects of a short-lived but highly effective international cartel; Andrews (1889) sketched what is quite possibly the world's first *global* cartel, the Secrétan copper syndicate of 1887-1889; Stevens' 1912 study of the convicted gunpowder trust is notable for focusing on what was believed to be the longest-running discovered cartel in the Nation's history.

Post-World War II Cartel Studies

During and immediately after World War II, a surge in publications examined the roles of cartels in international trade and in war production. Ervin Hexner (1946), a Czech refugee turned scholar at a U.S. university, produced the most comprehensive economic study of international cartels yet published.²⁸ Hexner had an insider's knowledge of cartels (Barjot 1994:65). Louis Marlio (1947), a French economist who wrote a detailed account of the international aluminum cartel, had a similar background (*ibid.* p. 66). Both of these authors found much to admire in the effects of international cartels, whereas post-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 plan of legal control... On the other hand, the general European approach ...has been altogether more tentative, more agnostic...and only in recent years moving towards an uncompromising condemnation of cartel activity...” (p. 40).

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

Perhaps the first publications to attempt to quantify systematically the price effects of cartels were a pair of books produced by a team of economists that had access to information handed over to investigators of Congressional committees and to criminal court proceedings (Stocking and Watkins 1946, 1948).²⁹ These books were the culmination of eight years of study by a team of economists.³⁰ They set a new intellectual standard for the economics literature on cartels, because they were the first to apply rigorous modern concepts of the emerging field of industrial economics; because of access to the information spawned by numerous Congressional investigations, the Federal Trade Commission, and law

²⁸ Hexner (1946) spent dozens of pages toying with alternative definitions of the cartel, ultimately adopting one quite close to Liefmann's.

²⁹ Stocking and Watkins had access to the results of a number of major investigations. The Temporary National Economic (or “Kilgore”) Committee published its hearings a few years before their books were published (U.S. Congress 1938-1940). Other Congressional committees investigated the munitions industry and patent pools. The authors also had information on U.S. criminal prosecutions by the Justice Department of more than 40 international cartels.

³⁰ Stocking appears to have had overall leadership of the team.

suits³¹; and because they were among the first to focus on the market effects of international cartels.³² Numerous and continuing citations to their books by leading contemporary scholars attest to their status as seminal works and classics in the field (Mueller 2007: 188).

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

In the second half of the 20th century relatively few books were written about the empirical economics of cartels, but there have been three brief periods of interest.³³ First, there was a short lived U.S. interest in domestic cartels when the "Great Electrical Equipment Conspiracy" burst onto the Nation's consciousness in 1960-1961.³⁴ The great electrical equipment conspiracy resulted in the release of more publications in a few years than any other single historical event since the beginning of cartel literature. The scope of the conspiracy, the fame of the leading companies involved, and the U.S. Government's aggressive prosecution of the violators – all these factors lead to a degree of public fascination and publicity about an antitrust action not seen since the Supreme Court decisions against the Standard Oil and American Tobacco trusts in 1911.³⁵ Several trials provided unusually detailed pictures of the cartel's organization. The books written about the heavy-electrical-equipment conspiracy include at

³¹ George W. Stocking was a professor at the University of Texas during 1926-47. He was appointed as the economic advisor to the new U.S. Attorney General Thurman Arnold in 1938, just as a revival of antitrust began in 1938 after repeal of the National Industrial Recovery Act; Stocking served as the co-chair of the Consent Decree Section of the DOJ through at least 1943 (Mueller 2007: 187-188). It was in the early 1940s that the DOJ investigated the many international cartels that would be formally indicted by the DOJ in 1944-48. As there were few if any economists employed by the DOJ, Stocking played a role something like the first Chief Economist of the DOJ. Both at the University of Texas and at Vanderbilt University (1947-1963), Stocking mentored many students who became leaders in the fields of industrial organization economics and antitrust law, including my mentor Willard F. Mueller (Anon. 1976, Marion 2007).

³² Technically, the 1911 conviction of American Tobacco *et al.* was the first U.S. prosecution of an international cartel, but the international character of the collusion was a minor aspect of the case.

³³ Overcharges were taken from about 50 books and chapters in edited books, of which 30 were published after 1950. Compared to the total number of economics books printed after 1950, the share of them devoted to cartel studies is smaller than before.

³⁴ When the guilty pleas were received in the Philadelphia U.S. District Court in early 1961, nearly every daily newspaper in the United States placed the events on their front page.

³⁵ 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.

least six monographs documenting the complex organizational details of these long-lasting and widespread bid-rigging conspiracies (Herling 1962, Smith 1963, U.S. Congress 1965, Sultan 1975, Epstein and Newfarmer 1980, and Bane 1973). Sultan's books are by far the most quantitative. In addition, three journal articles were devoted to the cartels (Kuhlman 1972, 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).

Second, there was a brief revival of focus on international cartels after 1973 when the Organization of Petroleum Exporting Countries (OPEC) first used its power to raise crude petroleum prices.³⁶ Many books and articles were written about the cartel, and two economic studies tried to predict OPEC's staying power by studying previous international cartels.³⁷ First, a chapter in a book by Eckbo (1976) is notable for its effort in classifying cartels according to a large number of potentially significant economic dimensions. One dimension is a binary variable that separates cartels with significant price effects from those that were ineffective in this respect. Second, the most comprehensive quantitative study of cartel price effects appears in a chapter by Griffin (1989).³⁸ 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 Index³⁹ of market power.

Third, four books 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 Joshua (2003) provide a legal overview of mainly EU cartel enforcement. Only Connor (2001) contains empirical overcharge data.

After 1973 most empirical analyses of cartel effects began to appear in professional academic journals. The shift away from monographs as the preferred outlets is remarkable. Of about 80 papers with useful overcharge information, 66 were published after 1973. While a few are historical narratives, these articles tend to focus on statistical tests of theoretical hypotheses or demonstrations of the superiority of a novel estimation technique. They form a small subset of the vast literature in economics

³⁶ 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.

³⁷ George W. Stocking wrote a non-technical study in 1970 of the oil industry, *Middle East Oil*, that his biographer calls "prophetic" (Anon. 1976: 454).

³⁸ Eckbo (1976) comes close. Eckbo studies 51 episodes in 18 markets, but does not really calculate overcharges so much as place them somehow in high/low categories; Griffin terms Eckbo's approach subjective.

³⁹ The Lerner Index is the same as the overcharge, except that it is measured by dividing the market price 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., $MO = L/(1-L)$.

that measures the price effects of market power, because external information is needed to identify markets in which sellers overtly colluded from the much larger number of markets characterized by presumptively tacit collusion. Perhaps the first published work that uses econometrics to estimate a cartel overcharge is Sultan's (1974) analysis of the U.S. electrical equipment conspiracy of the 1950s. Fisher (1980) and Feldstein and Levenbach (1983) show that econometric evidence was being presented by experts in U.S. civil, price-fixing trials as early as 1970. Econometric evidence on monopoly overcharges was published to critique government-enforced compulsory cartels; Kwoka (1977) is the first of many analyses of the price effects of agricultural marketing orders. However, quantitative analyses of the size of buyers' cartels undercharges are rare; Daggett and Freedman (1985) seem to be the first to publish such a study. Sophisticated econometric modeling has spread into historical studies of cartels: a notable pair of studies by Hausman (1980, 1984) examines two UK coal markets from 1699 to 1845 and Levenstein (1997) the century-old bromine cartel.

A new development in the cartel literature was the statistical analysis of auctions and bid rigging, much of it inspired by the urge to test game-theoretic notions (Porter 2001 surveys this literature). Howard and Kaserman (1989) study collusion in public tenders for sewer construction; Froeb *et al* (1993) federal-government procurement of frozen fish; Brannman and Klein (1992) state road-building contracts; and Lee (1999), Porter and Zona (1999), and Pesenforfer (2000) school-milk procurement. These studies were made possible by U.S. laws that mandate public access to bids for public project tenders, a policy that is uncommon outside of North America.

Novel methods continue to be applied to estimating cartel mark-ups. There is substantial work focused on understanding cartel stability from which price effects can be derived. Grossman (1996) looked at the 1851-1913 railroad express delivery market, and several have studied the 19th century Joint Economic Committee railroad cartel (Porter 1983, Briggs 1992, and Ellison 1994). Bajari and Yi (2003) applied the Bayesian method to a U.S. seal-coating conspiracy. Clarke and Evenett (2003) apply a trade model to importing countries to estimate price increases during the 1990's bulk vitamins cartel.

In addition to journal articles, this study draws upon nine 2000-2004 working papers of economists, many of which will become journal papers. One major source is a working paper that compiles data on the price effects of about 40 of 167 private international cartels that were discovered by antitrust authorities only since 1990 (Connor 2003). Other important sources of scores of overcharge estimates are the decisions of courts and competition-law commissions, most published since 1990.

Quantitative Estimates of Cartel Overcharges

Given the importance of the topic for legal-economic discourse, there have been surprisingly few compilations of the empirical findings of cartel overcharges.⁴⁰ 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.⁴¹

⁴⁰ 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.

⁴¹ 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

However, I have found six works that mention a significant number of studies of mark-ups due to overt collusion. The overcharges are assembled as a prelude to scholarly research, not as an end in themselves; none claims to be a comprehensive survey.

The most comprehensive quantitative study of cartel price effects appears in a chapter by Griffin (1989).⁴² He derives a simple behavioral empirical model that predicts the Lerner Index of market power using three factors. The model was fitted to data on 54 cartel episodes, most of which operated during the interwar period and all of which operated in a legal environment.⁴³ All but four of the cartel episodes were effective at raising price.⁴⁴ If the but-for price is the purely competitive price, then the Lerner Index is the same as the overcharge, except that it is measured by dividing by the monopoly price instead of the competitive or benchmark price.⁴⁵ 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.⁴⁶ If, on the other hand, the but-for price is supracompetitive, then the Lerner index might overstate the overcharge. Griffin (1989: Table 1) concludes that the mean cartel margin was 0.31, which is equivalent to a 45% price increase.

Cohen and Scheffman (1989) recognize that the average size of price-fixing overcharges generated by overt collusion is a critical issue in evaluating cartel fines. Their paper cites five to seven estimates for price-fixing cases.⁴⁷ A working paper by Werden (2003) cites 14 studies of cartel overcharges. All of his sampled studies were published since 1991, because he wished to study 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. Posner's (1975, 2001) treatise on antitrust law is an avowedly economic treatment of the subject. 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

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.

⁴² 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 politely characterizes Eckbo's approach as "subjective."

⁴³ I exclude 18 of Griffin's episodes from government-sponsored cartels.

⁴⁴ The present survey also finds that about 7% of the sampled cartels failed to raise prices.

⁴⁵ If P is the collusive price and C is the competitive price, then the Lerner Index is $(P-C)/P$, whereas an overcharge is $(P-C)/C$. That is why the Lerner Index is a *margin* (a mark down from the market price) and the overcharge is a *mark-up* (on costs or the but-for price).

⁴⁶ Suppose the competitive benchmark price is \$1.00 and the cartel mark-up (or overcharge) is 5%. Then the Lerner Index L is $(1.05 - 1.00)/1.05 = 0.0476 = 4.76\%$. However, if an overcharge is 25%, $L = (1.25 - 1.00)/1.25 = 0.20 = 20\%$. One can derive algebraically a one-to-one linear functional relationship between the overcharge and L ; it equals $L/(1-L)$. In this paper, I convert estimates of the Lerner Index of monopoly to the overcharge.

