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Determinants of EC Antitrust Fines for Members of Global Cartels

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Abstract

In this paper, we estimate quantitatively the determinants of variation in administrative fines imposed on companies by the European Commission for price-fixing violations. Estimates from our behavioral model provide the first direct test of the predictive power of the optimal deterrence theory of antitrust violations in the EU. In addition, they offer insights into other determinants of the EC's leniency program for cartels and its effectiveness.

Regressions are fitted to a sample of 192 corporate participants of hard-core global cartels fined between 1990 and January 2009 to explain variation in the absolute Commission fine. Independent variables fall into four groups: the extent of the cartel's antitrust injuries; factors that affect the probability of detection and conviction by antitrust authorities; the size of non-EC penalties on the cartel; and controls for time, for changes in EC guidelines, for nationality of the defendant, and for industry-specific characteristics. The predictive power of the final model is quite satisfactory.

We find that EC corporate cartel fines generally follow the precepts of optimal deterrence theory and the EC's Fining Guidelines. Fines are directly related to economic injuries from collusion and inversely related to proxies for factors that increase the probability of detection and conviction of clandestine cartels. If the elasticity of expected fine with respect to harm is less than one, deterrence is *ex post* sub-optimal; our estimate is 0.27. Expected fines are directly related to recidivism and almost doubled under the 2006 revised Guidelines.

However, we also find evidence that the Commission either deviates from optimal deterrence principles or follows practices unmentioned in its Fining Guidelines. Expected fines increase at a decreasing rate as other penalties increase, are rising by 8% per year, and are much higher for North American firms and for bid-rigging cartels. Furthermore, if the cartel had a whistleblower that was granted immunity, all the remaining members enjoyed a 20% fine reduction.

Key words: antitrust, European Commission, EU, cartel, collusion, price-fixing, optimal deterrence, penalties, leniency, amnesty.

JEL codes: L41, L44, L65, L11, L13, N60, K21, K14

INTRODUCTION

In its published cartel decisions, the Competition Directorate of the European Commission (EC) provides a detailed description of how each participant's fine was calculated and how the calculation conforms to its published Notices that have governed cartel fining. The fining *Guidelines* were formally implemented in January 1998 and substantially revised in 2006. The EC Guidelines are integrated with provisions for leniency rewards for cooperative defendants, a policy first implemented by the EC in 1996.

Like almost all other leading antitrust authorities, the EC states that its administrative penalty procedures are guided by the law-and-economics principles of *optimal deterrence*. Fines for criminal antitrust violations were to be formulated in a general way upon the illegal gains or economic damages generated by the offending entity. Damages are not regularly estimated in practice, but application criteria were adopted that embodied proxies for economic damages incurred by buyers and ultimately by consumers.

A review of the empirical law-and-economics literature finds very few studies that quantitatively estimate the sources of variation in corporate criminal fines. The present paper is the first to estimate the determinants of EC antitrust fines on cartels EC using formal quantitative techniques and to test whether EC guidelines conform to the theory of optimal deterrence. It also gives insights into the effectiveness of the EC's *Notice on Leniency* for violations of the European Union's (EU's) competition laws.

Objective

This paper analyzes the determinants of variation in cartel sanctions imposed on nearly 200 corporate participants of global cartels by the European Commission from 1990 to January 2009. The models to be tested primarily draw upon testable propositions suggested by optimal deterrence theory. However, we also augment the specification of the models and hypotheses by considering stated policies and historical sentencing practices. These latter factors may be considered constraints on the EC's ability to implement purely optimal fines.

Importance of the Topic

Greater understanding of the determinants of cartel fines is important for policy and disciplinary reasons. First, along with the Antitrust Division of the U.S. Department of Justice (DOJ), the EC's anticartel campaign is often held up as an exemplar of a highly successful antitrust paradigm for the scores of antitrust authorities that have been launched worldwide in the past two decades. Since the first EC cartel fines were imposed in 1969, the size of such fines has grown rapidly, often setting new record amounts every few years (Connor 2009b). Now that there is a substantial record of enforcement, a retrospective analysis is feasible. Second, of

disciplinary interest is the extent to which EC sentencing practices conform to the tenets of the optimal deterrence theory of crime that by the 1970s had become accepted as the dominant set of principles for guiding antitrust laws and enforcement by the world's leading antitrust authorities. There are few empirical studies assessing the adherence of corporate sentencing to optimal deterrence principles. Third, critics of the EC's cartel fining practices often emphasize the idiosyncratic features of sentencing, going so far as to deny the predictability of fines in advance of a decision. Given the typical three-year length of EC cartel investigations, the uncertainty of future fines creates financial planning risks for the company and its investors. The putative unpredictability of fines raises doubts about the transparency and proportionality of EC fining policies and practices.

The EC Anti-Cartel Program

Among many other legal scholars, Posner (2001) regards the suppression of cartels due to price-fixing enforcement as the single greatest accomplishment of the antitrust laws. The EC and the DOJ have been widely extolled for their visible and energetic campaigns against large and international cartels that took off in the mid 1980s in the EU and in the mid 1990s in the United States (Klawiter 2001; Harding and Joshua 2003; Connor 2004, 2007a, and 2007c).¹ They have adopted more aggressive investigatory techniques, increased the severity of corporate and individual sanctions, and developed methods for cooperating with dozens of antitrust authorities around the world. Perhaps most important, both authorities have attempted to increase the detection of secret cartels through corporate leniency programs. For more details on U.S. and EU cartel enforcement, see the Appendix.²

The DOJ and the EC have been faced with a flood of cartel cases since the late 1990s, most of which were initiated by leniency applications (Connor 2004). The idea of granting a successful leniency applicant a 100% reduction in its potential cartel fine is well accepted. Game-theory models of the Prisoner's Dilemma show that under a wide array of conditions full leniency reduces cartel stability (i.e., it induces members of functioning cartels to defect by confessing to antitrust authorities) (Aubert *et al.* 2006, Spagnolo 2008).³ Repeated game models of collusion that allow for cartels to alter their price paths confirm the effect of cartel destabilization when

¹ In international opinion surveys of antitrust enforcement, the DOJ and EC almost always rank at or near the top in the admiration of antitrust lawyers. See also Hoj (2007). However, these rankings depend on the subjectively identified measures of legal powers or enforcement performance employed.

² Readers familiar with trends in cartel enforcement will be broadly informed about trends summarized in the Appendix. However, those lacking such familiarity will benefit from knowing the policy context of this paper.

³ Leniency programs can under rather unusual circumstances stabilize cartels, but the empirical importance of this outcome is uncertain.

maximal leniency⁴ is offered (Chen and Harrington 2007). Although not following the rule of maximal leniency, legal scholars attribute to current U.S. corporate leniency programs an improvement in detection of secret cartels (Spratling and Arp 2005). A sophisticated game-theoretic analysis finds robust statistical support that the U.S. program increased detection of all cartels by about 60% after 1993 (Miller 2009). However, the design of the program is critical. The first EU leniency program instituted in 1996, since revised to become “automatic,” appears to have had no measurable effects on deterrence (Brenner 2005).

It is apparent that many non-U.S. antitrust authorities regard the anti-cartel policies and procedures long employed by the DOJ as exemplars. The EU, Brazil, Korea, Canada, and other jurisdictions have tended to adopt many features of the Division’s anticartel policies. The European Commission (EC) is visibly moving toward convergence on many features of U.S. enforcement practices.⁵ The Member States of the EU have in turn replicated most of the EC’s anti-cartel enforcement practices.⁶ Many Asian antitrust authorities have adopted the EU model, including the 2008 Chinese Antimonopoly Law. Understanding the details of EC anti-cartel policies and procedures can be relevant to developing effective multi-lateral antidotes to international price fixing.

A much debated but unresolved issue in cartel enforcement is the nature of the trade-off between the conservation of constrained prosecutorial resources and the size of corporate cartel fines. On the one hand, more rapid acceptance of guilty pleas can be induced by offering relatively large discounts from recommended cartel fines for a defendant’s cooperation (OECD 2008: 9-10). Large discounts will permit an antitrust authority to pursue more cases that involve difficult proof of guilt. Deterrence is improved. On the other hand, because the expected rewards shrink, overly deep discounting policy will lead to fewer amnesty applications and a greater number of cartel formations. Deterrence is hobbled. It is precisely in the presence of such trade-offs that an empirical study will be of assistance in choosing the right policy balance.

⁴ Maximal leniency is defined as a policy that abrogates all monetary penalties for which one guilty firm is liable and does not award any other participants with partial leniency (Spagnolo 2006: 6). This comes close to the U.S. Corporate Leniency Program for criminal antitrust violations committed after July 2004 (except that the winner must pay possible single private damages). Partial leniency forgives less than 100% of all possible monetary penalties. Both the EU and U.S. offer partial leniency.

⁵ Among those changes are the adoption of a conspiracy theory of cartel violations (Joshua and Jordan 2004), the use of unannounced raids (Harding and Joshua 2004), fines based on affected commerce (EC 2006, Wils 2007), the encouragement of antitrust private rights of action (EC 2005), and possible criminalization of the EU’s competition law (Wils 2005).

⁶Hammond (2006) makes the case that the system of negotiated guilty-plea agreements has not yet been adopted by most other antitrust authorities, but urges that it should be; indeed, he comes close to rebuking the EU and other authorities that promise specific percentage discounts to second-in cartelists (*ibid.* p.2).

Optimal Deterrence of Cartel Formation

Monetary penalties for price fixing violations can have strong effects on deterrence (Posner 2001).⁷ Optimal deterrence theory is couched in terms of the *expectations* of the founders and managers of cartels. Individual expectations about cartel penalties are formed on the basis of historical experience, that of the firm itself, its legal advisors, and of other firms that were defendants in comparable price-fixing litigation. The size of expected monetary penalties affects both the probability of detection and the rate of cartel formation. If expected fines are low, the incentive for applying for leniency is low, cartel defections slow, and the likelihood of detection is lowered. Therefore, increasing penalties will make cartels more fragile and increase detection rates. Assuming that the benefits of overt collusion derive from exogenous market characteristics, up to some point higher penalties efficiently discourage the formation of cartels.

The Commission clearly adheres to some concept of deterrence with respect to punishment of members of cartels. In its 1970 decision in *Chemiepharma*, the European Court of Justice declared that fines are justified “to suppress illegal conduct as well as to prevent it being repeated” (Wils 2006). This decision appears to articulate a goal of absolute general deterrence. As early as 1983, a Commission statement said that cartel fines are imposed to prevent illegal conduct from being repeated (Wils 2007: 200). Cartel fining Notices also contain language consistent with a deterrence goal. The first EC fining *Guidelines* recommended fines (1) that would, after assessing economic damages to consumers, be “sufficiently deterrent” and (2) that would be greater than the amount of “gains improperly made,” that is, the monopoly profits made by a cartel during the collusive period (EC 1998). These principles of fines appear to suggest an *ex post* notion of special deterrence, as there is neither reference to anticipated profits nor to the likelihood of detection.⁸ It is backward-looking rather than forward-looking. In the 2006 revised *Guidelines* the EC embraces both special *and* general deterrence (EC 2006b: §4).⁹ In addition, the *Guidelines* add a “specific amount” to deter cartel formations – the *ex ante*

⁷ The balance of academic opinion seems to favor an assessment that current levels of price-fixing sanctions under deter (Wils 2006, Connor 2007d). Cartel studies that have documented high levels of recidivism among cartelists in the years since rigorous enforcement began also support under-deterrence (Connor and Helmers 2006).

⁸ Wils (2008:208) claims that the EC 1992 decision in *Eurocheque* was the only one where a reliable overcharge was available and that the fine was exactly equal to the overcharge.

⁹ “Fines should have a sufficiently deterrent effect, not only in order to sanction the undertakings concerned (specific deterrence) but also in order to deter other undertakings from engaging in, or continuing, behaviour that is contrary to Articles 81 and 82 of the EC Treaty (general deterrence).”

concept of deterrence – as well as a penalty for deterrence by highly diversified firms (EC 2006b: §7 and §30).¹⁰

However, general deterrence in the EU sense appears to refer to penalties high enough to quash *all* cartel activity, which is inconsistent with the optimal deterrence concept (Wils 2006).¹¹ By contrast, in the United States, general deterrence refers to actual public penalties that are high enough to reduce the formation of new cartels *by example to other would-be cartelists* to an optimal level; this is contrasted with *specific* deterrence, which is the imposition of penalties of all types and from all sources on each guilty cartelist that recoup antitrust damages adjusted upwards for the probability of detection and conviction and thereby discourage the criminal from considering recidivism in the future. In the United States, general optimal deterrence is the primary goal of cartel fines, and specific deterrence is a secondary goal (Werden 2009: 7). Thus, the EC apparently follows a rule of absolute general deterrence that requires higher fines on comparable cartelists than would be applied under optimal general deterrence. The near absence of private cartel-damages litigation adds to case for superior EU fines.

One of the greatest differences between the U.S. and EU methods of deciding on fines is the role that negotiations play. Plea bargaining in criminal cases with prosecutors (or “settlements” as it is called in Europe) is a long-established practice in most common-law nations, and in the United States the vast majority of criminal cases are resolved by means of a deal in which a guilty plea and promises of cooperation are obtained in return for a promise of a reduced sentence (Fisher 2003).¹² However, in civil-law or administrative systems, plea bargaining is not very common and may be contrary to judicial practice (ICN 2008).¹³ As a result, the median time required to complete a decision is more than three times longer than in the common-law countries of North America.

¹⁰ “It is also considered appropriate to include in the fine a specific amount irrespective of the duration of the infringement, in order to deter companies from even entering into illegal practices.” Later, in §25 a sum equal to between 15% and 25% of the basic amount of the fine should be added to cover *ex ante* deterrence. “ and “The Commission will pay particular attention to the need to ensure that fines have a sufficiently deterrent effect; to that end, it may increase the fine to be imposed on undertakings which have a particularly large turnover beyond the sales of goods or services to which the infringement relates.”

¹¹ In their book on EC cartel enforcement, Harding and Joshua (2003: 255-257) suggest that a single instance of recidivism establishes the absence of general deterrence. They endorse Wils (2006) by suggesting that that optimal deterrence (which they say is from the “American literature” on deterrence) brings about unfeasibly high fines.

¹² In England and Wales, bargaining is not used to reduce a sentence, only to drop some charges.

¹³ Of course, during closed hearings, accused cartelists have an opportunity to offer facts and arguments about culpability that may result in a reduction in a proposed fine.

However, plea bargaining involving non-amnestied cartelists, many believe, is about to spread from common-law countries to antitrust authorities in civil-law jurisdictions. “The use of settlements has become a recent hot topic among anti-cartel enforcers” (ICN 2008: 2). A recent OECD (2008) report on plea bargaining assesses the practice from a global enforcement perspective, ultimately judging it to be a net benefit for most jurisdictions with substantial sanctions. Moreover, the huge backlogs of cartel prosecutions in several civil-law jurisdictions are prompting antitrust authorities to adopt “settlement” procedures very similar to DOJ plea bargaining (Wils 2008). In 2007 the European Commission’s Directorate General for Competition (DG-COMP) began seeking public comment on its proposed “direct settlement” policy (*International Herald Tribune* 2006). A May 2007 amendment to Brazil’s competition law permits “direct settlements” in antitrust litigation, and already by November 2007 two cartelists had agreed to reduced fines in return for cooperation with prosecutors (*Latin American News Digest* Nov. 29, 2007). Top officials admit that the Brazilian policy change was inspired by the DOJ model.¹⁴

Predictability of Fines

In general, the predictability of criminal sanctions is held to be an element of judicial efficacy and fairness. Under concepts of optimal deterrence of crime, potential law-breakers are presumed to be able to predict with some degree of certainty the material benefits and costs of criminal conduct *ex ante*. That is, rational criminal decisions are based on the assumption that reasonably accurate expectations about probable penalties can be formed at the time a participant is weighing the benefits and costs of initiating the illegal conduct. However, in the EU legal opinion is split on whether foresight about fines is desirable (Wils 2007: 204-206). Some decisions about cartel fines by the European Court of First Instance support predictability, while other decisions warn about risks to deterrence should firms be able to predict fines with a high degree of confidence. Under an optimal deterrence framework, predictable fines are as necessary as predictable returns from the crime and a subjective notion of the likelihood of being caught. The main economic arguments in favor of uncertainty about expected fines are (1) that a range of possible fines will discourage risk-averse firms from violations because they will focus on the high end of the range and (2) that cartel formation is less likely if diverse firms try to collude, including firms with inconsistent conjectures about the costs of being caught.

Moreover, one of the guiding principles of sanctioning illegal behavior is that of proportionality, i.e., between comparably culpable defendants the fine should fit the crime. Optimally deterring penalties are inherently proportional (to the harm caused). Doubts have been raised about

¹⁴ “Plea-bargaining has been a long-standing and successful practice in the US, and, we were of course, inspired by its system...” (Martinez 2007). Ana Paula Martinez is Director of the Competition Department of the Secretariat of Economic Law, one of the three units of Brazil’s antitrust authority.

proportionality among convicted cartelists, because Connor (2008) found that the discounts for non-U.S. participants in international price fixing are significantly different from foreign firms.

