



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

**THE FOOD AND
AGRICULTURAL GLOBAL
CARTELS OF THE 1990s:
OVERVIEW AND UPDATE**

by

John M. Connor
Staff Paper #02-4
August 2002

**Dept. of Agricultural Economics
Purdue University**

Purdue University is committed to the policy that all persons shall have equal access to its programs and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

THE FOOD AND AGRICULTURAL GLOBAL CARTELS OF THE 1990s: OVERVIEW AND UPDATE

by

John M. Connor

Dept. of Agricultural Economics, Purdue University

West Lafayette, IN 47907-1145

jconnor@purdue.edu

Staff Paper #02-4

August 2002

Abstract

“Greed is good.”

--Gordon Gecko in *Wall Street* (1987)

“Greed Is Bad.”

--Paul Krugman, *The New York Times*, June 4, 2002

“For many years, Archer Daniels Midland Co.’s philosophy of customer relations could be summed up by a quote from former ADM President James Randall: ‘Our competitors are out friends. Our customers are the enemy.’ This motto animated the company’s business dealings and ultimately led to blatant violations of U.S. antitrust law, a guilty plea and a staggering criminal fine against the company . . . The facts involved in this case reflect an inexplicable lack of business ethics and an atmosphere of general lawlessness that infected the very heart of one of America’s leading corporate citizens. Top executives at ADM and its Asian co-conspirators throughout the early 1990s spied on each other, fabricated aliases and front organizations to hide their activities, hired prostitutes to gather information from competitors, lied, cheated, embezzled, extorted, and obstructed justice.”

-- Decision of the U.S. Court of Appeals, 7th Circuit (Kanne *et al.* 2000:1-2)

“Globalization can bring great benefits to consumers and business, but it can also cause harm, as evidenced by the rise in global cartels such as the vitamin cartel . . .”

-- Senior official, Australian Competition and Consumer Commission, *Business Weekly Review* (December 13, 2001).

Keywords: Cartel, antitrust, market structure, collusion, overcharge, deterrence, U.S. Department of Justice, EU, European Commission, lysine, citric acid, vitamin

Copyright © by John M. Connor. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided this copyright notice appears on all such copies.

Contents

	<i>Page</i>
Introduction	1
Economics of Cartels	
Law of Price Fixing	
Objective	
Scope	
Market Structure	5
Concentration	
Homogeneity	
Barriers to Entry	
Other Plus Factors	
Collusive Conduct	9
The Lysine Cartel: Behavior	
Costs of Collusion	
Performance: Market Effects	16
Crime and Punishment	20
The U.S. Department of Justice	
Canada	
The European Union	
Summary	
Deterrence	36
Theory	
Practice: The United States	
Practice: Canada and the EU	
Final Thoughts and Speculation	43
Cartel Formation	
Fashioning Remedies	
References	48
Appendix Tables	51

THE FOOD AND AGRICULTURAL GLOBAL CARTELS OF THE 1990s: OVERVIEW AND UPDATE

by
John M. Connor

Introduction

The sudden discovery of a global pandemic of international cartels in the mid 1990s, after a hiatus of a half century, is puzzling. That the greatest number and most injurious conspiracies should be clustered in the food and feed ingredients industries adds an element of mystery to the puzzle. Whatever the causes of this unexpected resurgence of global price fixing, the reaction of the antitrust-enforcement agencies has been fascinating. If the burst in illegal price fixing exposes one of the dark sides of globalization, the strong responses of antitrust agencies to the challenge of global cartels is one of the bright aspects.

International private cartels are at least 125 years old.¹ The German-Swiss dyestuffs cartel that was established around 1880 is a prototype for the late 19th century international cartels. It was an amalgamation of two pre-existing national cartels that through predatory behavior against smaller producers in the UK, France, and Italy was able to ensure Western European dominance for its Swiss and German members. World War I destroyed international cartels of this type, though most of them were re-established in the 1920s.

The interwar cartels were more ambitious in scope, often incorporating agreements with U.S. manufacturers that divided the markets of Western Europe, Africa, and the New World into two hegemonies. By this time the United States had an effective anticartel law, the Sherman Act of 1890, that made U.S. producers wary of joining formed price-fixing agreements with European firms. Many U.S. firms may have believed that cartel arrangements that merely created spheres of influence were legal under the Sherman Act, but events would prove them wrong. From 1946 to 1950, a crusading U.S. Attorney General made the criminal prosecution of scores of these interwar cartels his highest priority. Aided by public revulsion about the assistance given by these cartels to the rise of National Socialism and the rearming of Germany during 1933-1941, the U.S. government enjoyed a long string of successes in the courts. The court victories apparently chilled the formation of international cartels for the next 40 years.²

The international cartels discovered and prosecuted since 1995 are qualitatively different from those operating in the interwar period. They are truly *global* cartels and as such represent the ultimate product of the evolution of the cartel as a form of business enterprise.³

¹ Many cartels, such as the Hansa League and the Organization of Petroleum Exporting Countries (OPEC), operated under the protection of state sovereignty. Other commodity-stabilization cartels are effectively parastatal organizations. This paper discusses only cartels that are not sanctioned by law.

² The U.S. government attempted to prosecute only three international cartels prior to 1996, but it was unsuccessful in court because of the difficulty of securing evidence and witnesses outside the United States.

³ To be more precise, the global cartels of the 1990s had as their goal raising prices in at least North America, Western Europe, and Japan – a group called “the Triad” in the marketing management literature. Typically, these cartels sought price control in all industrialized countries.

Contemporary international cartels incorporate a refinement of operational techniques, a global perspective, a multicultural pluralism, a leadership style, a degree of longevity, and a scale of operation that the world has never before seen. Needless to say, global cartels are also the most injurious price fixing ventures yet devised, causing massive losses in market efficiency, losses in income for customers, and losses in faith in the honesty of businessmen⁴ and the integrity of market institutions.

The behavior of global cartelists has scandalized the public and provoked the world's major antitrust agencies to impose unprecedented sanctions (Hammond 2001b). Beginning with the announcement of the U.S. investigation of the lysine cartel in July 1995, literally thousands of articles have appeared in newspapers and magazines around the world that have covered the machinations of about 30 known global cartels. Three books have been published on the subject (Lieber 2000, Eichenwald 2000, Connor 2001) and two Hollywood movies have or will appear (*Anti-Trust* and *The Informant*). Global cartels have become a major focus of antitrust agencies, which have imposed "titanic fines" (\$2 billion by the United States, €1.8 billion by the European Union) that have "dwarfed" the actions taken against previously convicted price-fixing conspiracies (Hammond 2001b). Prior to 1995, U.S. prosecution of foreign companies or persons for price fixing was practically unknown, but since then 50 to 70 percent of the companies indicted by the U.S. Department of Justice have been foreign; moreover, the DOJ has convicted cartel executives from 12 foreign countries, sending many to prison.⁵ International cartels successfully prosecuted by the U.S. DOJ have affected markets with more than \$55 billion in sales (Kolasky 2002).

The general purpose of this paper is to analyze the structural sources of collusive behavior, to measure the scope of global cartels and their economic impacts on customer welfare, and to assess the effectiveness of anticartel laws worldwide. That is, I will address market structure, conduct, performance, and competition policies in the context of global cartels in the food and agricultural system. Conduct will be illustrated by the lysine cartel, which insiders have called "a monumental case" for the U.S. DOJ (Hammond 2001b:3). "One could not ask for a better introductory lesson . . . as to why price fixing is a crime and why those who commit it are criminals" (*ibid.*, p.4).

Economics of Cartels

A cartel is an association of two or more legally independent entities that explicitly agree to coordinate their prices or output for the purpose of increasing their collective profits. Some cartels are organized by state agencies or government-owned corporations; other cartels have been formed by multilateral treaties to attempt to smooth commodity price cycles. This paper is concerned only with private business cartels that operate unprotected by the cloak of national sovereignty.

⁴ I use this gender-laden term purposefully. Among the hundreds of businesspersons named as conspirators in the 39 global cartels I have studied, only one (the CEO of Sotheby's auction house) is a woman.

⁵ IN 2000-2002, the EC fined 42 companies that were guilty of global price fixing, and 23 (55 percent) were non-EU firms.

Economics views cartels as a special type of oligopoly, an extra-legal joint venture of businesses that are normally rivals in the same industry. The mission of a cartel is to increase the joint profits of its members to a level as close as possible to that that a monopolist would earn; the strategy of a cartel is to implement one or more the “restrictive business practices” popularly known as price fixing. Cartels almost always agree to raise their list prices, to lower total production, or both; they may also reinforce this basic decision by fixing market shares for each member, allocating specific customers, imposing uniform selling conditions, sharing sales information, monitoring price agreements, pooling and redistributing profits, adopting a method for punishing deviants, and hiding or destroying evidence of their activities. The time and management resources required to negotiate the formation of a cartel and to carry out the agreements can be substantial.

Economic models of cartels emphasize the necessity of high concentration and of product homogeneity in an industry (Stigler 1964, Dick 1998, Connor 2001). Without small numbers of member-sellers and reasonably standardized products, the transactions costs of forming and maintaining a group consensus would become too high relative to the anticipated increase in profits. Moreover, because there is always a profit incentive for cartel members to cheat on the cartel’s agreement (i.e., to sell more or at a lower price than that agreed upon), only small numbers and homogeneity will keep the information costs of detecting cheating within acceptable bounds. Other conditions believed to facilitate the formation or successful operation of cartels include a large numbers of buyers, a small amount of noncartel production capacity, equality of production costs across firms, and relatively stable or predictable demand conditions. High barriers to entry into the industry will facilitate the formation and longevity of cartel agreements.

Law of Price Fixing

Section 1 of the 1890 Sherman Act deems cartels *per se* illegal. That is, an explicit agreement to fix prices is a “conspiracy in restraint of trade,” irrespective of the agreement’s actual impacts on market prices or output. Outside the United States, the competition laws of most industrialized nations judge the illegality of a cartel under the rule of reason. In practice, however, non-U.S. competition-law agencies routinely prosecute all naked cartels that they discover. In the EU rare exceptions are made for cartels with significant benefits for consumers from technological innovation. Many countries, the United States included, permit registered export cartels to operate.

Strict enforcement of laws against overt price fixing is a public policy widely supported by economists and legal scholars of all stripes. They may differ as to the causes giving rise to collusive behavior and as to the likelihood of long-term success, but they are unified in their evaluation of the negative economic effects of cartels.⁶ Effective cartels cause unrecoverable

⁶ The optimization problem facing a cartel management committee is formally the same as that facing a monopolist with multiple production locations. In stagnant or declining industries excess capacity may develop that could be ameliorated through merger or cartel-formation. Thus, it is theoretically possible that multi-plant economies could compensate for the net social losses from collusion, but such a scenario seems remote and unsupported by empirical evidence.

losses in production and consumption, transfer income from customers to the stakeholders of cartel members, and often engage in wasteful rent-seeking expenditures (Posner 2001, Ch. 1).

Objective

This paper attempts to collect and analyze economic and legal information on all known international cartels that operated during the 1990s in markets for food, feed, and agricultural ingredients. The vast majority of these 26 cartels were formed during the years 1989-1992 and ceased operation in the late 1990s. In every case, they were made public by investigations and prosecution by either the Antitrust Division of the U.S. Department of Justice (DOJ) or by the Competition Directorate of the Commission of the European Communities (EC). In addition, a limited amount of information is presented on 13 international cartels that affected markets outside of the food and agricultural sector. While 39 discovered cartels is a fairly substantial sample, doubtless there are scores of cartels that operated in the 1990s but were unknown to the U.S. and EU antitrust authorities. Finally, this paper serves to update developments described in Connor (2001) since late 2000.

Scope

The food and agricultural cartels of the 1990s share a number of common economic characteristics. However, this paper will focus on the economic dimensions and legal prosecution of four cartels for which the documentation is particularly rich. They are lysine, citric acid, and vitamins A and E.

Lysine is an essential amino acid, a building block of proteins that speed the development of muscle tissue in humans and animals. The form of lysine that we cartelized in the 1990s is a dry powder manufactured by a fermentation process and purchased by manufacturers of prepared animal feeds. *Citric acid* is an acidulant added to thousands of processed foods and beverages to enhance flavor and retard bacterial growth; a minor portion of industry output is used as an ingredient to replace phosphates in detergents. Citric acid is sold in two forms: a diluted aqueous form shipped in tanks and a dry salt form, usually sodium citrate. Since 1923, citric acid has been manufactured by a fermentation biotechnology. *Vitamins A and E* are two of about 15 commercially important vitamins or provitamins, proteins found naturally in foods that become catalysts in regulating the metabolic functions of humans and animals. Diets deficient in vitamins will cause diseases or functional impairments. Most bulk vitamins are sold to feed manufacturers; food-grade vitamins are added to many processed foods and minor portions are sold to the pharmaceutical industry. Vitamins have been by synthetic chemistry since the early 1930s, and this is now by far the dominant method of manufacture.⁷

Brief mention is made of a few additional food-and-agricultural products that were cartelized in the 1990s. *Methionine* is an amino acid added to animal feeds, swine in particular. *Monosodium glutamate* (MSG) and *nucleotides* are amino acids that enhance flavors of foods. *Maltol*, *sodium erythorbate*, and *sorbates* are chemical food additives that flavor or preserve foods. *MCAA* (monochloroacetic acid) and *organic peroxides* are chemical intermediates used to

⁷ For more detailed information on the uses, technologies of production, and marketing channels for lysine, citric acid, and vitamins, see Chapters 4, 7, and 10 of Connor (2001).

produce pesticides. What is strikingly common to all these products is that each of them are *minor ingredients* or components of more complex mixtures further processed by large numbers of manufacturer-buyers. This characteristic helps facilitate collusion by ensuring highly inelastic demand. In addition, market price information is both poor for buyers and asymmetric. That is, suppliers tend to be better informed than buyers about market conditions and average transaction prices, which gives suppliers advantages in forcing price changes.

Market Structure

The market environments for the lysine, citric acid, vitamins, and other global cartels discussed in this paper made possible and indeed fostered collusive price-fixing behavior by the leading firms in the industry. Two industry features tower above all the others in importance because they are absolutely necessary conditions for cartels to be formed and flourish: high seller market sales concentration and product homogeneity. High barriers to market entry are icing on the cake: with them cartels will be durable, without them new sellers will enter the industry and in time make cooperation in pricing a thing of the past. The remaining structural features of markets shown in Table 1 may be called “plus factors.” The plus factors are not necessary conditions for the formation of cartels, but they do facilitate the establishment of price agreements and increase the probability of serious price effects.

Concentration

There is no doubt that industry concentration – the share of sales or production capacity controlled by the leading suppliers – was high in every global cartel. The share of global production accounted for by the four largest manufacturers of lysine, citric acid, and vitamins A and E was in excess of 80 percent in the early 1990s. There is evidence that Western Europe, North America, South America, and Asia were viewed by the cartel members as geographically distinct markets. Except for citric acid in Asia, sales concentrations within the continents were even higher than global concentration (Table 1).⁸ Prices were set systematically higher in Europe and lower in most parts of Asia, yet never so far apart as to allow non-cartel firms to make profits through geographic arbitrage.

Exactly what threshold may be considered high enough to generate a measurable degree of market power is a matter of some debate in economics. Moreover, the degree of industry concentration required for *monopoly* pricing behavior – the form of pricing to which cartels aspire – is likely to be higher than that needed to achieve significant market power. Finally, the critical concentration level for monopoly pricing may vary according to the type of industry and whether concentration had been historically rising or falling. Despite these uncertainties, empirical studies of manufacturing industries have variously identified the critical level of four-firm sales concentration at between 40 and 65 percent (Connor *et al.* 1985). Observed levels of seller concentration in the cartelized industries (Table 1) exceeded the upper end of this range by a comfortable amount.⁹

⁸ China was a fast-growing source for citric acid in the early 1990s; it also became a significant source for vitamin C and one or two other vitamins in the mid 1990s.

⁹ In the few cases covered in Connor (2001) where entry caused industry concentration to dip below about 65 percent, cartel activity generally ceased.

Table 1. Economic Conditions Facilitating Global Price Fixing: Lysine, Citric Acid, and Vitamin A, Early 1990s.

Market Conditions	Lysine	Citric Acid	Synthetic Vitamins A & E
High seller concentration:			
Global market	CR4 > 95%	CR4 > 80%	CR4 > 95%
U.S. market	CR4 > 97%	CR4 = 90%	CR4 = 100%
Few cartel participants	4 or 5	4 or 5	3
High cartel supply control	95-99%	65-70% ^b	95-100%
Low buyer concentration	CR4 < 30%	CR4 < 40%	CR4 < 20%
Homogeneous product ^a	Perfect	High	High
High barriers to market entry:			
Large plant scales	\$150 mil.+	\$150 mil.	Probably
Sunk investment costs	Yes	Yes	Yes
Technology secret	Yes	Yes	Yes
Building new plants slow	3 years+	3 years+	3 years+
Transparency of market prices to buyers	None	Some	Little
Large, infrequent transactions	Yes	Yes	Yes
Major rivals have long history of strategic interaction	3 of 5	3 of 5	Yes ^c
Annual market growth	10%, steady	8%, steady	2-3%, steady
Cultural propinquity of cartel members	Low	Moderate	High ^c

Sources: Chapters 4, 7, and 10 of Connor (2001).

CR4 = Sum of the market shares of the top four suppliers or buyers.

^a Within well recognized industry grades when prices were at cartel-enhanced levels. There were no substitutes when prices were within a normal range.

^b Control by formal members of the cartel. Cargill, a major supplier with up to 20 percent of U.S. capacity, provided passive support for the cartel's pricing decisions.