⁴⁷ One of them (Block *et al.* 1981) is irrelevant because it quotes the ratio of out-of-court settlements to *annual* sales for several U.S. bread price-fixing cases. As Cohen and Scheffman recognize in footnote 66, both the numerator and denominator of this ratio are inappropriate indicators of an overcharge; nevertheless in the text of their article, they persist in citing this ratio.

exaggerated” (*ibid.* p.304). Given that Posner is an avatar of the Chicago School of economics, it is noteworthy that his estimates are among the highest of the six studies.⁴⁸

Levenstein and Suslow (2006) focus on the determinants of success for both the interwar and more modern cartels. Although the authors are modest about their accomplishment⁴⁹, this paper contains the fullest accounting of overcharges of any source. This paper provides a total of 21 estimates of price effects for international cartel episodes. 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 national antitrust authorities.⁵⁰ While not all of the survey responses can be converted to overcharge percentages, the usable responses represent an unusually authoritative compilation of data on mark-ups by contemporary cartels that have been prosecuted by courts or commissions.⁵¹ The six surveys just discussed are summarized in Table 1.

[TABLE 1 HERE]

DATA SOURCES AND COLLECTION METHODS

Selection Criteria

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.⁵² 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

⁴⁸ The Chicago School of industrial economics is well recognized in textbooks (e.g., Martin 1994:8-11) and by members of the school itself (Posner 1979). The Chicago School generally maintains that sustained collusion by private firms alone is empirically rare. Posner’s (2001) insistence on widespread cartel success is a departure from the School’s normal themes.

⁴⁹ “I have very little evidence on the excess profits ... [from] cartelization. For fifteen cartels ... I have anecdotal evidence of price increases...” (p. 20).

⁵⁰ 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.

⁵¹ 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.

⁵² Bringing criminal indictments for *only* hard-core cartels is a matter of custom, not law. Some of the 5 to 10% of U.S. DOJ horizontal or vertical conspiracy cases handled through civil indictments could be criminally actionable. In addition, some hard-core cartels are brought as civil matters because prosecutors judge that the criminal burden of proof cannot be met.

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.

Classifying the sampled 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 European anticartel laws. If these cartels were not formed by means of a legally enforced government monopoly, they are generally considered *private* schemes.⁵³ 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. However, commodity agreements known to have been initiated, actively sponsored, or overtly protected by national sovereignty are not included.⁵⁴ 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). Where judgment was required procedures were followed that would result in conservative overcharge statistics.

With very few exceptions, this paper reports on every scholarly or serious study that contained quantitative information on the price effects of hard-core private cartels.⁵⁵ Writings by economists, political scientists, economic historians, and legal scholars are included. Written decisions or detailed reports of decisions of antitrust authorities everywhere in the world were examined. While no time limit was placed on the literature search, the large majority of the sources consulted were written after 1945.⁵⁶

⁵³ 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.

⁵⁴ 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.

⁵⁵ See Connor (2004 b: Appendix Table 5) for a brief 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.

⁵⁶ 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.

I have examined more than 500 English-language books, journal articles, working papers, reports, and other short analyses of cartel price effects. Many were written primarily as historical case studies or are focused on demonstrating a new method. Some mention price effects only in passing. The great majority of the short cartel studies were written by economists. Nearly all economic articles are written by North American academics using cartel episodes that affected commerce in the United States or Canada.⁵⁷ The absence of empirical studies by European or Asian academics is striking.⁵⁸

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 Connor (2004b: Appendix Table 2).⁵⁹ 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.⁶⁰ 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. There may be substantial variation in the quality of the price data, the methods used, degrees of judicial scrutiny, and the professional orientation of the sources that could affect reliability as perceived by any individual. I noted above the lack of clarity among professional writers about the essential characteristics of 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

⁵⁷ 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 (Clarke and Evenett 2003, de Roos 2006).

⁵⁸ One might speculate as to why this is so. The supply of well trained industrial economists in Europe is unlikely to be an explanation. The principal European organization for industrial economists (EARIE) 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. 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).

⁵⁹ 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.

⁶⁰ Some scholars may have relied on what they judged to be credible journalistic reports of overcharges.

high court decisions over state or district courts, or they may have strong opinions about European versus American antitrust jurisprudence. Similarly, many economists might trust results published in refereed scientific journals more than other publication outlets that receive less peer scrutiny, prefer modern quantitative methods to deep historical case studies, or express skepticism about the analyses of economists writing before the Age of Game Theory.

To contend with the disparate preferences of readers, I have chosen to cast my net widely, but look across the sources for evidence of systematic bias. 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.⁶¹

Social Science Studies

The first of two 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.⁶² Newer publications were located by using various bibliographic search engines, by noting the references cited by authors in the works themselves, and by searching on-line library catalogs. These studies vary substantially in terms of depth and the degree of professional commitment to the study of cartels. Some economists and historians have spent substantial portions of their careers specialized in cartel analysis, but most of the publications quoted herein are by social scientists for whom cartels were just a passing interest. 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 2004a). 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 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.

⁶¹ The influences of types of publications and methods of analysis are formally analyzed in Connor and Bolotova (2006).

⁶² I have confined journalists’ accounts of cartels primarily to book-length treatments of cartels, in the belief that such monographs are in-depth accounts of a cartel collected from many sources, some of them anonymous, over a period of time sufficient for the author to provide a balanced account of conflicting claims. Books by journalists typically do not focus on the quantitative economic aspects of the case at hand, so in practice there are relatively few overcharges drawn from these sources in the present study. I rarely include overcharge estimates embedded in newspaper or magazine articles, though some specialists may judge such assertions to be sufficiently reliable to include in their published studies. For example, Elzinga (1984) cites Demaree (1969), and Carlton and Perloff (1990) cite Smith (1963).

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 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.⁶³ 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 (Baker and Rubinfeld 1999). 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.⁶⁴ Game theory has influenced contemporary concepts of collusion, the design of competition policies, and empirical modeling of oligopolies (Werden 2004). One type of econometric modeling is an elaboration of the before-and-after method. A structural model of the market before or after the conspiracy can be estimated and used to predict the competitive price during the conspiracy (Brander and Ross: 17-20). A second type of econometric model can specify demand, supply, and an oligopoly model (usually Cournot or Bertrand) and fit the model to data from the collusive period (*ibid.* pp. 21-23). The most common approach is a reduced-form model. These models usually specify the demand and supply conditions in the relevant market as a function of the observed market price before, during, and after a conspiracy; the analyst then investigates through statistical tests whether and to what extent changes in prices or output fail to respond to normal, competitive market forces (*ibid.* pp. 23-29).⁶⁵ Because these models can simultaneously incorporate multitudinous factors that explain prices, economists tend to regard overcharge estimates from such models as more accurate than analyses that depend on more informal ways of accounting for such factors.⁶⁶

Consistent with most previous empirical studies of cartels, each cartel episode is treated as a unique observation. Most cartels are organized and fall apart only once; not counting brief disciplinary

⁶³ 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.

⁶⁴ 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.

⁶⁵ Either a dummy variable is included for the assumed collusive period, or the model can forecast or backcast benchmark prices from a noncollusive period.

⁶⁶ 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.

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, in effect a new cartel is launched.

Decisions of antitrust Authorities

Decisions of courts, commissions, and other antitrust authorities are the second major source of overcharges. In theory one should be able to determine how high cartels raise prices by a straightforward examination of a statistically significant sample of the thousands of U.S. antitrust cases that involved cartels. However, the amount that prices changed, or even whether prices were affected at all, is not relevant to the issue of whether a cartel violated U.S. antitrust law.⁶⁷ In U.S. criminal antitrust cases it is unnecessary for prosecutors to present evidence of the extent of any overcharges or undercharges.⁶⁸ In civil cases, however, the damages awarded to a successful plaintiff are equal to three times the overcharges, so in these cases plaintiffs must demonstrate how much prices increased or decreased due to the actions of the cartel. Finding overcharge rates in civil actions proved to be extremely difficult, because almost every private antitrust suit for damages settles or is dismissed before an overcharge can be calculated by a neutral observer and made part of the public record of the case. As a consequence, final verdicts involving cartels where a judge or jury calculated an overcharge are surprisingly rare. Announced settlements are poor guides to actual overcharges⁶⁹ (Connor and Lande 2005).

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.⁷⁰ Three sources were explored: computer assisted searches of data bases,⁷¹ reading through a large number of articles and treatises on cartels and on antitrust damages, and messages to groups of knowledgeable antitrust professionals.⁷² Every qualifying final collusion verdict is included.⁷³ The small sample size (26) of overcharges from final U.S. decisions is disappointing.

⁶⁷ 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.

⁶⁸ Even at the sentencing phase of criminal price-fixing trials, prosecutors rarely offer information on damages.

⁶⁹ Class-action settlements in North America are widely advertised in legal notices, but information about the rate of overcharge is not usually provided. Notices on the Internet are fleeting.

⁷⁰ I excluded cases that were overturned on appeal.

⁷¹ Computerized searches were not, with only a few exceptions, particularly helpful. Most searches turned up hundreds of useless citations.

⁷² For example, inquiries were made on the antitrust list serves of the ABA Antitrust Section, the National Association of Attorneys' General, and of the American Antitrust Institute.

⁷³ Many of the verdicts found were only expressed in dollar amounts which could not be translated into percentages.

Besides U.S. court decisions, the web sites of many foreign antitrust authorities were examined.⁷⁴ 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.⁷⁵ 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.⁷⁶ Additionally, commission decisions can be appealed to a court that renders a decision with a recitation of the facts of the case.⁷⁷

The data are organized according to three levels of analysis: markets, episodes, and overcharge estimates. By “market” is meant the industry or product that was subject to price fixing. *Markets* are precisely self-identified by the participants in the conspiracy, though occasionally there are alternative names for the same market.⁷⁸ 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.⁷⁹ 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.⁸⁰ 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.

⁷⁴ The most useful sites were: The European Commission (EC); the Australian Competition and Consumer Commission (ACCC); the Canadian Competition Bureau (CCB); the German Bundeskartellamt (BKA); the Fair Trade Commissions of Japan, Korea, and Taiwan; and the competition authorities of Finland, Sweden, Norway, Denmark, the Netherlands, France, Italy, and Israel.

⁷⁵ 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).

⁷⁶ I read almost 100 EC decisions that imposed fines on cartels (listed in Burnside (2003: Annex 1) and others published since 2003). The UK Monopolies Commission also released detailed reports, and I read about 40 of the ones that declared the cartel was “not in the public interest.”

⁷⁷ Occasionally, the commission reported an absolute overcharge, and the size of affected sales needed to be estimated.

⁷⁸ 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.

⁷⁹ 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*.

⁸⁰ 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.

GENERAL DESCRIPTION OF THE SAMPLE

Markets

Publications from economists, historians, and related sources yielded useful overcharge or undercharge information on cartels that operated in 279 markets (Table 2). If one group of sellers decided to fix prices of a product in one geographical region and a different group colluded on the same product in a separate geographical region, these will be viewed as two markets. Of the 279 markets, 37% 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 63% of the cartelized markets.⁸¹ 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 side agreements with international cartels that protected their domestic market from exports from the international cartel’s members.