An analysis of the sources of variation in cartel fines is also useful in understanding and appraising the effectiveness of antitrust enforcement. Besides considerations of optimal deterrence, an antitrust authority may be appraised for consistency with stated policies and practices that are based on other legal theories or principles of punishment; the EC subscribes to multiple goals (Wils 2007: 200-201). For example, alternative theories propose goals that serve incapacitation, rehabilitation, or retribution. To some extent, these alternative goals may be coincidentally consistent with optimal deterrence (Cohen 1996: 409). Consistent with optimal deterrence, firms expected to be liable for significant private penalties will be awarded large fine discounts. Firms that have a low capacity to pay a proposed fine will normally be granted larger discounts in order to maintain competitive market structures in cartelized markets.¹⁵ Rehabilitation of corporations (perhaps through supervised probation) is unusual in U.S. federal criminal sentencing, but changes in corporate governance often follow convictions.¹⁶ Debarment of firms is also an uncommon feature of criminal sentencing, except in the case of bids for federal contracts. Because antitrust damages are closely related to the illegal gains of effective cartels, optimally deterring fines serve retribution. Finally, the predictability of cartel fines is important to corporate defendants for financial planning reasons. Besides developing a subjective notion of the maximum fine it faces, if penalty decisions drag on for long enough, a defendant must decide on how large a contingency fund to create in its financial statements. It appears that in recent years, corporate cartelists have set aside too little in anticipation of cartel fines.¹⁷

Organization

The rest of this paper is organized as follows. First, we briefly explain optimal deterrence theory in the context of price-fixing violations. Second, we describe the U.S. and EU competition laws and guidelines employed to ascertain a guilty firm's fine liability. Third, we survey the thin

¹⁵ The DOJ also permits installment payments on fines to avoid bankruptcy.

¹⁶ Some civil settlements by shareholders include agreements on changes in governance.

¹⁷ Examples include LAN Airways and Sasol. In the 3rd quarter of 2008, LAN Airways of Chile set aside a reserve of \$50 million for possible antitrust penalties for its participation in the global *Air Cargo* cartel (LAN 2008). However, LAN was assessed \$99 million in US fines alone in 2009, and it is facing much more liability for other governments' fines and private damages. Sasol's management was taken completely by surprise by the huge cartel fine (\$423 million or 86% of the company's cash reserves) imposed by the EC in 2008 for which they apparently made no prior financial provisions; investors were furious at the management, who blamed rogue employees (Njobeni 2008). When a corporation ends up paying a larger fine than the amount set aside in advance of an antitrust authority's decision, this market information tends to have a negative effect on a firm's stock-market price.

economic literature on formal empirical studies that explain variation in corporate cartel fines. Fourth, we discuss the data sources and sample. Fifth, we lay out our behavioral model, variables and hypotheses. Sixth, we explain in detail the results of the regression analysis. Finally, there is a short discussion of the implications of the estimation results for public policy.

OPTIMAL CORPORATE PENALTIES

The foundation of modern cartel fining rules is the law-and-economics theory optimal deterrence. Although providing certain ideal guidelines, U.S. laws and prosecutorial practices also influence the imposition of fines. The USSGs incorporate proxies for culpability factors that are difficult to observe or quantify. Moreover, the settlement of nearly all modern cartel cases takes place in the context of plea bargaining, which is an unobservable process subject to a great deal of case-by-case variation in outcome. Finally, after ascertaining a subjectively acceptable fine, DOJ prosecutors may discover that a defendant is unable to pay such a high amount.

Although Bentham and other classical economists wrote about the economic rationality of crime, modern interest dates from a seminal paper by Becker (Ehrlich 1987, Becker 1968). This approach assumes that offenders respond to incentives. They are utility maximizers who optimally allocate their time among competing legal and illegal activities. The decision to engage in crime is rational: a weighting of the expected marginal benefits of alternative activities, the perceived probability of apprehension and conviction, and the expected marginal penalties imposed for various crimes. For a survey of the economics of crime and formal proofs of these propositions, see Garoupa (1997) or Polinsky and Shavell (1979, 2000). Connor and Lande (2005) have a brief summary of these principles.

In the context of cartels, the decision to form a new cartel or to enter an existing cartel is *positively* related to the gain (anticipated monopoly profits) or harm (damages to victims) and is *negatively* related to the probability of detection (p) and expected severity of penalties ($E(F)$). In its simplest form, an optimal fine is $F^* = \text{HARM}/p$. HARM is the transfer of income from customers to owners of the cartel as a result of collusion; it is the monopoly gain. Penalties for corporations include fines, private settlements, debarment, and loss of reputation.¹⁸ One

¹⁸ Becker's (1968) original model assumed that a crime was committed by a single utility maximizer, which could well describe an owner-managed small business. However, most modern cartels are populated by large businesses with a cadre of professional top managers who do not have financial control of the company. If principal-agent problems exist, optimal corporate sanctions may still exist under some situations (Cohen 1996: 400-401). For

principle of optimal deterrence is that all types of monetary (or monetary-equivalent) sanctions are fungible. Thus, fines will be rationally lower when prosecutors or judges have knowledge or expectations that a defendant will pay extra-jurisdictional fine or civil penalties (OTHPEN).¹⁹ The first-order conditions for optimal deterrence of crime are summarized in Equation [1]:

$$F^* = (\text{HARM}/p) - \text{OTHPEN}. \quad [1]$$

The *perceived* probability of detection of a single firm is probably unmeasurable in natural markets, but prosecutors could develop some notion of the extent to which a cartel attempted to remain clandestine and elevate the negotiated fine as a result.²⁰ Monetary penalties are measurable, but what is available is *ex post* rather than the ideal *ex ante* penalties. Actual penalties are a good surrogate for expected penalties if criminals are risk-neutral and can correctly anticipate the size and probability of punishments. However, some legal theorists believe that the managers of cartels exhibit risk-loving behavior or “overconfidence bias” (Wils 2006). That is, potential offenders have a tendency to overestimate expected cartel profits and underestimate the probability of detection and conviction. When this happens, the optimal fine F^* is higher than F^* under risk neutrality.

ANTI-CARTEL LAWS AND FINING POLICIES

This section describes the legal basis for antitrust enforcement, the sanctions that can be imposed on cartels, and reasons for successful prosecution in the world’s two most active antitrust jurisdictions: the United States and the EU.²¹

example, in many countries, employers may pay for an employee’s personal fine. Under other conditions, a combination of corporate monetary penalties and executive incarceration may be optimal.

¹⁹ The majority of private civil suits are resolved well after criminal fines are imposed, but these suits tend to be filed within a month or two from the time a formal investigation begins or the first guilty pleas are made public. In addition, counsel for private plaintiffs often inform prosecutors of evidence in their possession. Thus, prosecutors typically have concurrent knowledge of actual or planned private suits and claimed damages.

²⁰ Cooperation after amnesty or during plea bargaining requires defendants to divulge evidence of destruction of meeting agendas, minutes, travel records, or other cover-up conduct. Since at least the mid 1990s, virtually all cartel defendants have had to offer full cooperation as a term in their plea agreements. While one might expect a relationship, Cohen (1996: Table 5) finds no evidence that cover-up conduct or a defendant’s cooperation was related to U.S. corporate sentencing.

²¹ A working paper authored by OECD economist Hoj (2007: 13-16) confirms the leading status of these jurisdictions in overall competition-law enforcement.

The United States

“Naked” cartels, those arranged through direct explicit communications between independent firms, are *per se* violations of U.S. law; no amount of evidence concerning circumstances in the industry or effects of the agreement on markets will be considered evidentiary in determining guilt (Hovenkamp 1999). More than 90% of detected conspiracies are serious enough and the evidence of intent strong enough that corporations and individuals will be charged by the Antitrust Division of the Department of Justice (“DOJ”) as a criminal matter.²² Unless an investigation is closed, nearly all indicted cartel participants agree to plead guilty.²³ Although the DOJ has a panoply of sanctions that can be imposed on guilty cartelists, by far the most common U.S. government sanctions are corporate fines, individual fines, and incarceration of responsible managers.

In general, the DOJ’s notable success in prosecuting international cartels after 1995 may be traced to several amendments to the law and improved investigatory techniques (Connor 2007b, Baker 2001, Werden 2009). The Sherman Act’s maximum criminal penalties were steadily increased by amendments in 1955, 1974, 1987, 1990, and 2004 (Connor 2007b). Before 1974, criminal price fixing was a misdemeanor under the law. In 1974, cartel conduct was made a *felony*, and prison sentences for individuals were raised from a maximum of one year to three years. From 1974 to 2004, the maximum corporate liability from government fines rose from \$50,000 to either \$100,000,000 or double a cartel’s illegal gains.

Around 1993 an enforcement policy shift took place in the DOJ that placed a higher priority on investigating international antitrust violations and that instructed the FBI to employ all the tools of their trade to collect evidence. The 1993 revision of the DOJ Corporate Leniency Program described below was a particularly important investigative innovation. In addition, the DOJ has introduced a number of methods of cooperating with other jurisdictions (ICPAC 2000, Pate 2003). Protocols and treaties permit sharing of information on cartel investigations or enforcement actions, subject to restrictions set by national laws on confidentiality. Regular international meetings of enforcement officials have fostered the exchange of effective investigatory techniques (ICN 2007).

²² This practice goes back to at least the 1940s.

²³ About 95% of all formal investigations of international cartels opened by the DOJ end in guilty pleas by at least one company (Connor and Helmers 2006). Typically this process takes less than six months. Convictions of companies at trial are rare – less than one per year -- but one or two trials of individual managers of cartels do occur each year.

U.S. Sentencing Laws

Since 1987, corporate cartel fines begin with applying the Federal Sentencing Guidelines (USSGs) to the particular defendant's antitrust offense.²⁴ First, a 10% overcharge is assumed to average 10%. To allow for the deadweight losses, a base fine is calculated by finding 20% of the company's sales of the cartelized product during the conspiracy; in principle the affected commerce could be global in scope, but in practice only U.S. sales are used (Connor and Lande 2005). Second, a pair of culpability multipliers is determined by reference to tabulated values in the Guidelines. Various aggravating factors raise the multipliers (size of company, whether bid rigging was alleged, involvement of top officers, a previous conviction for a similar offense, etc.), while mitigating factors lower them (cooperation with the DOJ's investigation, acceptance of responsibility, and the existence of a good antitrust training program). The highest possible multiplier is 4.0, and the lowest is 0.75, which means that a company can be fined as much as 80% of affected commerce. The result of these exercises is a guidelines range that the DOJ must present in writing to a Court.²⁵ Third, in return for cooperation, a company will usually receive a downward departure recommendation from the bottom of the range. In practice, the cooperation discounts for international cartels typically range from 40 to 90% of the maximum fine specified by the Guidelines (Connor 2008: 360-375).

Leniency, Plea Bargaining, and Cooperation Discounts

Corporate leniency programs are intended to increase the proportion of clandestine cartels that are discovered by antitrust authorities. Before leniency programs were implemented, the probability of discovery was estimated to be only about 15% (Bosch and Eckard 1991).²⁶ The DOJ's 1993 revised Corporate Leniency Program offers immunity from prosecution for only the first member of a cartel that applies and that meets a few criteria (Miller 2009).²⁷ Because applicants know those objective conditions in advance, acceptance by the DOJ into the Program is not discretionary – it is “automatic.” Leniency applicants that are accepted into the program

²⁴ Similar guidelines were developed and publicly promulgated in early 1977 for use within the DOJ (Werden 2009: 3)

²⁵ From 1987 to early 2005, the Guidelines were mandatory; since then they have been advisory. A second statute is permitted to be used for sentencing. From the time that hard-core price fixing became a felony crime in 1974, courts were given the latitude to apply an “alternative fine statute,” namely, 18USC §3571. The maximum fine is double the firm's harm created. The courts are instructed to apply whichever statute results in the largest fine. In practice both laws are cited in sentencing, but nearly all fines are based on the USSGs.

²⁶ Connor (2007d) finds 20 other published studies that either estimate or adopt for illustrative purposes probabilities in the 10% to 33% range.

²⁷ The main criteria are that the applicant must not be the initiator or “ringleader” of the cartel and that the application must either be made before the DOJ has begun an investigation of the cartel (Type A Leniency) or before the DOJ has sufficient information to sustain a conviction (Type B Leniency) [see <http://www.usdoj.gov/atr/public/guidelines/0091.htm>]. The main reason for the success of the 1993 revisions is that applicants can almost always be assured in advance that if they were the first, they will qualify.

receive *full leniency*, i.e., a 100% reduction in the criminal fine that they would otherwise have had to pay.²⁸ More importantly, all corporate officers of the leniency awardee will also be immune from fines and incarceration. Detection of cartels by the DOJ since 1993 has increased by about 60% according to a new study by Miller (2009); the probability of cartel discovery by the DOJ rose to 21% to 27.5% after 1993.

Less well known is the fact that the DOJ has a policy of *partial leniency*, i.e., negotiated promises of fine reductions of less than 100% in return for a signed guilty plea agreement.²⁹ In the past 20 years, nearly all corporate price fixers have been convicted through guilty-plea agreements.³⁰ This long-standing policy of negotiating downward departures³¹ from mandatory or suggested fines is followed in order to persuade alleged violators to plead guilty and for prosecutors to obtain additional inculpatory information about the cartel. A guilty plea agreement, when approved by a federal court, is classified as a criminal prosecution. Nearly all of the hundreds of cartel convictions in the United States have been secured through guilty pleas that are the result of plea negotiations (Hammond 2006: 1).³² The DOJ's recommended downward departures on cartel fines are almost always accepted after brief, *pro forma* judicial hearings.

²⁸ Since 2004, the awardee pays at most single private damages.

²⁹ Others refer to partial leniency as “alternative amnesty” or “post-investigation leniency” (Harding and Joshua 2003: 214). DOJ officials often speak about “rewards” for second-in cooperating firms. We prefer the term partial leniency fine discounts because “rewards” includes non-fine benefits and because the DOJ’s “Amnesty Plus” program is also post-investigation. In a recent interview concerning leniency policies generally, the EU Competition Commissioner in her fourth year in the job stated her belief that the DOJ had no policy for partial leniency (“...after all, the U.S. provides comfort only to the first company to report a cartel and provide evidence.” (Kroes 2008: 53)).

³⁰ One or two trials of *individuals* indicted for criminal price fixing are seen each year, but the authors are aware of only one *corporate* trial since 1995 (Mitsubishi in *Graphite Electrodes*).

³¹ In this paper, a “downward departure” refers to any one of the many possible monetary rewards that can affect the calculations of corporate criminal fines in ways that are favorable to defendants. The practice is also termed a “substantial assistance departure” or a “cooperation discount” (Hammond 2006: 14). These practices include shaving time from the true conspiracy period, reducing the scope of products known to have been cartelized, keeping the number of counts to a smaller number than the maximum possible, and offering a cooperation discount from the maximum specified by the Guidelines. It is not just the percentage reduction that is at issue, but also whether the discount will be applied to the upper end of the Guidelines’ range or -- more advantageously for defendants -- in the middle or at the lower end.

³² Connor (2008) finds that 314 companies were charged and 271 paid fines for criminal price fixing from 1995 to 2007. Yet, excluding four or five small family-operated firms, *only two* large corporations were convicted at trial for price fixing since 1994 – Mrs. Baird’s Bakery in 1996 and Mitsubishi in 2001. An official submission by the United States to the OECD says that “...over the last twenty years, over 90 percent of the corporate defendants charged with [a criminal] antitrust offense have entered into plea agreements...” (OECD 2008: 149).

The most common type of sentencing agreement is binding upon the court (OECD 2008: 156). That is, judges rarely question the negotiated plea agreements, and defendants know this.³³

The effectiveness of full leniency programs depends on having balanced partial leniency policies. Immunity from prosecution will be attractive to cartelists only if the failure to be first to win the “race to the courthouse door” results in painfully higher penalties. As Harding and Joshua (2003: 216) put it, the message to would-be leniency applicants must be “cooperate or else – remember it hurts to come in second.” Discounts for cooperation are normally granted after one member of a cartel qualifies for Immunity. Partial leniency discounts should not be too high or too low. Inadequate discounting might overwhelm DOJ resources available for trials. However, excessive discounting could contribute to under deterrence and undermine amnesty programs.³⁴ In the extreme, if all leniency applicants can reasonably expect to receive discounts close to 100%, there is little advantage to be had by being the first to apply. Habitual discounting of 50%, 60%, or higher might also undermines the effectiveness of leniency programs, simply to a lesser degree.