^c The vitamin conspirators were long time rivals from Western Europe, but in most of the other vitamin cartels Japanese or Northern American companies had to be recruited to the cartels.

Conceptually separate from the issue of overall industry concentration is the degree of control by the cartel itself. In every case except for citric acid the top four or five producers were all members of the cartel, so in practical terms industry concentration and cartel control of supply were one and the same. In the citric acid case the one missing leading firm – Cargill – appears to have passively followed the cartel’s pricing decisions while refraining from active collusion. Another dimension of concentration is the fewness of company numbers. In every case, the global cartel operated with three to five corporate conspirators. About 20 vitamin makers admitted colluding on prices, but when one looks at the *individual* vitamin markets (A, C, E, B1, etc.) no more than five firms were members of the cartel.¹⁰ While there are historical examples of successful cartels with ten to 20 members, the fewness of firms observed in the present global cartels made formation and monitoring of a price agreement eminently feasible.

Finally, consistent with cartel theory, the degree of buyer concentration was low. The buyers were feed manufacturers (2000 in the U.S. market alone), food processors (15,000 thousand in the U.S.), or chemical wholesalers (hundreds). In every instance, the top four direct purchasers accounted for less than 20 to 40 percent of the market, whether calculated at the global or regional level. Low buyer concentration makes it more difficult for purchasers to share credible information about transactions prices and prevents buyers from countervailing against the market power of sellers. Low buyer concentration may be one factor that accounts for the prevalence of global cartels in the food-and-feed-ingredient industries.

Homogeneity

Cartels can more easily agree on one price than on many and can more easily agree on a measurable market indicator like price rather than a fuzzier notion like superior product quality. Lysine, citric acid, and the vitamins are pure organic chemicals with unique chemical signatures. Within a recognized grade or type, each of the cartelized products was perfectly homogeneous.¹¹ The presence of conventional grades in the market did not present the cartels with an insuperable challenge. In some cases, such as liquid lysine or natural human-grade lysine, the cartel simply agreed to ignore these relatively insignificant market niches. In some other cases, such as citric acid, the liquid product forms were simply priced off the 100-percent pure dry form, employing traditional industry rules of thumb for discounts. In some cases, such as vitamin A in oil and vitamin A in dry powder form, the two types flowed through such distinct marketing channels that two prices had to be agreed upon.

With few exceptions, the food-and-feed-ingredient cartels sold a somewhat more purified form to food processors or pharmaceutical firms and a less purified form to animal-feed manufacturers. As a rule the food/pharma version was sold at the highest price while the feed version sold at recognized conventional discounts. If new entrants appeared during a cartel period, new firms typically began selling the cheapest version first because the manufacturing standards were not as rigorous. Differences in technical standards prevented substitution of the

¹⁰ The sorbates cartel and the sodium gluconate cartel each had six members (Appendix Table A.2).

¹¹ When cartels raise their prices to very high levels, substitutes can sometimes begin to appear. For example, a corn-soybean mixture could substitute for lysine or natural vitamin A could substitute for synthetic vitamin A. In practice, the cartels only rarely had to worry about the prices of substitutes.

lower priced grades for the high priced ones, thereby protecting the established sellers in the cartel from direct price competition in the most profitable segments.

In every case, when a cartel became successful in raising prices, participants had to take care not to raise them too high lest substitutes become price competitive. That is, product uniqueness and homogeneity is found only over a certain range of prices. In the case of lysine, soybean or fish meal became a cost-effective substitute in animal feeds if soymeal was at an average price and the price of lysine made by the conspirators from dextrose rose above \$2.00 per pound. Similarly, citric acid and vitamins can be extracted from natural vegetable matter, but only if the prices of the synthetic versions rose to well above the prices set by the cartel. The availability of substitutes at very high prices limited the ability of some cartels to charge the full monopoly price.

Barriers to Entry

Lysine, citric acid, and several vitamins are manufactured with fairly new fermentation technologies, many of which are still undergoing rapid improvements. Most of these processes are protected by patents or industrial secrecy. The finishing plants are usually dedicated to production of a unique product; while economies of scale for the finishing units are modest, there appear to be substantial economies from physical vertical integration with dextrose or other carbohydrate feedstocks. Even if an efficient technology is available, market entry is slow. The finishing plants require two or three years to be planned and built and generally require a year or more of learning-by-doing to reach optimal productivity levels. Thus, technological barriers of several kinds protect biotech industries making amino acids, food acids, and other organic chemicals.

Vitamins A and E are made with traditional synthetic chemistry. While patents are unimportant, the synthesis is described as difficult to master and key intermediate chemicals are often made by only a couple of suppliers. In general, the cartels that were most protected by technological barriers had low rates of entry and the most durable agreements.

Other Plus Factors

There are five facilitating factors for collusion that are present to varying degrees in the cartel case studies presented in this paper. First, collusion is difficult to maintain when frequent, accurate, public price reporting is available to buyers. For the cartelized products nearly the only price data available are irregular announced list or spot prices from trade magazines. While these sources occasionally announce transaction prices, the relationship between the two types of prices tends to narrow considerably at the start of a price-fixing conspiracy. Thus, list price series would tend to underreport price changes due to collusion. Moreover, list prices typically do not drop for months or years after collusion ends, even though transaction prices plummet. International trade data can sometimes provide monthly implicit prices of imported product by country, but lags in sales and transportation costs interfere with developing reliable transaction prices. Moreover, the trade data may be dominated by intrafirm trade that may generate nontransaction prices. Only citric acid had a publicly available price series, a monthly survey of prices reportedly paid by purchasing managers.

Second, in all the cartelized markets examined, the lion's share of product was purchased under annually negotiated supply contracts. Reliable reporting of contract prices was rare. Illegal price agreements are easier to maintain when transactions tend to be large and infrequent because the opportunities for cheating by cartel members are fewer in number and effects of cheating easier to detect.

Third, a long history of rivalrous interaction among potential members of a cartel may tend to discourage overt price fixing. The price increase from a risky collusive agreement will be lower if firms can legally cooperate on an oligopoly price than if the only alternative is a perfectly competitive price. Predictability in the strategic behavior of one's rivals makes various forms of tacit, less risky cooperation more feasible for a firm. On the other hand, an industry with a history of price fixing is more likely to repeat that behavior again. In all the cartels examined in this paper, some of the members of the cartel had engaged in price fixing in the 1980s or before. Also, in both lysine and citric acid, there were two new firms that had entered production only a year or two before the conspiracy was formed. The new firms would not have had enough time in the industry to learn how to cooperate tacitly. In vitamins, a unique combination of firms had to form a multinational coalition for each product, so here too tacit cooperation would have been difficult to achieve. Overt price fixing was a faster route to supranormal pricing.

Fourth, rates of volume growth were quite robust for lysine and citric acid, but vitamin growth had decelerated greatly since the 1970s and 1980s. For the first two products there is little evidence of cyclic growth patterns that may have induced price wars. However, in examining the financial records of the major participants in the cartels examined, in the late 1980s nearly all of them showed signs of shrinking profitability in major lines of business other than the ones chosen for price fixing. Rather than seeking explanations for collusion in market growth patterns, the anxiety of a looming corporate slowdown in growth or profitability may provide a predictor of a willingness to collude.

Fifth, cultural or geographic closeness among conspirators has often been cited as a positive factor encouraging collusive schemes. These forms of propinquity are most often interpreted as proxies for lower conspiratorial transactions costs or the likelihood of developing group trust of a type likely to lower the tendency to cheat. While cultural similarities may have facilitated the cartels formed in Europe and Japan prior to the 1990s, one of the striking features of the global cartels of the 1990s is the cultural plurality of their membership. At times the South Korean firms seemed to be endangering the harmony of the lysine cartel, but in general the broad mix of national and business cultures observed in the case studies seems not to have inhibited cartel formation or longevity. Cartels composed of companies drawn from all over the "triad" (East Asia, Western Europe, and North America) now seem eminently feasible, indeed *de riguer*.

Collusive Conduct

There are many specific actions encompassed by the idea of restrictive business practices. The behaviors of the three global cartels featured in this book illustrate nearly all the 24 specific restraints of trade associated with cartels (Table 2). Under the category of setting common

prices, all the techniques employed by historical cartels were practiced by the three food-and-feed-ingredient cartels except setting precise transaction prices. However, transaction prices were indirectly set by the cartels because spot purchases were made at list prices and contract prices typically tracked slightly below list prices.

Only a few tactics were not tried by the cartels discussed in this paper. Although no overt agreements were known to have been made on restricting plant investments, evidence in the lysine cartel indicates that expansion rates slowed markedly during the peak years of conspiracy as the higher prices choked off some demand growth. Under the enforcement methods category, none of the three cartels was reported to have employed a trigger-price mechanism or pooled their sales through a common agency.

To provide a concrete picture of how global cartels are formed and managed, the following section briefly summarizes the conduct of the conspirators in the lysine cartel of 1992-1995.¹² The vitamins cartels were a bit more elaborate, but the citric acid cartel operated in a very similar fashion to the lysine case. All three were historically and causally related (Figure 1).

¹² Details may be found in Connor (2001, Ch. 8) and Appendix A of Connor (2000). Many of these were corroborated by testimony or exhibits from the 1998 criminal trial (Tr.). For popular accounts of the cartel, see Eichenwald (2000) and Lieber (2000). The final legal decision is Kanne *et al.* (2000).

Table 2. Restraints of Trade in the Lysine, Citric Acid, and Vitamins Cartels.

Types of Collusive Behavior	Lysine	Citric Acid	Vitamins
Setting Common Prices:			
1. List price agreement	X	X	X
2. Transaction price agreement			
3. Agreement on customer discounts		X	
4. Agreement on price-protection clauses	X		
5. Rigging bids	X		X
Setting Company Market Shares:			
6. Global sales shares		X	X
7. Global quantity shares	X		?
8. Regional or national shares	X		X
9. Allocating specific customers			X
Setting Production Limits:			
10. Global output reductions ^a	X		
11. On exports to specific destinations	X	X	X
12. On arbitrage by buyers	X		X
13. On production capacities			
Monitoring the Illegal Agreements:			
14. Reporting company production data	X	X	X
15. Sales certification by third parties		X	?
16. Inspection of plant records or inventories on site		X	
Cartel Enforcement Methods:			
17. Trigger price mechanism			
18. Dominant firm threatened excess production	X	X	
19. Periodic compensation for under-share members	X	X	
20. Marketing agency for pooling of sales			?
21. Pooling and division of profits			X
Cover-up Efforts:			
22. Create or exploit an industry trade association	X	X	X
23. Hide evidence of travel, meetings, or communications	X	X	X
24. Employ code words or code names	X		

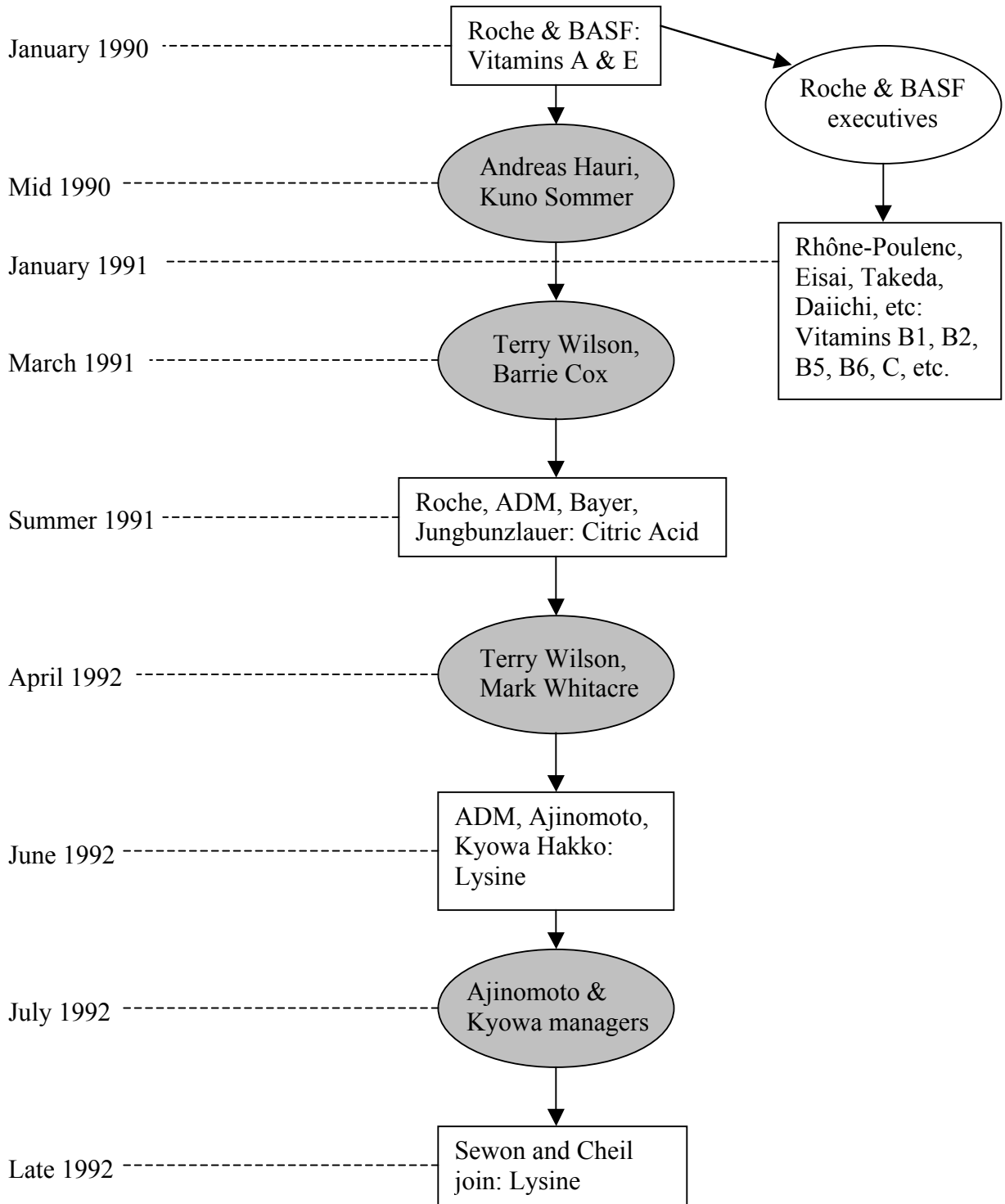
Source: Chapters 5, 8, and 11 of Connor (2001), Kolasky (2002).

X = Behavior observed or highly probable in cartel above.

? = Some unconfirmed reports of such behavior.

^a Production limits are set below historical rates of growth in the market.

Figure 1. Linkages



The Lysine Cartel: Behavior

Early in 1989 ADM was approached by Degussa, a German metal and chemicals company, to negotiate a long term supply agreement for dextrose. Degussa informed ADM about plans for building a U.S. plant to manufacture lysine, an amino acid about which Degussa had significant technical expertise. In late 1989, ADM broke off the negotiations, instead hiring Degussa's chief negotiator, Dr. Mark Whitacre, and announcing that ADM would build the world's largest lysine plant in Decatur, Illinois. After spending more than \$100 million dollars, that plant began production in February 1991 using a fermentation technology purchased from Eastman Chemical Co.

Ajinomoto, Kyowa Hakko, and Sewon began meeting as early as April 1990 to try to forge a plan to cope with ADM's entry, but they were fatalistic about ADM's impending success. After ADM entered production, the Asian manufacturers repeatedly signaled their willingness to raise lysine prices, but ADM appeared to be steadfast in its drive toward sharing global dominance with the world leader, Ajinomoto. By mid-1992, ADM had captured an impressive 80% of U.S. sales, and it was exporting more than half its production. Ajinomoto and Kyowa experienced large operating losses in late 1991 and early 1992. In June 1992, the U.S. transaction price reached \$0.68 per pound, which was \$0.10 per pound below the long-run marginal cost of ADM (see discussion of costs below).

By early 1992, the Asian incumbents were considering asking ADM to join them in a more cooperative arrangement. It must have seemed something of a godsend when in April 1992 the President of ADM's lysine division showed up in Tokyo with another more senior ADM officer to propose the formation of a lysine "trade association."¹³ Under the cover of establishing such a trade group, Ajinomoto, Kyowa, and ADM officers met in Mexico City in June 1992 and agreed to raise the global price of lysine to \$1.05 per pound. This was the first of 25 multiparty price-fixing meetings among the five corporations that joined the cartel; dozens of supplementary bilateral meetings by regional sales managers and hundreds of telephone calls cemented agreements on prices in as many as 13 countries or regions. The price agreements covered only dry feed-grade lysine.¹⁴ In early 1993, a brief price war broke out among the conspirators, mainly because of ADM's insistence that the participants had to agree to global market shares. After a top-level meeting in October 1993 resolved the issue, the cartel displayed a high level of harmony and consensus. Cheating was restrained in part by largely accurate monthly reporting of each company's lysine sales volume to all the members of the cartel.