[TABLE 2 HERE]

Almost 30% of the sample consists of markets affected by bid-rigging cartels.⁸² Although most cartels have some sales to government entities or industrial customers that purchase by tenders, these cartels are explicitly described to have been principally or exclusively engaged in bid rigging. 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. Recall that the U.S. sentencing guidelines assume 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.⁸³

Two-thirds of the cartels were found to be in violation of antitrust laws by at least one legal body.⁸⁴ Sometimes these are called “discovered” cartels. The determination of guilt or liability may take

⁸¹ 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. Thus, the potash cartel as a whole is counted as international; however, the earlier domestic episodes (and overcharges imposed at that time) are classified as national.

⁸² In Europe, bid rigging is generally referred to as collusion involving “tenders.”

⁸³ Only a couple of cartels were oligopsonies.

⁸⁴ 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. Seven unfinished probes by antitrust authorities are placed in this category.

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, consent decrees, or other sanctions; of the payments of civil penalties; or of negotiated settlements by defendants in a suit. The remaining 31% 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 not known to have been punished by an antitrust authority. Other legal cartels were organized and registered under antitrust exemptions, such as export cartels or ocean shipping conferences.

Episodes

Although I have collected data on 279 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. The sources have distinguished a total of at least **512** episodes. This term, which might better be called an observational time period, though commonly used in cartels studies, 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 cartels the interregnum is a period of contract renegotiation. The aluminum market, 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 bid-rigging convictions in the fluid milk markets of the Southeastern United States within a few years (Lanzillotti 1996). I count each conviction as an episode.⁸⁵ 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 is quite similar to the distribution of cartelized markets (Connor 2004b: Table 3). 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.

Overcharges

⁸⁵ 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.

Two kinds of cartel mark-up data are available. First, researchers usually report the *average* price increases over a representative portion or a whole episode (Table 3). 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 770 average overcharge estimates. 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. Some of the overcharge estimates are said to be *minimum* estimates. To be conservative, all such minimum estimates are counted as averages.⁸⁶ Finally, some analysts give minimum and maximum estimates.

The majority (57%) of the average overcharge estimates are drawn from international cartel episodes. More than two-thirds of the estimates come from cartels that were sanctioned and nearly four-fifths from “classic” price-fixing schemes.

Second, 270, one-fourth of all the 1040 overcharge figures that were assembled, are *peak* price effects. One-third 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 peak estimate.

[TABLE 3 HERE]

SUMMARY OF THE RESULTS

Number of Overcharge Observations

There is a total of 1040 quantitative estimates of overcharges and undercharges drawn from 259 publications.⁸⁷ The 770 average overcharge estimates are shown in Figure 1 arrayed by the cartel episode’s end year.

[FIGURE 1 HERE]

The six periods distinguished in this and subsequent tables were selected to represent different antitrust regimes in the United States and abroad.⁸⁸ In addition, the periods correspond roughly to the major changes in the relationship of antitrust jurisprudence to economics (Kovacic and Shapiro 2000).

⁸⁶ I have preserved these ranges in the appendix tables of Connor (2004b), but have used the midpoints of the ranges for the tables in this paper. The median ranges, if any, are quite narrow.

⁸⁷ 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.

⁸⁸ They are also convenient to chart changes in the historical views toward cartels or in methods of analysis.

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.⁸⁹ 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).⁹⁰ 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. During 1914-1919 nearly all international cartels, a few 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. The years 1945-1946 are another logical break point. During 1939-1945 nearly all of the interwar international cartels were disbanded; moreover, wartime price controls and cost-plus government contracts made cartels superfluous. Scores of U.S. criminal prosecutions of international cartels during 1940-1945 clarified the illegality for U.S. firms of many more subtle forms of cartel participation, such as patent pools, cross-licensing of technologies, and the creation of overseas subsidiaries as loci for cartel participation..

The post-World War II era is characterized by the emergence of industrial-organization as a separate discipline within economics, of rapid advances in empirical methods of analysis, and of the adoption of effective anticartel laws outside of North America. Kovacic and Shapiro (2000) note that in the United States by the 1940s "...there was considerable consistency between judicial decisions and economic thinking..." (pp. 51-52). Moreover, the vast expansion of higher education in North America and Europe brought about a parallel expansion of the economics profession as a whole and, consequently, an acceleration in the total resources devoted to theoretical modeling (particularly after 1980) and related empirical testing on collusion.⁹¹ 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 in 1974. Class action suits became far more common by the mid 1970s because of changes in federal court rules, a change that permitted plaintiffs to attract better lawyers and economic expertise (White 1988:Table 1.1). 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.

⁸⁹ 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.

⁹⁰ But few economists. The first time the Supreme Court took notice of economists was in the 1925 *Maple Flooring* decision (Kovacic and Shapiro 2000:47).

⁹¹ 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.

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.

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 million⁹². 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 to impose fines above the \$10-million statutory cap by means of an alternative sentencing provision. These devices were in some cases adopted by the EU and other antitrust authorities, which significantly improved the investigation and prosecution of international cartels. Both U.S. and EU prosecutions of international cartels increased markedly.

Except for a hiatus in 1946-1973, the number of observations per year has grown over time (Figure 2). 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 on London coal prices in 1699. Although highly unstable, the Vend finally collapsed in 1845, making it the most durable cartel in the data set.⁹³

The primary factor that explains the upward trend in the number of overcharges is the growth in the number international cartels with usable data (Figure 3).⁹⁴ Up until 1890 when price-fixing was legal everywhere in the world, only one estimate is available about every six months on average. During this early period, the vast majority of price effects are reported for domestic cartels operating in the United States, the United Kingdom, and Germany. Although there were large numbers of domestic cartels extant in the late 19th century; the small size of the fledgling economics profession, a literary approach to writing in economics, and inevitable destruction of most business records over time contributed to the fewness of quantitative overcharge observations for 19th century cartels.

[FIGURES 2 AND 3 HERE]

From 1891 to 1945 most data are drawn from studies of international cartels. Four to six overcharge estimates are available per year during these periods. 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.⁹⁵ The increasing awareness of the illegality of price fixing in the

⁹² Raised to \$100 million in April 2004; maximum prison sentences rose from 3 to 10 years.

⁹³ This cartel was controlled by mine owners who sent coal by coastal ships from Newcastle to London. The number of mines was quite large at times. Coal was mined in many parts of Britain, but when railroads from the Midlands reached London in the early 1840s, the Newcastle owners’ transportation-cost advantage disappeared.

⁹⁴ Although there is a dip in 1946-1990, the correlation between the number of observations per year and a linear time trend is $r = +0.72$.

⁹⁵ When the UK, Germany, and the EEC began requiring registration of cartels in the 1950s, hundreds came forth in each jurisdiction.

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.

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

Many of the interwar international cartels were organized as federations of national cartels and were aimed primarily at creating national monopolies and assigning shares for export sales.⁹⁶ As nearly all of them were believed by their members to be legal at the time, their activities often were openly reported by the business press.⁹⁷ Members of these cartels did not attempt to hide their activities; indeed they often publicized their operations, particularly if they achieved putatively efficiency-enhancing industry rationalization, protected national markets, increased national employment during stressful economic times, or promoted price stability. During this period, many countries passed legislation specifically authorizing cartels that controlled national exports, even if that meant agreements on prices in various overseas markets. In a few cases, including the United States, these cartels were used as cover organizations for domestic price-fixing.

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

Several explanations have been offered for the hiatus in international cartel formation in the decades following 1945. The destructiveness of World War II left the United States with as much as 65% of world industrial capacity in the late 1940s. As a result, manufacturers in Europe and Japan were oriented mainly toward rebuilding their domestic markets; not only were few industrial partners available

⁹⁶ 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 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.

⁹⁷ 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.

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.

On the other hand, 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 cartelized markets. Other factors that may be responsible for the surge in overcharge estimates may include greater interest in collusive phenomena by economists, shifts in antitrust enforcement priorities, expansion in the sheer number of antitrust authorities worldwide, and improved cartel-detection programs. The number of overcharge observations in 1990-2005 exceeds 17 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 (Figure 4). Prior to 1946, about one-third of the observations refer to cartels known to have been sanctioned.⁹⁸ 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).⁹⁹ 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 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.¹⁰⁰

[FIGURE 4 HERE]

⁹⁸ This ratio may be deceptively high. Many durable cartels straddled eras that bridged shifts in public attitudes or antitrust enforcement. Almost all the sanctioned-cartel observations prior to 1890 derive from the Newcastle Vend, which was not "punished" until the 1830s when a British Parliamentary committee issued an unfavorable report but no further consequences. Similarly, the U.S. anthracite coal cartel operated for four decades before it was indicted.

⁹⁹ Export cartels that in theory did not affect the jurisdiction's commerce were permitted in the United States from 1918 and in most other nations throughout the 20th century. Today fewer than one-third of all countries permit export cartels, and many that have an antitrust exemption appear ready to repeal the loophole (Levenstein and Suslow 2004).

¹⁰⁰ 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.

A third factor that is associated with the increase in cartel overcharge observations is the surge in studies of bid-rigging conspiracies since 1945 (Figure 5). Prior to the 1950s, only two cartels were identified as primarily engaged in bid-rigging conduct.¹⁰¹ Remarkably, in the 1945-1989 periods almost half of all the overcharge observations in the sample were primarily bid-rigging conspiracies. Awareness of the importance of bid rigging among economists may have been triggered by the well publicized U.S. electrical equipment conspiracies discovered around 1960. Post-War studies of bid-rigging cartels focused on national cartels in the United States, most of them local milk or construction conspiracies. The immediate victims of most of these bid-rigging conspiracies were governments. Relatively few international cartels rely primarily on rigging auctions or tenders for public projects. What may seem like a surge in this practice may in fact be a consequence 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.

[FIGURE 5 HERE]

Trends in Average Overcharges over Time

Table 4 displays the medians of all average overcharges reported, distinguished by membership type, legal type, and mode of pricing conduct, and by time period. Median percentages are displayed instead of the means because nearly all the cells contain positively skewed figures. That is, a few very high overcharges in any particular category tend to overwhelm the larger number of low-to-medium percentages when calculating the more common type of average, the mean. Moreover, while there is no upper limit on overcharge estimates, they 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%.¹⁰² The median overcharge for national cartels is 18.8%, whereas for international cartels it is 31.0% (65% higher).

Cartel mark-ups are above average for all types of cartels in the 1891-1945 periods, well below average during 1946-1973, and close to the all-periods average for the other three time periods. Variation over time appears to be related to changes in the mix of cartels types. For example, overcharges are relatively high when the period mix is rich in international cartels but poor in bid-rigging cartels. There is a strong downward trend in overcharges of international cartels, but weaker evidence of trends for the other types.¹⁰³

[TABLE 4 HERE]

¹⁰¹ They are UK copper smelting (1787-1829) and cast-iron pipes in the United States (1895-1896). There are no examples from the early 20th century.

¹⁰² “Successful” cartels are those with nonzero overcharges.

¹⁰³ The correlation of median overcharges of international cartels to a linear time trend is $r = -0.805$ and for domestic cartels $r = -0.196$; there are too few periods to test the bid-rigging types; the trends for the other types are insignificant (for example, among cartels found guilty, the coefficient is $r = 0.238$, the only positive trend). Grouped data are from Table 6; time is the midpoint year. The time trends are similar but slightly stronger among the successful cartels; using 336 micro observations, the correlation of average overcharges with the episode end date is -0.162 (spreadsheet dated August 2005). Connor and Bolotova (2006), fitting a sub set of this study’s sample to a regression model, confirm the decline.