“Cooperation” or “assistance” is the principal justification for a partial leniency program, even where one firm has already agreed to cooperate under full leniency. Cooperation is in essence the divulging of secret information about the cartel’s collusive conduct. In particular it refers to testimony or documents held by one member of a cartel and divulged about other members (Spratling 1999: 4-9).³⁵ Cooperation after guilty pleas benefits prosecutors by assembling testimony (eyewitness accounts of meetings and communications among the conspirators), written documents (such as memoranda of meetings or scorecards), other indisputable records (telephone logs, travel receipts, and the like), and electronic recordings³⁶ of cartel activity – all of which would add up to an airtight case against all the defendants should the case go to trial. In a criminal antitrust system, prosecutors have many reasons to prefer resolving convictions through guilty-plea negotiations to a trial. Trials can take years of preparation and months of

³³ Connor (2007a) notes only one case in which a supervising judge challenged the DOJ. A DOJ-authored report confirms that only one instance of judicial refusal occurred between 1997 and 2007 (OECD 2008: 156-157).

³⁴ Preparation, court time, and appeals can easily exceed 20 or 30 person-years. Perhaps as a result, the number of corporate cartel cases resolved by trials is extremely limited.

³⁵ Cooperation discounts under this section of the USSGs do not apply to self-incriminating facts. “Self-reporting, cooperation, and acceptance of responsibility” are mitigating circumstances rewarded by reductions in the defendant’s culpability score under §8C2.5(g) of the Guidelines.

³⁶ Individual participants employed by an amnesty applicant may be required to make secret, consensual tape recordings during a face-to-face cartel meeting.

courtroom time. Often prosecutors face defendants' legal-economic teams that are many times larger, better financed, and more experienced.³⁷

Spratling (2000, 2001) was among the first to explain the DOJ's second-firm fining policy. He asserts that there are many factors used to determine downward departures and that these are "not subject to precise calculation." Factors used by the DOJ to place a monetary value on the size of a downward departure include: Delay in guilty-plea cooperation, rank of the firm in the queue of cooperating firms, number of firms in the cartel, significance of the information provided, length of the conspiracy, use of coercive tactics, brazenness of top management, tolerance of collusion by top management, and size of the overcharge.

The European Union

The European Commission's Directorate General for Competition (DG-COMP) is one of the world's two most powerful and effective antitrust authorities (Hoj 2007, Connor 2006). While differences remain in other areas of competition law, in their treatment of cartels the U.S. DOJ and Europe's EC appear to have undergone a substantial convergence (Baker 2007). EU law moved away from requiring a market-effects test to punish cartels to a legal theory that merely depends on proving that a conspiracy existed (Joshua 2004).³⁸ Thus, by the late 1980s the EC had adopted, with the blessing of the European courts, what is essentially a *per se* rule of illegality for hard-core cartel conduct. This burden of proof is a lighter one for EC prosecutors than having to prove market effects.

Another notable step forward in EU anticartel enforcement was the adoption of "dawn raids" to gather evidence about illegal price-fixing conduct and interview company employees. Although empowered by Article 14 of Council Regulation 17/62, the first dawn raid in the EU occurred in 1979 (Harding and Joshua 2003: 165). Dawn raids became standard operating procedure in the 1980s. The element of surprise helped solve the problem of concealment and destruction of written evidence of a secret conspiracy. In 2001, the ability to search was extended to places other than business offices. Fines can be levied for obstruction in these inspections. Now the EC has powers of investigation that are almost as powerful as the grand jury system employed by DOJ prosecutors in alleged criminal matters.

³⁷ In late 1994, the DOJ's prosecution of General Electric and DeBeers Consolidated for price fixing in the global market for industrial diamonds was dismissed after the prosecution presented its case. Commentary cited the overwhelming legal resources of General Electric relative to the Government's resources as a major factor in this defeat (Connor 2007a: 75).

³⁸ The linking in court decision of illegal collusion in the U.S. Sherman Act with the ancient common law crime of conspiracy was completed in the first three decades of the Act. Under Article 81 agreements that have either the effect or *object* of distorting competition are prohibited; thus proof requires only evidence of intent (Motta 2009: 109).

The EU first adopted detailed *Penalty Guidelines* in 1998 for calculating firm-by-firm cartel fines, though they may be regarded as written notices of unwritten practices of the early 1990s (Harding and Joshua 2003: 240-252, Wils 1998). Under the 1998 Guidelines, the EC first considers the “gravity” of the offense. Although a matter of discretion, cartels are usually placed in the “very serious” category, which is the highest of three levels of antitrust infringements. Cartels with large damages that are geographically widespread add to the gravity. Although the goal is for companies in very serious infringements is the end up with a fine above €20 million, the *starting point* is vague and discretionary (Joshua and Camesasca 2004). Maks *et al.* (2005) noted the perverse effect this method has on small, specialized companies. Second, to account for disparities in the power of fines to deter, relatively large companies are fined more than smaller participants, but the size groupings vary in number and in effect on the fine multiple. This step was increasingly used to introduce proportionality among the members of the cartel (Wils 2006: 17). Third, fines are increased by 10 percentage points per year for each year the cartel is effective (except up to 50% for 1 to 5 years’ duration). Fourth, these three factors result in a base fine (called a “basic amount”) for each company that is then adjusted for culpability. Aggravating factors (recidivism,³⁹ leadership, lack of cooperation, etc.) and mitigating factors (passive participation, extensive cheating, negligence, etc.) result in unspecified premia or discounts, respectively. Fifth, under the EU’s 1996 Leniency Notice, violators are given 10% to 50% discretionary discounts, depending on their degrees of cooperation. Sixth, the 10% sales cap and inability to pay might result in reductions for a few violators.⁴⁰

The EC’s first Leniency Notice was in effect from July 1996 to February 2002. During those six years, the Commission received 80 applications for immunity or reductions in fines (i.e., partial leniency), or about one application per month (EC 2008). Slightly more than half were for immunity and the rest for partial leniency. However, by the end of 2002, only 16 final decisions were rendered as a result of immunity applications.⁴¹ This modest record led to the proclamation of a second Leniency Notice, which took effect in February 2002. The new program offered nearly automatic immunity for qualified applicants, much like the U.S. program. The improved program attracted much larger numbers of applicants.⁴² From 2002 to December 2007, 236 applications were received, or four per month, of which 124 were

³⁹ In practice, from 1998 to late 2006, the increase was 50% for each instance of recidivism in the EU alone.

⁴⁰ Motta (2008) argues forcefully that inability to pay is highly unlikely to arise in the context of EU cartel penalties because of the 10%-of-sales cap. And even if a firm were to exit the industry after being heavily fined, efficiency in the industry would be improved.

⁴¹ A few more decisions were made later that resulted from the 1996 Leniency Program, but still less than half of the immunity applications produced convictions.

⁴² In December 2006 the third Leniency Program came into force, but it was little changed from the Second Notice.

immunity applications. A higher proportion of immunity applications were granted under the new Notice than the previous one. In the years after the Notices were introduced, the number of EC cartel decisions with fines jumped: from 1.6 per year (1990-96), to 5.5 (1997-2003), to 7.8 (2004-08). Despite this favorable response, it is apparent that the Commission's cartel resources will be unable to turn all grants of immunity into final decisions.⁴³

In September 2006, revised EU fining guidelines were adopted (EC 2006b). The new Guidelines are expected to double average fines (Veljanovski 2007, 2009). Generally, the revised guidelines have been praised by scholars as more transparent, predictable, and a step forward toward optimally deterring fines (Camilli 2006, Motta 2008). In a departure for previous practice (but like the U.S. and Dutch Sentencing Guidelines), the new EC starting point is a percentage of the violator's affected EEA sales for the entire duration of the cartel, net of taxes (EC 2006b: §13-§17).⁴⁴ In the case of global cartels, the EC asserts a bold concept of extraterritoriality: a company's basic fine will be calculated as a percentage of global sales in the cartelized market (EC 2006b: §18). Relying on affected sales means that no duration adjustment is needed. For hard-core cartels the starting-point range is 15% to 30% of affected sales (EC 2006b: §19-§26). The percentage chosen for the starting point is affected by the nature of the violation, the cartel's market share, and the geographic scope of the cartel.⁴⁵ In addition, an amount of from 15% to 25% of affected sales will be added for hard-core cartels. Thus, for most hard-core cartels, the "basic amount" of the fine is 30% to 55% of EEA affected sales.

The basic amount can be increased up to 100% for *each* previous infringement of the EU's competition laws, a doubling of the previous percentage (EC 2006b: §28-§29).⁴⁶ Obstruction of an investigation, cartel leadership, and cartel instigation are additional aggravating factors. Mitigating circumstances include negligence, substantial cheating,⁴⁷ and conduct approved by

⁴³ There were 124 immunity applications received during 2002-07, of which 80 to 100 were granted. Not all cartel cases originate from leniency applications, and fewer than 60 cartel cases are likely to be decided from 2004 to 2011.

⁴⁴ More precisely, the violator's last full year of collusive sales will be multiplied by the number of years, where the years are rounded up to the nearest half year. As noted by Wils (2006: 15), the EC before 2006 had imposed cartel fines in the range of 2% to 9% of the violator's global sales for one year only, the last year of the cartel's life. Under the 2006 revisions, a fine for a single-line firm *starts at* 15% of its affected sales in the last year of collusion multiplied by the years of duration of the cartel; for a typical five-year duration, the basic fine could be from 45% to 150% of affected sales in the final year of collusion, which is an enormous increase for a specialized firm. For diversified firms, the new sales method could be lower than the previous method.

⁴⁵ One would think that the last two factors are already reflected in affected sales.

⁴⁶ The period of look-back for recidivism now extends to all adverse EC decisions; moreover, decisions of the Member States are now counted. The maximum 100% increase is multiplied for each occurrence of recidivism.

⁴⁷ Note that cheating creates more profits for a firm than rigidly adhering to the cartel agreement.

governments. No specific percentages are suggested for culpability adjustments to the basic amount. A special additional penalty may be added for large, diversified members of cartels or those for which the gain from collusion is known and is larger than the fine (EC 2006b: §30-§31). After culpability adjustments are made, there are three possible downward adjustments: the 10% sales cap, total or partial leniency discounts for cooperation with prosecutors, and inability to pay. Technically, both full immunity and partial leniency are handled under the 1998 or 2001 *Leniency Notices*, not the Guidelines themselves, but published decisions typically treat leniency simply as a penultimate step in the fine calculation.

A statistical study of every fully published cartel decision from 1998 to 2007⁴⁸ finds that adjustments for culpability on average raise the basic amount by 14% (Veljanovski 2009: Figure 2). Slightly more than half of the firms had their fines increased to achieve deterrence. Leniency rewards resulted in an average reduction of 36% from the pre-leniency fine (*ibid.*). About 26 (8.5%) of firms in the sample were granted full leniency and 156 (51%) more got partial cooperation discounts. Put another way, decided fines would have been 38% higher without leniency. Full leniency accounted for 39% and partial cooperation for 61% of the amount of fine reductions. Inability to pay was rarely invoked to adjust fines, but for 8% of the firms the 10% sales cap was invoked. In a parallel analysis, Veljanovski (2007) concludes that EU cartel fines under the 1998 Guidelines are not related to the harm caused, nor are they close to being optimally deterring.⁴⁹ Schinkel has a similar analysis that focuses on the size of the probability of detection implied by typical EC cartel fines; he too concludes that deterrence of discovered EU cartels is sub-optimal. However, Motta (2008) shows that under the new 2006 EC Guidelines, optimal and supra-optimal fines are possible.

As of May 2009, the EC had published full, public decisions on only three EU cartels: *International Moving and Storage Services* (Services de déménagements internationaux), *Professional Video Tape*, and *Flat Glass*.⁵⁰ None of them is global in scope. However, they give a glimpse into how more severe EC fines will be under the new 2006 Notice. In the first case, the average fine was 166% of EEA sales during the affected period, with a range from 1% to 746% for individual participants. In the second case, the average fine was 16.9% of EEA sales, with a range from 10% to 24%. In *Flat Glass* the average fine was 29% of affected sales, with a range of 15% to 55%. One global decision, in *Elevators*, produced an EU and world record fine of \$631

⁴⁸ All of the published decisions were made under the 1998 Notice. One of the first fully published decisions to be released (in early 2009) is *Flat Glass* [<http://ec.europa.eu/competition/antitrust/cases/decisions/39165/en.pdf>]. Unfortunately, it is heavily redacted.

⁴⁹ The author assumes that the overcharge is 20%, and that the probability of detection is 33%, which are strong and not completely satisfying ways to proceed.

⁵⁰ These are the only ones in English or French. For details, see the Appendix Table.

million on ThyssenKrupp. The new Guidelines resulted in dramatic fines relative to affected sales of 324%, and ThyssenKrupp's fine was 1850%, though it is not clear that the Commission followed its new procedures rigorously for ThyssenKrupp's fine.⁵¹ It is clear from these examples that the EC fine structure shifted strongly after late 2006.

Unlike North America, where the right to appeal is given up in plea agreements, most fined cartel members appeal their Commission decisions. Fully 99% of the value of the EC fines is contested in the European courts (Veljanovski 2009: 5). About 60% of the appeals are successful for violators, and the courts on average reduced the contested EC fine by 19%. In this paper we ignore appeals of EC fines.

Unlike the United States, EU law treats antitrust violations solely as civil infractions by business entities.⁵² Individual conspirators are not personally liable for monetary penalties or prison sentences (Connor 2007b). A handful of EU nations (UK, France, Ireland, Norway) have criminalized price fixing, and the EU seems to be moving slowly in that direction, but until 2008 instances of incarceration for antitrust crimes in Europe seem to be unknown (Harding and Joshua 2003: 258-262). In 2008, two managers of the global *Plastic Hose* cartel were shipped from detention in the United States to the UK, where they were sentenced to long prison terms. Some legal analysts have argued that criminalization of EU competition law is both feasible and desirable (Wils 2005). Others believe that criminalization is politically unlikely, but that a system of private rights of action combined with greater attention to fostering a culture of competition would better assist in cartel deterrence (Motta 2009).

Private Enforcement in the United States and the EU

The Sherman Act authorizes private suits by direct buyers for treble damages and reasonable legal costs in federal court (Hovenkamp 1999). Besanko and Sperber (1990) show that treble damages generally leads to positive welfare increases if the probability of conviction and the multiple of damages recovered is high enough. Since the late 1970s, the largest private cartel cases are initially organized as class actions and end with judicially approved negotiated settlements. Moreover, in about half of the states of the United States indirect purchasers can sue for damages; alternatively, indirect buyers of cartelized products can also receive compensation through suits initiated in federal court by state attorneys general.

⁵¹ The decision fails to multiply affected sales by the 15% to 30% range called for. Moreover, duration was handled as in the old guidelines, there was no added penalty for global price fixing, and no added penalty for firm size and diversification.

⁵² Besides the USA and Canada, eight other countries provide for criminal sanctions: Austria, Germany, France, Norway, Ireland, Slovakia, Japan, and South Korea (Hammond 2002). The UK criminalized antitrust in 2005.

By contrast, there is little or no tradition in the civil-law countries of Europe for private litigants to seek antitrust damages (Ashurst 2004).⁵³ However, substantial changes are afoot in the UK, Germany, Denmark, and France (Wiseman *et al.* 2007, Møllgaard 2007). In the UK, which liberalized its rules for launching private suits, at least 21 such actions against cartels have resulted in settlements for monetary damages in 2000-2005 (Rodger 2007). Moreover, in 2009 there were at least two private cartel suits going forward in courts in Germany. To avoid using class actions, a legal entity was created that purchased the rights to damages from injured customers; this company is the sole plaintiff. In June 2008, the EC announced that it will launch a path-breaking compensatory suit in a Belgian court for damages sustained by the Commission from bid rigging by the global *Elevators* cartel (White 2008). Renda *et al.* (2008) projected billions of Euros in welfare benefits for EU citizens from instituting a right of private actions in cartel cases. The common law countries of the EU (UK and Ireland) may have better developed legal systems in which claimants can seek damages, but the near absence of representative actions, legal contingency fees, and very small awards inhibit significant private compensatory actions in Europe. Courts may order restitution in Norway and some other EEA nations, but such orders are few and appear to be limited to governments as buyers.⁵⁴ Schinkel (2007: 25) estimates that were awards of actual single damages in cartel cases to be made, the deterrence impact of monetary penalties in the EC would roughly *double damages*.

PREVIOUS EMPIRICAL STUDIES

Surveys of the general crime-and-punishment literature note the paucity of quantitative empirical studies of the determinants of punishment, citing the lack of appropriate data and methodological problems as reasons for so few studies (Ehrlich 1987: 723). Veljanovski (2009) is the latest in a series of papers that explains the mechanics of fine setting under the EC Guidelines, with some analysis of the changes that have occurred. Girardin and Henry (2005) provide a categorical legal analysis of EC decisions, employing information from the decisions themselves. Schinkel (2007) gives useful summary statistics of EC cartel decisions and appeals to them with an aim to evaluate their deterrence power. Werden (2009) evaluates the need for individual penalties for cartel conduct in the EU, in part justified by the unacceptably large

⁵³ For brief reviews of private cartel suits in Asia and Latin America, see Connor (2008b, 2009a).