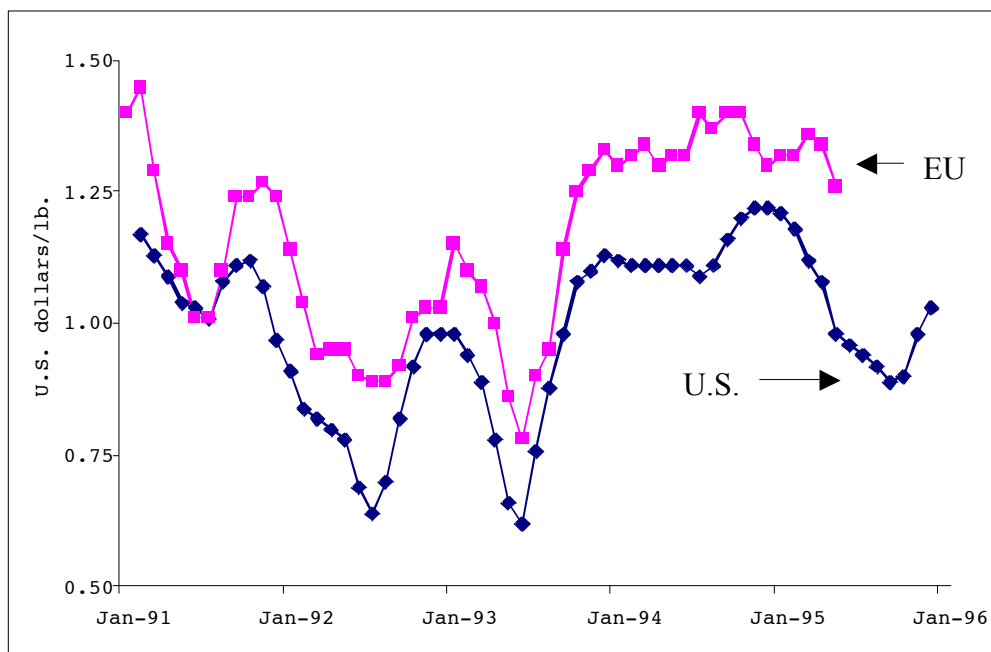
The lysine cartel ended with the FBI raid on cartel offices in June 1995, almost exactly three years after the first price-fixing meeting had occurred. During that time, the average U.S. transaction price of lysine (manufacturers' delivered price) rose from \$0.68 per pound when the cartel began operating to a plateau of \$0.98 (October-December 1992), fell again to \$0.65 (May 1993), and rose quickly again to above \$1.00 for most of the remainder of the conspiracy period

¹³ A year or two later, the International Amino Acids Manufacturers' Association was formed and recognized as a "working party" of the Agriculture Directorate of the European Commission.

¹⁴ In the U.S. market ADM sold a somewhat diluted aqueous version delivered in tanker trucks to nearby customers. On an active-ingredient basis, liquid lysine was less expensive but highly correlated in price movements to the powder form. Liquid lysine accounted for well under 5 percent of the U.S. market.

(Figure 2). Prices in the European Union closely tracked those in the United States, albeit at a level \$0.10 to \$0.25 higher.¹⁵ Target prices were also higher than the U.S. target price in Latin America, Japan, Oceania, and most parts of Asia (Connor 2001, p. 238). However, in the rest of this paper, only U.S. prices will be analyzed.

Figure 2. Lysine Transaction Prices, U.S. and EU Markets, 1991-1996.



Note: U.S. prices from sales by the four largest manufacturers (see Appendix A of Connor (2000) for details). EU prices from a European Commission notice published on the *RAPID* web site in 2001, in euros, translated into U.S. dollars at the prevailing monthly interbank exchange rate.

Costs of Collusion

Many economists, especially those of the Chicago School of industrial-organization economies, assert that the real-world incidence of cartels is low and that their lives are fleeting. These theorists base their predictions on what they believe are insuperable costs of achieving and maintaining a collusive contract, a type of agreement not enforceable by law (see Posner 2001:60-69). These contracting costs include agreeing on uniform prices or a reduction in output, agreeing to accept firm-specific reductions in production, monitoring adherence to the price or output decisions, developing a method of punishing cheaters, and redistributing the monopoly profits. Unfortunately, the history of the lysine cartel and related global cartels prosecuted in the late 1990s does not support this sanguine view.

¹⁵ The correlation in prices is even higher when one compares the U.S. price in dollars to the EU price in Deutschmarks. That is, that U.S. \$/DM exchange rate, which is rather unpredictable, introduced more variability into the European price because the conspirators used the dollar to fix prices quarterly.

Internal memorandums and extensive trial testimony by cartel participants confirm that the conspirators reasonably anticipated that the rewards from price fixing would far outweigh the costs of operating the cartel (Connor 2001, Ch. 8). At a key meeting in late 1992, a top ADM official predicted that their recently concluded agreement would generate \$200 million in joint profits in a global market for lysine that varied from \$500 to \$700 million in annual sales. His prediction, from ADM's perspective, was spot on; ADM would earn just about \$200 million in profits from the cartel over three years with its one-third share of sales in the worldwide lysine market.

Direct management costs of operating the cartel were modest. During the four years of preliminary negotiations and actual cartel operation, each of the four (later five) companies sent two men to meetings held on average once every three months. Late in the conspiracy, regional sales managers became involved, but the total number of conspirators never exceeded 40 (Connor 2000:App. A). Counting the monthly production reports submitted by each firm and other communications, it appears that each corporate member of the cartel managed the conspiracy with an input of 15 to 25 man-days per year. Total labor costs for all corporate conspirators could not have exceeded \$1 million for the entire conspiracy period.

It is certainly true that the cartel members squabbled frequently and that the two smallest members, both South Korean companies, were strongly inclined to cheat on the price and market-share agreements. Infighting led to one sharp price war for a few months in 1993, the second year of the conspiracy. This brief war cost the cartel two or three months of monopoly profits, but it reminded the smaller members of the cartel of why they had joined the cartel in the first place. The lysine cartel was clearly more disciplined in the two years after the brief price war than the first seven or eight months of the conspiracy.

A number of techniques adopted by the cartel and the impressive diplomatic skills of the cartel's dual leaders, ADM and Ajinomoto, kept the effects of cheating to tolerable levels. Among the most important practices that cemented cartel harmony was the tonnage quotas agreed upon in late 1993. Combined with accurate monthly sales reports and politic concessions of additional quotas to the two Korean firms, the market-share agreements would be honored with impressive precision throughout 1994 and 1995. The formation of an amino acid trade association under European Commission sponsorship provided excellent cover for the group's illegal meetings in Europe and elsewhere. A compensation system was adopted to punish members that exceeded their quotas, but it was never necessary to implement the scheme. ADM, with its new efficient plant and ample excess capacity, frequently reminded the cartel of its willingness to flood the market with lysine; its threats were credible because it had twice driven the world price of lysine to below its own average total cost of production, inflicting the others with operating losses. Moreover, ADM had taken the rare step of inviting its rivals in the lysine market to an intimate tour of its capacious production facilities. Finally, it should be recalled that for the three largest Asian companies in the 1992-1995 cartel, they had had a great deal of experience in organizing price-fixing schemes for two decades. ADM too, it is now known, was a serial price fixer.¹⁶

¹⁶ ADM conspired to fix prices in the markets for sodium gluconate and citric acid; highly possible cases include corn sweeteners, monosodium glutamate, methionine, other nucleotides, carbon dioxide gas, and wine alcohol.

Performance: Market Effects

The global food-and-feed cartels of the 1990s achieved their goals brilliantly. During the conspiracy periods, the cartel managers were able to perform market magic. They raised the transaction prices of their companies' products simultaneously nearly everywhere in the world to levels well above the economic costs of production and distribution, thereby expanding the pool of industry profits to levels that were several times what natural market forces would have yielded. What a thrill it must have been to these salesmen to manipulate markets that formerly had been mere constraints on their pricing discretion.

At the same time, their customers were faced with substantial price increases that no amount of searching, bargaining, and negotiating would lower. In many cases, the food and feed manufacturers that purchased the cartelized products found that only one supplier would deign to negotiate a deal. Even the largest buyers, long used to getting concessions on list prices or other terms of sale, found that no amount of negotiations would yield favorable discounts from the world's suppliers. All the offers were suddenly identical.

Customers of effective sellers' cartels are negatively affected in two ways. First, and quantitatively larger, purchasers of cartelized products overpay for the goods they continue to buy during the conspiracy period. This is the customer overcharge. A customer overcharge is a transfer of income from buyers as a group to the sellers as a group.¹⁷ As a cartel's collusive behavior begins to raise prices above competitive levels, the joint profits of the cartel members rise roughly by the same amount that buyer's purchases fall. If a cartel is able to operate at peak efficacy, the sum of its members' profits will be almost as high as a monopolist would be able to extract in the same market. In equilibrium, the monopoly profits going to the conspirators will be equal to the sum of the lost revenues of direct and indirect buyers and the effective reduction in purchasing power by the ultimate consumers.

The second negative impact on buyers is the so-called "dead-weight loss" or "social loss." This injury to buyers is an indirect consequence of higher prices. Under normal demand conditions, as a cartel is effective in raising market price, the quantity of sales will fall. The value of these lost sales is the dead-weight loss to customers. Because it represents both lost production as well as lost consumption, all social groups are injured: owners of the productive units, workers, intermediate buyers, and consumers. Consumers must use the disposable income they would have spent on the overpriced good on some other good they regard as inferior. Of course, cartel participants do not make profits on sales they do not make.

Table 3 summarizes the market effects of 26 international food-and-feed-ingredient cartels that were discovered during 1996-2002. The average duration of these cartels was about 8 years; the longest conspiracy was in the sorbates market, which lasted nearly 18 years. The durability of the international food-and-agriculture cartels shown in Table 3 is considerably higher than domestic cartels discovered in Germany and the United States (Voight 1962, Fraas

¹⁷ If some sellers do not join the cartel, their customers are still injured if the noncartel sellers follow the cartel's price increases. Although overcharges are conventionally viewed as pure income transfers, many economists agree with Posner (2001) that much or all of the overcharge is a social cost. Under U.S. antitrust law, cartel members are responsible for their own overcharges as well as those by nonmembers.

and Greer 1977). This rather surprising because the greater need for international travel and for electronic communications between meetings in the case of international cartels would appear to have raised the likelihood of exposure. The superior longevity of international cartels must be related to higher barriers to entry into the cartelized industries, many of which seem protected by sophisticated production technologies (in the chemical industries) or large economies of scale (e.g., beer).

The average number of participants in these food-and-agriculture cartels was 3.3, and the range was from two companies (four cases) to eight. The fact that these cartels comprised six or fewer members comports nicely with theoretical models of cartel formation. Selten (1973) developed a cartel model that predicted that the maximum number of sellers would be five equal-size firms, and a model by Philips (1995) suggests that the threshold is six firms. However, the international cartels of the 1990s had fewer members than discovered and prosecuted U.S. cartels. Samples studied by Hay and Kelly (1974) and Fraas and Greer (1977) also confirmed that most cartels had few members, but in about one-third of their cases the cartels operated with more than six sellers.

The small number of cartel participants is a consequence of the high degree of seller concentration already noted above in Table 1. Global concentration in the lysine, citric acid, and vitamins A & E markets as measured by the four-firm concentration ratio (CR4) averaged above 92 percent. In all but one case (citric acid), the three-to-five formal members of the cartel controlled more than 95 percent of global supply of the cartelized products.¹⁸

Whether global or regional concentration is the more appropriate concept in these cases is an interesting question. High *global* concentration is clearly a necessary condition for achieving an initial collusive consensus, if only because the products were highly tradable internationally. Lysine, citric acid, bulk vitamins, and most of the other food-and-feed ingredients were storable commodities with prices high enough relative to transportation costs that significant shares of domestic supply were imported or exported. However, once global price fixing began, the focus of decision making shifted to *regional* markets (continents, countries, or groups of countries). Price fixing at regional levels was made more complicated by fluctuations in currency exchange rates but was made easier by virtue of the fact that regional concentration was equal to or higher than global concentration.¹⁹

¹⁸ In the citric acid cartel, there is evidence that one leading producer, while not an active formal member, did cooperate in a passive fashion with the cartel and may have explicitly agreed to do so.

¹⁹ Regional concentration was considerably higher where the region contained a plant operated by a cartel member, was somewhat higher if the region had importers located close at hand, and was about equal to global levels if the region was “equidistant” from the cartel’s production points in a cost sense.

Table 3. Twenty-Seven Discovered International Cartels, Food and Agricultural Ingredients, 1996-2002.

Cartel Product	Years	No. of Companies	Affected Market Sales			Customers' Overcharge
			U.S.	EU	World	
			<i>Million dollars</i>			
Vitamin A	(1989-99)	3	850	1,730	5,740	1,600
Vitamin E	(1989-99)	4	1,700	2,875	10,840	3,800
Ten other vitamins ^a	(1990-99)	20 ^a	2,450	3,700	11,440	2,100 ^c
Lysine	(1992-95)	5	460	605	1,950E	240 ^c
Methionine ^b	(1989-99)	5	2,900	3,200	7,900E	1,580 ^c
Citric acid	(1991-95)	4	1,400	1,200	4,300E	700 ^c
Sorbates	(1979-96)	6	1,000 ^c	1,100E	3,000E	1,200E
Maltol	(1989-95)	2	70?	0E	70E	10E
Sodium erythorbate	(1992-94)	2	150E	170E	450E	50E
Sodium glutamate	(1987-95)	6	8E	250E	400	80E
Monosodium glutamate ^b	(1990-99)	3-8	4,300E	3,000E	17,100E	2,000E
Belgian breweries ^d	(1993-98)	4	NA	1,500+E	1,500+E	150+E
Luxembourg breweries	(1985-98)	4	0	?	?	?
Monochloroacetic acid	(1995-99)	2-5	145E	NA	NA	15-25E
Organic peroxides	(1997-98)	2-4	450	300E	1,000	?
Wine alcohol	(1992-98)	3+	0	NA		50%
Nucleotides	(1992-96)	3	NA	NA	NA	5-10?
Danish-Dutch beer market ^d	(1993-2000)	2	0	1,400E	1,400E	150E
Total		80-90	15,883	21,030	67,090	13,690

Sources: Connor (2001a, 2001b), Connor (2003), EC (2002), DOJ (2002), and Table A.2.

E = Estimate by author

NA = Not available or not applicable

? = Uncertain

^a Other products include: C, B4, B3, B1, B2, B5, B6, B12, D, (K?), Folic acid, 2 Cartenoids, premixes, and biotin (H). On average 2.2 cos. per cartel.

^b Only 3 convicted by an antitrust agency but strong evidence that cartel operated. Excludes China.

^c Middle of range of estimate.

^d Not global cartels, but members from two or more countries.

“Affected market sales” (the manufacturers sales during the period of effective collusion) varied considerably across the food-and-agriculture cartels. Worldwide affected sales for cartelized lysine totaled \$1,950 million (\$650 million per year) and for citric acid totaled \$7,900 million (\$1,975 million annually). While these are important markets, they are dwarfed by the cartelized sales of vitamins, which totaled an impressive \$28 billion for all 12 vitamins or about \$275 million per vitamin per year. Other notably large affected markets were for monosodium glutamate or MSG (\$17,100 million), monochloroacetic acid or MCAA (\$4,500 million), and sorbates (\$3,000 million). Several other cartels affected much smaller global markets (e.g., sodium gluconate) or markets of unknown size. All told, the food-and-agricultural cartels of the 1990s raised the wholesale prices on at least \$70 billion in global commerce. On average, 23 percent of these purchases occurred in North America, 31 percent in Europe, and the remainder in Asia and Latin America. Because the direct buyers (tens of thousands of food processors and feed manufacturers) inevitably passed on these price increase to wholesale and retail distributors, the world’s consumers of foods and medicines very likely were overcharged on at least \$200 billion of their retail purchasers.

Finally, data are available on the dollar overcharges achieved by many of these international cartels. Of the 26 cartels, the U.S. overcharges are known with a fair degree of precision for 16 of them (lysine, citric acid, 12 vitamins, methionine, and sorbates). Global overcharges are then estimated by considering the geographic distribution of affected sales. For the 16 cases, direct customers were overcharged \$11,220 million during the cartel periods. The overcharge rate (the dollar overcharge divided by affected sales) varied from 35 percent for vitamin E to 12 percent for the lysine cartel. The weighted average rate for the 16 cartels with fairly accurate overcharge information was 24.7 percent of affected sales worldwide. For whatever reason, this overcharge rate appears to be more than double the rate typically observed historically.²⁰ An average overcharge rate of 25 percent would make it difficult for government antitrust agencies to impose fines high enough to make corporate price fixers disgorge all of the monopoly profits accumulated by a global cartel, especially if the agencies use national sales of the violators as the base upon which the fines are computed. That is, the high degree of effectiveness of global cartels calls into question the ability of government fines to deter recidivism.

The number and size of international cartels in food and agricultural markets far outweighs the cartels discovered in all other markets. The 14 non-agricultural conspiracies exposed since 1995 involved 56 to 60 companies, but most of the affected markets were relatively small in terms of sales or geographic size (Table A.1). It appears that global sales during the conspiracies will be in the \$12 to \$15 billion range; the graphite-electrodes case accounts for more than one-third of the total. The size of the customer overcharges is likely to total \$3.5 to \$4.0 billion. Thus, affected global sales of international cartels are highly concentrated (more than 80 percent) in food and agricultural markets.

²⁰ The U.S. Sentencing Guidelines for corporations that violate federal antitrust laws incorporate a presumptive rate of 10 percent. In the EU, a maximum fine of 10 percent of company sales is permitted for antitrust infringements.

Crime and Punishment

In a standard textbook on antitrust policies written in the early 1980s, the author tells the story of the international uranium cartel of 1972-1975. This cartel was comprised of 29 suppliers of uranium, 17 of them U.S. firms, that was successfully sued for treble damages by the largest U.S. buyer of uranium. The fact that the U.S. DOJ never indicted the cartel

“... demonstrates that the strict [U.S.] policy against price fixing largely exempts foreign cartels, even if they have U.S. members ... and probably affect prices in the United States” (Shepherd 1985:20).