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.¹⁰⁴ 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.¹⁰⁵

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.

Average Overcharges across Types

There are significant differences in the height of overcharges when the sample is split according to three cartel characteristics: national or international in membership, bid-rigging or classic price-fixing conduct, and sanctioned or unsanctioned cartels history (Figure 6). In the aggregate and for all time periods, higher mark-ups are associated with international membership, classic price-fixing methods, and no history of official sanctions.

[FIGURE 6 HERE]

The strongest characteristics pattern that emerges is that in every historical period international cartels have had higher overcharge rates than domestic (mostly U.S.-based) cartels (Figure 7). Up to the 1990s, international cartels were on average 133% more effective in raising prices than “national” cartels (cartels that fixed prices in one country and export cartels comprised of firms from single countries). This is not so surprising in the pre-World War II era because international cartels were formed without concern about prosecution, and most of the prewar sample of national cartels operated in the United States.¹⁰⁶ But the fact that the differences persisted in the postwar period is somewhat unexpected.

¹⁰⁴ 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.

¹⁰⁵ This last observation should be ignored because there is only one legal cartel formed after 1990.

¹⁰⁶ Few international cartels in 1900-1945 had U.S. corporate members. Those U.S. companies that did join international conspiracies may have believed that they had structured their participation in international cartels in ways that would not run afoul the Sherman Act.

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

[FIGURE 7 HERE]

In the 1990-2005 period, the superior pricing power of international schemes ebbed. The median overcharge fell to an historical low of 24.4%. In a sharp break from the first five periods, overcharges of international cartels averaged only 16% higher than national ones. The reasons for the convergence of national and international cartel mark-ups are difficult to divine.¹⁰⁷

A second pattern noted the inferior price effects of bid-rigging cartels compared to conventional conspiracies that set selling prices or allocate market shares. In the sampled cartels classic price-fixing conduct led to 29% higher median overcharges than observed for bid-rigging methods. Bid rigging cartels often are organized to exploit tenders for government public-works projects. Some economists have hypothesized that government buyers are less competent in detecting rigged bids than are professional industrial buyers.¹⁰⁸ Relatively few international cartels engage primarily in bid rigging, so this conduct category may be confounded with the geographic types just discussed above. Nevertheless, this finding directly contradicts the hypothesis of Cohen and Scheffman (1989) and the U.S. Sentencing Guidelines that impose higher penalties for bid rigging. It also challenges a rationale of the U.S. Government's antitrust policy shift in the 1980s that shifted resources toward the targeting of bid rigging against governments.

Third, an examination of the columns that contrast cartels according to their legal status sheds light on sample selection bias, an important methodological issue in cartel studies. Many such studies depend on samples of *convicted* cartels, and critics of these studies have asserted that cartels discovered through government investigations or sued by private plaintiffs are as a group inept compared to cartels that either had no fear of sanctions or remained clandestine. "...[I]t is not known whether cartels that find themselves in court are unsuccessful or merely unlucky" (Carlton and Perloff 1990:216-217). In particular, an influential study by Asch and Seneca (1976) finds that price fixers that were caught in 1958-1967 were significantly less profitable during collusion than a control group of unprosecuted firms.¹⁰⁹ Lower profitability ought to be reflected in relatively low overcharges. The data in Table 4 suggest a resolution of this paradoxical finding. Cartels punished in the time period covered by the Asch and Seneca study were indeed relatively inept: their median overcharges of 13% are the lowest by far of "guilty" cartels in any of the six time periods. Moreover, their sample appears to have been drawn disproportionately from domestic bid-rigging conspiracies, the categories that throughout history have generated the lowest overcharges. While a more precise analysis is needed, it appears that the Asch and Seneca study may itself be flawed by sample selection bias.

¹⁰⁷ One possibility is the rise in exports of manufactures from China. Prior to 2005 there is no example of a Chinese company joining an international cartel.

¹⁰⁸ Cohen and Scheffman (1989:345) also cite low normal profits and declining demand.

¹⁰⁹ The authors interpret their results in two ways. Firms are more likely to collude when industry conditions cause profits to decline, or cartels that are relatively ineffective at raising prices are also inept at hiding their illegal conduct and, consequently, the most likely to be detected and indicted by the antitrust authorities.

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 in the studies relied upon. Injurious cartels may be inherently more interesting to analysts and the results more publishable than those about incompetent cartels.

Size 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. Figure 8 classifies the average estimates into eight 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.

[FIGURE 8 HERE]

Because of the interest in prosecutable cartels, the discussion of Table 5 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%.¹¹⁰ 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.

[TABLE 5 HERE]

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. Figure 9 and 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.¹¹¹ 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 levels than monopoly levels. While overt collusion should be somewhat more effective than tacit collusion at raising prices *ceteris paribus*, information failures, potential competition, and cheating also typically result in sub-monopoly price effects. Because the peak periods are generally too brief for significant changes in the structure of the industry to change, the observed peak overcharges are measures

¹¹⁰ Note that from a legal perspective, each episode is an actionable offense. For the highest overcharges the implied own-price elasticities of demand are very large. One of the highest overcharges (800%) is for tungsten carbide, for which General Electric had a monopoly in the United States in 1927-1937. This newly developed material was sold at \$453/lb. to most customers and at \$360/lb. to a few favored buyers; up to 1927, the Krupp sold it at \$50/lb. in the United States and during 1927-1937 at \$45 to \$50/lb. in Europe (Stocking and Watkins 1948: 132). These numbers imply that the U.S. elasticity of demand was 81.5 to 64.8. U.S. consumption was less than one-twelfth that of Europe.

¹¹¹ There is no need to examine effective cartels separately, because nearly all of the peak price effects are non-zero.

of the short-run market power exercised by cartels when the discipline of the members is at its most cohesive.¹¹² Thus, the peak price effects are instructive about the potential harm that cartels can cause when they are unfettered by coordination problems.

[FIGURE 9 HERE]

From Figure 9 it is apparent that the peak overcharges are about double the average overcharges for all types of cartels. The range of the ratio is narrow: from 83% for national cartels to 108% for bid-rigging cartels.

Table 6 shows the median peak overcharge over time and across types of cartels.¹¹³ The trends in peak effectiveness over time are all negative.¹¹⁴ The decline in peak overcharges of international cartels is particularly strong.¹¹⁵ 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 85% higher. Peak mark-ups are only slightly higher for prosecuted cartels. And since 1945, when bid-rigging studies became plentiful, cartels that fixed prices or production levels were significantly more harmful than bid-rigging agreements.

Table 7 provides calculations of how *much* higher peak overcharges were compared the longer run averages for given episodes. Generally speaking, the peaks are about double 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.¹¹⁶

[TABLE 6 AND 7 HERE]

Overcharges by Location of Cartel

¹¹² Peak price changes may well be affected by short-run shifts in demand. Exogenous, unanticipated shifts in demand may exaggerate the peak price changes. However, in some cases these shifts are endogenous. Especially when a well financed cartel felt free to announce a new agreement that buyers perceived as likely to be effective, “panic buying” often ensued, which amplified the purely collusive effect on prices.

¹¹³ 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.

¹¹⁴ The correlation for bid-rigging types was not calculated because only three periods have sufficient observations.

¹¹⁵ The correlation over time (the mid-point year of each period) for international cartels is $r=-0.900$ and for national cartels $r=-0.220$; for guilty cartels $r=-0.074$ and legal cartels $r=-0.213$ (first four periods) or -0.586 (six periods); and for classic cartels $r=-0.284$.

¹¹⁶ These ratios could be relevant for assessing whether cartels intended to maximize price increases or gave greater weight to controlling *variation* in their collusive prices. Apologists for cartels, particularly those writing about international cartels during the Great Depression, tended to assert that cartels did not aim to raise prices so much as stabilize prices (Marlio 1947, Pyndyck 1979). There is little evidence in table 9 that the interwar, international cartels achieved greater price stability than those before or after.

Law-makers and antitrust enforcement officials may be interested in the locus of decision-making by the cartels in the sample. Figure 10 and Table 8 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 corporate members. In most cases corporate membership mix corresponds to a cartel's geographic field of operations.¹¹⁷

Cartels may be composed of member companies with headquarters in only one country or one continent; in most of these cases the cartel is a "virtual" joint venture with no permanent address. On the other hand, many early 20th century cartels established secretariats with professional staffs in London, Zurich, or similar locations. In more recent decades trade associations or management consulting firms have assisted with cartel operation. In these cases the geographic locus is easy to identify. Cartels with corporate members from multiple regions are more difficult to classify, but if a supra-majority of the companies were headquartered in North America, Western Europe, or Asia, the cartel is categorized in one continent. Global cartels are those with a diverse mixture of participants from two or more continents; nearly all global cartels aimed at controlling prices in at least Western Europe, North America, and East Asia .

[FIGURE 10 HERE]

[TABLE 8 HERE]

There are some significant differences in average cartel overcharges across geographic regions. Those that operated across multiple Western European countries¹¹⁸ 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.¹¹⁹ Median overcharges for global conspiracies were relatively high.¹²⁰

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 analyzed neither factor (e.g., Hay and Kelly 1974, Asch and Seneca 1975, Fraas and Greer 1977, Posner 1976). Eckbo's (1976) and Griffin's (1989) studies have information on price effects but do not link them to cartel size. Moreover, subsequent empirical evidence does not support a positive market size-overcharge connection.¹²¹

¹¹⁷ The major exception is export cartels, which are categorized in their country or region of origin but set prices in the "rest of the world."

¹¹⁸ In the past few decades, these correspond to intra-EU international cartels.

¹¹⁹ Connor and Bolotova (2006) confirm that North American cartels and those from Western Europe as a whole have significantly lower overcharges.

¹²⁰ When this analysis is repeated using post-1989 data, the ranking remains the same but differences are smaller.

¹²¹ 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

DECISIONS OF ANTITRUST AUTHORITIES

A survey of final verdicts of U.S. courts in collusion cases finds that 25 collusive episodes had a median average overcharge of 21.6% and a mean average overcharge of 30.0% (Connor and Lande 2006).¹²² 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 10%. Due to the small number of final verdicts it would not be meaningful to analyze these verdicts in even smaller groups.

Figure 11 and Table 9 combine that U.S. court survey with other overcharge estimates derived from cartel decisions by other antitrust authorities. There are 264 such observations – 36% from analyses of guilty findings of U.S. and Canadian courts, 24% from decisions of the European Commission that imposed fines, 20% from commissions of European nations, and most of the rest from Asian antitrust authorities. Texts of most of these decisions can be found on the web sites of the authorities or in various searchable law archives (Lexis Nexis, WestLaw, the *Official Journal of the European Communities*, EUR-Lex, and the like). In some cases press releases or press summaries contained sufficient information to calculate an overcharge, but more commonly an analyst used the product definition and conspiracy dates in the opinion and applied this information to prices from a third party to calculate an estimate. As in the case of U.S. final verdicts, only a small minority of available decisions contain the appropriate quantitative data.¹²³

[FIGURE 11 HERE]

The median overcharge is 23.5%, and the mean is 43%; both of these figures are close to the entire sample of 770 overcharge estimates. Besides the European Commission, a large number of observations come from decisions about mostly domestic schemes made by the UK Monopolies Commission in the 1950s and 1960s. Most of the remaining decisions are from other commissions that typically fined international cartels discovered since 1990. The estimated overcharges from decisions of the EU, Taiwanese, and Japanese authorities are relatively high. With few exceptions, overcharges from a jurisdiction are highly positively skewed.

of the 1990s. Correlation statistics were calculated for a number of sub samples. The first sample of 50 cartels examined the largest geographic market for each cartel; the coefficient 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.