⁵⁴ On governments as buyers from cartels, see Connor (2009b).

optimal fines needed in the EU.⁵⁵ None of these studies seeks to assess quantitatively the determinants of EC fines using external economic information.

We have found three published sources that have some relevance in terms of the hypotheses and methods for the present paper. First, Cohen (1996) examines variation in the size⁵⁶ of U.S. corporate criminal penalties for a sample of up to 961 companies during 1984 -1990; a subsample of 285 observations has an estimate of harm.⁵⁷ He specifies a Tobit model with 21 independent variables, of which three are suggested by optimal deterrence theory: (1) a principal result is that the monetary value of harm to the market has the expected positive effect on both fines and total penalties;⁵⁸ (2) in the case of fines only, when a judge was aware of other noncriminal penalties, the fine was significantly reduced; and (3) the size and severity of penalties was unrelated to two proxies for the probability of detection (*ibid.* pp. 404-406). Based on suggestions from characteristics of the judicial system and prosecutorial practice, Cohen confirms four other statistically significant determinants of penalties: (1) trials produce far higher penalties than plea agreements; (2) antitrust violations result in higher penalties than corporate fraud, tax evasion, or other criminal acts; (3) large firms are penalized more than small; and (4) judges reduce fines when ability to pay is an issue.⁵⁹ Although the Cohen study is an important one with several fascinating results, it is of limited value as an antecedent for this paper because only 8% of his full sample consists of antitrust violators and few if any were members of international cartels.

Second, Bolotova and Connor (2008) analyze the determinants of variation in total monetary penalties imposed on international cartel that were sanctioned between 1990 and 2005. Note that unlike the previously mentioned studies, the latter one covers all types of antitrust

⁵⁵ Werden assumes that prices increase by 10% for six years, profits increase 57%, the but-for price is double marginal costs, the probability of detection is 0.25, the time value of money is 6%, and demand elasticity is -0.7. The optimal penalty is 200% of affected sales.

⁵⁶ Cohen (1996: 404) reports that estimation of models trying to explain the severity of sanctions (relative to harm) "failed." The median corporate fine was very low by modern cartel standards -- \$10,000 -- and was about 17% of the harm caused.

⁵⁷ Cohen's major statistical results for the latter sub-sample are reproduced in Table 4 below.

⁵⁸ Total penalties include U.S. government fines, restitution, and civil and administrative settlements. Cohen does not contemplate penalties imposed outside the United States. The dependant variables, harm, and other sanctions were converted to natural logs, which results in coefficients that are elasticities. The elasticity of harm on fines was 0.41 and on all penalties 0.71.

⁵⁹ Other plausible but insignificant determinants include time and ownership type of firm. Most of the variables mentioned in this sentence are qualitative (zero-one) measures.

sanctions worldwide and observes whole-cartel penalties. Bolotova and Connor's model [2], which derives from [1] above, is quite simple:

$$Sanction_i = \alpha + \beta*(Overcharge_i) + \gamma *AffectedSales_i + \pi*Duration_i + \vartheta_i + \varepsilon_i . \quad [2]$$

$Sanction_i$ is specified as either fines only or total penalties (both fines and compensation recovered by private parties) expressed in current U.S. dollars. The explanatory variables (for both types of sanctions) are: dollar or percentage damages to buyers ($Overcharge_i$), the volume of sales affected by cartel ($AffectedSales_i$), cartel duration ($Duration_i$), ϑ a set of control variables that capture differences among defendants or jurisdictions that affect computations of Sentencing Guidelines or policies on discounts from the Guidelines, and an error term (ε_i).

Bolotova and Connor's data set comprised 112 cartel penalties imposed on 56 international cartels by U.S., EU, Canadian, and other antitrust authorities or courts during 1991 - 2005. All monetary variables are highly positively skewed. While all the cartels were sanctioned somewhere, 31% of the possible fines and 21% of total penalties were zero. Estimated by means of a Tobit ML procedure, six determinants explained 64% of the variation in government fines and 33% of the variation in total penalties. That is, cartel fines are considerably more predictable than are private settlements.

Bolotova and Connor (2008: Table 4) find that affected sales are positively related to both fines and total penalties, as expected; that fines are larger for more durable cartels; that EU fines are significantly higher than those in the rest of the world, and that private settlements make total penalties significantly higher in North America compared to the EU. The only surprising result concerns the role of the dollar overcharge, which is *negatively* related to both fines and total sanctions; when replaced by the percentage overcharge, there is no relationship to penalties. These overcharge findings are contrary to optimal deterrence principles and do not support Cohen's (1996) findings.

Third, Connor and Miller (2009) examine the variation in U.S. DOJ corporate fines for global price fixing for the years 1995 to 2008. This study is the immediate antecedent of the present paper. The U.S. study draws a sample of 108 companies from the same data source, use similar methods, and attempt to test the same hypotheses suggested by optimal deterrence theory that are used in the present paper. Many of the propositions of optimal deterrence theory are upheld by the U.S. estimation results, which yield very good predictive power. Naturally, their model is developed with controls that are specific to the laws and practices specific to the U.S. antitrust tradition.

SAMPLING AND DATA DESCRIPTION

The sample of convicted global cartelists is drawn from an original data set, Private International Cartels (PIC), constructed by the first author of this paper.⁶⁰ PIC attempts to identify and collect information on the members, market characteristics, penalties, and other legal-economic dimensions of all international cartels discovered or convicted by any antitrust authority⁶¹ since about January 1990. By members is meant the names of the companies and their executives that were identified by prosecutors as participants in illegal hard-core price-fixing schemes. Every cartel has members resident or headquartered in two or more nations; *global* cartels operated in two or more continents. For a large proportion of the cartels we identified the revenues of the cartels during the collusive period (“affected sales”). Monetary sanctions include both government fines and the settlements reached in private damages suits. Finally, for a large minority of the cartels, PIC contains market price effects (the buyer overcharge) of these cartels. Details of data collection methods are in Connor and Helmers (2006).

At the end of 2008, PIC contained information on 516 formally investigated international cartels, of which 32 were eventually exonerated⁶² and about 100 were still under investigation. More than 6000 companies are implicated as perpetrators; about 2900 ultimate parents are known by name and location. A few facts: (1) the mean number of corporations per cartel is nine, but the number is highly skewed across cartels;⁶³ (2) median duration is 4.8 years and mean duration is 7.4 years; (3) two-thirds made industrial products, of which industrial intermediates were the majority; (4) almost half operated within Europe and 20% were global (and the latter also set prices in Europe).

⁶⁰ Published studies based upon earlier versions of the PIC data set include Bolotova and Connor (2008), Connor (2004, 2007a, 2007d, 2008, 2009a, and 2009b), Connor and Helmers (2006), and Connor and Miller (2009).

⁶¹ This term includes criminal law agencies like the DOJ, civil-administrative commissions like the EC, and national courts. “Discovery” is revealed by public evidence that a formal investigation of price fixing is underway (i.e., raids on alleged violators, reporting of an amnesty recipient, serving of subpoenas, or empanelling a grand jury). In some cases, the existence of a formal cartel investigation is only known when a decision is announced in press releases.

⁶² Investigations were closed without any announced sanctions, mostly because of insufficient evidence of a serious violation, and all private compensatory actions were dismissed.

⁶³ The large majority of cartels has six or fewer corporate members. Moreover, some participants in a given cartel were convicted by one jurisdiction while a different, usually partially overlapping set of firms were convicted by a second jurisdiction.

The sample employed in this paper comprises all but three of the 195 companies in 41 global cartels penalized by the European Commission for price fixing from 1990 to December 2008. The available data for three firms in one cartel (aluminum fluoride) is sparse, so these cases were deleted from the data set for purposes of this study. A summary of the sample of 192 convicted companies is given in Table 1. The two largest industries represented are chemicals (41% of the violators) and shipping (26%). Looking only at decisions after 1996, 53% of the cartelists were members of cartels that were discovered through immunity applications. Even though they are mentioned in EC decisions, we exclude immunized firms. Decisions on granting immunity applications are quite different from decisions on the sizes of fines for non-immunized members of cartels. We do not have market structure data on all the cartels, but for a large subsample these cartels controlled an average of 86% of supply in their markets; the typical firm controlled 19.8% of the cartelized market. Very few of the cartelists (less than 8%) were convicted for bid-rigging conduct. Only six of the violators were given extra penalties for recidivism that occurred under EU law, but this greatly underestimates actual recidivism in the sample. Looking at cartel convictions worldwide for the years 1990-2008, we note that the *vast majority* (73%) of the violators were recidivists and that they had participated in a mean of 6.4 illegal cartels. One firm, Total SA of France, has been condemned 26 times.

TABLE 1 HERE

Although the EC has condemned about 600 firms for cartel infringements during 1990-2008, our sample of 192 firms were assessed \$7.3 billion in fines, which is almost half of all EC fines. This shows that the members of global cartels have paid disproportionately higher EC fines than firms in punished intra-EU cartels. In part this difference is due to the fact that the EC came late to the practice of investigating global cartels. But it may also be explained by the extraordinary harmfulness of these cartels to the EU economy. For those 88 firms for which we have data on overcharges, *the mean overcharge is an extraordinary 62% of EU affected sales*; the median is 43%, which is about double the severity of overcharges for more than 100 EU cartels (Connor 2009c).

EMPIRICAL MODELS AND HYPOTHESES

Empirical Models

Optimal deterrence theory of crime suggests the following testable model:

$$ECF = \alpha + \beta \cdot HARM + \gamma \cdot (1/p) + \delta \cdot OTHPEN + \epsilon, \quad [3]$$

where ECF is the amount in current U.S. dollars of fines imposed on a corporate cartel participant by the EC, α is a constant term, HARM is the monetary value of the cartel's overcharges, p is the probability⁶⁴ of detection and conviction of various cartels (thus, $1/p$ is the *difficulty* of detection and conviction), OTHPEN is the actual size of monetary penalties imposed on the firm by other antitrust authorities or on the firm's convicted managers, and ϵ is a well behaving error term.

HARM is, of course, only a partial measure of the market injuries, but unless the elasticity of demand varies widely, the unmeasurable deadweight loss will be proportional to the measurable overcharge. Because direct estimates of damages are in fact rarely, if ever, employed by the EC to calculate recommended fines and because we have relatively few observations of HARM,⁶⁵ following Bolotova and Connor (2008) we will substitute the cartel's affected sales in the EU (AS_{EU}) as a proxy for HARM.

While $1/p$ cannot be directly measured, we will introduce proxies for the ability of cartels to cover up or to implement a punishment regime that discourages members from seeking amnesty. Cover-up may be assisted by the direct involvement of an organization such as an industry trade association or may take the form of destruction of evidence. Some of the proxies relate to the organizational features of the cartel. There are many suggestions from cartel theory (Jacquemin and Slade 1989, Grout and Sonderegger 2005) and from economists seeking empirical regularities in cartel detection (Harrington 2008). For example, cartels with many small firms are more likely to be unstable than those with few firms (Carlton and Perloff 2005: 127-144); Davies and Olczak (2008: 199) suggest that inequality of sizes among firms in a cartel makes punishment of defectors more likely than a cartel of more symmetric participants; bid rigging may be harder to discover than price- or quantity-fixing collusion; markets where cartels sell to many buyers tend to facilitate long-lived conspiracies; cartels with a large share of members from Europe or Asia may find clandestine agreements more compatible with their business cultures than firms from North America; and cartels with a large fringe are expected to be easier to detect than cartels with near monopolies over supply.

⁶⁴ One interpretation of p is that it is a subjective probability of apprehension and conviction by legal authorities developed through a *consensus of the collusive group*; another interpretation is that it is a consensus of the *business and expert legal communities* based on their observations of actual recent penalties, with perhaps some adjustment for trends in penalties. In both cases, expectations of the probabilities are formed by immediate past penalties imposed on comparable cartels.

⁶⁵ We have dollar and percentage estimate of cartel-wide damages in the EU for 20 of the 41 cartels (of which nine are vitamins cartels) and 91 of the 193 companies. In Table 1, one can see that the median EU overcharge is \$332 million and the world overcharge is \$862.5 million. For the 91 observations, the correlation between HARM and AS_{EU} is +0.54.

Optimal deterrence can be achieved by the sum total of several types of monetary penalties or non-monetary punishments that have monetary equivalency.⁶⁶ That is, expected fines imposed on these global cartels by other antitrust authorities (OTHF) are, dollar for dollar, perfect substitutes for ECF. Furthermore, the expected cost of private settlements (PVT) also deters cartel formation. Whether the number and severity of individual penalties affects ECF is an open question, though deterrence theory clearly suggests that they ought to substitute for ECF. OTHPEN is a vector of alternative penalties (OTHF, PVT) that ought to explain variation in ECF because EC prosecutors tend to have good notions of the size of all penalties at the time a plea is being negotiated. The Commission's administrative decision process tends to take three or four years to complete. As a result, EC prosecutors usually are aware of fines imposed by other governments and sometimes awards in private settlements.⁶⁷

As mentioned above, we will test an augmented model [4] that takes into account external constraints on the size of fines and the legal and prosecutorial conventions surrounding EC anticartel policies:

$$\text{ECF} = \alpha + \beta \cdot \text{HARM} + \gamma \cdot (1/p) + \delta \cdot \text{OTHPEN} + \lambda \cdot \text{CONTROLS} + \epsilon, \quad [4]$$

where CONTROLS is a vector of variables that capture variation in the degree of culpability of a defendant (not already reflected in HARM). We introduce variables that capture differences in market supply and demand characteristics through a fixed-effects approach and legal or institutional constraints on the EC's ability to set fines.⁶⁸ Industry dummies will crudely capture structural difference in demand. Duration of cartels, if independent of HARM or AS, is a factor that increases culpability under the EC fining guidelines. Bid rigging increases USSG culpability scores, but that criterion is unmentioned in the EC Guidelines.⁶⁹ Nevertheless, rigging tenders

⁶⁶ The most obvious example is prison sentences on executives of cartel members; the monetary equivalent is the sum of money an individual would pay to secure his freedom and reverse the stigma of conviction. Legal defense costs (including defendants' managerial time), which are rarely revealed, are penalties. Corporate debarment and reputational loss also have monetary equivalents. None of these are easy to measure.

⁶⁷ EC prosecutors have frequent contact with cartel prosecutors in other antitrust authorities, but most previous fines are well publicized by several competition-law bulletins. Receiving information on private suits is less likely, because settlements often take several years to resolve, and opt-out settlements are not generally public information.

⁶⁸ Ability to pay sets an upper limit on fines. We have no measures on ability to pay, but might be able to develop a proxy from DOJ sentencing memoranda, namely, whether a fine was paid in installments.

⁶⁹ We examine bid rigging primarily because of cartel-theory considerations and its relationship to the probability of deterrence. A reasonably thorough search failed to turn up any scholarly discussions of bid rigging as a culpability factor in EU competition law or enforcement.

offered by government agencies in the EU may be treated with greater severity by the EC than when private firms are buyers.⁷⁰

Hypotheses

Harm

As predicted by the economic theory of crime, optimal cartel sanctions are a positive function of a defendant's overcharge (HARM). Therefore, we hypothesize⁷¹ that $\beta > 0$. Furthermore, the magnitude of the estimated coefficient for β is meaningful. If ECF performs only a compensatory function, then β is approximately equal to one. If EC sanctions additionally perform a deterrent function, then the magnitude of β is optimally greater than one. When HARM is represented by AS, the absolute value of β will tend to be smaller, because most cartels have historically generated overcharges that are well below 100% of affected sales (Connor 2007b). We also expect that AS_{EU} will be more strongly related to ECF than AS_{WORLD} because the U.S. Sentencing Guidelines require the base fine to be computed using AS_{EU} . However, the two measures of affected sales are highly correlated.

Probability of Detection and Conviction

We expect that optimal fines to be inversely related to p , the probability of detection and conviction of a cartel. The sign of γ will be *positive* when the chances of cartel detection are low, the costs of detection are high for buyers or prosecutors, or difficulties of prosecution are high. Six variables are designed to capture variation in cartel structures that proxy the chances a cartel will be discovered by buyers or antitrust authorities. Public bid rigging is harder to detect because with open-record laws, monitoring cheating is easier for cartel members because public agencies typically reveal all the bids after they are opened. Moreover, government workers are alleged to be inept at detecting collusion compared with procurement specialists with firms in the private sector.⁷² Cartels that engage in bid rigging ($BIDRIG=1$) and

⁷⁰ Connor (2009a) shows the striking tendency of governments everywhere to impose higher fines (relative to affected sales) on bid-rigging against governments than on bid rigging against private buyers. He identifies a theory that might explain this empirical tendency.

⁷¹ These are alternative hypotheses.