How different the attitude is two decades later. Since 1995, the U.S. DOJ has had a large number of legal victories against harmful, secretive global cartels. The Antitrust Division, together its sister competition agencies in many other jurisdictions, has steadily expanded its investigatory methods, powers to negotiate guilty pleas, and harshness of penalties for noncooperative violators.

Antitrust authorities have been goaded into action by the disrespect shown by cartelists to competition laws and those who enforce them. Speeches after speeches by top antitrust officials betray 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 break their own companies' rules (Kolasky 2002). Particularly surprising to antitrust prosecutors is the involvement of the most senior officers of colluding firms in the management of the cartel. At the same time, these global cartelists have shown a fear for the ability of U.S. authorities to detect their illegal activities by avoiding meetings on U.S. territory and by trying to hide the existence of the cartel from U.S. employees; these practices were particularly evident after the lysine-cartel investigation became public in 1995. Elaborate measures were taken to cover up the cartel's activities wherever the conspiracy took place.

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. Prior to 1995, less than 1 percent of the corporations accused of criminal price fixing were foreign-based firms; after 1997, more than 50 percent were non-U.S. corporations (Connor 2001:6). Fines imposed on global price fixers escalated steeply from 1996 to 1999, with new record amounts collected nearly every year. In 1999 alone, the \$900-million-plus collected from international price fixers was far more than the entire 108 years of U.S. antitrust enforcement (Klein 1999). Nearly four-fifths of the DOJ's fines for criminal price fixing were imposed on non-U.S. firms in the late 1990s. The use of personal fines and prison sentences has also escalated; since 1995, the U.S. government has sent more than 30 executives to prison for price-fixing, and a high proportion are not U.S. citizens. Perhaps more importantly, the success enjoyed by the U.S. DOJ has been increasingly mimicked abroad by the antitrust agencies of Canada, the EU, Mexico, Korea, Brazil, and Australia. In 2001, the EU collected more than €1.8 billion in price fixing fines; from 1998 to 2001, the total was €2.5 billion (Arbault *et al.* 2002).

This section presents some original data on the prosecutions by the U.S., Canada, and EU of international cartels, most of them global in scope.²¹ The purpose is to show the pattern of anticartel enforcement by government agencies of three jurisdictions that have the most active programs to deter price fixing. These data are necessary to develop a fuller understanding of the potential for effective cartel deterrence in the long run.

The U.S. Department of Justice

The U.S. Sherman Act became law in July 1890. While the U.S. Congress has implemented many clarifying amendments over the years, the section of the Sherman Act that prohibits all agreements, contracts, or conspiracies in restraint of trade has remained virtually untouched in its original form. “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. If the conspiracy is serious enough and the evidence of intent strong enough, corporations and individuals may be charged by the DOJ as a criminal matter. In practice, the DOJ files about 95 percent of all price-fixing cases as criminal matters, and nearly all other antitrust violations are treated as civil matters, for which the burden of proof is merely the preponderance of the evidence. All other parties that bring suits against price fixers, including other federal agencies and state attorneys general, may file only civil complaints.

Although preceded by antitrust laws passed by 13 states of the United States and at least two other countries (France and Canada), the Sherman Act became the first truly effective anticartel statute. By 1897 the U.S. DOJ had successfully prosecuted the first of many domestic price fixing conspiracies. The famous *American Tobacco* case decided by the Supreme Court in 1911 had some international elements; two of the defendants were UK firms. However, except for the period of five years following the end of World War II, the DOJ prosecuted very few international cartels (Connor 2001:66-67), even though the Sherman Act applies to any conspiracy that affects U.S. markets. It appears that international cartels formed between 1945 and 1990 were few, very well hidden, or had no U.S.-corporate membership. Moreover, in the three or four cases of global cartels that were prosecuted between 1950 and 1995, the DOJ lost the cases because the witnesses were foreign or key evidence located abroad could not be obtained by prosecutors.

The notable success in prosecuting global cartels after 1995 may be traced to several improvements in the law and in investigatory techniques. First, the Sherman Act’s penalties were steadily increased by amendments in 1955, 1974, 1987, and 1990 (Table 4). In 1974, corporate fines were increased twenty-fold and personal participation was made a *felony* (prison sentences were raised from a maximum of one year to three years). In 1987, a federal judicial commission further raised the possible fines on corporations up to a maximum of double the cartel’s overcharge, a level that could far exceed the previous statutory cap of \$1 million; larger

²¹ Recall that under the U.S. DOJ’s definition of “foreign” or international at least one target (corporate or individual) of an investigation or conviction must have non-U.S. registration, citizenship, or residence. Global cartels are subsets that aimed at affecting prices in three or more continents.

personal fines also became feasible. In 1990, the Sherman Act received a centennial “birthday present” of yet larger statutory fines from the Congress.

Table 4. Criminal Penalties for Price Fixing, U.S. Sherman Act, 1890-Present.

Year Enacted	Maximum Fines for Companies	Maximum Penalties for Individuals	
		Fines	Prison (Months)
1890	\$5,000 per count ^a	\$5,000 per count	12 ^b
1955	\$50,000 per count ^a	\$50,000 per count	12 ^b
1974	\$1,000,000	\$100,000 ^c	36 ^c
1987	Larger of \$1,000,000 or double the harm with multipliers ^d	Larger of \$100,000 or 5% of the harm with multipliers ^d	36
1990	Larger of \$10,000,000 or double the harm with multipliers ^d	Larger of \$350,000 or 5% of the harm with multipliers ^d	36

^a In serious cases, prosecutors can file multiple counts against firms involved in one conspiracy. Not used much in recent years.

^b Misdemeanor

^c Became a felony for individuals.

^d The base fines are calculated using either double or 5% of the estimated monopoly overcharge. The base fines are multiplied by upper and lower figures that depend on the degree of “culpability” (larger numbers for several exacerbating factors and smaller ones for extenuating factors). In the 1990s, the multipliers have often been between 1.5 and 4.5. If the overcharge is not known, it is presumed to be 10% of affected sales, which yields a base fine of 20% of affected sales, and a typical fine range of 30% to 90% of cartel sales. However, if a cartel creates a 25% overcharge, then the base fine is 50% of affected sales and the final fine range will be 75% to 225% of sales. “Sales” is usually U.S. only, but may be global cartel sales. In rare cases individuals can be fined up to \$25,000,000 depending on their cartel’s overcharge amount.

Second, 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. Prior to 1993, price-fixing fines had been cheerily paid with all the embarrassment associated with a parking ticket. The FBI had treated price fixers with the gentleness accorded a shoplifter. But after 1992, price-fixing probes had all the trappings of a major conspiracy by the worst types of organized criminals. Armed with intimidating new powers to sanction firms and their managers, prosecutors bargained hard to obtain confessions and to “flip” conspirators into useful witnesses against their co-conspirators. The 1993 Corporate Leniency Program described below was a particularly important investigative innovation. Prosecutors became sophisticated in their use of amnesty, leniency, or other blandishments to induce cooperation. By 2001, nearly 70 percent of all corporate price-fixing defendants were foreign-based (Hammond 2002).

The U.S. DOJ’s criminal price-fixing record is summarized in Table 5. During 1980-1999, the Antitrust Division convicted more than 50 price-fixing crimes per year on average.²² Until late 1996, nearly all the cases prosecuted were domestic schemes that involved modest sales in the affected markets. Indeed, during the 1980s, more than 80 percent of the price-fixing

²² The DOJ convicts more than 80% of those indicted for antitrust. Nearly all convictions are through plea bargains.

cases involved bid-rigging, mostly construction firms colluding on government projects or suppliers to local school districts; fewer than 15 percent were directed against conventional corporate cartels.

Table 5. Fines or Prison Sentences Imposed in All U.S. DOJ Price-Fixing Cases, 1970-1999.

Years	Total Criminal Cases Filed	Cases in Which Fines Imposed	Cases in Which Prison Sentences Imposed			
			Total Number	Largest Sentences		
			< 1 yr.	1-2 yrs.	2+ yrs.	
<i>Number</i>						
1970-1979	176	156	25	24	0	1 ^b
1980-1989	623	513	196	183	10	3
1990-1999	416	324	61	47	12	2
Global only, 1996-1999	10	10	3 ^c	1	1	1
<i>Percent of Total</i>						
1970-1979	42 ^a	88.6	14.2	96.0	0	4.0 ^b
1980-1989	84 ^a	82.3	31.5	93.4	5.1	1.5
1990-1999	68 ^a	77.9	14.7	77.0	19.7	3.3
Global only, 1996-1999	NA	100.0	30.0	33.3	33.3	33.3

Sources: Posner (2001:45), Connor (2001), Tables A.1, and A.2.

^a Proportion of criminal cases to total DOJ antitrust cases.

^b An unusual case; individual found guilty of racketeering as well as price fixing.

^c Seven persons have been indicted in a fourth, the sorbates case, but are fugitives as of 2002.

After 1990, enforcement patterns returned to the more traditional pattern of prosecuting horizontal collusion by corporate perpetrators. More importantly, starting with the lysine cartel in September 1996, the most important U.S. price-fixing convictions have been global conspiracies in food-and-feed ingredients. Ten such cartels have been fully or partially prosecuted in the six years since 1996, and more than 30 similar cartels are presently under investigation by the DOJ (Hammond 2002a). Total corporate fines imposed in the ten food-and-feed cartels was \$1,326 million on 33 multinational corporations (five more companies were granted amnesties) (Table A.2). In addition, the U.S. DOJ has convicted members of ten global cartels in other markets (Table A.1). However, the food-and-agricultural cartels accounted for 81 percent of the cartelized sales and 85 percent of all the fines on discovered international cartels (Tables 3, A.1, A.2, A.3).

Since 1969, the DOJ has obtained fines from a high share (83 percent) of the corporations found guilty of criminal price fixing (Table 5). The global cartels prosecuted in the late 1990s were clearly all fairly serious cases because all of them resulted in fines for the corporate

participants.²³ Indeed, *all* cartel members were fined except for those offered amnesty (Table 6).²⁴

Table 6. Fines and Sentences Imposed on Global Cartels by U.S. DOJ, 1996-2002.

Case Filed	No. of Fines		Prison Sentences Imposed			
	Corporate	Persons ^a	Year	No. Persons	No. Months	Max. Months
1996 Lysine	5	6 ¹	1999	3	99	36
1996 Citric acid	5	4	--	0	0	0
1997 Sodium gluconate	5	5	--	0	0	0
1998 Heavy-Lift marine construction	1	1	--	0	0	0
1998 Heavy-Lift marine transport	2	2	--	0	0	0
1998 Graphite electrodes	7	3	1999	2	26	17
1998 Sorbates	5 ¹	0 ⁷	Pending	--	--	--
1999 Vitamins	10	6 ²	1999	6	22.5	5
1999 Sodium erythorbate	1	0	--	0	0	0
1999 Maltol	1	0	--	0	0	0
2000 Bromines	1	0	--	0	0	0
2000 Isostatic graphite	3	2 ³	Pending	--	--	--
2000 Art auctions	1	1 ²	2002	1	12	12
2001 Nucleotides	3	0 ¹	--	0	0	0
2001 Magnetic iron oxide	1	1 ³	Pending	--	--	--
2002 MCAA	2	0	--	0	0	0
2002 Organic peroxides	1	0	--	0	0	0
2002 Carbon cathode block	3	2 ²	Pending	--	--	--
2002 Stamp dealers	1	0 ²	Pending	--	--	--
Total	58 ¹	33 ²³	--	12	159.5	70

Source: DOJ (2002).

^a Superscripts indicate persons indicted but not convicted (either awaiting trial, awaiting sentencing, or fugitives). Some may be fined or imprisoned after mid-2002.

²³ Table 5 includes every global cartel case filed after September 1996 and largely concluded by mid 2002.

²⁴ Only one corporate cartel participant risked a jury trial, and it lost badly. Mitsubishi Corp. had very little direct involvement in the global graphite-electrodes cartel, yet it was fined \$134 million in 2001 (Nanni 2002).

Prison sentences are imposed by the courts, which almost always follow the DOJ's recommendations in these matters, in a minor share (23 percent) of all price-fixing convictions. The threat of prison is still reserved for the most serious types of price-fixing, namely, those involving large economic injuries or cases in which the cartel managers resisted pleading guilty and cooperating with prosecutors. Moreover, the frequency with which prison sentences were imposed is significantly higher for the late-1990s global cartels; the share of long sentences imposed on the cartel ring leaders is particularly striking. In the one case where the managers resisted making deals for pleading guilty, the lysine cartel, the three ADM executives lost at trial and were sentenced to a collective 99 months in prison; ADM's Vice Chairman was the first person in antitrust history to receive the maximum 36-month sentence.

Criminal indictments and convictions of food-and-agricultural price fixers display an interesting geographic pattern (Table 7). Out of 76 cases, 30 (39 percent) of the corporations are headquartered in Asia, 29 (38 percent) in Europe, and 17 (23 percent) in North America. Relative to the sizes of their national chemical industries, Japan, South Korea, Switzerland, and the Netherlands seem to be overrepresented.

Table 7. Nationality of International Price Fixers of Food and Agricultural Ingredients, 1996-2002.

Rank	Country	Indicted or Convicted ^a in U.S.	
		Corporations	Individuals
1.	Japan	24	22
2.	United States	16	13
3.	Germany	8	9
4.	France	6	3
4.	South Korea	6	1
4.	Switzerland	6	3
7.	Netherlands	5	5
8.	Belgium	3	1
9.	Canada	1	2
9.	United Kingdom	1	3
11.	Italy	0	1
11.	Sweden	0	1
	Total	76	64

Sources: Table A.2, DOJ (2002), Table 6, Table 8.

^a Recidivists are double counted. Some probable indictments included.

In general, the fines collected from individual criminal conspirators are modest compared with their corporate salaries, often between \$75,000 and \$150,000. However, there are two noteworthy examples of high fines paid by the ringleaders of global cartels. The first, in 1998, was a fine of \$10 million paid by the German Chief Executive Officer of SGL Carbon, the instigator of the graphite electrodes cartel (Table 8). He paid a fine well above the statutory cap of \$350,000 to avoid a prison sentence. Second, in 2002, the Chairman of Sotheby's auction house was convicted at trial for fixing the fees for selling precious works of art. His fine of \$7.5

million was the first *litigated* example of the alternative fine statute being applied for price fixing. This statute permits personal fines of up to \$25 million, depending on the size of the overcharge caused by the cartel's operations.

The conviction and imprisonment of non-U.S. executives for criminal price fixing by U.S. authorities is an extraordinary development in recent enforcement history (Table 7). During 1995-2002, the U.S. DOJ has arranged guilty-pleas from dozens of top executives who were nationals of 12 foreign countries: Germany, Belgium, the Netherlands, England, France, Switzerland, Italy, Sweden, Canada, Mexico, Japan, and South Korea (Hammond 2002a). 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. Although some are indicted fugitives, nearly 80 percent of all price fixers of food-and-agricultural cartels are foreign nationals. Moreover, about ten foreign nationals from Canada, Germany, Switzerland, and Sweden have served significant prison sentences in the United States. 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 2002a). 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. 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.

Corporate sanctions need not stop with fines. In a little publicized conviction of bid-rigging against the U.S. Agency for International Development on building projects in Egypt, a U.S. court required two convicted firms to pay for large advertisements in the *Wall Street Journal* and *New York Times* that detailed their shameful transgressions (Hammond 2002:7). The U.S. DOJ intends to seek similar court orders in appropriate cases. Corporate governance restructurings, divestitures, or disgorgement are possible additional sanctions that courts may require.

Table 8. U.S. Convictions of Individual Price Fixers, Selected Global Cartels.

Name	Nationality	Corporate Position	Sanctions	
			Fines	Prison
			<i>U.S. dollars</i>	<i>Months</i>
LYSINE (1999):				
Michael D. Andreas	U.S.	Vice Chairman, ADM	350,000	36 ^a
Terrance Wilson	U.S.	Pres., Corn Products Division, ADM	350,000	33
Mark Whitacre	U.S.	Pres., Bioproducts Division, ADM	350,000	30
Kanji Mimoto	JP	Div. Mgr., Ajinomoto	75,000	0
Hirozaku Ikeda	JP	Div. Mgr., Ajinomoto	0	0
Kaztoshi Yamada	JP	Mng. Dir., Ajinomoto	Fugitive	0
Masaru Yamamoto	JP	Div. Mgr., Kyowa	50,000	0
Jhom Su Kim	SK	Pres., Sewon America	75,000	0

CITRIC ACID (1997-98):				
Hans Hartmann	DE	Pres., Bayer subsidiary	150,000	0
Udo Haas	DE	Managing Director, Roche subsidiary	150,000	0
Rainer Bilchbauer	CH	President, Jungbunzlauer	150,000	0
Silvio Kluzer	CH	Mng. Dir., Eridania sub.	40,000	0
VITAMINS (1999): ^c				
Kuno Sommer	CH	Mng. Dir., Roche	100,000	4
Roland Brönnimann	CH	Div. Pres., Roche	150,000	5
Andreas Hauri	CH	Mktg. Dir, Roche	350,000	4
Reinhardt Steinmetz	DE	Div. Pres., BASF	125,000	3.5
Dieter Suter	CH	Div. Pres., BASF	75,000	3
Hugo Strotmann	DE	Group V.P., BASF	75,000	3
SORBATES (2001):				
Yuji Komatsu	JP	Genl. Mgr. Sales + Director, Ueno	Fugitive	0
Yoshihiko Katsuyama	(JP)	Dep. Sales Mgr., Ueno	Fugitive	0
Wakao Shinoda	JP	Genl. Mgr., Ueno USA	Fugitive	0
Hitoshi Hayashi	JP	Salesman, Organic Chem. Div., Daicel	Fugitive	0
ART AUCTIONS (2002):				
A. Alfred Taubman	US	Chairman, Sotheby's	7,500,000 ^a	12
Sir Anthony Tenant	UK	Chairman, Christies'	Fugitive	0
Jane Doe	US	CEO, Sotheby's	Pending	0
SODIUM GLUCONATE (1997):				
Cornelius Nederveen	NL	Mgr. Dir., Glucona	100,000	0
Marcel van Eekhout	NL	Mgr. Dir., Glucona	100,000	0
Bertrand Dufour	F	Mgr. Dir., Roquette	50,000	0
Akira Nakao	JP	Asso. Div. Dir., PMP	200,000	0
GRAPHITE ELECTRODES (1998-99):				
Robert Krass	US	Pres., UCAR Intl.	1,250,000	17
Robert Hart	US	COO, UCAR Intl.	1,000,000	9
Robert Koehler	DE	CEO, SGL Carbon	10,000,000 ^b	0

Note: Not shown here are convictions of Canadian and Swedish executives who were imprisoned.