¹²² These figures were calculated by Robert Lande and research assistants under his direction in 2004. Less than 1% of all U.S. published court opinions contain both the dollar damages and the affected sales of a cartel. For a discussion of the merits of examining only final verdicts, see Connor and Lande (2006).

¹²³ Guilty pleas and sentencing memoranda of the DOJ and Canadian Competition Bureau almost never mention damages. The EC has fined almost 100 cartels since 1969, but the full decisions are not always published, and only a small number included price data. About 37 EC decisions yielded usable overcharges information. However, the web site of the Italian, French, Korean, and Taiwanese antitrust commissions contain the detail necessary in a large minority of cases.

In three jurisdictions, there are enough observations to examine changes over time. In each case, median overcharges from 1990-2005 are higher than from earlier periods. This rise is most likely attributable to the higher priority being given to prosecuting international cartels in the last 15 years.

[TABLE 9 HERE]

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 view criminal trials or guilty pleas as the gold standard of fact-finding, regarding civil commission hearings and other processes with skepticism.

Three approaches are taken to learn whether the various overcharge estimates are sensitive to the methods, data sources, time period, or disciplines of the authors. These analyses are reported in detail in Connor (2004b: 56-67) and are summarized here.¹²⁴

Sources of the Estimates

Confidence in the estimates may be judged in part by the sources from which the overcharge estimates were derived. 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 (Connor 2004b: Table 11). In addition, 15% of the estimates were taken from economist' working papers, most of which were distributed since 2000, examined modern international cartels, and appear to be intermediate versions of book chapters and journal manuscripts.¹²⁵ The majority of the government reports (4% of the estimates) were authored by civil servants with specialized training in economics, and some were written 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. Court and competition-law commissions accounted for 12% of the estimates. In sum, four-fifths of the estimates are drawn from the formal or informal writings of

¹²⁴ The three analyses reported in this section are somewhat preliminary, because factors like publication dates are probably correlated with things like a change in the mix of cartel types. Multiple regression analysis is an appropriate tool to handle such analytical issues, and that is the approach taken in Connor and Bolotova (2006), a research project begun in January 2005 and is scheduled to be completed in April 2006. In footnotes to follow, I will alert the reader to findings from Connor and Bolotova (2006) that may be different from Connor (2004b). Note that Connor (2004b) employs a slightly smaller data set than that shown in tables above.

¹²⁵ Several of them have notes to that effect.

academic social scientists, and most of the remainder was the product of professionally trained individuals subject to the checks and balances of internal reviews.¹²⁶

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.¹²⁷ The intuition here is that the authors of more recent empirical studies of cartels have learned to avoid the methodological pitfalls of their predecessors.¹²⁸ 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. In industrial economics there is a trend away from evaluating cartels from the point of view of the theory of pure monopoly toward a more sophisticated and nuanced view informed by game theory and other conceptual advances.

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

[FIGURE 12 HERE]

The results of a temporal analysis are displayed in Connor (2004b: Table 12A). The publications are classified according to four periods that correspond roughly to milestones in social-science analysis of cartels (before 1891, 1891-1945, 1946-1989, and 1990-2004). There is no evidence for concluding that overcharges vary systematically by date of publication. For example, in the case of 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.¹²⁹ 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%.¹³⁰ For cartels that ended between 1890 and 1989, current research produces median estimates that are quite close to contemporary chroniclers of the same cartels.

¹²⁶ Controlling for other factors, Connor and Bolotova (2006) find that government reports tended to have systematically lower overcharges, while court and commission decisions were higher.

¹²⁷ Note that the cartel end date places a lower limit on the publication date, but they are not the same. The results in this sub section do not contradict the earlier finding that end dates and overcharges are negatively correlated, a finding verified by Connor and Bolotova (2006).

¹²⁸ Alternatively, one might infer that analysts may have increasingly employed techniques that have won court approval as forensically reliable (see Connor 2004a).

¹²⁹ The samples of cartels in each time period overlap, but are not identical. I will correct for changes in the sample immediately below.

¹³⁰ 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.

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 pairs of estimates applied to identical cartel episodes. Recall that a cartel episode refers to a single market, time period, and form of cartel organization. There are 291 pairs of observations available for this analysis of reliability, which examines six general methods of estimation. The most widely used is the so-called before-and-after method in which the price during the episode is compared to one of three “but-for” or base prices. The second most popular method is statistical modeling, which accounts for 20% of the estimates. The yardstick methods accounts for about 10% of the sample. Overcharges derived from costs of production or profits are the least frequently employed method (about 3%). These five methods have been sanctioned by U.S. courts for determining damages in price-fixing trials (Connor 2004a). Sixth, approximately 10% of this study’s estimates are quotes from or interpretations of decisions made by antitrust authorities.¹³¹

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. Nevertheless there are two differences worth commenting on. One somewhat surprising result is that the before-and-after method produces cartel-overcharge estimates that are *higher* than econometric modeling applied to the same episodes. Econometric techniques offer the opportunity to the analyst to make precise allowances for several sources of shifts in demand and supply, for seasonality, for trends in technology, and for feedback effects. If in fact econometric techniques are the most accurate, what this result seems to suggest is that authors of traditional before-and-after analyses are failing to adjust for all the competitive factors that might drive up the competitive benchmark price. However, this result could be explained by other factors, such as the time available to perform a calculation or to differences in access to confidential price data.¹³² Second, compared with the before-and-after, the cost-based and yardstick techniques yield relatively high overcharge estimates.¹³³ This suggests that the methods that use costs or profits fail to fully account for all competitive industry costs, perhaps those related to product marketing or overhead. Similarly, as yardsticks are frequently chosen to be prices in proximate *regions* in which the cartel did not attempt to fix prices, this result suggests that analysts may be identifying prices in regions with lower cost structures than the conspiracy-affected markets. Possibly the full costs of transportation and transfer from geographic yardsticks to the affected geographic market are underestimated. If the yardsticks are *product* substitutes, analysts may have underestimated quality differences between the cartelized product and the analogous product.¹³⁴

CONCLUSIONS

¹³¹ Seventh, “method unspecified” estimates are on average quite close to the before-and-after price method.

¹³² See Connor (2004a) for just such an example. Connor and Bolotova (2006) find no differences between before-and-after estimates and econometric estimates.

¹³³ These two methods seem to be conservative relative to statistical modeling, but the number of pair-wise observations is quite limited. Historical case studies, many by historians with access to original documents, tend to produce lower estimates (Connor and Bolotova 2006).

¹³⁴ Yardstick prices are more likely to be available at geographic points close to large centers of supply (concentrations of production or major ports of importation). Public price reporting of products with multiple grades normally is restricted to the most common, least differentiated grade.

This paper's major goal is to collect and analyze the largest possible body of serious, quantitative estimates of price-fixing and bid-rigging overcharge rates. In publications dating from 1888 to mid 2005, some 1,040 such estimates were assembled.

This survey analyzes information found in 259 social-science studies and adverse legal decisions regarding mark-ups by private, hard-core cartels. Those publications yielded 770 observations of "average" overcharges.¹³⁵ The primary finding is that the median¹³⁶ cartel overcharge for all types of cartels over all time periods is 25.0%: 18.8% for cartels with solely domestic membership and 31.0% for international cartels.¹³⁷ Thus, international cartels have been about 65% more effective in raising prices than domestic cartels. Cartel overcharges are skewed to the high side, pushing the mean overcharge for all successful¹³⁸ cartels to 43.4%. The 270 "peak" cartel overcharges in the sample are typically double those of the long-run averages.¹³⁹

This paper's findings are generally consistent with the few, more limited works that comment on cartel overcharges.¹⁴⁰ Six previously published economic studies with samples ranging from five to 38 overcharges report a simple average median overcharge of 28.1% and a weighted average mean overcharge of 36.7% of affected sales. Moreover, the social-science and legal sources yield generally similar estimates. 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%.¹⁴¹ Outside the United States, decisions of competition commissions contained information that resulted in 154 overcharge estimate; median average overcharges across jurisdictions typically¹⁴² ranged from 19% to 29% of affected commerce, and the mean range was 21% to 73%. Overall, the decisions of all courts and commissions implied a median cartel mark-up of 23.5% and a mean of 43.0%.

The authors' professions, types of publications, years of publication, degrees of peer review, and analytical estimation methods from which these estimates are derived vary greatly. There is some indication that estimates prepared from the yardstick method and those based on decisions of antitrust

¹³⁵ Average overcharges are those calculated from an entire cartel episode, not just a peak or isolated result.

¹³⁶ All medians presented in this section incorporate all relevant zero estimates and omit peak results.

¹³⁷ This study has a majority of episodes and estimates taken from international cartels.

¹³⁸ Those with positive overcharges.

¹³⁹ 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.

¹⁴⁰ All of the relevant estimates in the six works are incorporated in the sample assembled for this paper.

¹⁴¹ In addition, the 9 cases that reported peak overcharges produce a median peak overcharge of 71.4% and a mean peak overcharge of 130%.

¹⁴² Two jurisdictions I place outside the normal range: two decisions of the Australian authority were exceptionally low (median of 11%), and eight decisions of the Taiwan FTC were abnormally high (median of 68%).

authorities are higher than other approaches.¹⁴³ Otherwise, however, extensive examinations of variation in overcharge rates across such categories give no reason to regard any sub set of the sample as inherently biased or unreliable.

The results of the survey have significant policy implications. First, 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. This survey's results, which are based upon an extraordinarily large amount of data spanning a broad swath of history of all types of private cartels, sharply contradict these views. In fact, the data suggest the opposite. Mean overcharges are two to four times as high as the level presumed by the U.S. Sentencing Commission. Second, bid rigging was no more injurious to direct buyers than other forms of collusion. These results suggest that antitrust sanctions' guidelines should not treat bid rigging more harshly than other forms of collusion. Third, international cartels are typically more destructive of competitive market forces than domestic conspiracies. Connor and Lande (2004) propose raising the overcharge presumption for U.S. fines to 15% for domestic cartels and 25% for international cartels.¹⁴⁴ This is a conservative and modest proposal in light of this article's demonstration that cartels typically generate at least two or three times the antitrust damages presumed by the current Sentencing Guidelines.

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. This survey suggests that overcharges generated by cartels discovered in most jurisdictions are higher than North America-centered cartels. Consequently, anticartel laws and fine-setting practices abroad are in even greater need of strengthening.

Global cartels have historically generated greater overcharges than other international conspiracies. Despite the evident increases in cartel detection rates and the size of monetary fines and penalties in the past decade, a good case can be made that current global anticartel regimes are under-detering (Bush *et al.* 2004, Connor 2005). Global cartels are more difficult to detect, have less fear from entry of rivals, achieve higher levels of sales and profitability, and systematically receive weaker corporate antitrust sanctions than comparable domestic cartels. Base fines of 20% of cartelists' affected commerce, even when adjusted by significant culpability multipliers,¹⁴⁵ will do little to deter most of these cartels.