⁷² There is a large body of writings in the branch of economics known as Public Choice that critically examines the assumption of neutrality of politicians and civil servants that is common in the economics of taxation and spending (Tullock 1987). Tullock refers to this topic as the "Theory of Bureaucracy." The main hypotheses are that civil servants cannot always be counted on to reflect the priorities of their duly elected managers, and that they make decisions that serve their self interests (job security, promotion, aggrandizement of authority, and perks). Similarly,

cartels that sell to government buyers are somewhat correlated conceptually, but at least one of them should be positively related to the optimal ECF.⁷³ When a cartel has a dominant member (LEADER = 1), cartels are likely to be more stable and harder for the authorities to catch. Thus, when these three determinants take on high values, optimal fines are higher and γ will be positive. On the other hand, large-membership cartels (N is high) and are expected to be more discoverable because they are more fragile, which suggests a negative sign for γ .

Leniency programs are believed to affect the stability of on-going cartels (Spagnolo 2008). Although under some conditions, the implementation of corporate leniency programs may stabilize cartels, under most conditions the net effect is to make them more fragile. If they encourage defections, then detection is made easier and more likely for antitrust authorities and prosecution made easier as well, which suggest a negative value for γ in Equation [4]. To test for the effect of leniency programs on EC fines, we define two leniency variables: AMNESTY1 for those decisions taken during the time that first EC Leniency Notice was in effect and AMNESTY2 for EC decisions made after the improved program came into force in late 2002 (EC 2006a). In our sample, 82% of the fined companies were in cartels where one of its members received immunity under one of the two Leniency Programs (Table 1). The two amnesty variables capture the impact on the fines on the *remaining non-immunized* members of the cartel that did not defect from the cartel.⁷⁴ Brenner (2005) finds that the 1996 EC program was ineffective, but Miller (2009) finds that the U.S. Leniency Program did increase rates of discovery after August 1993. The U.S. and EU Leniency Programs are complementary: amnesty applicants in global cartels typically apply for leniency simultaneously in several jurisdictions. In terms of EC cartel leniency applications, there was a notable surge in applications after the 2002 EC program came into force. Thus, on the basis of optimal deterrence considerations and empirical observations, we expect AMNESTY1 and AMNESTY2 to have negative effects on ECF, with the latter stronger than the former.

Other variables affect p through the costs and difficulties of prosecution after detection. For example, when a cartel has a record of conducting protracted plea negotiations, optimally deterring fines will be higher (γ will be positive). For example, consider a possible proxy for

government procurement agencies may become captives of rent-seeking by firms subject to antitrust enforcement.

⁷³ The two variables are also somewhat interrelated as well with MANYBUYERS because much bid rigging is directed at tenders issued by government agencies, which are monopsonies for particular contract proposals (i.e., low value of MANYBUYERS). If this is correct, the optimal ECF might decline when MANYBUYERS is high.

⁷⁴ That is, these variables do not signify a 100% reduction in the EC fine for a company, because all amnesty recipients are excluded from our sample. However, partial LENIENCY *does* capture variation in discounts for cooperation for applicants to the EC's Leniency Program.

cover-up: the length of time the EC took to investigate a case (PROBE)⁷⁵; a lengthy probe may well signal that the defendants had destroyed or were slow to turn over the evidence needed to convict them. A long PROBE implies relatively greater effort was needed to convict, it is reasonable for prosecutors to impose higher penalties on firms that were particularly uncooperative during negotiations. Similarly, many bid-rigging cartels sell to government buyers, which raises the cost of prosecution because investigations of such cartels place the burden of proof on prosecutors to establish restitution (damages calculations) that is not needed for prosecution of most classic cartels. Thus, PROBE and BIDRIG are positively related to ECF. On the other hand, MANYBUYERS assists discovery because it is representative of the number of potential tips that may be generated, which in general reduces the costs of conviction. For this reason, MANYBUYERS is the one determinant with dual effects; the net effect on ECF depends on which if any of these effects dominates.

LENIENCY is a direct measure of the *partial* ECF discount given to a company that values the cooperation given by a company to the Commission. It is by construction negatively related to the final ECF (Veljanovski 2009). LENIENCY has a completely different interpretation from AMNESTY, because AMNESTY signals a discount of 100% awarded to *another* member of the cartel that was the first to qualify for (full) amnesty. LENIENCY might possibly signal a company that was insensitive to the impending collapse of its cartel – a firm that has less agile management – but in general we believe that it represents a firm's behind-the-scenes cooperation in its own prosecution.

We consider two measures of the impact of cartel recidivism on ECF. Recidivism makes detection harder because prior experience in organizing cartels can result in the adoption of more effective tactics to cover-up illegal conduct. The first measure is RECID_{EU}, which represents the percentage increase in ECF due to prior EU cartel convictions only. Second, RECID_{WORLD} is the total number of times up to December 2008 a particular firm has been a member of cartels discovered by *non-EC* antitrust authorities around the world between 1990 and 2008. Under its Guidelines, the EC takes into account only EC prior convictions, but its prosecutors may be more severe with violators with long records of recidivism outside the jurisdiction. Although a practice for years before, the EC made explicit its intention to fine recidivists more severely in its January 1998 Guidelines; under the revised EC Guidelines, starting in September 2006 the recidivism fine premium was raised to 50% to 100% for *each* EU prior conviction for price fixing. The expected marginal effect on ECF of both recidivism variables is positive, but the significance of RECID_{WORLD} is likely to be lower.

⁷⁵ PROBE has significant measurement errors caused by the secrecy that surrounds many EC investigations. In a minority of cases an investigation is revealed on the same day that the first cartel indictment is announced. More commonly, especially in global cartel cases, the start of an investigation becomes public when corporations reveal that EC raids occurred when prosecutors exercise search warrants or cooperating foreign antitrust authorities conduct simultaneous raids.

In sum, because of their influences on p , ECF is hypothesized to be *inversely* related to N , AMNESTY1, AMNESTY2, and LENIENCY, but *directly* related to PROBE, LEADER, BIDRIG, RECID_{WORLD}, and RECID_{EU}. The effect of MANYBUYERS is ambiguous.

Other Antitrust Penalties

Optimal deterrence regards all monetary penalties as fungible and, thus, optimal deterrence predicts that $\delta < 0$. That is, to the extent to which EC prosecutors are cognizant of investigations that have concluded or have a likelihood of resulting in additional fines imposed by other antitrust authorities (OTHF), ECF will be lower; most fines by the U.S. and Canadian authorities are made well before most EU fines. Similarly, if deterrence principles are followed, expected private penalties in North America (PVT) – many of them not completed or well publicized before EU fines are imposed -- they will lower the optimal ECF. We also construct and test OTHPEN, which is the sum of OTHF and PVT.

Until a 2006 ruling by the European Court of Justice, there was some uncertainty as to whether violators could claim reductions in their EU fines if they were also fined by the other jurisdictions (Buck and Tait 2006). The Commission took the view that fines in other jurisdictions were irrelevant in setting fines in the EU, and the Court upheld this position. Nevertheless, it is possible that the EC was more conservative in the size of fines for violators heavily fined in other jurisdictions. On the whole, we expect that OTHF, PVT, or OTHPEN will display non-positive effects on ECF, especially when OTHPEN is large and well publicized.

Time

There are three groups of control variables. Here we consider measures of time. As they overlap considerably, we intend to test each type sequentially and retain the temporal variables that best predict variation in ECF. First and most straightforward is the number of years after January 1990 that the cartel was convicted (T). Connor (2008) noted signs of increasing intolerance of international cartels over time in statements of EC officials, and this suggests that T will have a positive sign.

A second temporal measure models the effects on fines of the implementation of the EC's two notices on antitrust fining guidelines. The first EC Notice came into force in January 1999 and the second in September 2006 (EC 2006b); these dates correspond to the dummy variables GUIDELINES1 and GUIDELINES2. Observers say that the first Notice simply made transparent Commission practices that had been followed for years before (Harding and Joshua 2003).

However, the second guidelines are widely regarded as a symbolizing a significant increase in the severity of EC cartel fines; Veljanovski (2007: Table 7) shows that by applying the newer guidelines to companies fined in EC earlier decisions, on average fines would have more than doubled. Thus, while GUIDELINES1 may have only a weak nonnegative effect on ECF, GUIDELINES2 ought to have a larger positive coefficient. The 20% of the companies fined prior to 1999 serve as the reference group.

Our study period 1990-2008 spans three EC Commissioners: van Miert, Monti, and Kroes. Previous commentators have noted significant shifts in EU antitrust enforcement that accompanied a shift in Commission regimes (Schinkel 2007). Kroes and Monti are both perceived as more forceful than their predecessors. Thus, a second temporal variable uses the dummy variables MONTI (52% of the sample) and KROES (30%) for decisions rendered during their respective administrations. Decisions endorsed by earlier Competition Commissioners comprise a reference group. However, because the model already incorporates several other temporal variables (GUIDELINES 1 and 2, AMNESTY 1 and 2, LENIENCY, and time), MONTI and KROES represent rather intangible administrative effects on fines not already captured by cartel-detection and guidelines policies that these Commissioners themselves implemented. Consequently, we have no hypotheses regarding the signs of the coefficients of KROES and MONTI.

Industry Effects

Among the control variables are market or industry dummies. Although we cannot assign signs to their expected coefficients, the industry pattern of discovered cartels over wide swaths of history is to find cartels in markets for industrial intermediate materials with high barriers to entry; the organic chemicals industry is an exemplar. Our industry variables may also capture variation in elasticities of demand, a factor predicted by economic theory to account for the formation of cartels. A history of cooperative conduct may foster cartelization. Industries populated by firms that were in recent years⁷⁶ subject to government price regulations also seem likely to support more stable cartels; recently deregulated industries -- such as airlines, surface freight transportation, telecommunications, insurance, and banking -- have had a history of passive and cooperative pricing conjectures that may carry over into a deregulated industry regime. It is possible that the industry dummies may be proxies for the internal organization of the cartels in our sample, features beyond the scope of the present analysis. The intra-cartel methods and internal management structure for enforcing a cartel's agreement likely affect cartel effectiveness and, hence, its probable fine (Harrington 2006: 43-80).

⁷⁶ Deregulation of most of these sectors began in the United States in 1979 and was mostly complete by 1990. However, we are examining global cartels, and in much of the rest of the world, deregulation was contemporaneous with the 1990-2008 period that we analyze.

As a starting point, we identified seven broad industry groups: manufacturing of organic chemicals (ORGCHEM), other chemicals (OTHCHEM), rubber and plastic (RUBBER), graphite products (GRAPHITE), and metals (METALS). There is one service-sector industry, oceanic shipping conferences (SHIPPING).⁷⁷ The initial reference group of all other industries consists of miscellaneous manufacturing (mostly machinery and electrical equipment).

EC Penalty Guidelines Factors

There are several factors that the Commission weighs in deciding the degree of culpability of a cartel and its members. Even after controlling for the size of the affected market, cartel DURATION is hypothesized to be positively related to the size of cartel sanctions. As noted above in the discussion of cartel discounting, plea bargains often include a concession to a defendant on the dates of its collusion. In some cases, the EC shortens the cartel span because it lacks documentary or testimonial evidence on the beginning stages of a lengthy cartel. Often, other convictions, particularly in private rights of action in North America, find courts approving a settlement based on a significantly longer conspiracy period than revealed by EC decisions. As a result HARM or AS frequently may be understated when calculating ECF when DURATION is high.

CAP is a direct downward adjustment on a company's fine due to a Commission rule that fines must not exceed 10% of the firm's global (all products, all regions) sales in the year before the decision. There are 15 firms in our sample that got CAP reductions. It is a crude and oft-criticized way of accounting for a violator's ability to pay. Its coefficient will be negative by construction.

Finally, we assess the EC's oft-mentioned goal of proportionality across suspected cartelist by including two dummy variables for their "nationality." ASIA and NO AM test whether firms headquartered in Asia (26% of the sample) or in North America (5.7%) receive systematically higher or lower fines than firms headquartered in Europe (the reference group). If the EC in fact treats firms in a non-discriminatory fashion, the coefficients of ASIA and NO AM will not be significantly different from zero.

The definitions of our 32 independent variables in Model [5] and their associated hypotheses are summarized in Table 2.

TABLE 2 HERE

⁷⁷ The shipping cases are the earliest "global" cases in the sample. Each of them involved scheduled liner conferences that were permitted under an EU legal exemption to coordinate non-price conduct. They may be so different that they belong to a different population from the rest of the sample. We test for this below.

ESTIMATION RESULTS

Adjustments in Model Specification

To begin, we estimated Model [4] by ordinary least squares (OLS) based on the full set of explanatory variables described in Tables 1 and 2. As noted in the preceding section, we use the affected sales variables (AS_{EU} and AS_{WORLD}) as proxies for the associated HARM variables. Also, there were a substantial number of missing observations for two of the explanatory variables (LEADER and PVT), and the missing values were recoded as zeroes for estimation purposes.⁷⁸ Given the fitted regression model, we used Ramsey's RESET procedure (Wooldridge, 2009, page 303) to evaluate the model for specification errors. We rejected the null hypothesis (i.e., there are no missing nonlinearities in Model [4] at the 10% level), and the test results agree with the findings presented by Parker and Atkins (1999).

Next, as noted above, the monetary variables exhibited very high degrees of skewness. Following a similar decision by Cohen (1996), we specify a revised version of Model [3] that is logarithmic in the key monetary variables (e.g., ECF and HARM) and linear in the non-monetary control variables (e.g., count and dummy variables). Although we initially tried logarithmic transforms of the OTHF and PVT variables, we found that a quadratic specification was supported by the model diagnostic tests. The final form of the model is:

$$\text{LN}(\text{ECF}) = \alpha + \beta \cdot \text{LN}(\text{HARM}) + \gamma \cdot (1/p) + \delta_1 \cdot \text{OTHPEN} + \delta_2 \cdot \text{OTHPEN}^2 + \lambda \cdot \text{CONTROLS} + \varepsilon. \quad [5]$$

We then refined the fitted model by excluding 13 of the 32 explanatory variables that exhibited very limited statistical significance (HARM_{WORLD} , AS_{WORLD} , PROBE, LEADER, AMNESTY1, LENIENCY, MANYBUYERS, OTHF, PVT, GUIDELINES1, CAP, DURATION, and SHIPPING).⁷⁹ We also found that the variables in the OTHPEN vector (i.e., OTHF and PVT) were moderately correlated with the logarithms of the affected sales variables (AS_{EU} and AS_{WORLD}), and the resulting OLS estimates of both groups of parameters were not robust. To resolve this potential problem, we used linear and quadratic terms based on the sum of OTHF and PVT to form the final version of the regression model.

⁷⁸ There are several observations for which full European Commission decisions were not yet published, relative market shares of the participants obtained, or similarly rich accounts of the internal structure of the cartels could be found in press reports. The problem with PVT is that settlements typically take years to be resolved after a fine is imposed or that the parties wish to keep them confidential.

⁷⁹ Many of these excluded variables are collinear with one or more of the remaining independent variables. For example, HARM_{EU} , AS_{EU} , HARM_{WORLD} , and AS_{WORLD} are all closely intertwined. AS_{EU} and AS_{WORLD} are highly positively correlated, $r = +0.83$. Similarly, OTHPEN is (by construction) highly positively correlated with OTHF ($r = +0.73$) and with PVT ($r = +0.96$).

To evaluate the model specification, we repeated Ramsey's RESET procedure to test for the presence of unspecified nonlinearities and also conducted White's test for heteroskedasticity (Wooldridge 2009: 275). The test results reported at the bottom of Table 3 show that both null hypotheses were not rejected at the 10% level for the OLS model. That is, the null hypothesis of homoskedasticity cannot be rejected, and the null hypothesis of misspecification due to functional form cannot be rejected either. Although all of the recorded fines are positive, there are 14 observations between \$1,000 and \$10,000 which may be viewed as a lower censoring bound on the observed fines. Thus, the OLS estimator may be subject to bias under this censored regression. Although the magnitude of the potential bias may be limited because the censored observations only represent about 7% of the sample, we also computed the maximum likelihood (ML) Tobit estimates of Model [5]. The ML Tobit estimation results are reported in the rightmost columns of Table 3.