^a Largest litigated personal antitrust fine.

^b Largest personal antitrust fine.

^c Two anonymous executives are indicted fugitives.

In summary, the financial penalties applied by the U.S. DOJ to global price fixers in the late 1990s were unprecedented in their harshness. Average corporate fines for members of global cartels in the late 1990s were many times higher than the fines collected in 1990-1996 (Table 9). The main reason for the escalation in fines in the late 1990s was the extraordinary escalation in legal standards, 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.

Unique to the United States is its history of imposing serious sentences on individual price fixers. Both the fines and prison sentences were higher for the managers of global conspiracies than for managers of domestic conspiracies (Table 9). In 2001, the average U.S. prison sentence for convicted price fixers was 15 months (Nanni 2002). Only Canada and Israel have jailed managers of global cartels outside the United States since 1995 (*ibid.*). The UK and Australia are contemplating making prison sentences possible for serious price-fixing violations. Whether this newly harsh regime of sanctions will have a lasting impact on deterrence is a matter for speculation at present.²⁵

Table 9. Average U.S. Criminal Penalties for Price Fixing, 1890-1999.

Years	Fine Per Company	Fines Per Person	Prison Sentence Per Person
	<i>Dollars</i>		<i>Months</i>
1890-1899	0	0	0
1900-1919	20,000	0	0
1920-1939	77,800	0	0
1940-1949	52,000	0	0
1950-1959	40,000	NA	0
1960-1969	131,000	NA	0.1
1970-1979	301,000	5,000 ^a	2
1980-1989	368,000	NA	4E
1990-1996	1,000,000	67,000	5E
1997 ^b	7,000,000	125,000	0
1998 ^b	11,000,000	131,000	0
1999 ^b	38,000,000	1,871,000	19

Sources: Posner (2001), Shepherd (1985), Connor (2001), DOJ (2002).

NA = Not available, but a small amount.

^a From the *Folding Carton* case.

^b Global cartels (Connor 2001:Table 13.A.1). The corporate lysine case is placed in 1997, but the individual sentences were delayed to 1999.

²⁵ Data are incomplete for 2000-2001 because several indicted global cartel cases are not finished, but the upward trend in sanctions is not likely to persist in 2000 or 2001.

Canada

The Canadian Competition Bureau (CCB) enforces laws similar to those in the United States, and its prosecutions follow those in the United States by a year or so (Table A.3). Cartel violations are crimes treated in effect as *per se* illegal acts. Persons can be fined and imprisoned, but this power is used quite sparingly. The CCB is a small agency that cooperates closely with the U.S. DOJ. Its indictments of global cartels in the 1990s usually followed those announced by the DOJ after a lag of one year. As in the United States, the CCB has imposed record antitrust penalties, but at a level proportionately lower than the U.S. fine rates, typically representing 10 to 20 percent of Canadian sales during the affected period. In several cases, except for leniency discounts, apparently to save the costs of economic analysis and litigation, the CCB has imposed identical percentage-of-sales fines on each of the conspirators.

The principal Canadian corporate fines for global price fixing are shown in Table 10. In the 1990s, prior to the lysine indictments in 1998, the total price-fixing fines collected were C\$22 million. However, in 1998 the fines from just two global cartels (lysine and citric acid) totaled nearly C\$30 million. By mid 2002, Canada had collected C\$164 million in global cartel fines since 1997.

Only one person, the CEO of a Canadian vitamin manufacturer, has been incarcerated. This sentence of 90 days was the first such punishment in many years. Three more cartel managers, from Germany, Switzerland, and Japan, have paid large fines for their roles in the citric acid, vitamins and sorbates cartels. They paid a total of \$750,000, which were the third-largest fines in recent antitrust history.

As in the United States, Canadian fines for international price fixing were imposed predominantly on conspiracies in food in agricultural markets; since 1997, more than 85 percent of the fines have been imposed in these industries. Moreover, the vitamins cartels were by far the largest cartel cases uncovered. The vitamins fines accounted for 61 percent of all cartel fines imposed in Canada since 1997. Although Canada has a relatively small national market and many of the convicted firms sold cartelized products only through exporting (thus, owning few if any assets in Canada that could have been seized in the event of nonpayment of fines), it has been able to mount a surprisingly effective anticartel campaign in the last five years using very slim enforcement resources. Canada is a model for many smaller industrialized countries that have tough anticartel laws on their books yet have weak enforcement. Unlike many other areas of law enforcement, the returns to Canada's treasury far exceed the outlays.

Table 10. Canadian Global Price-Fixing Convictions and Fines, 1991-2002.

Year	Product:	Company (Ultimate Parent)	Fine <i>C\$ million</i>
1991-96	Various:	12 Companies	21.80
1998	Lysine:	ADM	14.00
		Ajinomoto	3.50
		Sewon America	0.07 ^a

		Kyowa Hakko	0.00 ^a
1998	Citric acid:	Jungbunzlauer	1.90 ^a
		Haarmann & Reimer (Bayer Corp.)	4.70
		Hoffmann-La Roche	2.90
		ADM	2.00
		Cerestar Bioproducts (Eridania)	0.70
1998	Sodium gluconate:	ADM	0.00 ^a
		Jungbunzlauer	1.00
		Roquette Frères	0.70
		Fujisawa Pharmaceuticals	0.36
		Glucona (Akzo Nobel)	0.35
1999-2000	Vitamins: ^b	Hoffmann-La Roche	50.90
		BASF	19.00
		Rhône-Poulenc	14.00
		Takeda	5.20
		Daiichi	2.50
		Eisai	2.00
		Chinook International	2.25
		Roussel (Höchst)	2.50
		E. Merck	1.00
1999-2001	Sorbates:	Ueno Fine Chemicals	1.25
		Daicel Chem. Industries	2.46
		Höchst (Aventis)	2.50
		Eastman Chemical	0.78
		Nippon Gohsei	Pending
		Chisso Corp.	Pending
2000-2001	Graphite electrodes:	SGL Carbon	12.50
		UCAR Intl.	11.00
		Tokai Carbon	0.25
2001	Sodium erythorbate:	Pfizer	1.50
		Fujisawa	0.00 ^a
2001	Isostatic graphite:	Carbone of America	0.30
		Ibiden	Pending
		Toyo Tanso	Pending

Source: Canada Department of Justice, Fines Chart dated November 23, 1999, News Releases, and Statements of Fact.

^a Discounted because of early cooperation with the Ministry.

^b Investigations continuing as of early 2000. Two individuals were fined C\$250,000 each (not shown).

The European Union

Like Canada, the European Commission's Directorate General for Competition (DG-IV) has cooperated with U.S. and other national antitrust agencies, but it is also terribly understaffed and relatively slow to act. The EC's decisions take an average of four years after U.S. prosecutions are announced (Table A.3). The EC's lysine decision came eight years after the U.S. DOJ began investigating. Unlike the United States, Canada, and some of its member states, EU law treats antitrust violations solely as a civil infraction by a business entity.²⁶ Individual conspirators are not personally liable for monetary or prison penalties (Connor 2001:81-91). In this sense the powers and procedures of the DG-IV resemble those of the U.S. Federal Trade Commission more closely than the U.S. DOJ's Antitrust Division.

Prior to the strengthening of the Sherman Act's sanctions during 1974-1990, the EC's formal authority to impose fines for major cartel violations was considered superior to the DOJ's powers. Since the signing of the Treaty of Rome, corporate members of cartels have been subject to maximum fines of 10 percent of sales in the year or years prior to an effective price-fixing agreement. The EC's fines can be based on the *global* sales of an offending firm in *all* its lines of business, but in practice cartel fines are mostly based upon a violator's EU sales in the affected line of business only (Connor 2001:401-407).

The difference between U.S. and EU powers to fine corporations may be easily illustrated using a hypothetical but realistic example. Take ADM's situation in the citric acid market during the mid 1990s: annual global sales of about \$10 billion and citric acid sales of about \$200 million per year (distributed equally between North America, Western Europe, and the rest of the world) out of \$900 million in global citric acid sales. Then consider three cartel scenarios: (I) a short-lived cartel of modest effectiveness (a 10-percent overcharge), (II) a cartel of three-years duration and highly effective (30 percent), and (III) a ten-year, highly harmful cartel.

Table 11 demonstrates ADM's maximum antitrust liability under current U.S. and EU laws. By assumption, the overcharges on ADM's buyers in the EU and USA are identical and equal to \$6.7 million per year. Looking at cartel scenario I (a short, weak conspiracy), ADM would be liable for a top U.S. fine of \$13 to \$60 million, depending on the company's degree of culpability (i.e., whether it was the cartel's initiator, chief enforcer, or failed to cooperate with the DOJ's investigation).²⁷ In the EU, ADM would be liable for simply an amount equal to its monopoly profits of \$6.7 million, unless the EC took the unusual step of invoking global sales to calculate the cartel fine. In the latter case, the EC could impose a \$1,000-million fine on ADM. Thus, the sales base employed by DG-IV has a critical effect on whether EU fines can be higher or lower than comparable U.S. fines.

²⁶ Besides the USA and Canada, eight other countries provide for criminal sanctions: Austria, Germany, France, Norway, Ireland, Slovakia, Japan, and South Korea. Australia and the UK are considering such laws (Hammond 2002).

²⁷ Under the Sentencing Guidelines approach, the U.S. DOJ arbitrarily adopts 20 percent of sales as the base fine, and then multiplies this base by the culpability factor, which for global cartels in the late 1990s ranged from 1.5 to 4.5. Under the simpler felony approach, ADM is liable for twice the overcharge.

Examining the scenario with the long-lasting, high-overcharge assumptions, the DOJ can request greatly enlarged fines of \$200 to \$600, because the overcharge in scenario III is 30 times larger (\$200 million) than that for scenario I (\$6.7 million). However, the EC’s ability to fine is severely hampered by its 10-percent-of-sales rule. In particular, under its usual practice, the EU’s top fine on ADM would be quite a bit lower than ADM’s monopoly profits from its EU operations during the cartel. That is, based on jurisdictional sales only, the EU’s ability to disgorge cartelists’ illegal profits is weak. It is in such cases that the EC is most likely to consider ADM’s global sales as a basis for its antitrust penalties.

Table 11. Maximum U.S. and EU Fines for a Company with \$200 Million in Affected Sales in a \$900-million Global Cartel.

Cartel Scenarios	Economic Harm to Company’s Buyers	United States		European Union ^a	
		Sentencing Guidelines	Felony Guidelines	Cartelized Market Sales	Group Sales of \$10 Billion
<i>Million dollars</i>					
I. One year, 10% overcharge					
A. Jurisdiction sales basis ^b	6.7	20-60	13.3	6.7	333
B. Global sales basis ^c	20.0	60-180	40	20.0	1,000
II. One year, 30% overcharge					
A. Jurisdiction sales basis ^b	20.0	20-60	40	6.7	333
B. Global sales basis ^c	60.0	60-180	120	20.0	1,000
III. Ten years, 30% overcharge					
A. Jurisdiction sales basis ^b	200.0	200-600	400	6.7	333
B. Global sales basis ^c	600.0	600-1,800	1,200	20.0	1,000

Source: Connor (2001:87).

^a Assumed that the sales of the cartelized product were \$66.7 million in the EU out of \$900 million in the world.

^b Assumed that of \$900 million in global sales of cartel, \$300 million occurred in the U.S. and 4300 million in the EU. The company has a 22% share of each geographic market. The USSG multipliers are 1.5 to 4.5, depending on the seriousness of the offense.

^c Rarely applied by U.S. authorities. More commonly applied (but in a minority of cases) by the European Commission.

As in all jurisdictions, maximum fines are one thing and actual fines another. The EU has recently adopted guidelines for calculating firm-by-firm discounts from the maximum statutory fines. First, the DG-IV considers the “gravity” of the offense; cartels are always the “most serious” (the highest of three levels) type of antitrust infringements, and large overcharges that are geographically widespread only add to the gravity. Second, large companies are fined double the amount of “small” ones: in the lysine case the threshold was €3 billion. Third, fines are increased by 10 percent per year for each year the cartel is effective. Fourth, these three factors result in a “base fine” that is adjusted upward by 50 percent for cartel leadership and downwards 20 percent for passivity. Fifth, a 10-percent discount is given for immediate cessation of the conspiracy. Finally, under the Leniency Notice, violators are given discounts for

their degrees of cooperation, from 10 percent for minimal cooperation to 50 percent for the most cooperative. In rare cases, amnesty is granted.

The description just given for fine-setting probably overstates the degree of precision of the process. Moreover, firms can and usually do appeal the EC fines to the European Court of First Instance where they often receive modest downward adjustments. Nevertheless, the fines meted out by the EC for global price fixing have reached impressive amounts (Table 12). The first large cartel fined was lysine, with a total of nearly \$100 million.²⁸ In 2001, decisions were reached in four huge cartel cases with total fines of \$1,115 million (together with other antitrust fines, DG-IV imposed €1.8 billion in fines in 2001). In 2002, the EC announced an historic decision to fine four companies \$250 million for global price fixing in the market for the amino acid methionine; this is the first time that the EC has prosecuted a global cartel prior to a U.S. conviction. Another 12 or more global cartel cases under investigation are likely to result in continuing large fines for the next few years.

Table 12. EU Global Price-Fixing Convictions and Fines, 1996-2002.

Year	Product	Company (Parent)	Fine
			<i>Million dollars^a</i>
2000	Lysine	ADM	42.1
		Ajinomoto	25.2 ^b
		Kyowa Hakko	11.8 ^b
		Cheil Sugar	10.9
		Sewon	7.9
2001	Citric acid	Hoffmann-La Roche	56.5
		ADM	35.3
		Jungbunzlauer	15.7
		Bayer	12.7
		Eridania	0.2
2001	Vitamins	Hoffmann-La Roche	408.0
		BASF	261.5
		Takeda	32.7
		Daiichi	20.7
		Eisai	11.7
		E. Merck	8.2
		Solvay	8.0
		Rhône-Poulenc (Aventis)	4.5 ^c
		Höchst (Aventis)	1.6
		Lonza	0 ^c
		Sumitomo	0 ^d
		Sumika	0 ^d
Tanabe	0 ^d		

²⁸ The EC's lysine investigation was launched one year after the FBI raids were publicized and four years after the FBI's probe began. The EC's decision was announced four years after the DOJ's convictions.

		Kongo	0 ^d
2001	Sodium gluconate	Jungbunzlauer	18.2
		Roquette Frères	9.6
		Akzo Nobel	8.0
		ADM	9.0
		Avebe	3.2
		Fujisawa	3.2
2001	Graphite electrodes	SGL Carbon	68.5
		UCAR International	43.1
		Tokai Carbon	20.9
		Showa Denko	14.9 ^b
		VAW Aluminum	9.9
		SEC	10.4
		Nippon Carbon	10.4
		Carbide Graphite	8.8
2002	Methionine	Rhône-Poulenc/Aventis	0 ^b
		Degussa-Hüls	116.3
		Novus International	125.2
		Nippon Soda	8.9
2000-2002	Total		1,463.7
2002-2004 (pending)	Sorbates		
	Nucleotides		
	Wine alcohol		
	MCAA		
	Organic peroxides		
	Sodium erythorbate		
	Maltol		
	Bromines		
	Isostatic graphite		
	Art auctions		
	Carbon cathode black		

Source: EC (2002).

^a Translated to dollars in the month announced. Actual fines may be larger due to rise in the value of the euro since 2000 and delays in payment dates.

^b Vary large leniency reductions (50 to 70 percent).

^c Amnesty or near amnesty.

^d Guilty but not fined because of statute of limitations.

Four of the five cartels prosecuted by the EC in 2000-2001 operated in the food-and-agriculture sector. As in the United States and Canada, these cartels accounted for the lion's share of fines: 85 percent in the EC case. A recent survey of EC competition-law enforcement did not anticipate these cases (Buccirossi *et al.* 2002).²⁹

Summary

Global cartelists face investigations and possible fines in as many as ten national and supranational jurisdictions. Mexico, Brazil, Japan, South Korea, Australia, New Zealand, and a few other countries have active anticartel agencies. However, the three jurisdictions with heretofore the most consistent legal responses to global cartels are the United States, Canada, and the EU.

The fines imposed by the United States, Canada, and the EU are roughly proportional to the sizes of the affected markets' sales in the respective jurisdictions. In the five overlapping cases of global cartels available as of mid-2002, government anticartel fines were highest in the United States and the EU and about 6 to 8 percent as high in Canada (Table 13). Even more impressive is the high degree to which fines were correlated in size between jurisdictions. The simple correlation between the U.S. and EU fines was +0.95, and the correlations between the other two remaining pairs ranged from +0.95 to +0.99; the rank correlations were perfect (1.00). Thus, corporate members of global cartels can use their fines imposed by the U.S. DOJ, usually the first to act, to predict with a high degree of certainty what their fines will be a year or two later in the EU and Canada.