One sanguine development is that for most types of cartels there are reductions seen in cartel mark-ups over time. 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.

¹⁴³ Two other types (historical case studies and government reports) tended to be low.

¹⁴⁴ As an anonymous reviewer suggests, such changes need to be considered alongside appropriate levels for private settlements. These recommendations are particularly complicated by corporate leniency programs and by the joint fining policies of overseas antitrust authorities for international conspiracies.

¹⁴⁵ For a variety of factors, however, very few firms actually pay a fine amounting to 20% or more of the amount of commerce affected. Most violators have their fines reduced by 60% to 80% of the maximums for a variety of reasons.

APPENDIX: The Early Literature on Cartels

Interest in collusive organizations began well before industrial-organization economics was recognized as a distinct discipline. Prior to World War II, fewer than a dozen 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.¹⁴⁶ Consistent use of these terms was not well established until the mid 20th century.¹⁴⁷ 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).¹⁴⁸ By 1916 Ripley could differentiate these phenomena using terms that became commonly accepted jargon by the 1940s.

Pools or corners were contractual joint-profit-increasing agreements by independent sellers over prices or quantities; today these are called cartels (Ripley 1916: xiv).¹⁴⁹ 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 1897), and a patent pool for porcelain bathtubs.¹⁵⁰ Trusts proper were legal instruments used in the United States from about 1879 to 1902 for combining companies under a single board of directors; beginning in the late 1890s trusts were supplanted as a means of industrial merger by the holding company (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 throughout the early 20th century to cover both cartels and mergers intended to increase market power. As late as the 1930s, several terms were often used interchangeably for cartels (Plummer 1936, Curtis 1931). Curtis considered cartel to be a term used mainly in Europe. His preferred terminology was pools for more informal and unstable cartels and trusts for cartels with strong central direction and control.

¹⁴⁶ Other terms include monopolies, trade associations, conventions, *comptoirs*, *ententes*, and intergovernmental commodity agreements.

¹⁴⁷ Until World War I or later, the word “cartel” or *Kartell* was not in general use among Anglophone economists; Sayous (1902), a French economic historian, discusses 16th and 17th century cartels. Sayous (1902:381) appears to be the first academic writer in a U.S. journal to use the word cartel in its economic sense. He clearly distinguishes private cartels from government-run schemes, trusts, holding companies, and the like. The more famous Dutch East India Company, he argues, was a government-supported monopoly. Sayous believes that a cattle-procurement monopoly by butchers of Anvers, France in the 16th century also qualifies as an early European cartel. Notz (1920, 1929), whose work is discussed below, helped popularize the term in the United States.

¹⁴⁸ 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.

¹⁴⁹ However, pools often were organized to obtain only short run profits, whereas cartel connotes a more enduring scheme. “Cartel,” from the German cognate *Kartell*, came into general use in British writing in 1902 (Connor 2001:20). Although more common in the 19th century, modern cartels do not usually endow a joint venture with capital contributions, though they may set up a sales office or secretariat. The first work in the United States that I have seen referring to German cartels is to “combinations” that “regulate” industries (Bullock 1901:207). Ripley (1916: xiv) cites German *kartells*. On the continent of Europe, “syndicate” or *comptoir* was often used to describe a cartel, with a joint sales agency often implied.

¹⁵⁰ 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).

Bullock (1901,1905), a professional economist and author of an early American economics textbook, wrote the first English-language survey of cartels and trusts in the social-science literature. After noting that there was a near absence of publications on the topic during 1890-1896, he finds an astonishing outpouring of 34 books and 48 serious articles in 1897-1900.¹⁵¹ Interest in the subject continued in the early 20th century, with most of the cartel literature from 1900 to 1940 appearing in books.¹⁵² Some of these works were written by historians and others by some of the earliest practitioners of the emerging field of industrial economics. Most of these studies contain little or no quantitative data. Bullock opines that the quantitative measurement of the market-price effects of cartels and trusts is not possible.

Liefmann (1897) published one of the first economic monographs that contained the word *Kartell* in its title.¹⁵³ 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 Liefmann was leagues ahead of his contemporaries in the analysis of the cartel phenomenon. He coined one of the most cited and pithy definitions of cartels: "free [voluntary] associations of producers for the monopolistic control of the market (Liefmann 1932: ix)." By this definition he meant to include only arrangements by independent companies linked by formal or informal contractual agreements; compulsory commodity schemes enforced by government decrees or parliamentary statutes are not true cartels by his definition, though international agreements negotiated between compulsory national cartels would qualify if the negotiated agreement did not require statutory enforcement.¹⁵⁴ He dismisses the widely accepted view of the time that cartelists are merely aiming to achieve a "reasonable profit," insisting that cartels are instruments for maximizing profits. Liefmann assembles a great deal of information on German cartels and limited information on cartels outside Germany, but with one exception he includes no useful price series that could be used to compute price effects.¹⁵⁵

¹⁵¹ 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.

¹⁵² Among the earlier post-Bullock monographs in English with significant economic content are books by Liefmann (1897, 1932), Jenks (1900, 1907, 1911), Jenks and Clark (1917, 1929), Hirst (1905), Jones (1914, 1921), Levy (1927, 1968), Michels (1928), Seagar and Gulick (1929), Domeratsky (1928), Notz (1929), von Beckerath (1930), Piotrowski (1933), and Plummer (1934, 1951). Levy (1968), a careful historian, cites about 30 books on cartels and closely related subjects published before 1927, the great majority in German.

¹⁵³ 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.

¹⁵⁴ 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.

¹⁵⁵ 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)."

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).¹⁵⁶ Indeed, the book contains no price data.

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 significant shares of domestic output to other countries at lower prices than their fixed domestic prices, he proposes using the export prices as a yardstick. Although there is some danger of overstating the domestic overcharge if the cartel is dumping product at predatory prices or if the marginal costs of exporting are lower than comparable domestic sales, he applies this method to six German cartels using 1900-1902 prices.¹⁵⁷

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.¹⁵⁸ 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.¹⁵⁹ 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

¹⁵⁶ However, Beckerath undercuts his agnostic position by noting that most cartels have members with varying costs and set their common price so as to allow its highest-cost member to make a profit (p. 265); it follows that at such a price all the others are making economic profits.

¹⁵⁷ This method also may result in an inaccurate benchmark price if the elasticity of demand in the export market differs from that in the domestic market and this difference is not taken into account. In Hirst's study, however, I judge this factor to be a minor source of inaccuracy, because the export markets (mostly the Benelux countries) were geographically proximate to Germany and were at similar levels of industrial development.

¹⁵⁸ Jenks seems to be the originator of the cost-based method of calculating overcharges. The 1921 edition of Jenk's book received a glowing review by a well known cartel economist (Dana 1922). The most complete biography of Jenks appears in Brown (2004).

¹⁵⁹ The Association was still operating successfully in 1888. Jenks judges that the Association had only four limited and brief upward effects on prices; as an exclusive marketing organization, it may have lowered the costs of transportation and selling in the upper Midwest.

public hearings in 1898-1899 on conditions in several oligopolistic industries. His books (1900, 1901, 1903, 1917, 1929) contain carefully constructed series of wholesale prices for refined sugar, whiskey, wire nails, barbed wire, steel, and other products controlled by cartels or dominant firms. Among his analytical advances was the creation of coterminous price series for the principal inputs for the final products (corn for whiskey, steel for nails, etc.). By correcting for changes in product prices due to input prices, he was able to determine more precisely when and how strongly prices were affected by a cartel.

Harvard University seems to have been the leading campus for economic and legal studies of cartels in the early 20th century.¹⁶⁰ One indication of its preeminence is the publication of what is probably the first textbook on cartels, mergers, and monopolies in 1905.¹⁶¹ 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).¹⁶² Ripley aimed at applying the case-study method pioneered by Harvard Law School into advanced economics courses.

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

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.¹⁶³ The Dutch Company of the

¹⁶⁰ Other economists with interests in cartels worked at California, Columbia, Cornell, and Stanford universities.

¹⁶¹ 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.

¹⁶² A similar book was edited by Curtis (1931).

¹⁶³ Sayous (1902:381), a French economic historian, appears to be the first academic writer in a U.S. journal to use the word cartel in its economic sense. He clearly distinguishes private cartels from government-run schemes, trusts, holding companies, and the like. The more famous Dutch East India Company, he argues, was a government-

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.¹⁶⁴

Nevertheless, it is Germany that has the best claim as the birthplace of contemporary industrial cartels. Liefmann (1932) believes that the first domestic German cartel was the Neckar Salt Union, an 1829 combination of salt mines in three German states. Five more were formed prior to 1870. However, Liefmann and other writers point to the German depression of the mid 1870s as a peak for cartel formation. A 1905 German government survey found 385 industrial cartels operating; the number rose to 3000 by 1925.¹⁶⁵ 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) quotes a German book that found 114 international cartels in 1912; by 1920 he could identify 11 international cartels with participation of U.S. companies.

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

Two lengthy reports from analysts in the U.S. Department of Commerce presage the triumph of the more precise German usage of the term cartel (Domeratsky 1928, Notz 1929). Notz (1929) accepts Liefmann's classic definition of a private cartel: a voluntary association of two or more independent business organizations in the same line of business with the aim of increasing joint profits by controlling markets or reducing competition.¹⁶⁶ Essential is an overt agreement to divide market territories, set or stabilize prices, limit or allocate industry supply, establish a common sales agency, pool intellectual property, or some combination of these five strategies. If the organizations are registered in at least two countries, then it is an international cartel. While the Department of Commerce reports are strong in detailing cartel membership and industry supply conditions, they have little to offer by way of price effects.

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, MacGregor 1927, Wiedenfeld 1927, and Economic and Financial Section 1927).¹⁶⁷ These

supported monopoly. Sayous believes that a cattle-procurement monopoly by butchers of Anvers, France in the 16th century also qualifies as an early European cartel.

¹⁶⁴ 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.

¹⁶⁵ Liefmann (1932) notes that these numbers do not count hundreds of local German price-fixing agreements among hair dressers, hotels, and other service providers.

¹⁶⁶ 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.

¹⁶⁷ The United States was not a member of the League of Nations and sent only observers to the 1927 conference.

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 and Japan. In this decade cartels were often embraced because they were perceived as antidotes to the world wide depression and, in some industries, deflation. Indeed, the Brookings Institution sponsored a series of books during this time to assist policy makers in implementing the National Recovery Act (e.g., Pribram 1935). U.S. Supreme Court decisions quickly restored the antitrust laws by 1938 (Wells 2002). When President Roosevelt and his advisors became apprised of the intimate connections between national socialism and compulsory cartels in Germany in the 1930s, they rejected using cartels to foster economic recovery.

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 laws were being debated and first enforced, though none of these works suggested that their approaches had forensic value.¹⁶⁸ Among the most useful papers for overcharges are Jenks (1888), Andrews (1889), Edgerton (1897), Hudson (1890), Walker (1906), Stevens (1912), Tosdal (1916), 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.¹⁶⁹ Edgerton's (1897) paper on the U.S. Wire Nail Association is a superb analysis of the evolution, operation, and price effects of a short-lived but tightly structured, highly 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.¹⁷⁰ 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

¹⁶⁸ 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.