TABLE 3 HERE

Predictive Power of Model [5]

The OLS parameter estimates, t statistics, and associated p-values for the final version of Model [5] are presented in the first three columns of Table 3. The 19 independent variables that remain explain 68.1% of the variation in the natural log of ECF. This degree of goodness of fit is quite satisfactory, given the highly disaggregated nature of the data. Bolotova and Connor (2008: Table 4) are able to explain 64% of the variation in more aggregated total cartel fines, albeit with fewer independent variables. Our model predicts much better than the previous most comparable study by Cohen (1996).⁸⁰

From Table 3, we find that the OLS and Tobit parameter estimates generally exhibit similar degrees of statistical significance. Only one of the slope coefficients (KROES) has a different sign, and all of the estimated coefficients have similar magnitudes. The reported pseudo- R^2 statistic for the fitted Tobit model is not directly comparable to the OLS R^2 statistic, but the observed value indicates that the ML estimate provides reasonably good overall fit to the data. The standard deviation of the model errors (SIGMA) is directly estimated by the ML Tobit estimator, and this value (0.9943) is quite close to the corresponding estimate derived from the OLS residuals (0.9972). Although one cannot directly compare the OLS and Tobit parameter estimates, we note that the relative magnitudes of the estimates are very similar. Further, the average marginal effect for $\text{LN}(\text{AS}_{\text{EU}})$ in the Tobit model (0.2544) is reasonably close to the OLS

⁸⁰ Cohen's (1996) Tobit analysis has a pseudo R^2 of 0.093 (see Table 4). Our pseudo R^2 is 3.2 times higher with a model that has about the same number of independent variables of Cohen's model.

estimate of this marginal effect (0.2677). For these reason, we focus mainly on the OLS estimates of the marginal effects for purposes of interpreting the estimation results.

Optimal-Deterrence-Variables Results

First, the marginal effect of our proxy for HARM, $\text{LN}(\text{AS}_{\text{EU}})$, is positive at a conventional level of statistical significance or better, as expected. The double-log relationship among these variables implies that the estimate of β is an elasticity. Consequently, our model predicts that the dollar value of EC cartel fines increases by 2.7% as EC affected sales (AS_{EU}) increases by 10%. For the one-sided null hypothesis $H_0: \beta \geq 1$, the observed t test statistic equals -4.95. So, we reject the null hypothesis at any of the standard Type I error rates, and the elasticity of 0.27 strongly implies that the imposed fines are only partially compensatory in their function.⁸¹ From an *ex post* perspective, deterrence is not being served.

Second, there are five variables that we have argued are related to the odds of detecting or convicting cartels. Recall that optimal deterrence theory makes a strong prediction that γ is negative, i.e., optimally deterring criminal fines are higher when the *difficulty* of detection is high, and vice versa.⁸² The signs of the coefficients of all five detection variable support the optimal-deterrence theory hypotheses, though only three of the five are statistically significant. Bid rigging (often against governments) is often asserted to be more difficult to detect than classic price-fixing (typically against more expert corporate procurement specialists), and we find that the estimation results confirm that BIDRIG has a positive and highly significant effect on ECF in both models. Bid riggers get fines that are 87% higher than fines imposed on members of classic price cartels. The estimated coefficients for both recidivism variables, RECID_{EU} and $\text{RECID}_{\text{WORLD}}$, are positive and highly significant, as expected. The results indicate that the expected EC fine increases by roughly 131% if the added penalty under the revised Guidelines for prior EU recidivism increases by 50%.⁸³ Because the fine effect is far greater than 50%, EU recidivism is apparently associated with other aggravating characteristics that the

⁸¹ Cohen's (1996) regression analysis of corporate criminal fines computes an elasticity of 0.41 (Table 5). However, he had actual harm estimates available, which implies that his 0.41 is larger in its impact on fines than our 0.27 that is based on affected sales. In another of Cohen's models, one that includes all federal monetary penalties, the elasticity is 0.71. Cohen argues that these elasticities, though less than unity, do not imply suboptimal deterrence because of nonmonetary penalties, reputational losses, and other research that shows that shareholders do not benefit from corporate crime (*ibid.* p. 404).

⁸² Because optimal deterrence theory has such strong theoretical underpinnings (if one accepts the premise that criminal decisions are rational) and clear predictions, we will apply one-tail tests of significance to variables that are proxies for detection probability or other penalties. Regression coefficients for these variables will be interpreted as "strongly related" if the p-value exceeds 0.05 and "weakly significant" if the p-value is below 0.05 and above 0.10. Variable representing time or other controls will be interpreted with two-tail tests.

⁸³ The sample contains only six examples of this explicit penalty; the penalty was a 50% increase for five of them.

Commission builds into the final ECF. By contrast, though $RECID_{WORLD}$ is comparably statistically significant, the expected fine increases only about 2.9% for each instance the violator accumulates a *non-EC cartel conviction* during 1990-2008.⁸⁴ It is somewhat surprising that the Commission pays any attention to convictions outside its jurisdiction. The estimated coefficient for AMNESTY2 is not significantly negative under a one-sided test at the 10% level, and the estimate implies that the expected fine for the remaining non-immunized cartelists declines by about 20% if another firm in the cartel is granted amnesty. Thus, the remaining members of a cartel where one of the conspirators defected to EU authorities are awarded for the whistleblower's opportunism, relative to cartel participants discovered the old-fashioned way.⁸⁵ We also find that expected fines decline by about 1.9% as N, the number of companies in a cartel, increases by one, but this marginal effect is not statistically significant.

Third, the proxies for other antitrust penalties have unexpected effects on ECF. The OLS and Tobit estimates for OTHPEN and OTHPEN² are highly significantly positive and negative, respectively, under one-sided t tests at the 5% level.⁸⁶ The signs on the quadratic terms indicate that the impact of other penalties on ECF is increasing at a decreasing rate. The net positive impact on ECF occurs for values of OTHPEN between zero and \$604 million. For example, when non-EC fines or private settlements are at the average level (\$42 million), the EC fine is expected to increase by roughly 0.51% if the other penalties increase by \$1 million, *ceteris paribus*. The decline in this rate is relatively slow, and it only drops to roughly 0.17% per \$1 million increase when the other penalties are initially at the \$420 million level. When OTHPEN exceeds \$604 million, the impact on ECF turns negative, but this only applies to two of the cases in this data set (Hoffmann LaRoche in *Vitamin C* and *Vitamin E*). In short, the prosecutors of DG-COMP rigorously adhere to their stated policy of ignoring punishments outside of their jurisdiction, even though optimal deterrence would permit reductions of EC fines for such penalties.

Control-Variables Results

⁸⁴ To illustrate the impacts of the two recidivism factors, the average EU recidivist in our sample is penalized 135%, whereas the expected ECF is 18.4% higher for the average degree of non-EU recidivism.

⁸⁵ What may be happening here is when an amnesty recipient's cooperation with the Commission becomes known, the remaining members of the cartel realize the "the jig is up" and work hard to earn cooperation discounts. In cartels exposed by the EC itself or complaints from customers or other third parties, a belief that the Commission's evidence of wrongdoing is sketchy, encourages cartel members to withhold some of their information that might raise the ultimate antitrust penalties (such as the starting date of collusion, range of products included in the agreement, or other facts that will reduce AS_{EU}).

⁸⁶ OTHPEN by itself was uniformly positive, contrary to expectations, but the quadratic specification markedly improved the overall fit of model [5].

The four time-control variables exhibited some statistical significance and generally supported our hypotheses. The estimated coefficient for the TIME variable is weakly significantly positive under a one-sided test at the 10% level. The magnitude of the coefficient of TIME implies that the expected fine increased by roughly 8.4% for each additional year since 1990. Next, the estimated coefficient for the GUIDELINES2 dummy variable is positive (as expected) but not statistically significant at a conventional level; the magnitude implies that the expected fines increased by roughly 107% during the EC's Second Fining Guidelines regime (i.e., after September 1, 2006); note that this 107% is *in addition to* the 8.4%-per-year premium from time alone. Although there were no expectations concerning the residual effects⁸⁷ of the Kroes and Monti regimes, the estimated coefficients for these dummy variables are significantly negative for MONTI and insignificantly negative for KROES after controlling for the general time trend and the GUIDELINES2 effects. Although the direct "Kroes effect" (relative to van Miert and earlier commissioners) is not significantly different from zero, the indirect effects are significant in the model. In particular, Kroes is responsible for the revised EC Guidelines, which did boost EC fines, and she is the Commissioner with the highest values of TIME. Further, the insignificant but negative coefficient for KROES means that EC cartel decisions in the past few years are simply *on trend*. That is, high EC fines during Commissioner Kroes' administration are due to the nature of the cartels, enforcement trends already underway, and the more severe Guidelines she pushed through the Commission, rather than the force of her personality or administrative style *per se*.

We find mixed results from the other controls included in the model. The North American dummy variable (NO AM) has a significantly positive coefficient. EC fines are roughly 62% higher for firms headquartered in North America relative to firms with European headquarters. The Asian dummy variable coefficient is not significant but implies that the expected fines are roughly 21% lower for Asian-based firms relative to firms with European headquarters. Finally, the remaining industry dummy variables are all significant and positive, which implies that expected fines levied in these industries are higher than the reference group of companies in the shipping or miscellaneous manufacturing industries. Guilty companies in cartels that operated in the organic chemicals, graphite, and metals industries received especially severe sentences.

The shipping-industry dummy variable requires further attention. SHIPPING was insignificant, so there is no intercept shift in the model for this group of firms. However, as noted in footnote 77, the shipping cases all occurred in the early 1990s and may represent a different sample. Accordingly, the slope and intercept coefficients in the model may be different if this is true. For the subset of explanatory variables that are non-constant for firms in the shipping group (LN(AS), TIME, RECIDW, and ASIA), we add dummy-interaction terms with SHIPPING plus

⁸⁷ These are the effects not already captured by TIME, implementation of amnesty (by the Monti regime) and revised guidelines (by the Kroes administration), and all of the many deterrence-related cartel characteristics.

the SHIPPING dummy variable to the model, which allows both the relevant slope and intercept parameters to be different for firms in the shipping group. We then conduct an F test of the joint null hypothesis that the added slope and intercept coefficients are all equal to zero, which is a Chow-like test of structural differences between the shipping and non-shipping groups. The observed test statistic is $F = 0.73$ with p-value $p = 0.6033$, and we fail to reject the null hypothesis. Thus, the firms in the shipping group are not significantly different than the other firms in the sample.

DISCUSSION

Given levels of disaggregation of the data employed in this study, the overall fit of the models is quite satisfactory. In particular, the variables that measure predictions drawn from optimal deterrence theory of crime do very well in predicting⁸⁸ variation in the size of fines on corporations convicted of global price fixing by the EC. Given levels of disaggregation of the data employed in this study, the overall fit of our models is quite satisfactory. Together with several control variables, the OLS estimates explain 68% of the variation in fines.⁸⁹ The dollar value of fines imposed is positively related to the proxy for the economic injuries imposed on buyers by these cartels; the elasticity of EC fines with respect to affected sales is +0.27.⁹⁰ This elasticity is below the value of unity that would suggest *ex post* optimal deterrence. Fines are also related as hypothesized to six proxies that affect the probability of antitrust detection of cartels.

The one element of the optimal deterrence theory that does not hold up well in the EC is the idea that penalties imposed in jurisdictions outside the EU are good substitutes; rather, we find evidence that the EC piles on greater penalties on cartels when non-EC penalties are less than \$604 million. This result could reflect a belief on the part of EC competition officials that worldwide penalties on global cartels are sub-optimal, a view widely shared by economists who specialize in empirical cartel studies.

⁸⁸ Of the eight variables in Model [5] that measure deterrence-theory factors, six are highly significant and the other two have expected signs.

⁸⁹ The comparable U.S. study by Connor and Miller (2009) had an R^2 of 73%, whereas the fit of Cohen's (1996) model was less than one-third the present study.

⁹⁰ Recall that the mean ratio of overcharge to sales in a subsample is 0.62; thus, the elasticity of ECF to overcharges is about 0.44. In the United States, the elasticity for global cartels with respect to U.S. affected sales is +0.37 (Connor and Miller 2009). This suggests that the new EC Guidelines will likely increase this elasticity.

The estimation results suggest in most ways that the Commission follows the 1998 Fining Guidelines that governed most of the study period. Clearly, it calibrated its fines to AS_{EU} , its proxy for harm. Moreover, the EC did award companies reductions for partial leniency. However, we did not find that cartel duration, a lengthy investigation, or leadership within the cartel increased fines; neither did the 10% sales cap have a significant impact on fines, perhaps because it was applied to so few firms in the sample.

Perhaps more remarkable are significant factors about which the Guidelines are silent. First, though only weakly significant, we find that, *ceteris paribus*, EC cartel penalties are increasing by 8% per annum during 1990-2008; moreover, after the revised fining guidelines were implemented in September 2006, fines jumped another 107%.⁹¹ Taking into account these temporal changes, it still comes as a surprise that fines imposed during the Monti regime were much lower, *ceteris paribus*, than in previous competition-commissioner regimes. Second, another fairly surprising result is that North American cartelists receive systematically higher fines. We are uncertain whether EC officials are consciously departing from proportionality; more likely, these firms may as a group exhibit some culpability factor that our model does not incorporate. Third, bid riggers receive higher penalties than members of classic price cartels, a factor that has not previously been noted. Fourth, DG-COMP habitually penalizes firms with a history of recidivism more heavily, both if these “bad boys” are extra-jurisdictional recidivists and if they are recidivists in the EU. Fourth, although consistent with optimal deterrence principles, EC fines for bid rigging are markedly higher than for classic price cartels. The United States Sentencing Guidelines explicitly sanction higher fines for bid rigging, but the EC Guidelines are silent about this aggravating factor.⁹² Finally, industry effects are very strong; firms in organic chemicals, graphite, and metals market conspiracies paid about triple the fines of the reference group.

The results reported in this paper exhibit mixed agreement with the findings reported in two comparable studies. First, Cohen’s (1996) pioneering study of U.S. non-antitrust criminal fines⁹³ agrees with our finding that the elasticity with respect to harm is less than one and with our

⁹¹ Although not in the Guidelines, recent Competition Commissioners have been outspoken in warning about increased fines. It is noteworthy that Veljanovski (2006a) predicted a similar increase from the language of the revised guidelines alone, before any fines were actually applied.

⁹² The U.S. rule was established on the erroneous belief that bid rigging generated relatively high percentage overcharges (Connor and Lande 2005). In Germany, bid rigging is treated more harshly than other types of price fixing (Vollmer 2006: 257-58).

⁹³ Cohen’s (1996) key estimation results are summarized in Table 4 below.

finding that cooperation during the government's investigation⁹⁴ is not a significant factor in explaining fines. However, in contrast to our findings, Cohen also reports that the fines tend to decline over time (i.e., 1984-1990) and they are monotonically decreasing as the other U.S. penalties increase. Second, Connor and Miller (2009)⁹⁵ find that the elasticity of U.S. fines with respect to affected sales for global cartels is 0.37, which is comparable to our estimate (0.27). Also, their estimated marginal impact of the number of firms in the cartel on the expected fine (-1.3%) is reasonably close to our estimate based on European data (-1.9%), and they find a quadratic (concave) relationship between the expected U.S. fines and other penalties. In contrast, for global cartelists fined by the United States, TIME and BIDRIG are not statistically significant. That is, while the EC is forging ahead in increasing fines, the DOJ experienced a slowdown during the Bush Administration; and ironically where U.S. fining guidelines require more severe fines for bid rigging, they are not imposed, whereas the EC guidelines do not mention higher fines for bid rigging, they are imposed. Another contrast concerns the U.S. fine premium for lengthy probes, while the EC pays no attention to that factor in determining fines

⁹⁴ The measures of cooperation differ. Cohen's dummy variable is one if firm-specific cooperation is mentioned in the judicial decision; our variable refers to the length of the EC probe, which we argue is a proxy inversely related to the cartel's degree of cooperation.

⁹⁵ Their estimation results are shown in Table 5 below.

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Table 1. EC Sanctions on Members of Global Cartels: Descriptive Statistics.						
Variable	Units	Mean	Median	Std. Dev.	Minimum	Maximum
Dependent variable:						
ECF	\$US million	37.77	11.6	79.06	0.001	631
Basis for Damages:						
HARM _{EU} *	\$US million	425.9	332	369.0	11	1200
HARM _{WORLD} *	\$US million	1236.6	862.5	1651.9	78	8400
AS _{EU}	\$US million	3129.5	1318	4014.8	10	12,250
AS _{WORLD}	\$US million	7889.2	2636	9471.6	24	34,661
Detection probability:						
PROBE	Years	2.66	2.70	2.09	0	6.46
BIDRIG	Dummy	0.078	0	0.269	0	1
LEADER*	Dummy	0.318	0	0.467	0	1
RECID _{WORLD}	Number	6.36	3	7.41	0	26
RECID _{EU}	Percent	1.61	0	9.04	0	60
AMNESTY1	Dummy	0.339	0	0.474	0	1
AMNESTY2	Dummy	0.479	0	0.501	0	1
LENIENCY	Percent	17.46	10	20.01	0	90
N (cartelists)	Number	8.94	8	4.63	2	17
MANYBUYERS	Dummy	0.760	1	0.428	0	1
Other Penalties:						
OTHF	\$US million	13.63	0	36.44	0	300
PVT	\$US million	28.48	0	90.09	0	794.9
OTHPEN	\$US million	42.12	0	115.19	0	942.2
Time Controls:						
TIME (T)	Years	12.70	15	5.09	2	18
KROES	Dummy	0.302	0	0.460	0	1
MONTI	Dummy	0.516	0	0.501	0	1
GUIDELINES1	Dummy	0.590	1	0.493	0	1
GUIDELINES2	Dummy	0.219	0	0.414	0	1
Other Controls:						
CAP	Percent	2.94	0	13.51	0	91.6
DURATION	Months	126.91	98	88.87	19	365
NO AM	Dummy	0.057	0	0.233	0	1
ASIA	Dummy	0.260	0	0.440	0	1

ORGCHEM	Dummy	0.281	0	0.451	0	1
OTHCHEM	Dummy	0.130	0	0.337	0	1
RUBBER	Dummy	0.031	0	0.174	0	1
GRAPHITE	Dummy	0.109	0	0.313	0	1
METALS	Dummy	0.042	0	0.200	0	1
SHIPPING	Dummy	0.260	0	0.440	0	1
Source: Global Cartel Fines spreadsheet dated 3/1/2009.						
*= Fewer than 100 observations.						