Table 13. Five Global Cartels with Corporate Fines Imposed by U.S., EC, and Canada, 1996-2002.

Cartel	U.S.	EC	Canada
	<i>Million U.S. dollars</i>		
Lysine	92.5	97.9	11.5
Citric Acid	110.4	120.4	7.9
Vitamins	906.5	756.9	64.0
Sodium gluconate	32.5	51.2	1.6
Graphite electrodes	436.0E	172.0	15.5
Total	1,577.9	1,213.3	100.5

Sources: Tables 10, 12, A.2, and A.3.

Note: These are the only five global cases for which all three jurisdictions had taken actions by mid-2002. The list of overlapping cases ought to double or triple by 2004.

Given the near absence of private antitrust litigation in Europe, the total liabilities of cartelists operating in Europe are overall quite a bit lower in practice than an otherwise identical violation punished under U.S. or Canadian laws.

²⁹ These authors concluded that the DG-IV's priorities in the agricultural-inputs industry was tacit collusion. Overt price fixing was mainly a concern in the food processing industries.

Deterrence

The corporate fines and personal sanctions handed out to global price fixers since 1995 were beyond and above the worst nightmares of corporate defense lawyers might have had in the early 1990s. Corporate cartelists, when they are unmasked by antitrust investigators, are now routinely paying fines that exceed their monopoly profits earned in North America and in Western Europe. Indeed, in North America, when the private treble-damages suits by buyers or the state attorneys general are factored in, prosecuted price fixers are nowadays normally disgorging close to double their illegal “earnings” (Connor 2001:469-476). Nevertheless, serious doubts remain that even the heightened fine structures observed since 1995 are sufficient to prevent recidivism (repeat offenses of the same crime).

Theory

A rational policy with respect to the design of legal sanctions would admit to two principal objectives: deterrence and compensation of victims.³⁰ The EC’s cartel decisions are explicit in mentioning deterrence as the main objective of its determination of fine levels; to the extent that these fines are used to defray the EU budget, European consumers are at least indirectly compensated.³¹ In the United States, treble damages (i.e., settlements equal to three times the victims’ economic losses) were explicitly instituted in the 1890 Sherman Act to compensate buyers from cartels as well as to deter firms from forming cartels *ex ante*. However, the advent in the 1990s of the double-the-harm standard for setting government fines has led some legal writers to criticize cartel sanctions as having reached *supradeterrent* levels.

These criticisms confuse the *ex post* liabilities faced by discovered cartel members with the *ex ante* decision making process that deterrence-fines are supposed to affect. True, the *theoretical* maximum fines and private settlements faced by prosecuted cartelists have reached surprisingly high multiples of cartel overcharges in the U.S. legal system. A domestic cartel successfully prosecuted in the United States is liable to pay up to *double* the cartel’s overcharge to the federal government and *triple* the overcharge to direct buyers who file civil suits. In addition, the cartel can be sued by the state attorneys general for another set of *treble* damages incurred by indirect buyers.³² Thus, domestic cartels are obligated to pay as much as *eight* times their illegal monopoly profits if they are found guilty. Moreover, suppose the cartel is a global one with a typical one-third of its sales in the United States. Then, the U.S. DOJ has the option of calculating its fine on the basis of global overcharges (which are likely to be three times the domestic overcharges). In this case the federal fine could rise to *six* times a cartel’s U.S. overcharges. It is the possibility of fines and settlements totaling *eight to twelve times* a cartel’s U.S. monopoly profits that leads critics to make claims of overdeterrence.

³⁰ A third motivation is sometimes mentioned, viz., funding the costs of detection and prosecution. In U.S. law, these costs are borne by both the government and by plaintiffs’ lawyers.

³¹ In 2001, EU antitrust fines amounted to 2 percent of its annual budget.

³² These are called *parens patriae* actions. Indirect buyers include both corporate and consumer purchasers. In 2000, 45 states joined together to sue the six largest companies in the vitamins cartels. Indirect buyers may also sue in about 16 state courts. Pass-on by direct buyers is no defense for these actions.

However, deterrence effects of anticartel policies must be evaluated *ex ante*, that is, from the perspective of a company considering forming or joining a price-fixing conspiracy. Such a company must evaluate the probable additional profits from the cartel relative to the *probable costs* associated with being discovered and prosecuted. The evidence is that potential conspirators are adept at calculating the annual profits from an effective cartel, though they might have uncertainty about the scheme's longevity.³³ As to the probability that a cartel will be discovered, most evidence seems to suggest a 10- to 20-percent chance (Bryant and Eckard 1991, Connor 2001:29). Moreover, even if cartelists are indicted by the U.S. DOJ, the chances of being convicted are less than 100 percent (Connor 2001:60-61, 68-69). The DOJ likes to boast that more than 80 percent of its indictments end in guilty pleas, which is true because the *per se* evidence is so damning in most cases that defendants usually negotiate a guilty plea. On the other hand, when accused price fixers choose to litigate a criminal price-fixing case, the government wins their cases less than half the time. Thus, cartelists adept at covering up their clandestine meetings or able to afford the best legal defense teams might well judge their chances of conviction to be in the 50 to 75 percent range.

Given the rational expectations about the certainty of punishment just mentioned, what is an appropriate level of financial sanctions to deter price fixing before it starts? At a minimum, to ensure absolute deterrence of a global cartel, total financial sanctions should be *twenty times* the expected U.S. cartel profits (the overcharge); at the upper end, deterrence would require penalties equal to *sixty times* U.S. overcharges.³⁴ These extraordinary multiples demonstrate that, from a purely benefit/cost approach, even the theoretical U.S. legal sanctions of eight to twelve times overcharges is insufficient to deter recidivism.

Practice: The United States

Recidivism in global price fixing is depressingly common. In part, this may be caused by the highly diverse businesses found in most large multinational firms. Price fixing in the 1990s bears all the marks of contagion, between and *within* enterprises. For example, soon after Hoffman-La Roche and BASF implement price fixing in vitamins A & E, the positive financial results prompted them to form at least five more highly complex cartels in eight other vitamins industries a year later (Connor 2001:307). Furthermore, Roche's success in vitamins instigated one top Roche executive to write a memorandum to the head of the company's citric acid marketing department encouraging him to form a citric acid cartel (*ibid.*: 310). Soon after ADM and Roche began fixing the price of citric acid in 1991, the ADM vice president in charge of citric acid taught ADM's head of the lysine department how to form and run the lysine cartel (see Figure 1 above). At least a dozen firms convicted of global price fixing in the 1990s have become repeat offenders (Connor 2001:500).

Although the theoretical financial costs of price fixing may strike some as high, the actual amounts of the fines and private settlements are much lower than what is legally possible, a fact noted by Lande (1993) in cases settled before 1990. A wide gap between the maximum penalties

³³ Historically the average global cartel lasted about eight years, with a range of two to 18 years.

³⁴ These estimates assume that a global cartel's U.S. profit comprise one-third of its total monopoly profits worldwide. Strictly national cartels would require seven- to 20-times penalties. These estimates ignore the legal fees paid by defendants. If legal fees are substantial, the required multiple to deter would be somewhat lower.

prescribed by the law and the actual penalties imposed has persisted after 1995 in fines imposed on global price fixers, despite the higher sanctions in force since Lande’s study was completed.

In the three best documented prosecutions of global cartels, U.S. government corporate fines of \$1,106 million were precedent-shattering. Yet they represented merely 10 to 79 percent of the maximum possible fines that could have been levied (Table 14). To place them further in perspective, these fines represented only 2.8 percent of global sales during the three conspiracy periods and only 12.6 percent of the cartel’s illegal profits (Connor 2001:Table 19.5).³⁵ Individual fines and prison sentences were also far more lenient than the law permits. These fines and sentences averaged 3 to 7 percent of the maximum levels allowed. Moreover, less than one-fourth of the individual conspirators were sanctioned at all.

Table 14. Potential and Actual U.S. Government Sanctions Applied in Three Global Cartels.

Cartel	Corporate Fines ^a		Individual Sanctions					
	Maximum	Actual	Number ^b		Prison		Fines ^c	
			Max.	Actual	Max.	Actual	Max.	Actual
	<i>\$ million</i>		<i>Number</i>		<i>Months</i>		<i>\$ million</i>	
Lysine	225-559	92.5	40	7	1440	99	14.0	0.9
Citric acid	189-721	105.4	12	4	432	0	4.2	0.8
Vitamins	994-9850	908.5 ^d	52	13	1872	22.5	18.2	0.9
Total	1408-11,130	1,106.4	104	24	3744	121.5	36.4	2.6

Sources: Connor (2001:Tables 13.1, 13.2, and 13.3).

^a Based on either the usual 20-percent of U.S. affected sales with a culpability score of 9 and multipliers of 1.8 to 3.6 or twice the U.S. overcharge. In general, had global sales been the basis of the fines, the maximum amounts shown in this table would be trebled.

^b Named conspirators in the DOJ’s proffers to the courts.

^c Based on the \$350,000 statutory cap, not on the much higher amounts allowed by the alternative sentencing statute.

^d A few small companies have yet to plead guilty.

The major reason for the relatively low government fines is the ancient practice of prosecutors everywhere of offering rewards for a defendant’s cooperation. Such cooperation may be needed to induce price fixers to testify against other, more recalcitrant co-conspirators; it may be given to low-ranking employees in order to prosecute high-ranking executives with greater deterrence value; or it may be justified as a method to conserve constrained prosecutorial resources. What is new is the promulgation of formal leniency programs in the 1990s by the U.S. DOJ and the EC’s DG-IV for price fixing.

Here is how the U.S. Leniency Program works. If a cartel member is not a ringleader or enforcer in the conspiracy and if the DOJ is not aware of the illegal activity, then the *first* firm to confess is granted automatic amnesty, that is, a 100-percent discount on its fine specified by the U.S. Sentencing Guidelines. In the view of the DOJ, amnesty is valuable because it sets up a “race” to be first to confess and leads to tension and mistrust among cartel members (Hammond

³⁵ As a proportion of U.S. sales and estimated overcharges, the respective percentages are 14.0 of sales and 60 to 74 of overcharges.

2001a). An extension of this program called “Amnesty Plus” offers amnesty to suspected price fixers if they are the first provide evidence of cartel activity in an unrelated market about which the DOJ was ignorant. The many vitamins cartels were unmasked by this type of amnesty granted to BASF (*ibid.*). Indeed, as of 2001, more than half of the 30 grand juries established to investigate alleged cartel activity were set up as a result of the Amnesty-Plus Program.

The Leniency Program also extends concessions to later arrivals on the doorstep of the Justice Department. The *second* member of a cartel to offer its cooperation to prosecutors is entitled to a 50- to 80-percent fine reduction. The *third* and *fourth* conspirators to arrive may expect less generous discounts, but in effect all cooperators but the last firm to hold out are rewarded with substantial discounts. The actual operation of the Leniency Program is shown in Table 15. If anything, these leniency discounts, which were approved by a court, are larger than the official policy suggests. While the first and second firms to plea follow the Leniency Program standards, those that plea later receive discounts that exceed the program’s stated guidelines. Similar incentives to cooperate are offered to individual conspirators: reduced fines, short prison sentences, or the freedom to cross the U.S. border.³⁶

An example of how a company will fare if it is the last to be sentenced and does not cooperate is provided by the Mitsubishi conviction at trial in February 2001 (Hammond 2002:4-6). For its indirect role of aiding and abetting price fixing in the graphite-electrodes cartel, it received a fine of \$134 million. What is impressive is that the fine was 76 percent of affected U.S. sales, probably a record percentage, and very nearly at the top of the Sentencing Guidelines range; it was also *7.6 times* the assumed overcharge.

The U.S. Leniency Program for price fixing has been widely imitated by antitrust authorities in other jurisdictions. The most important adoption was by the European Union in February 2002.³⁷ Its new program makes the process for applying for full immunity “far more transparent and predictable” (Hammond 2002:12). Amnesty is *automatic* for the first company to reveal a cartel if (1) the EC was unaware of the cartel already, (2) cooperation is fully satisfactory, (3) the company immediately ceases price fixing, and (4) the company never coerced other companies to join to cartel (Arbault *et al.* 2002). Thus, the new EC policy sets up strong incentives in the “races to be first” (to confess) to Brussels. Moreover, this race complements the race to be first to Washington, DC, Toronto, London, Paris, Brazilia, and at least three other national capitals where a company can earn multiple prizes. The global convergence of antitrust leniency policies has now become the major single source of information of formerly clandestine illegal activities that were nearly impossible to detect. To a large extent, the potentially huge and automatic financial rewards for informing antitrust authorities has made the disease of global price fixing self-medicating.

³⁶ As a general rule, convicted felons may not be issued passports or obtain visas to enter U.S. territories. However, by arrangement with the U.S. State Department, the Antitrust Division may obtain an exemption for some convicted price fixers. This concession has proven to be a valuable incentive to induce cooperation by middle-aged non-U.S. residents.

³⁷ The 2002 EC Notice replaced a 1996 leniency program that was not working very well because it retained too much discretion for EC officials and did not guarantee amnesty for the first applicants. Indeed, the EC did not grant any company amnesty until November 2001 when the vitamins cartels were fined (Hammond 2002).

Table 15. Two Examples of the U.S. Department of Justice's Leniency Program for Corporate Price-Fixers.

Case: Company	U.S. Sentencing Guidelines' Fine	Actual Fines Paid				
		Official Leniency Policy ^a Amount	Amount	Proportion of Affected Sales ^a	Discount from Guidelines	
Vitamins ^b :	120-240E 1312-2624 409-818 80-180E 150-320E	<i>Million dollars</i>	<i>\$ million</i>	<i>Percent</i>		
		First to plea (Rhône-Poulenc)	0	0	0	100
		Second to plea (Roche)	360-900	500	14	62-81
		Second to plea (BASF)	160-420	225	14	43-72
Fourth to plea (Daichi)	80-180E 150-320E	25-40	25	24	69-86	
		55+	40	22	73-88	
Graphite Electrodes ^c :	90-250E 65-135 125-275E 100-240E	0	0	0	100	
		First to plea (Carbide/Graphite)	32-82	32.5	10	50-76
		Second to plea (Showa Denko)	175-250	110	15-18	12-60
		Third to plea (UCAR Intl.)	150+	135	24-28	0-44
Last to plea (SGL Carbon)						

Sources: Connor (2000), Spratling (2000).

E = Estimated by the author.

^a According to the Antitrust Division's chief of litigation, the official policy is to offer the second firm to plead guilty a fine based on 10- to 20-percent of the firm's affected U.S. sales (Spratling 2000). The third to plea gets a fine of 25- to 35-percent of its affected sales, and those that plea later pay more than 30 or 35 percent.

^b Includes vitamins A, E, B1, B2, B5, B6, beta carotene, and vitamin premixes. The dates of the guilty plea agreements were February 1998 (amnesty), May 1999 (Roche and BASF, the cartel's leaders, were tied for second), and the rest of September 1999. Lonza pleaded guilty in September 1999, but was not indicted for any of the vitamins cited above. U.S. affected sales were about \$6.4 billion.

^c The dates of the latter three guilty pleas were February, April, and May 1998. Carbide/Graphite applied for amnesty some time in early 1997. SGL AG of Germany was the cartel's leader, but SGL Carbon Inc., its U.S. subsidiary, paid the fine, because SGL Carbon was small, its fine was below the normal leniency level because it "could not afford to pay." U.S. affected sales were \$1.5 billion to \$1.75 billion.

Finally, to get a complete picture of the actual U.S. financial sanctions for collusion, one must consider the treble-damages suits filed by injured parties. In the three best-documented global cartel cases, private plaintiffs garnered record-making settlements totaling between \$1,745 and \$2,445 million (Table 16). However, compared to fairly reliable estimates of what U.S. treble overcharges were, these settlements are well below what the Sherman Act promises to direct buyers. Lysine buyers received 35 percent of treble damages, citric acid buyers 32 to 40 percent, and vitamins buyers 32 to 54 percent. That is, injured parties got *single* damages (or slightly higher), not treble damages.³⁸ There is some evidence that the largest direct buyers that opted out of the federal classes obtained settlements that were twice as rich.

Table 16. Potential and Actual U.S. Private Settlements Paid by Three Global Cartels.

Cartel	Corporate Settlement Amounts	
	Treble U.S. Damages	Actual Settlements ^a
	<i>Million dollars</i>	
Lysine	240	85
Citric acid	600-750	239
Vitamins	3,660-4,515	1,421-2,121 ^b
Total	4,500-5,505	1,745-2,445

Sources: Connor (2001:Table 16.A.1).

^a These amounts include federal suits by direct purchasers (both class actions and firms that opted out of the classes), a *parens patriae* settlement in vitamins, and estimates of indirect-purchaser suits in state courts. The latter amounts may be generous.

^b Several cases still in negotiation or litigation.

To summarize, government and private antitrust penalties on the lysine, citric acid, and vitamins cartels amounted to between \$2,850 million and \$3,550 million. Although by historical standards these amounts were great accomplishments for public prosecutors and private plaintiffs, they fall far short of what the Sherman Act intended. These price-fixing penalties amounted to about 47 percent of affected U.S. sales, or somewhere between 179 percent and 194 percent of the cartels' illegal profits. Less than double overcharges will not deter.