¹⁶⁹ Until World War I or later, the word "cartel" or *Kartell* was not in general use among Anglophone economists; Sayous (1902), a French economic historian, discusses 16th and 17th century cartels. Notz (1920, 1929) helped popularize the term in the United States.

¹⁷⁰ 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.

of 1887-1889. Stevens' 1912 study of the gunpowder trust is notable for focusing on what was believed to be the longest-running discovered cartel in the Nation's history; Stevens carefully delineated three distinct phases of the cartel, and he drew upon the records of a 1911 antitrust trial to document the final episode. Tosdal (1916) and Walker (1906) provide competent analyses of the earlier episodes of two highly durable domestic German cartels, potash and steel, respectively; subsequent scholars have repeatedly returned to these cases. Ripley (1916) reprints a fascinating court decision of the U.S. enameled bath tub cartel, which used patent licenses on a new machine to achieve effective collusion. Allen's (1923) account of the 18th century English copper-smelting cartel is the first quantitative assessment of cartel effectiveness by a European economist to appear in a peer-reviewed academic journal.

The absence of cartel studies in professional journals in the 1920s and 1930s is striking.

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TABLES

[NEED TO UPDATE WITH 2008 DATA]

Table 1. Summary of Six Economic Surveys of Cartel Overcharges

Reference	Number of Cartels		<u>Average Overcharge</u>	
			Mean	Median
			<i>Percent</i>	
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 ^a	12	15.75		12.75
Total, simple average		102-104	30.7	28.1
Total, weighted average		102-104	36.7	34.6

a) Two total overcharges in this survey with missing affected sales were converted to percentages using highly reliable, publicly available affected sales data. A few percentages cited to be “as high as” were omitted.

Table 2. Number of Cartel Markets, by Type

Type of Cartelized Market	Number		Percent
International membership	102		36.6
Members from one nation	177		63.4
Bid-rigging schemes	83		29.8
Classic cartels	196		70.3
Cartel found guilty or liable	185		66.3
Currently under investigation (presumed “illegal”)	7		2.5
Known to have been operating legally	57	20.4	
No record of sanctions (presumed “legal”)	30		10.8
	Total	279	100.0

Source: Appendix Table 1 dated XXXXXXXXXXXX

Table 3. Number of Average Overcharge Observations, by Type of Cartel

Type	Number	Percent
International membership	441	57.3
National members only	329	42.7
Bid-rigging schemes	159	20.7
Classic price-fixing cartels	611	79.4
Cartels found guilty or liable ^a	529	68.7
No record of sanctions (“legal”)	241	31.3
Total	770	100.0

Source: Appendix Table 1 dated August 2005.

^a Included are seven cartels still being investigated by antitrust authorities in 2005.

Table 4. 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	20.0	50.8	14.0	22.6	27.5	21.0	22.3
1891-1919	19.0	49.5	24.4	34.0	--	29.5	30.4
1920-1945	18.3	35.8	37.7	31.3	--	32.8	34.0
1946-1973	15.0	33.6	15.0	26.3	13.0	23.0	15.0
1974-1990	18.0	41.5	20.0	22.5	20.0	18.5	24.0
1991-2004	21.0	24.6	24.6	21.3	19.0	25.0	24.0
ALL YEARS	18.8	31.0	23.3	28.5	18.8	25.5	25.0

Source: Price Fixing Overcharges Master Data Set, spreadsheet dated XXXXXX

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

Includes many zero estimates. See Table 5 for the numbers of observations in each cell.

DO BEGIN DATE TOO?

Table 5. Mean Average Overcharges by Size Category

Percentage Range ^a	Number of Observations Number	Mean	Distribution of Observations	
			Total Percent	Non-Zero
Zero or less ^b	50	0	6.5	0

0.1-9.9	111 ^c	6.4	14.4	15.4
10.0-19.9	159	14.4	20.7	22.1
20.0-39.9	223	28.8	29.0	31.0
40.0-59.9	119 ^d	48.1	15.5	16.5
60.0-79.9	49	68.3	6.4	6.8
80.0-99.9	14	89.4	1.8	1.9
100.0-199.9	28	129.5	3.6	3.9
200 to 886	19	422.2	2.5	2.6
Total	770	40.6 ^e	100	100

Source: Appendix Table 2 dated August 2005.

^a Point estimates or 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 For effective cartels (those with positive overcharges) the mean is 43.4%.

Table 6. 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	42.4	104.5 ^b	46.8	51.2	18.5 ^b	55.5
1891 - 1919	26.2	81.0	41.5	71.6	11.9 ^b	54.5
1920 - 1945	46.0 ^b	68.0	60.0	66.0	69.0 ^b	63.1
1946 - 1973	45.0	53.0	48.3	33.0	43.0	50.0
1974 - 1990	33.3	72.0	35.0	39.0 ^b	35.0	51.6
1991 - 2003	31.2	53.4	50.0	25.0 ^b	37.5	50.5
ALL YEARS	33.3	60.5	48.3	55.0	35.0	54.5

Source: Appendix Table 2 dated August 2005.

^b Fewer than four observations.

Table 7. 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	2.12	2.06	3.34	2.27	--	2.64
1891 - 1919	1.38	1.64	1.70	2.11	--	1.85
1920 - 1945	2.51	1.90	1.59	2.11	--	1.92
1946 - 1973	3.00	1.58	3.22	1.25	3.31	2.17
1974 - 1990	1.85	1.73	1.75	--	1.75	2.79
1991 - 2003	1.49	2.17	2.03	--	1.97	2.02
ALL YEARS	1.77	1.95	2.07	1.93	1.86	2.14

Source: Tables 4 and 6.

-- = Too few observations

^a The ratio of the median peak overcharges to the median full-period overcharge.

Table 8. Average Overcharges by Cartel Headquarters Location

Principal Location of Cartel Members	Number of Estimates	Average Overcharge	
		Median percent	Mean percent
USA and Canada	234	20.25	28.53
Single nations in W. Europe	136	16.95	47.98

Multiple nations in W. Europe (EU)	126	42.70	53.66
Asia and Oceania	53	28.80	52.69
Global	248	28.00	50.24
Africa, So. America, & E. Europe	23	18.80	23.89

Source: Total of 770 observations from Appendix Table 2 dated August 2005.

Table 9. Cartel Overcharges from Decisions of Antitrust Authorities

Antitrust Authority	Number of Observations	Median Percentage	Mean Percentage
North America:	94	20.0	36.8
US and Canada, pre-1990	55	18.5	38.7
US and Canada, 1990-2005	39	21.6	34.0
United Kingdom:	28	19.0	73.3
UK Monopolies Commission	24	13.4	74.3
UK, 1990-2005	4	41.9	67.6
Other European Nations:	26	18.8	22.8
France	9	22.0	27.4
Germany	4	11.0	12.0
Italy	4	30.5	28.7
Other Europe	9	9.0	20.5
European Union:	64	27.5	35.0
European Commission, pre-1990	11	25.0	31.7
European Commission, 1990-2005	53	29.0	57.1
China	2	21.1	21.1
Japan FTC	10	28.4	26.3

Taiwan FTC	8	67.5	94.9
Korea FTC	13	20.0	29.4
Australia	2	10.5	10.5
Mexico	1	18.8	18.8
Total	248	23.5	43.0

Source: Appendix Table 2 dated August 2005. Several decisions have alternative estimates by single authors, and some have estimates by multiple authors.

FIGURES

Figure 1. Number of “Average” Overcharges Collected

(Total of 770 observations/spreadsheet dated 8-1-2005)

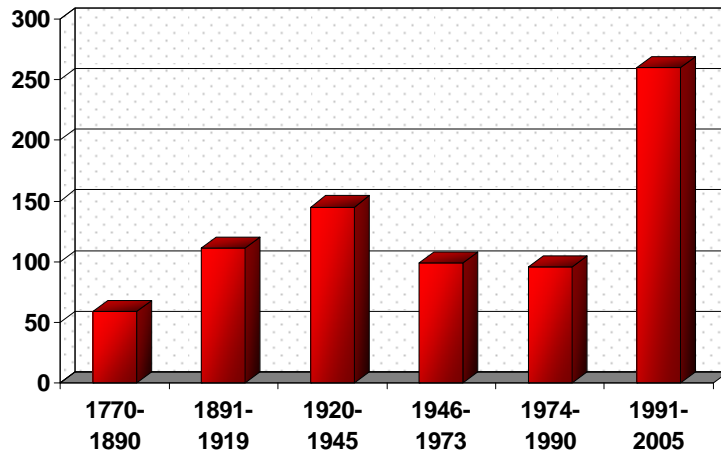


Figure 2. Number of “Average” Overcharges per Year

(Total of 770 observations by end date/spreadsheet dated 8-1-2005)

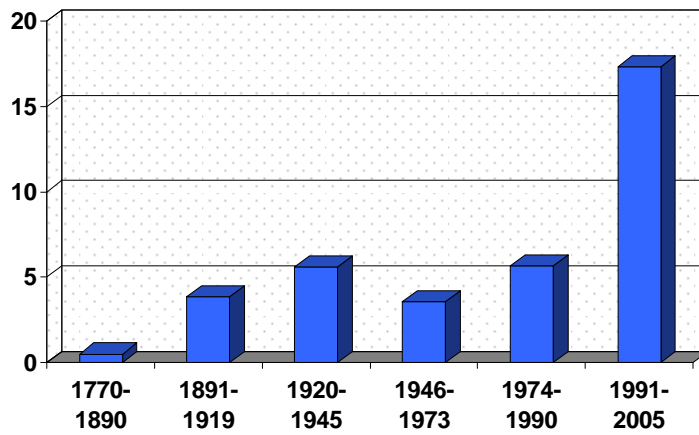


Figure 3. Proportion of Cartels that Are International

(Total of 770 Overcharge observations/spreadsheet of 8-1-2005)

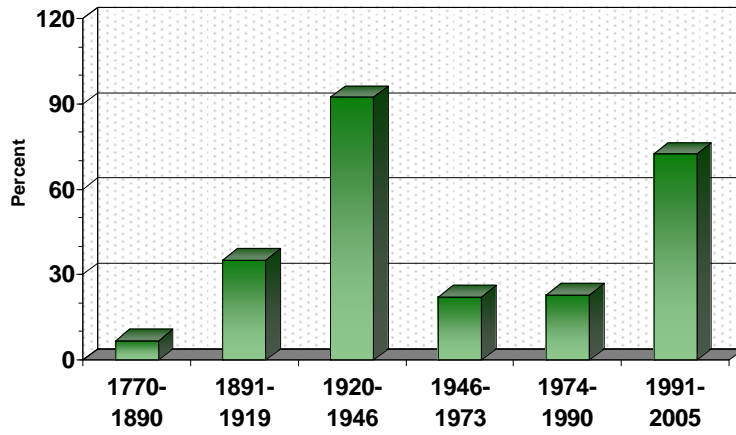


Figure 4. Proportion of Cartels Sanctioned

(Total of 770 observations/spreadsheet dated 8-1-2005)