Table 2. Definitions and Expected Signs of Variables Explaining Variation in ECF		
Explanatory Variable	Definition, <i>Measurement</i>	Expected Sign
<i>Cartel Injuries:</i>		
HARM	Overcharge attained by cartel in the EU, a continuous variable, <i>measured in \$US million</i> (if not available, AS substituted)	+
AS _{EU}	The volume of EU market sales affected by cartel, a continuous variable, <i>measured in current \$US million</i>	+
AS _{WORLD}	The volume of global market sales affected by cartel, a continuous variable, <i>measured in current \$US million</i>	+
<i>Factors that affect detection probability ^a:</i>		
PROBE	Length of time from the date a formal investigation is launched (if known) to the date of the press release of the EC's decision, a proxy for the effort required to convict, <i>measured in years</i>	+
BIDRIG	=1 if bid-rigging cartel, a form of collusion easier to hide from buyers	+
LEADER	=1 if intra-cartel market shares are unequally distributed, i.e., cartel has a leader with at least a 30% cartel production share and usually 40%+; may make cartels more stable (harder to catch) because dominant firms are highly credible sources of punishment of defection in cartels.	+
RECID _{WORLD}	A count of the total number of times this company has been a member of cartels discovered by antitrust authorities anywhere in the world from 1990 through December 2008, <i>measured by the number of international cartels</i> .	+
RECID _{EU}	An alternative to the variable above for the EU only, <i>measured by the percentage increase in the EC fine due to prior EU cartel convictions</i> .	+
AMNESTY1	=1 if the EC granted <i>another</i> member of the cartel (not this company) full immunity (a 100% reduction in the EC Guidelines fine) under the EC's first Leniency Notice, 1996-Feb. 12, 2002	-
AMNESTY2	=1 if the EC granted <i>another</i> member of the cartel (not this company)	-

	full immunity (a 100% reduction in the EC Guidelines fine) under the EC's Second Leniency Notice, Feb. 13, 2002 to present	
AMNESTYO	=1 for the period of analysis during which the EC had no amnesty program, i.e., January 1990 to end of 2005.	Reference
LENIENCY	The size of the EC fine discount for a "Partial Leniency" award (ranges from 10% to 90%) for this company's cooperation and assistance in convicting other members of the cartel, <i>measured in percentage reduction</i>	-
N	Number of sellers in cartel; increases the probability of defection, the chance of effective cheating, and the likelihood that one member will apply for amnesty.	-
MANYBUYERS	=1 if cartel sells to more than 100 buyers; with dispersed buyers, individual transactions are more costly for a cartel to monitor, which makes cheating harder to detect for the other members of the cartel. On the other hand, a large number of buyers implies that there are many possible tipsters, which reduces prosecutors' costs of detection.	+/-*
Other Substitute Penalties:		
OTHFINE	Size of fines imposed on this company by a government antitrust authority outside the EU, most of them imposed earlier by the U.S. DOJ, <i>measured in current \$US million</i>	-
PVT	Size of settlements paid by this company (if known) or by this company's cartel in a private suits by direct or indirect purchasers in the United States or Canada (some prior to the EC's decision and some not yet announced), <i>measured in current \$US million</i>	-
OTHPEN	OTHPEN = OTHFINE + PVT and is also <i>measured in current \$US million</i>	-
Time Controls:		
TIME (T)	T may proxy greater overall severity of fines over time, <i>measured by the last two digits of the year after 1990 in which the cartel was fined by the EC</i>	+
KROES	=1 if the fine was imposed during the term of Competition Commissioner Neelie Kroes, after Dec. 15, 2004	+/-*
MONTI	=1 if the fine was imposed during the term of Competition Commissioner Mario Monti, Sept. 15, 1999 to Nov. 2004	+/-*
VANMIERT	=1 if the fine was imposed during or before the term of Competition Commissioner van Miert, which ended Sept. 15, 1999	Reference
GUIDELINES1	=1 for decisions announced during the period Jan. 14, 1999 to August 31, 2006 when the EC's first Fining Guidelines were in force	+
GUIDELINES2	=1 for decisions announced during the period after September 1, 2006 when the EC's Second Fining Guidelines were in force	+
GUIDELINES0	=1 for decisions announced during January 1990 to January 13, 1999 when the EC had no guidelines on antitrust fines in force	Reference
Other Controls:		
CAP	Though seldom applied, a reduction in the final fine because the Guidelines' amount exceeds 10% of this company's global sales in the year before the decision was announced, <i>measured in the percentage reduction from the specified fine</i>	-

DURATION	Cartel duration, the longest dates proven by any antitrust authority, <i>measured in months</i>	+
NO AM	=1 if firm is US or Canadian	+/-*
EUR	=1 if firm is headquartered in Europe	Reference
ASIA	=1 if firm is headquartered in Asia or Oceania	+/-*
ORGCHEM	=1 if an organic chemical product market	+/-*
OTHCHEM	=1 if chemicals, but not an organic chemical product market	+/-*
RUBBER	=1 if a rubber or plastic product market	+/-*
GRAPHITE	=1 if graphite or graphite product market	+/-*
METALS	=1 if a metal product market	+/-*
SHIPPING	=1 if an ocean shipping conference	+/-*
MISCMFG	=1 if other manufacturing market, mostly electrical or mechanical	Reference

a) When a factor represents a *small* probability of detection (hard to catch) or *large* probability of difficult or costly conviction, the optimal ECF will be *high* (i.e., positive coefficient), and *vice-versa* when detection is easy or the effort needed to convict is low.

* The estimated coefficient is expected to have either a positive or a negative sign, depending on which factor predominates.

Table 3. OLS and ML Tobit Estimation Results for Model [4] Explaining Variation in EU Fines on Members of Global Cartels, 1990-2008

	OLS Estimates			ML Tobit Estimates		
	Coefficient	t statistic	p-value	coefficient	t statistic	p-value
Intercept	0.2146	0.39	0.696	0.0954	0.17	0.861
Proxy for Harm:						
LN(AS _{EU})	0.2740	1.82	0.071	0.3003	1.99	0.046
Detection probability:						
BIDRIG	1.0271	2.81	0.006	1.0266	2.83	0.005
RECID _{WORLD}	0.0265	2.09	0.038	0.0286	2.27	0.023
RECID _{EU}	0.0245	2.77	0.006	0.0247	2.81	0.005
AMNESTY1	-0.3444	-1.30	0.195	-0.3426	-1.30	0.195
N (cartelists)	-0.0274	-0.99	0.324	-0.0361	-1.30	0.193
Other Penalties:						
OTHPEN	0.6164	3.92	0.000	0.6149	3.93	0.000
OTHPEN ²	-0.0479	-2.11	0.036	-0.0481	-2.13	0.033
Time Controls:						
TIME (T)	0.2097	1.38	0.169	0.1921	1.27	0.205
KROES	-2.2380	-1.69	0.093	-1.9307	-1.46	0.145
MONTI	-1.8671	-1.01	0.314	-1.5015	-0.81	0.416
GUIDELINES2	0.7507	1.38	0.170	0.8144	1.50	0.133
Other Controls:						
CAP	-0.0102	-1.67	0.096	-0.0100	-1.66	0.097
NO AM	0.6231	1.80	0.073	0.6426	1.87	0.061

ASIA	-0.1989	-0.96	0.340	-0.1740	-0.84	0.399
ORGCHEM	2.0280	5.50	0.000	2.0383	5.55	0.000
OTHCHEM	0.9186	2.34	0.021	0.9411	2.40	0.016
RUBBER	0.9562	1.87	0.064	0.9590	1.88	0.060
GRAPHITE	2.1537	4.78	0.000	2.2032	4.91	0.000
METALS	2.8441	5.64	0.000	2.8410	5.66	0.000
General Regression Statistics:						
SIGMA	0.9963			0.9901	18.69	0.000
R2 statistic	0.6840			Pseudo-R2	0.2944	
RESET F stat (nonlinearity)		0.045	0.832			
White stat (heteroskedastic)		111.6	0.599			

Table 4. Selected Tobit Estimation Results of Cohen (1996) Explaining Variation in the Natural Log of U.S. Federal Corporate Criminal Fines (LN(USF)), 285 Non-Antitrust Convictions, 1984- 1990			
	Tobit Estimates		
	coefficient	t statistic	p-value
Intercept	31.46	1.72	<0.05
Harm:			
LN(HARM)	0.41	2.28	<0.01
LN(HARM)/USF	0.33	1.27	<0.20
Detection probability:			
PROBE Cover up	-1.26	-1.21	<0.20
PROBE Cooperation	-0.09	0.15	
Other Penalties:			
LN(OTHPEN) known at sentencing	-0.185	-3.08	<0.01
LN(OTHPEN) expected at sentencing	0.75	1.15	
EXEC (individual sentenced dummy)	0.29	0.47	
Controls:			
TIME (year at sentence)	-0.31	1.48	<0.10
Convicted at trial dummy	3.42	4.38	<0.01
Inability to pay dummy	-2.62	-3.59	<0.01
General Regression Statistics:			
Pseudo-R2	0.093		
Note: From Table 5 of Cohen (1996), but omits 11 more variables with p values greater than 20%.			

Table 5. OLS and ML Tobit Estimation Results for Model [5] Explaining Variation in the Natural Log of U.S. Criminal Antitrust Fines (LN(USF)) on Corporate Members of Global Cartels, 1990-2008

	OLS Estimates			ML Tobit Estimates		
	coefficient	t statistic	p-value	coefficient	t statistic	p-value
Intercept	0.1062	0.25	0.809	-0.2703	-0.61	0.541
Proxy for Harm:						
LN(AS)	0.3669	8.17	0.000	0.4180	8.77	0.000
Detection probability:						
BIDRIG	-0.1283	-0.48	0.633	0.0912	0.33	0.739
PROBE	-0.1626	-2.39	0.019	-0.1806	-2.69	0.007
N (cartelists)	-0.0132	-2.37	0.020	-0.0196	-2.14	0.032
MANYBUYERS	0.5805	1.89	0.062	0.4800	1.54	0.122
Other Penalties:						
OTHPEN	0.8958	5.95	0.000	0.8927	6.04	0.000
OTHPEN ²	-0.0715	-3.35	0.001	-0.0726	-3.47	0.001
EXECS	0.0549	2.17	0.032	0.0501	2.01	0.044
Controls:						
TIME (T)	-0.0256	-0.75	0.458	-0.0184	-0.55	0.585
CHEM	-0.5484	-1.77	0.079	-0.3548	-1.11	0.266
DURATION	-0.0107	-0.67	0.505	-0.0115	-0.74	0.460
General Regression Statistics:						
SIGMA	0.8908			0.8710	14.92	0.000
R2 statistic	0.7144			Pseudo-R ²	0.3419	
RESET F stat (nonlinearity)		0.0742	0.786			
White stat (heteroskedastic)		76.49	0.225			
Source: Connor and Miller (2009).						

APPENDIX:

GENERAL TRENDS IN U.S and EC CARTEL ENFORCEMENT

The acceleration in annual rates of detection of international cartels is quite impressive. Recall that “detection” is the first date that a formal investigation becomes publicly known. When an investigation has been kept secret, discovery dates are also the dates that sanctions are announced. Almost 33 international cartels were detected each year during 2004-2007 – a rate five times higher than 1990-95 (Figure 1).

Until 1969, the U.S. DOJ was alone in the world in imposing fines on cartels. By the end of 1969, the DOJ had already accumulated more than \$700 million (in 2007 real dollars) in cartel fines (Table 12). As this paper will show, European antitrust authorities have also launched an era of notable anticartel activism since the late 1990s. From a cautious start in 1969, the European Commission’s international-cartel fines accelerated from the late 1980s. In the early 1990s, the EC’s fines surpassed those of the DOJ for the first time. In 2000-2007, the EC’s fines were almost triple those of the United States, and by 2006 the real value of the EC’s historical accumulation of price-fixing fines was greater than the DOJ’s. Beginning in 1994, Europe’s National Competition Authorities began to sanction international cartels; by the end of 2007, these NCAs had nearly surpassed the DOJ in fines.

Another trend is the decline in the duration of detected international cartels (Figures 5 to 8). In the early 1990s, the average cartels had endured for more than 100 months, but longevity has declined steadily to a time barely half as long in 2004-07. The duration of international cartels averages 4.5 years (Table 9). The longevity of global cartels is much higher, but that of European cartels is particularly brief.

The prosecutorial success of the U.S. DOJ and the EC’s DG-COMP appears to have encouraged other national agencies to focus more resources on anti-cartel enforcement, to adopt new laws strengthening investigatory powers or raising sanctions, and to reorganize the antitrust authorities. Antitrust authorities have been goaded into action by the disrespect shown by cartelists to competition laws and those who enforce them. Speech after speech by top antitrust officials betrays a visceral antipathy for global price fixers. The global conspirators are consistently described in highly emotive language as brazen, cold-blooded, contemptuous of the law, disdainful of their customers, and eager to ignore company antitrust compliance policies (Hammond 2002, Spratling 1999, Monti 2002).

U.S. Department of Justice

The Antitrust Division of the DOJ reached a peak size of 939 positions in 1980, fell to 578 positions in 1990 because of cuts made during the Reagan Administration, and climbed slowly back to a plateau of 810 to 850 positions during 1997-2007 (Connor *et al.* 2008: Table 1). However, because of a heavy workload in merger control, only 210 to 240 persons (26% to 28%) in the DOJ’s employees are assigned to horizontal restraint matters, many of them dispersed to the seven regional offices maintained by the DOJ around the country. The DOJ began to have a few Ph. D. economists working on enforcement in the early 1970s, one of which is a Chief Economist appointed from the outside each year or two. In recent years, the

DOJ has employed about 70 Ph.D. economists with specialization in industrial economics (Oliver 2008).

General Criminal Enforcement

These modest resources have been able to open an average of 33 formal criminal investigations⁹⁶ annually during 1990-2007. These investigations resulted in an average of 45 corporate or individual criminal cases being filed annually; during 1990-2007, those filings dropped from about 70 to 23 per year. As a result of plea bargaining, the DOJ wins convictions in 100% of those cases in most years. Criminal cartel cases can be ended by cease-and-desist orders, consent decrees or other sanctions, but most are terminated with fines. The DOJ fined 567 companies \$4.2 billion during 1990-2007 (32 firms per year). The number fined tended to decline, while the size of the fines rose from an average of \$484,000 per firm 1990-94 to \$36.8 million in 2005-07.

The DOJ rigorously applies criminal penalties to cartel managers, increasingly individuals who reside outside U.S. jurisdiction (*ibid.*). During 1990-2007, it charged 805 individuals for price fixing, of which it convicted 478 individuals (27 per year on average or 59% of all individuals charged). All but a handful are “convicted” by means of guilty pleas. The median fine is only \$50,000. Incarceration is the most feared sanction: on average 35% of all charged price fixers were imprisoned, but that ratio has risen to about 50% since 2000; moreover, the length of imprisonment has been rising, reaching 22 months in 2000-2007. The 284 imprisoned cartel managers during 1990-2007 represent nearly the universe of persons imprisoned for price fixing.

Once the threat of global conspiracies came to be recognized by the newly appointed head of the Antitrust Division in 1992-1993, the agency reordered its priorities fairly quickly. Beginning in the late 1990s, about four-fifths of the DOJ’s fines for criminal price fixing were imposed on non-U.S. firms. The use of personal fines and prison sentences has also escalated, many of them applied to non-U.S. citizens.

International Cartel Enforcement

During 1990-2007, the Antitrust Division convicted 67 international price-fixing crimes (Table 5). Starting with *Lysine* in September 1996, the most important U.S. price-fixing convictions have been global conspiracies. Thirty-six such cartels were fully or partially prosecuted during 1996-2007. About 200 companies have been fined by the DOJ for international price fixing since

⁹⁶ These are hard-core cartel cases handled by grand juries. More than 90% of all price-fixing allegations are criminal matters, and about 95% of these investigations result in one of more criminal indictments. Technically, the DOJ recommends fines in a sentencing agreement presented in a federal court to a supervising judge, but these proceedings are brief, *pro forma* affairs; at most one such recommendation has been altered by a judge in the past 20 years (Connor 2008c).