Practice: Canada and the EU

The enhanced fines on global conspirators imposed by the governments of Canada and the EU help deter, but their incremental influence is still not sufficient to prevent the formation of new cartels.

In 1998-2000, the Canadian Competition Bureau (CCB) obtained court orders requiring the lysine, citric acid, and vitamins cartelists to pay a total of C\$145.7 million (Table 10). In addition, class-action suits were filed by direct and indirect buyers; two of these private damages

³⁸ As a percentage of U.S. sales (equals U.S. purchase values), lysine buyers obtained 18.5 percent, citric acid buyers 16.4 percent, and vitamins buyers 23.7 to 42.4 percent. The average was 32.6 percent. (Compare footnote 26 above).

actions were moderately successful. Taken together, the members of the three cartels have paid about U.S. \$100 million in fines and settlements to parties in Canada.

In 2000-2001, the same three cartels were fined U.S. \$975 million by the European Commission (Table 12). Although legal in the courts of some of the member states of the EU, no significant private antitrust settlements are expected. The Australian, Mexican, and Brazilian antitrust agencies have launched investigations of the three cartels, but except for small fines for vitamins in Australia, none has yet resulted in significant fines.

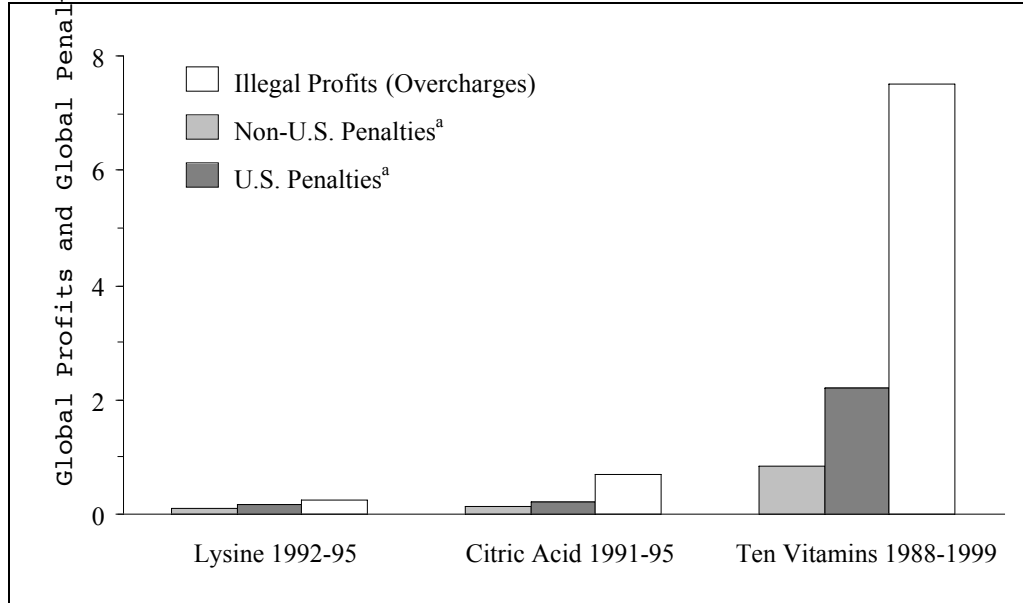
The ability of direct buyers who purchase cartelized products outside the United States to obtain compensation is quite limited. Canada, Australia, and several European countries have laws that permit private suits for injuries due to price-fixing overcharges, but mostly these national courts do not award sufficiently large to make such suits worthwhile (Connor 2001). Moreover, the possibility of class actions to recover damages is low. However, class actions against the lysine and citric acid cartels have been moderately successful in Canada under a 1992 law. Moreover, a March 2002 decision by the U.S. Court of Appeals for the 2nd Circuit (*Kruman v. Christie's International*) has extended the rights of foreign buyers to sue for damages under the U.S. Sherman Act (Nanni 2002). Oddly, instead of U.S. legal standards spreading to other nations, the U.S. court system itself is becoming a globalized legal institution.

The additional \$1.1 billion in non-U.S. fines for price fixing in the markets for lysine, citric acid, and vitamins certainly moves global anticartel policies in the right direction. Nevertheless, the global penalties imposed on the three cartels (\$3,950 to \$4,650 million) still represent modest amounts when compared to either worldwide affected sales (9.9 to 11.7 percent) or to worldwide overcharges by the cartels (51 to 60 percent) (Connor 2001:553).

The relationship of global public and private penalties to the cartels' illegal gains is illustrated in Figure 3. Estimated worldwide profits made from collusion are compared to U.S. and non-U.S. penalties for the three cartels. In each case, U.S. penalties are about double the non-U.S. (mainly EU and Canada) penalties. These penalties slightly exceed the cartel's monopoly profits only in the case of lysine, by about \$40 million. However, in the other two cases, cartel crime did pay. The corporate members of the citric acid cartel made a net return of about \$370 million; that is, they retained about 53 percent of their illegal profits after paying their fines and private settlements. The members of the vitamins cartels kept more than \$4 billion of their illegal profits, or almost 60 percent of their customers' overcharges.³⁹ For ADM, probably the most heavily fined conspirator relative to its size, the antitrust costs of its lysine and citric acid ventures were about equal to its illegal net revenues (Connor 2001:536).

³⁹ Recall that this is an *ex post* analysis. Viewed from the dates of cartel formation (1988-1992), the *expected* profit-retention rate would have been well above 90 percent.

Figure 3. The Bottom Line: Does Cartel Crime Pay?



Sources: Tables 3 and A.2, Connor (2001).

^a Government fines on corporations and private settlements paid to buyers of cartelized products.

Final Thoughts and Speculations

After spending a possibly inordinate amount of time on the subject of global cartels, I still perceive a number of unanswered questions raised by the eruption of global cartels in the 1990s. Two seem paramount. What were the economic, financial, and political forces that facilitated the establishment of dozens of effective international cartels in the late 1980s and early 1990s? What remedies can be implemented to discourage and possibly deter the formation and effectiveness of global cartels?

Cartel Formation

The temptation for a company in an appropriately structured market to launch or join a cartel is well understood: it is a golden opportunity to increase profits to levels higher than those being earned, at present or in the foreseeable future. Were it not for the possibility of punishment under antitrust laws, cartels would run rampant, monopolizing vast stretches of national economies or international trade. We know this to be true because of numerous reliable economic studies of cartel activity during eras prior to the adoption of effective anticartel legislation. This was the state of affairs in the United States before the 1890 Sherman Act (Connor and Schiek 1997:37-42), in Germany before 1945 (Voight 1962), in the United Kingdom before 1956 (Symeonidis 2002), and in international trade before the U.S. prosecutions of the late 1940s (Stocking and Watkins 1946). In the UK in the early 1950s, hundreds of formal, open, and legal cartels operated in nearly half of the manufacturing sector, some of them of 70-years duration (Symeonidis 2002:21). Hundreds of international cartels operated in the

interwar period, affecting nearly half of international merchandise trade (Stocking and Walkins 1946).

The temptation facing company managers to form or joining a cartel are more varied and complex. Loyalty to their employer and a desire to contribute to its financial performance often seem to play a role. At a more personal level, the desire for advancement and monetary rewards cannot be discounted. In the case of some managers in the lysine cartel, other personal motivations included the sheer thrill of controlling markets (akin to the mariner's dream of sailing against the wind) and the nervous pleasure derived from the cloak-and-dagger aspects of outwitting the authorities (Connor 2001:199-229).

International cartels were relatively few during 1950-1990, especially compared to the interwar period (Caves 1996). Among the economic conditions accounting for the paucity of cartels after 1950 were the emergence of more aggressive behaviors by the largest U.S. manufacturers (through foreign investment and acquisitions that broadened their product lines), the focus of most European firms on rebuilding their domestic market positions, and a shift away from homogenous products toward differentiated consumer of high-tech goods. Most of the global cartels discovered after 1995 were formed during a narrow period, 1998-1992. There are tantalizing hints that slowing profitability in the late 1980s may have stimulated many of the cartelists to consider more risky alternative strategies. In the organic chemicals industry, a pronounced cyclic slowdown was apparent in the late 1980s; several pharmaceutical companies had "blockbuster" products coming off patents at the time; and in starch manufacturing, the period of rapid growth in high fructose corn syrup ended abruptly in 1986-1987 (Connor 2001). In Japan, the first troubling signs of the end of the "bubble economy" began to emerge in the late 1980s. By the early 1990s, massive corporate and government debt and falling asset prices had led to chronic recession, a weaker yen, and falling profits.

Changes in corporate management philosophies, especially evident in U.S. firms but also spreading to European companies, may have contributed to the acceptability of price-fixing. Criticism of top management of U.S. companies became intense during the decade of slow U.S. growth that began in 1973. A widespread solution during the 1980s was the implementation of new managerial reward structures that tied leaders' pay more closely to financial performance, often short run profits and stock price. Boards of directors approved generous stock-option plans and other compensation policies that made stockholders' interests the only stakeholders of importance. Restructuring corporate management to remove putatively unnecessary layers of management and other changes meant to enhance flexibility and speed of decision making came at the cost of cross-checks and accountability. Increasingly, corporate leaders were being trained in MBA programs with increasingly uniform curricular that emphasized applied management tools and had little room for courses on business ethics. Many critics of modern business principles decry what they perceive to be a decline in corporate ethics, extending to the consulting and accounting professions as well (Krugman 2002).

The third area that may have fostered cartel formations is that of politics and policy. The successful prosecution of scores of global cartels in the late 1940s is cited by Caves (1996) as one factor explaining the decline in cartel activity for 30 years or more thereafter. Perhaps these lessons were lost as successive generations of corporate leaders assumed the helms of their

companies, or perhaps the lessons were not institutionalized through antitrust management-training programs or the monitoring efforts of corporate counsel. The enforcement of antitrust became more lax during the Reagan-Bush administrations (1981-1992) as the antitrust agencies' budgets were cut nearly in half. Price-fixing enforcement shifted toward bid-rigging violations affecting small markets (Connor 2001:66-68). U.S. antitrust authorities failed to investigate ADM's attempt to monopolize the lysine industry when it prevented Degussa's entry in 1989 and ADM's acquisition of Pfizer's citric-acid assets in 1990, both key events in the formation of two important global cartels.⁴⁰ The European Union's allocation of anticartel resources may also be criticized as inadequate up until at least the late 1990s. Another policy of the European Commission that inadvertently contributed to cartel effectiveness was the sponsorship of industry trade associations that became ideal covers for illegal price-fixing discussions for global cartelists. These organizations were also used to threaten trade reprisals against suppliers that remained outside the cartel.

Fashioning Remedies

The major objective of anticartel policies should be to lower the benefits (profits) or raise the costs (penalties) of price fixing. Other than vigilance in merger control, public policies can do little to change the structural features of markets that make cartels profitable: inelastic demand, large numbers of buyers, economies of scale, homogeneity, and so forth. Policies can sometimes have effects on trading conditions, such as the publication of transaction prices in markets characterized by lack of transparency. However, the principal role for antitrust is to develop rules, laws, and investigative procedures that make punishment surer and harsher than at present. Reforms should be implemented soon because the present favorable public and legislative support may not last.

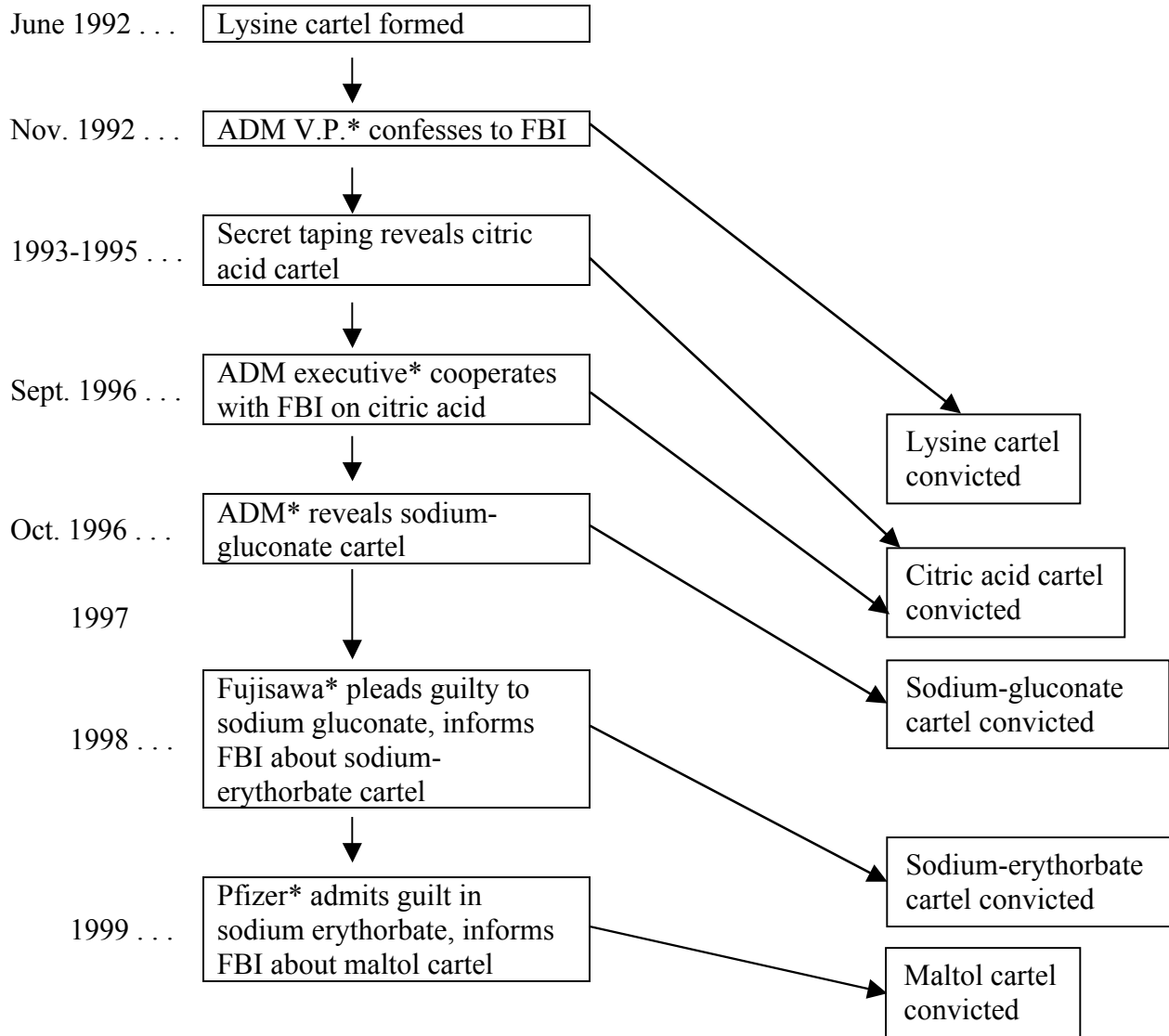
It is clear from the geographic location of cartel meetings that, as a general rule, United States territory was avoided because of its well-deserved reputation for tough anticartel enforcement. Instead, conspirators met in Switzerland, Mexico, Japan, Hong Kong, and several EU cities that were regarded as less risky. This behavioral pattern is perhaps the best indicator that U.S. anticartel policies are the ones other jurisdictions should emulate.

One investigative technique that has proven especially useful in discovering cartels is the DOJ's 1993 Leniency Program. Similar programs were subsequently adopted in Canada, the UK, Germany, Brazil, and the EU (Hammond 2001a:3). A novel variation is the "Amnesty Plus" program that rewards indicted companies if they inform the DOJ about collusive activity in a market not yet being investigated. In 2001, more than half of the DOJ's 30 global-cartel investigations were the result of Amnesty Plus leads (*ibid.*:6). An example, admittedly the most productive one so far, is shown in Figure 4. Starting with 1992 information from one cooperating witness in 1992, the DOJ was able to leverage five global-cartel investigations into convictions of 10 companies, 11 executives, and \$225 million in fines. Other U.S. policies worthy of globalization include: fines based on multiples of overcharges rather than arbitrary percentages, increased penalties for recidivists, encouragement of private antitrust suits, and the criminalization of antitrust violations. This last initiative is especially important because it

⁴⁰ The EU may also have missed a potential monopolization infraction when Ajinomoto took steps in the early 1970s that prevented Rhône-Poulenc's entry into lysine manufacturing.

reduces the number of safe havens for fugitives from U.S. antitrust laws. These policy reforms are especially needed in Japan (which has an arbitrary fine of 6 percent of sales for price fixing by manufacturers) and other industrialized Asian countries (Chemtob 2000, Hammond 2001a).

Figure 4. Amnesty Plus and DOJ Cartel Convictions.



*Parties received reduced sentences or amnesty

U.S. anticartel policies themselves are hardly above criticism. Periods of weak enforcement seem to be associated with clusters of cartel-formation, such as occurred in the 1930s and 1980s. While it is treacherous to second-guess the decisions of DOJ prosecutors, there seems to be a pattern of overly generous fine discounts being given routinely to late-arriving cartel members; actual discounts are often bigger than the stated discount policy. Given the relatively low levels of fines and private settlements outside the United States, consideration should be given to calculating fines routinely on the basis of *global* sales of the cartelized product, rather than as the rare exception it is today. Then DOJ threats of imposing fines “as

high as 80 percent” of the value of affected commerce might really approach full deterrence levels.⁴¹

Many legal writers believe that personal penalties may have more deterrence value than corporate fines. The present U.S. Sherman Act cap of \$350,000 has little punishment value for most multi-millionaire executives convicted for criminal price fixing in recent years. An alternative fine statute, first applied in 2002 litigation, should be made the new standard; at least Congress needs to clarify to the judiciary when it should be applied (see Connor 2001:434-436). As to prison sentences, three years may be too low a limit. Other countries have five-year maximum sentences for the same offense. The DOJ has been criticized for overuse, of at least unjustified use, of grants of immunity for top executives; closer supervision of these concessions by the courts is warranted. On the other hand, a small somewhat clearer policy is needed on granting immunity to “whistle-blowers” or cooperating witnesses, akin to automatic amnesty available for corporations.