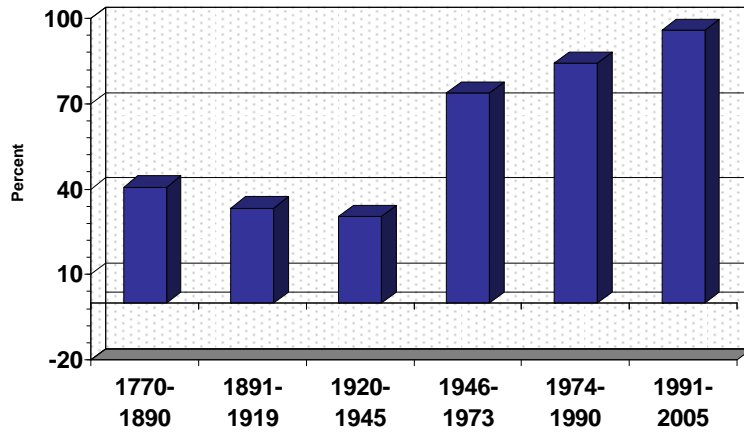


Figure 5. Proportion of Cartels that Rigged Bids

(total of 770 overcharge observations/spreadsheet dated 8-1-2005)

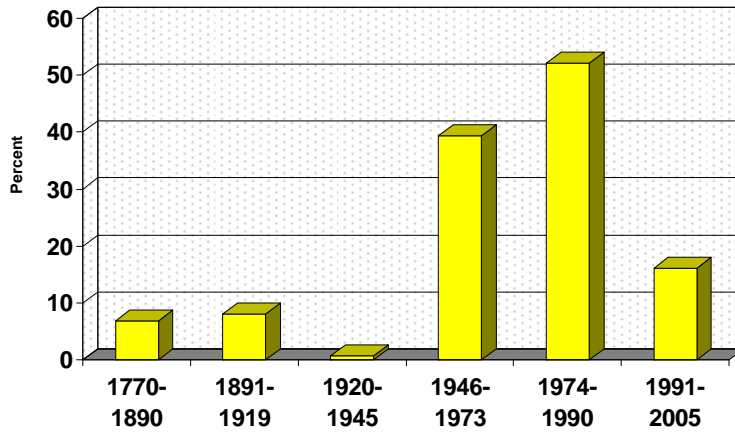
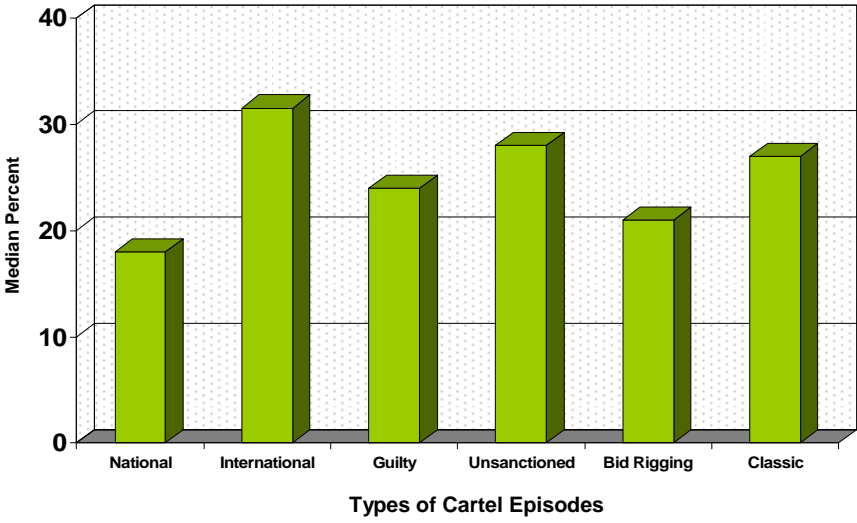


Figure 6. Average Overcharges by Cartel Type*



*Includes some interpretations of court and commission decisions.

Figure 7. Median Average Overcharges over Time

(Total of 770 overcharge observations/spreadsheet dated 8-1-2005)

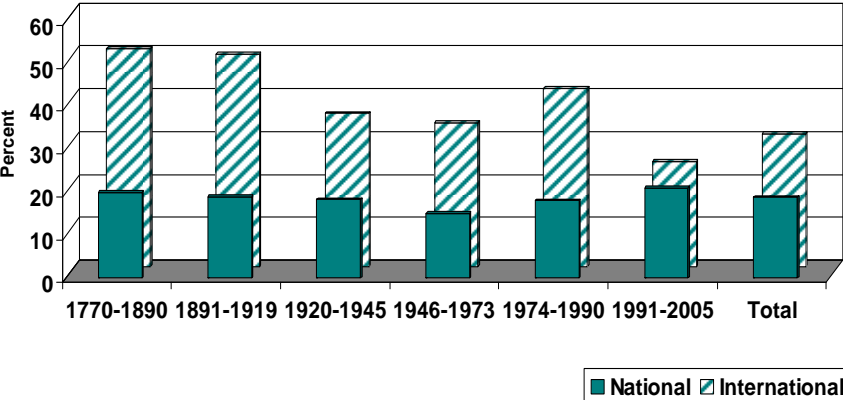
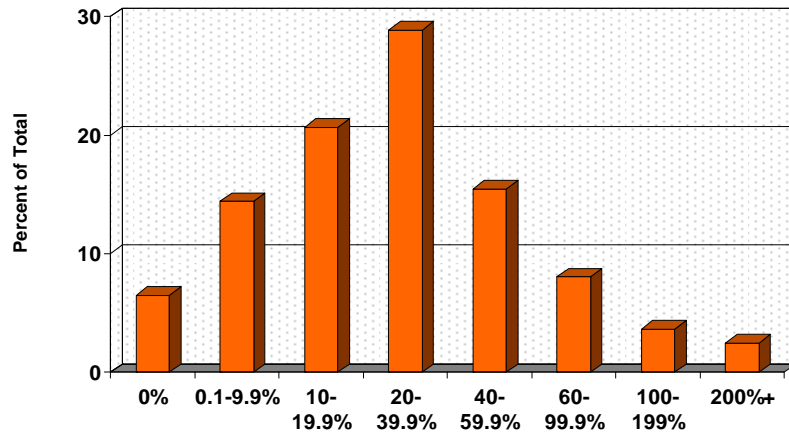


Figure 8. Cartel Overcharges by Size Category ^a



a) Total of 770 median overcharges, average of entire episode or a representative portion of the collusive period. (spreadsheet 8/3/05).

Figure 9. "Peak" versus "Average" Overcharges

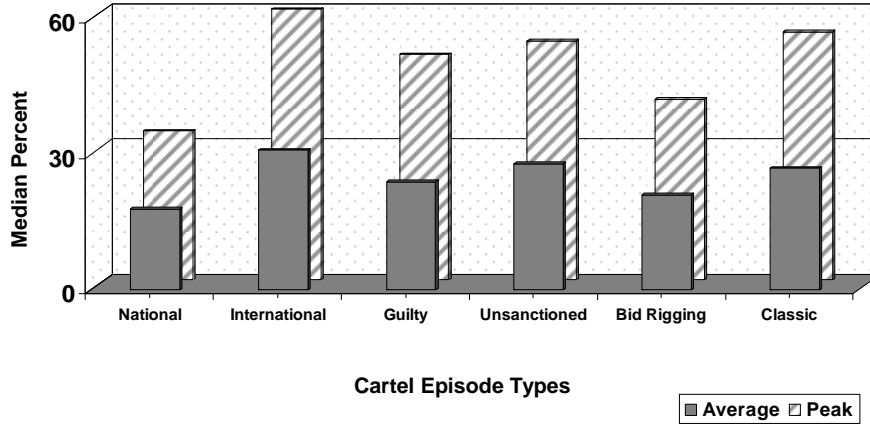


Figure 10. Median Average Overcharges by Geographic Location

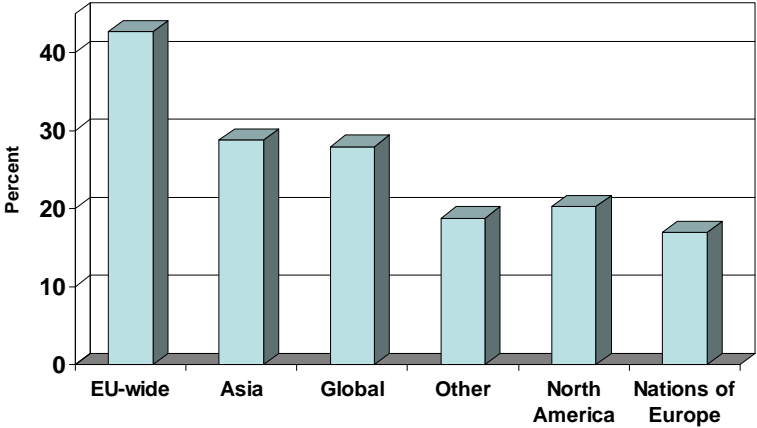
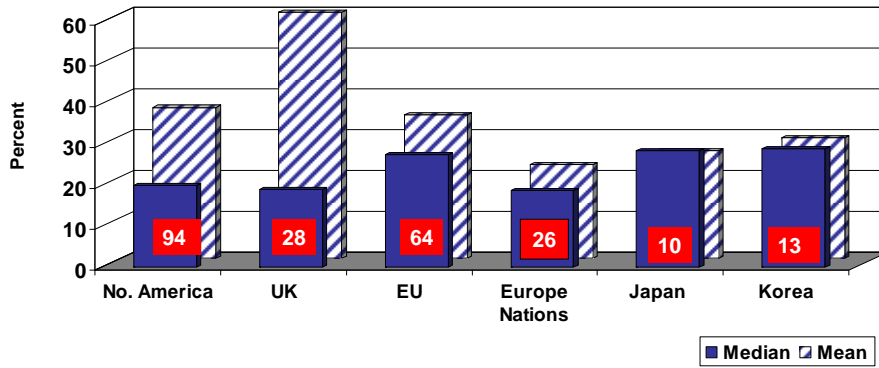
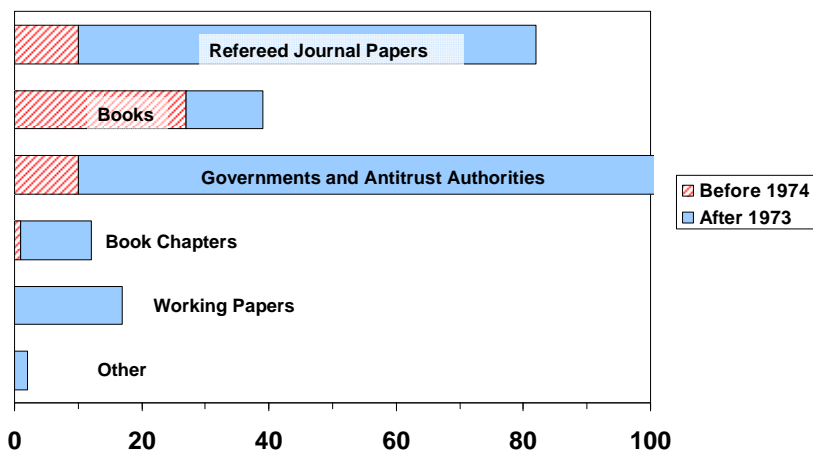


Figure 11. Average Overcharges from Courts and Commissions



Number of decisions shown in red

Figure 12. Publication Sources of Average Overcharge Estimates



Total publications 259 as of August 2005. Antitrust authorities counts decisions.

APPENDIX TABLES

Appendix Table 1. Alphabetic List of Cartelized Markets

[INSERT TABLE HERE]

NB. Appendix Tables 2 to 5 can be found at:

<http://www.agecon.purdue.edu/directory/details.asp?username=jconnor>