1995, and these fines account for 98% of all corporate criminal fines. The DOJ has obtained corporate fines totaling \$4.1 billion, of which 90% was from participants in global cartels (Table 6). It is likely that the future number of international-cartel cases will continue to be high. In the early 2000s the DOJ had about 100 grand juries empanelled on price-fixing allegations, of which half were examining international cartels (Pate 2003); in 2007 there were 130 such investigations (Masoudi 2007).

In general, the fines collected from individual criminal conspirators are modest compared with their corporate salaries, but prison sentences are becoming more severe. Historically, the DOJ sought prison sentences for individuals in a minority of price-fixing cases; the rate was 23% of all price-fixing cases during 1970-1999 (Connor 2007b). But in the case of *global* cartels, the DOJ has obtained prison sentences in about 50% of the cartel cases since 1995. Since 1990, 125 managers of international cartels have been imprisoned, which is 44% of cartel managers handed down prison sentences (Connor *et al.* 2008: Table 1). On average, about three executives plead guilty or are indicted per global cartel, and the number and severity of prison sentences has been increasing since the mid 1990s. This policy reflects an oft-repeated belief by DOJ prosecutors that prison sentences are the most effective tool for deterring cartels.

The conviction and imprisonment of non-U.S. executives for criminal price fixing by U.S. authorities is an extraordinary development in antitrust enforcement history. The U.S. DOJ has arranged guilty-pleas from more than 50 top executives who were nationals of about 20 foreign countries (Hammond 2001a, Masoudi 2007). Many of these executives worked in the United States, but some traveled from their residences abroad to submit to the jurisdiction of the U.S. court, plead guilty, and pay fines. One reason for foreigners' willingness to serve time in U.S. prisons is that if they reside or even *pass through* countries that have criminal statutes for price fixing, they may be extradited to the United States (Nanni 2002). The United States has explicit treaties with Canada, Ireland, and Japan that permit extradition for antitrust violations, though none of these has yet been invoked. The first non-voluntary extradition of a cartel manager (Ian Norris case here) is still active in the UK courts. In 2002, Interpol added U.S. antitrust fugitives to its "Red Notice" watch list for the first time. When foreign executives plead guilty for price fixing, they are frequently granted the right of free passage across U.S. borders for their cooperation.

In summary, the financial penalties applied by the U.S. DOJ to international and global price fixers in the late 1990s were unprecedented in their severity. Despite an increasing number of amnesties, average corporate fines for members of global cartels after the mid 1990s were many times higher than the fines collected earlier. While individual fines remained modest on the whole, managers of global conspiracies were more than twice as likely to receive prison sentences as managers of domestic conspiracies, and the length of the sentences has risen markedly. The main reasons for the escalation in fines in the late 1990s were the extraordinary escalation in the maximum fine levels allowed, the expanded size of the markets affected, the high overcharge rates, the longevity of many of the conspiracies, and, if truth be told, the rising intolerance of the judicial system for "thieves dressed in expensive suits." This rise is especially notable in light of the fact that, correcting for inflation, average corporate fines were essentially unchanged for the first 90 years of the 20th century.

European Commission

The Directorate General for Competition (DG-COMP) is probably the second largest competition-law authority in the world. With approximately 700 officials, it appears to be close in size to the DOJ's Antitrust Division. However, unlike the DOJ, it has onerous responsibilities enforcing rules on state aid that occupies half of its employees (de la Mano 2008). Thus about 350 officials have antitrust and merger-control responsibilities. Of these officials, most are trained in law, but roughly 35 have graduate degrees in economics. The first Chief Economist of DG-COMP was hired around 2000 and now supervises about 20 economists with Ph.D. degrees in industrial organization.

The EC has made an average of 13.5 formal antitrust decisions (of which 5.5 were horizontal restraint cases and 4.1 cartel cases) and participated in 4.2 appeals annually during 1994-2004 (Carree *et al.* 2008). Cartel-infringement decisions with fines began in 1969 and merger control in 1989. By definition, all EC cartel decisions are international, because they involve violations with substantial cross-border trade. In fact, several decisions have been directed at national price fixing conduct. The EC finds infringements in 79% of the cartel cases it opens (Schinkel 2007: 2). Until as late as the early 1980s, the EC cleared many cases that today would be regarded as hard-core cartels or issued rulings to cease and desist without fines (*ibid.* pp. 3-4). EC cartel decisions can take as long as five years. Schinkel (2007) reports that the average time required for formal cartel decisions has dropped from 42 months before 1990 to 27 months in 1990-2006, which is considerably longer than comparable U.S. DOJ investigations (Connor 2006).

Since the early 1980s, the pace of cartel cases decided has increased and the size of cartel fines has greatly accelerated. Under Commissioner van Miert (1993-99) the Commission issued 3.6 cartel decisions annually, but since then it has averaged close to 11 per year. In 1970-79, the EC imposed a mere US\$0.75 nominal million on average per year in cartel fines (Table 11). In 1980-89 the average rose to \$3.9 million, in 1990-99 to \$61.9 million, and in 2000-2007 to and astounding \$855 million annually.⁹⁷

International cartels detected since 1990 have generated more affected commerce in Europe than in any other part of the world (Tables 3 and 4). The known affected sales of fined "EU-wide cartels" (i.e., any cartel investigated by the EC that is not global) is \$315 billion; for such cartels with formal investigations underway (*Power Utilities, Air Cargo, Air Passenger, etc.*) the affected sales is preliminarily estimated to be more than \$7 trillion. In addition, 29% of the affected world sales of global cartels (\$464 billion) was generated in Europe. Thus the grand total of \$8 trillion accounts for approximately 73% of the affected sales of all the world's international cartels. One reason for the high affected sales of EU-wide cartels is that they are

⁹⁷ Nominal fines are recorded on the day of the decision and converted into U.S. dollars on that day using the interbank clearance rate. No adjustment is made for inflation or for subsequent reductions made on appeals to the European courts, which typically reduce the initial fines by about 10%. Appeals are almost unknown in North America.

more durable than most – lasting 62 months on average.⁹⁸ (These data do not include international cartels prosecuted by the NCAs – see section below).

Cartels cause a great deal of economic harm to European businesses and consumers. Following Schinkel (2006), one could estimate the overcharges imposed on buyers from discovered guilty international cartels (EU-wide and global) to be conservatively⁹⁹ about nominal \$156 billion. If the cartels presently under investigation are found guilty of infringements (as almost all are), the total harm to EU buyers could rise to \$1.4 trillion. A more targeted estimate of overcharges can be derived from the PICs data set. It has fairly reliable estimates for a sub-set of international cartels discovered operating in Europe. The minimum aggregate cartel overcharges is \$ 57 billion. As some of these cartels were quite durable, the net present value of these cartel overcharges would be two or three times higher. Moreover, correction of missing observations, dead-weight losses, and undiscovered cartels would surely raise the harm to Europeans by a large multiple.

In 2005, the European Commission reached a new milestone: surpassed the DOJ in the lifetime amount of fines imposed on cartels. Since then it has retained its crown as the world’s single most aggressive antitrust authority. Moreover, the mix of cartels has changed. It has fined 89 *international* cartels US\$15 billion during 1990-2007, of which 53 were intra-EU and 36 global. The first global cartel fined by the EC in the 1990s was lysine.¹⁰⁰ This fine of US\$110 million was the fifth largest ever imposed by the EC. In 2001, decisions were reached in four huge cartel cases with total fines of US\$1,115 million – a record amount for any antitrust authority.

Despite the sterling record of EU fines since the late 1990s, these penalties are far below what is needed to recoup cartel profits *ex post facto*. EC fines on international cartels are estimated to have amounted to a median of 17% of EU overcharges. At most three cartels had half or more of their profits disgorged. The median EC record on disgorgement is about one-third that of public and private cartel penalties in the United States. Combined with my previous point on the deleterious effect of the time value of money and a probability of detection well below 30%, such fines are far below what is necessary to achieve optimal deterrence.

The future seems to point to larger numbers of fines and substantial increases in fines per cartel. New Fining Guidelines were implemented in late 2006 that are likely to lead to far higher cartel fines (see Table X below). In 2007 the EC had a backlog of over 100 amnesty applications, which makes it likely that there will be continuing large fines by the EC for the next few years. To handle the backlog, the EC is about to institute a process of “direct settlement” with corporate cartelists that is similar to the DOJ’s practice of plea bargaining that exchanges inculpatory information for partial leniency.

⁹⁸ Global cartels, most of which affect the EU, endure 73 months on average, but North American cartels typically operate only about 48 months (Connor 2008a).

⁹⁹ Mean overcharges are generally higher than average for international, global, and EU-wide cartels (Connor and Lande 2005). See also Table 8.

¹⁰⁰ Ironically, the first two cartels fined in 1969 (*Quinine, Dyestuffs*) were global schemes, but there were few others of this type in the 1970s or 1990s.

National Competition Authorities of Europe

This section examines the recent but accelerating number of international-cartel prosecutions of national competition authorities (NCAs) in Europe that are now or were prospective members of the EU-27. Since 1990, each of the original members of the EU has had competition laws that are compatible with the EU Treaty. All new members have had to have effective NCAs before joining. Some NCA's competition laws predate the Treaty, but all NCAs have developed increasingly convergent anti-cartel laws and policies. Some NCAs, like the Netherlands in 1998, have passed amendments strengthening their NCA's abilities to investigate or hand down substantial cartel fines.

For many years the dividing line between the Brussels' anti-cartel activities and those of the NCAs was unclear. Before 1999, an investigation by an NCA that involved some non-domestic firms could be pre-empted by the EC. The devolution of the EC's cartel-prosecution activities to its Member States began in 1999 and became formalized in 2003 with the establishment of the European Competition Network (ECN). Now the NCAs can investigate both purely domestic cartels as well as those with significant sale across member-states. Brussels retains jurisdiction over global cartels and those with large cross-national EU market effects.¹⁰¹

Nineteen NCAs in the European Economic Area (EEA) have fined a total of 112 international cartels, issued six cease-and-desist orders, and as of late 2007 were investigating another 20 international cartels. These 138 cartels comprise about one-fourth of the PICs data set. The NCAs' total fines for 1994-2007 amount to \$6.1 billion. Despite their late start, the accumulated amount of fines imposed by the European NCAs on hard-core cartels¹⁰² is now larger than the United States – an impressive amount given the restricted size of these national economies and the relatively few years of active enforcement. However, few of these cartels have been global in scope.

The first international cartel to be fined by a Member State was *Non-Life Insurance Premiums*, a case decided by the national antitrust authority of Italy in June 1994. Hungary and the Czech Republic also fined international cartels by the end of 1994. In 2007 dollars, these fines totaled \$24 million. The acceleration in such fines has been astounding: by 2005-2007 the NCAs of the EU were piling on nearly \$1 billion in cartel fines annually.

Although it was the last of the original signatories of the Treaty of Rome to pass a national antitrust law, Italy has become the most aggressive Member State in prosecuting international cartels – 28 in all – with fines totaling nominal \$1,386 million. The majority of Italian fines have been generated by cartels in various petroleum distribution markets. These and markets like insurance, cigarettes, telecom, and water services, are recently denationalized and deregulated

¹⁰¹ The precise borderline is not known; it appears to be an outcome of case-by-case EC-NCA negotiations.

¹⁰² Classification of cartels as hard-core in some cases requires a close reading of press reports and press releases; sometimes multiple infractions are alleged or what was initially believed to be a hard-core cartel morphs into a different category of offenses.

sectors. Nine cartels of pharmaceutical suppliers that rigged tenders by Italy's national health service were detected and fined.

The national antitrust authorities of the Netherlands, France, Hungary, and Germany round out the top five. They have become very energetic in prosecuting international cartels – 45 cases with fines. All of the Netherlands's authority's international cases were launched since mid-2001, shortly after its investigative powers were strengthened. Until that time, the EC had intervened in several Dutch markets with hard-core cartels. Much of its work has been consumed by a major scandal involving big rigging by more than 2000 construction companies. Its 14 cases resulted in \$689 million in fines between 2001 and 2007. In addition to ten cartels in various construction industries, the Netherlands too has investigated several formerly regulated industries (banking, insurance, telecom).

The Bundeskartellamt has imposed more fines on international cartels than any other NCA: \$1,652 million on five cartels, many of them bid rigging with large numbers of participants. Three other international cartels received warnings. The first cement case had 17 members; in what might prove to be an important legal precedent, cement buyers have brought this cartel to court seeking damages. The BKA has fined a large number of cartel managers, but imprisoned none.

France's Conseil de la Concurrence (now the Autorité Concurrence) has become a force to reckon with since it began imposing fines on international schemes in 2002. It has been unafraid of fining many of the country's national champions. Twelve cartels have paid \$910 million in fines, including \$628 million on three telecom mobile operators. Bid rigging has been the punished conduct in half of the cartels.

Several of the newer members of the EU are pursuing active anticartel programs. Hungary has fined 12 international cartels; total fines of \$92 million are quite impressive relative to the size of the economy. I would place Sweden, Finland, Greece, and a few other states in Central Europe in this class of "over-achievers." Belgium, Ireland, the UK, Austria, and Norway are examples of NCAs that are well supplied with cartelized industries, and yet have little activity thus far. Others, perhaps Denmark fits this group, seem to be directing their anticartel programs toward domestic cartels.

Table X. Illustrations of EC Cartel Fine Calculations under the 2006 Notice: Gosselin NV in <i>International Military-Goods Moving and Storage</i> /Sony in the <i>Professional Video Tape Case</i> / ThyssenKrupp in <i>Elevators</i>			
Item: First case/second case/third case	Gosselin	Sony Corp	ThyssenKrupp
	Amount in €		
Total sales in EU last year of cartel, fiscal year 2003/ sales of Betacam SP and Digital Betacam tapes made cartel the EEA during fiscal year ended on 31 March 2002/ sales in BL, DE, NL, LX in 2003	10,067,246	suppressed	49,300,000 ^e
Starting Point Amount: Sales to U.S. military during participation: 1984-2001 excluding “3 rd party” sales/sales of professional video tape in EEA 1999-2002/sales of equipment and repairs in 4 EU States 1995-2004 with duration multipliers	2,214,222	7,967,600	345,100,000*
Upward adjustment of sales due to global extent of violation	0	0	Not discussed
Gravity of offense is “very serious” (15%-30% range) but at lower end of the range: 17% of the sales above/18% of above/ no discussion	376,418	9,401,768	Not discussed
Duration of offense is 10 years 7 months, so multiplier is 11/duration 2 years 8 months, so multiplier is 3/old pre-2006 method of multiplying by 10% for each year is followed.	4,140,595	28,205,100	?
Additional penalty for hard-core cartels: 17% out of a possible 15% to 25%/17% also	4,844,496	33,000,206	Not discussed
Basic Amount: EC rounds down the above figures	4,500,000	33,000,000	345,100,000
Aggravating circumstances: none found for Gosselin/Sony employees shredded documents, refused to answer questions, so 30% added for obstruction/50% added for 1 recidivism by ThyssenKrupp	0	42,900,000	517,650,000
Mitigating circumstances: none found for Gosselin/none allowed for Sony/ 21% discount for Thyssen’s cooperation	0	0	408,943,500
Special increase for deterrence: none for Gosselin/ Sony very large diversified company, so 10% added to above/ no discussion	0	47,190,000	Not discussed
Reduction for 10% sales limit: for Gosselin €14,363,000 in 2006/Sony 10% limit €5,530,000	0	0	0
Leniency application: Gosselin did not apply/ Sony did not apply/ Thyssen granted 25% reduction for BL market, 40% for NL, and 1% for others	0	0	?

Final Amount of Fine	4,500,000	47,190,000	479,669,900*
<p>*The duration rule in the 2006 guidelines is not followed; rather the 1998 rule that adds 10% for each year is followed. Moreover, final fine seems too high and does not square with previous discussion in the decision.</p> <p>Sources: <i>DÉCISION DE LA COMMISSION Du 11 mars 2008 Relative à une procédure d'application de l'article 81 du traité CE et de l'article 53 de l'accord EEE (Affaire 38543 - Services de déménagements internationaux</i> [http://ec.europa.eu/competition/antitrust/cases/decisions/38543/fr.pdf], <i>COMMISSION DECISION of 20 November 2007 relating to a proceeding under Article 81 of the EC Treaty and Article 53 of the EEA Agreement Case COMP/38.432 – Professional Videotape</i> [http://ec.europa.eu/competition/antitrust/cases/decisions/38432/en.pdf], and <i>COMMISSION DECISION of 21 February 2007 relating to a proceeding under Article 81 of the EC Treaty Case COMP/E-1/38.823 - PO/Elevators and Escalators</i> [http://ec.europa.eu/competition/antitrust/cases/decisions/38823/en.pdf]</p>			