Finally, nongovernmental solutions to price-fixing behavior should be explored (Connor 2001:542-547). Companies should implement internal antitrust compliance programs: training in legal standards of behavior, formal involvement in monitoring of contacts with rivals by corporate counsel, confidential whistle-blower communication methods, guidelines for dismissal of guilty employees, and surprise audits of participation of employees in trade-association meetings (Kolasky 2002).⁴² Governance structures are critical if companies are to avoid future price-fixing allegations. In particular, boards of directors must be composed of a majority of members independent from management and outsiders should be the majorities on the all-important nomination and audit committees of the board.

⁴¹ Hammond (2001a) mentions this figure. It assumes the usual 10-percent overcharge level, which is automatically doubled and then multiplied by a culpability index as high as 4.5. However, among the better documented global cartels in Tables 7 and A.2, the average overcharge was close to 25 percent of affected sales. Therefore, fines as high as 225 percent of U.S. sales during the conspiracy are in fact credible, or even 800 percent if the DOJ were to base its fine on *global* affected sales.

⁴² Federal legislation passed by Congress in July 2002 mandates the Securities and Exchange Commission to establish standards of professional conduct for lawyers who practice before the SEC. Lawyers will be required to report evidence of fraud or other misconduct by corporate managers to the firm’s CEO or, if no action is taken, to the board of directors (Schmit 2002). This rule originated from a letter from 40 law-school professors that cited ethical concerns about the role of lawyers in the Enron Corp. scandal.

References

- Arbault, Francois, *et al.* The Commission's New Notice on Immunity and Reduction of Fines in Cartel Cases. *Competition Policy Newsletter* (June 2002:15-22).
- Borgeson, Nancy S. *Amino Acids*. Palo Alto, California: Chemical Economics Handbook, SRI International (May 1999).
- Bryant, Peter G. and E. Woodrow Eckard. Price Fixing: The Probability of Getting Caught. *Review of Economics and Statistics* 73 (1991):531-540.
- Buccirossi, Paolo, Stéphan Marette, and Alessandra Schiavina. Competition Policy and the Agribusiness Sector of the European Union. *European Review of Agricultural Economics* 29 (forthcoming August 2002).
- Caves, Richard E. *Multinational Enterprise and Economic Analysis: 2nd Edition*. Cambridge: Cambridge University Press (1996).
- Chemtob, Stuart M. Antitrust Deterrence in the United States and Japan, remarks at a conference, Competition Policy in the Global Trading System, Washington, DC (June 23, 2000).
- Connor, John M. and William A. Schiek. *Food Processing: An Industrial Powerhouse in Transition: Second Edition*. New York: Wiley (1997).
- Connor, John M. *Archer Daniels Midland: Price-Fixer to the World (Fourth Edition)*, Staff Paper 00-14. W. Lafayette, IN: Department of Agricultural Economics, Purdue University (December 2000).
- Connor, John M. *Global Price Fixing: Our Customers Are the Enemy*. Boston: Kluwer Academic Publishers (2001).
- Connor, John M. Global Cartels Redux. *The Antitrust Revolution (Fourth Edition)*, John Kwoka and Lawrence White (editors). Oxford: Oxford University Press (forthcoming 2003).
- Dick, Andrew R. Cartels. *The New Palgrave Dictionary of Law and Economics*, John Eatwell (editor). London: Macmillan (1998).
- DOJ. Selected Press Releases [www.usdoj.gov]. (2002 and previous years).
- EC. Selected Press Releases [<http://europa.eu.int/comm/competition>]. (2002 and earlier).
- EC. Commission Decision of 7 June 2000 (Case COMP/36.545/F3-Amino Acids). *Official Journal of the European Communities* (7 June 2001): L152/24-72.
- Eichenwald, Kurt. *The Informant: A True Story*. New York: Broadway Books (2000).

- Fraas, Arthur G. and Douglas F. Greer. Market Structure and Price Collusion: An Empirical Analysis. *Journal of Industrial Economics* 23 (1977):21-44.
- Gallo, Joseph C. *et al.* Guess Who Came to Dinner: An Empirical Study of Federal Antitrust Enforcement for the Period 1963-1984. *Review of Industrial Organization* 2 (1985):120.
- Hammond, Scott D. When Calculating the Costs and Benefits of Applying for Corporate Amnesty, How Do You Put a Price Tag on an Individual's Freedom?, speech at the 15th Annual National Institute on White Collar Crime, San Francisco, California, March 8, 2001a.
- Hammond, Scott D. From Hollywood to Hong Kong – Criminal Antitrust Enforcement is Coming to a City Near You, address at Antitrust Beyond Borders conference, Chicago, November 9, 2001b.
- Hammond, Scott D. A Review of Recent Cases and Developments in the Antitrust Division's Criminal Enforcement Program, speech at the Conference Board's 2002 Antitrust Conference, New York City, March 7, 2002.
- Hay, George A. and Daniel Kelley. An Empirical Survey of Price Fixing Conspiracies. *Journal of Law and Economics* 17 (1974):13-38.
- Kanne, Michael S., Ilana Diamond Rovner, and Terence T. Evans. *Opinion, U.S. Court of Appeals for the Seventh Circuit in U.S. v. Michael D. Andreas and Terrance S. Wilson* (2000 U.S. App. LEXIS 14572). Chicago, Illinois (June 26, 2000).
- Klein, Joel I. Address, International Anti-Cartel Enforcement Conference, Washington, DC (September 30, 1999).
- Kolasky, William J. Antitrust Compliance Programs: The Government Perspective, address at the Corporate Compliance 2002 Conference, Practising Law Institute, San Francisco, Calif. (July 12, 2002).
- Krugman, Paul. Greed Is Bad. *The New York Times* (June 4, 2002) [www.nytimes.com].
- Lande, Robert H. Are Antitrust "Treble" Damages Really Single Damages? *Ohio State Law Journal* 54 (1993):117-174).
- Lieber, James B. *Rats in the Grain: the Dirty Tricks of "Supermarket to the World."* New York: Four Walls Eight Windows (2000).
- Nanni, Anthony V. Squeezing the Cartels: Criminal Enforcement Gets Tough. *Legal Times* (April 20, 2002):30-35.
- Philips, Louis. *Competition Policy: A Game-Theoretic Perspective*. Cambridge: Cambridge University Press (1995).

- Posner, Richard A. *Antitrust Law: Second Edition*. Chicago: University of Chicago Press (2001).
- Schmit, Richard B. Law Asks Corporate Lawyers to Report Fraud by Clients. *Wall Street Journal* (July 25, 2002):B1.
- Selton, R. A Simple Model of Imperfect Competition, where 4 Are Few and 6 Are Many. *International Journal of Game Theory* 2 (1973):141-201.
- Shepherd, William G. *Public Policies Toward Business: 7th Edition*. Homewood, Illinois: Irwin (1985).
- Stigler, George J. A Theory of Oligopoly. *Journal of Political Economy* 72(1964):44-61.
- Stocking, George W. and Myron W. Watkins. *Cartels in Action: Case Studies in International Diplomacy*. New York: Twentieth Century Fund (1946).
- Sullivan, Lawrence A. and Warren S. Grimes. *The Law of Antitrust: An Integrated Handbook*. St. Paul, MN: West Group (2000).
- Symeonidis, George. *The Effects of Competition: Cartel Policy and the Evolution of Strategy and Structure in British Industry*. Cambridge: The MIT Press (2002).
- Voight, Fritz. German Experience with Cartels and Their Control During Pre-War and Post-War Periods, in *Competition, Cartels, and Their Regulation*, J.P. Miller (editor). Amsterdam: North Holland (1962).

Table A.1. Fourteen Discovered International Cartels Outside the Food and Agriculture System, 1997-2002.

Cartel Product	Years	No. of Cos.	Affected Sales			Customer Overcharge
			U.S.	EU	World	
			<i>Million dollars</i>			
Graphite electrodes	1992-98	9	1,750	1,675E	4,900	2,400
Heavy-lift marine construction	1990-97	2	NA	NA	} 50E }	60E
Heavy-lift marine transport	1990-97	2	NA	NA		
Bromines	1995-98	3	800	0	800	10-25
UK stamp dealers - U.S. auctions	1990-97	2	NA	0	NA	NA
Magnetic iron oxide	1991-98	2+	200+	150E	750E	75E
Carbonless paper	1992-95	10	NA	800	800	300E
Zinc phosphate	1994-98	6	0	60	60	10-15
Art auctions	1992-2000	2	1000+	1000E	2000+	500E
Isostatic graphite	1993-98	3+	NA	NA	NA	10-20?
Carbon cathode block	1995-97	3+	NA	NA	NA	2-5?
Danish air routes ^a	1998-2001	2	0	NA	NA	50E
Austrian banks ^a	1993-2001	8	0	NA	NA	NA
“Three Tenors” CD	1997-2000	2	NA	NA	NA	NA
Greek ferries ^a	1992	4	0	NA	NA	1E
Seamless steel tubes ^a	1990-95	8	NA	NA	NA	100E
Stainless steel flat products ^a	1993-96	6	0	NA	NA	25E
District heating pipe ^a	1990-95	10	0	1,200E	1,200	100E
German banks ^a	1997-99	5	0	NA	NA	100E
British sugar ^a	1986-90	4	0	NA	NA	50E
Total		93+	3,750+	4,885+	10,560+	3,813+

Sources: EC (2002), CCB (2002), DOJ (2002), Lexis-Nexis.

^a International cartels prosecuted by the European Commission, but comprised of companies with headquarters within the European Union that fixed prices only within the EU.

Table A.2. Government Fines Imposed on International Price Fixers.

Cartel	Company (Country)	Amount of Fines				Percentage Fines								
		U.S.	EU	Other	Total	U.S. Sales	EU Sales	World Sales	Overcharges					
LYSINE	ADM (US)	70.0	42.1	9.1	121.2	<i>Million U.S. dollars</i>	<i>Percent</i>							
	Ajinomoto (JP)	10.0	25.2	2.3	37.5									
	Kyowa Hako (JP)	10.0	11.8	0.0	21.8									
	Sewon (SK)	1.25	7.9	0.1	9.3									
	Cheil Sugar (SK)	1.25	10.9	NI	12.2									
	Subtotal	92.5	97.9	11.5	201.9					20.1	16.2	10.4	84.2	
	CITRIC ACID	ADM (US)	30.0	35.3	1.3					66.6				
		Roche (CH)	14.0	56.5	2.0					72.4				
		Bayer (DE)	50.0	12.7	3.2					65.8				
		Jungbunzlauer (CH)	11.0	15.7	1.3					27.9				
Eridania (FR)		0.4	0.2	0.5	1.1									
Subtotal		110.4	120.4	8.3	239.1	7.5	10.0	5.4	33.4					
VITAMINS		Roche (CH)	500.0	408.0	42.6	950.6								
		BASF (DE)	225.0	261.5	16.1	502.6								
		Rhône/Aventis (FR)	0	4.5	12.2	16.7								
		Takeda (JP)	72.0	32.7	3.4	180.1								
	Eisai (JP)	40.0	11.7	1.4	53.1									
	Daiichi (JP)	25.0	20.7	1.7	47.4									
	Degussa (DE)	13.0	NI	NI	13.0									
	E. Merck (DE)	14.0	8.2	0.7	22.9									
	Lonza (CH)	10.5	0	0	10.5									
	Chinook (CA)	5.0	NI	1.5	6.5									
	DCV (US)	Pend	NI	0	0									
	Nepera (US)	Pend	NI	0	0									
	Mitsui (JP)	Pend	NI	0	0									

SODIUM GLUCONATE	Reilly (US)	2.0	NI	0	2.0				
	Solvay (BE)	NI	8.0	0	8.0				
	Höchst/Aventis (DE)	NI	1.6	1.7	3.3				
	Sumitomo (JP)	NI	0	0	0				
	Sumitaka (JP)	NI	0	0	0				
	Tanabe S. (JP)	NI	0	0	0				
	Kongo (JP)	NI	0	0	0				
	Subtotal	906.5	756.9	81.3	1,744.7	18.1	9.1	6.2	23.5
	Fujisawa (JP)	20.0	3.2	0.3	23.5				
	Jungbunzlauer (CH)	0	18.2	0.1	18.3				
Roquette Freres (FR)	2.5	9.6	0.5	12.6					
Avebe (NL)	0	3.2	NI	3.2					
ADM (US)	0	9.0	0	9.0					
Akzo Nobel (NL)	10.0	8.0	0.2	18.2					
Subtotal	32.5	51.2	1.1	84.8	93.0E	85.0		NA	
SORBATES	Höchst/Aventis (DE)	36.0	Pend	1.6	37.6				
	Daicel (JP)	53.0	Pend	1.6	54.6				
	Nippon Gohsei (JP)	21.0	Pend	0	21.0				
	Ueno (JP)	11.0	Pend	0.8	11.8				
	Chisso (JP)	Pend	Pend	Pend	0				
	Eastman Chem. (US)	11.0	Pend	0	11.0				
	Monsanto (US)	NI	Pend	NI	0				
	Subtotal	132.0	0	4.0	136.0				
	Pfizer (US)	10.0	Pend	1.0	11.0				
	Fujisawa (JP)	0	Pend	0	0				
Subtotal	10.0	0	1.0	11.0					
MALTOL	Pfizer (US)	10.0	NI	NI					
	Unknown	0	NI	NI					
	Subtotal	10.0	0	0					

METHIONINE	Rhône-Poulenc/Aventis (F)	NI	0 ^a	NI	0	
	Degussa-Hüls (DE)	NI	116.3	NI	116.3	
	Mitsui (JP)	NI	NI	NI	0	
	Nippon Soda (JP)	NI	8.9	NI	8.9	
	Novus Intl. (US)	NI	NI	NI	0	
	Subtotal	0	125.2	0	125.2	
MCAA (MONOCHLORO- ACETIC ACID)	Akzo Nobel (NL)	12.0	Pend	Pend	12.0	
	Total Fina Elf (FR)	5.0	Pend	Pend	5.0	
	Clariant (DE)	Pend	Pend	Pend	0	
	Höchst/Aventis (DE)	Pend	Pend	Pend	0	
	Daicel (JP)	Pend	Pend	Pend	0	
	Subtotal	17.0	0	Pend	17.0	12.0+
ORGANIC PEROXIDES	Total Fina Elf (FR)	3.5	Pend	Pend	3.5	
	Akzo Nobel (NL)	Pend	Pend	Pend	0	
	Hucules (US)	Pend	Pend	Pend	0	
	Niacet (US)	Pend	Pend	Pend	0	
	Nippon Kayaku (JP)	Pend	Pend	Pend	0	
	Subtotal	3.5	0	0	3.5	1.2
MSG (MONOSODIUM GLUTAMATE)	ADM (US)	Pend	NI	Pend	0	
	Ajimoto (JP)	Pend	NI	Pend	0	
	Sewon/Daesang (SK)	Pend	NI	Pend	0	
	Kyowa Hako(JP)	Pend	NI	Pend	0	
	Cheil Sugar (SK)	Pend	NI	Pend	0	
	Deko Intl. (?) Subtotal	Pend 0	NI 0	Pend 0	0 0	
NUCLEOTIDES	Ajimoto (JP)	6.0	NI	NI	6.0	
	Cheil Sugar (SK)	3.0	NI	NI	3.0	
	Sewon/Daesang(SK)	0.1	NI	NI	0.1	

	Unknown	Pend	NI	NI	0
	Subtotal	9.1	0	0	9.1
EU WINE ALCOHOL	ADM (US)	Pend	Pend	NI	0
	Hogan & Co. (US)	Pend	Pend	NI	0
	ED & F Man (UK)	Pend	Pend	NI	0
	Subtotal	0	0	0	0
BELGIAN BEER, HORECA & PRIVATE LABEL	Interbrew (NL)	NI	41.9	NI	41.9
	Danone (FR)	NI	40.1	NI	40.1
	Haact (BE)	NI	0.2	NI	0.2
	Martens (BE)	NI	0.2	NI	0.2
	Subtotal	0	82.4	0	82.4

Sources: Connor (2001), DOJ (2002), EC (2002), CCB (2002).

NI = Not indicted

Pend = Target of investigation, fine determination pending.

Table A.3. The World-Wide Pursuit of International Food-and-Agricultural Cartels, 1996-2002.

Cartel	Prosecutions by Antitrust Authorities ^a			
	United States	Canada	European Union	Other Nations
EU wine alcohol	Pending ^b	NA	Pending ^b	
Methionine	Pending ^b	NA	2002 ^c	
MSG	Pending ^b	NA	Pending ^b	
Lysine	1996	1998	2000	Mexico
Citric acid	1997	1998	2001	
Sodium gluconate	1997	1998	2001	
Sorbates	1998	2000	Pending	
Maltol	1999	NA	NA	
Sodium erythorbate	1999	2001	Pending	
Vitamins	1999	1999	2001	Australia, Japan, Brazil
Nucleotides	2001	NA	Pending	
MCAA	2002	NA	NA	
Organic peroxides	2002	NA	NA	

Sources: DOJ (2002), EC (2002), CCB (2002), Lexis-Nexis.

NA = No information available.

^a dates of first major conviction.

^b Investigation announced.

^c First EC decision to precede a U.S. prosecution.