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Background Paper for the World Bank's *World Development Report 2001*

"Private International Cartels and Their Effect on Developing Countries"

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Executive Summary

The U.S. Department of Justice, the European Commission, and the Organization for Economic Cooperation and Development have all recently voiced concern about, and in the former two cases, increased their prosecution of, international cartels. While the OECD's report "Hard Core Cartels" argues that "particularly harmful effects" from international cartel activity will be felt by less developed countries, the documentation of the effects of price-fixing conspiracies is limited to the harm brought to consumers in wealthy, industrialized countries.

In this report we examine the possible effects of recent private international cartels on developing countries by looking in detail at five case studies. The producers in these cartels come almost exclusively from industrialized, OECD countries. We discuss the direct effects of cartels on developing country consumers, via the increase in price. We also discuss the ambiguous indirect effects on developing country producers -- potentially beneficial effects from the existence of a price umbrella, for example, or the harmful effects of increased barriers to entry.

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We combine trade data with reports of the estimated price effects of each cartel in order to make a first attempt at quantifying the order of magnitude of the consequences of these cartels on developing countries as consumers. Due to the secrecy surrounding cartel operations, we rely largely on anecdotal evidence from which only tentative conclusions can be drawn. In addition to the classic problem that concealment of cartel activities causes for the empirical analysis of cartel effects, one of the main lessons learned from this study is how ill-suited current trade data and access to results of government investigations are for the study of the effects of international cartels on developing countries. The lack of antitrust prosecutions by developing countries themselves reinforces the paucity of information on the activities of these cartels in developing country markets. With these qualifications in mind, the following are highlights and principal findings from the report:

- It is impossible to gauge the true number of international cartels in existence in the 1990s. However, we do know that the U.S. Department of Justice and the European Commission have recently investigated and prosecuted, or are currently investigating, at least forty different international price-fixing conspiracies that were in force at some point in the past decade. Many of these conspiracies appear to have had primarily U.S. or EU effects, but some of the larger cartels clearly had an effect on markets worldwide.
- In 1997, the latest year for which we have trade data, developing countries imported \$81.1 billion of goods from industries which had seen a price-fixing conspiracy during the 1990s. These imports represented 6.7% of imports and 1.2% of GDP in developing countries. They represented an even larger fraction of trade for the poorest developing countries, for whom these sixteen products represent 8.8% of imports. The consumption impact appears to be largest for upper middle income countries, for whom these imports represent 1.5% of GDP. (Note that 4 of these conspiracies are still under investigation by anti-trust authorities; if these four are excluded from our analysis, the total value of imports drops to \$42.8 billion, and to 3.5% of imports and 0.64% of GDP.)

- There are a variety of different techniques that cartels have used to block entry into these industries. These techniques, if successful, can harm developing country producers. In the steel beam and graphite electrodes cases, for example, cartel members attempted to restrict information about technology. Such activity might encourage developing country entrants to participate in joint ventures with established producers. These joint ventures might well accomplish both welfare-enhancing (e.g., sharing technology, access to capital) goals and competition-reducing (e.g., the cartel accommodates developing country entrants under its own terms) goals of the firms.
- This, in turn, suggests that a more comprehensive approach to promoting competition may be necessary. Current regulatory institutions are neither international enough nor sufficiently focused on promoting competition rather than simply prohibiting particular anti-competitive techniques to assure that global markets will be competitive and open to new producers. There is currently no competition authority that considers it their purview to assure that developing country producers have access to markets uninhibited by restraints from private agreements by established producers.

Five product markets were chosen for case study: bromine, citric acid, graphite electrodes, steel tubes, and vitamins. These cases were chosen, in part, based on the size of developing country imports of the product and whether price data were available for the product in question. We included only cases in which, based on the public record of the cartel's activity, we had some reason to believe that the cartel likely had an effect on markets worldwide. In each case we give an overview of the product, the industry structure, the conspiracy, and its potential effects on developing country consumers and producers. A few highlights from each case study are as follows:

- In the bromine case the price and trade data are poor. Since the demise of the cartel it appears that existing producers are accommodating the entry of developing country producers, but they do so by establishing joint ventures which may limit the extent of competition offered by new producers.

- In the citric acid case, China has presented vigorous competition to an otherwise highly concentrated industry, both in the U.S. and Europe. Producers in the U.S. tried twice to use anti-dumping duties to protect the U.S. market from Chinese citric acid imports; once during the conspiracy and once after. Both times the petition was denied.
- Numerous mini-mill steel producers in developing countries claim to have been damaged by the cartel in the graphite electrode industry. This is the only case of the five industries studied where we see developing country producers filing a follow-on civil suit in the U.S., after firms pled guilty to U.S. charges of price-fixing. It is not clear to us why developing country consumers have not filed similar suits in other industries, since this may represent one of the simplest ways for (large) consumers to be compensated, as it does not require legal changes by either the U.S. or developing countries.
- Seamless steel tubes, pipes, and casings are used in the construction of wells in the oil and gas industry. Import data on iron and steel tubes exist, but the category is much broader than the oil and gas products covered in the conspiracy. It is therefore difficult to gauge the true effects of the cartel on developing countries. All of the cartel participants have, since the breakup of the cartel by the EC, entered into joint ventures with one another and with firms based in developing countries.
- The intricate and long-lasting vitamin cartel most likely had worldwide effects. Evidence of this comes in part from the fact that in addition to prosecutions by antitrust authorities in the U.S. and EC, there have been investigations or cases filed in Australia, Brazil, Japan, and Mexico. The import data on vitamins understates the full effects of the cartel, since developing countries also import vitamin-enriched foods for human and animal consumption.

A complete evaluation of the impact of even these cartels about which a fair amount of information has been made public is difficult without more finely disaggregated trade data, more information about transactions prices, and more information about the methods of distribution and other dimensions of competition in these industries. We can say, however, that these cartels have been shown to be able to raise prices on products that are of importance to developing

country economies. Just as importantly, we believe, for the future of world competitive markets, the firms in these cartels seem to be able to respond to developing country entry in ways that may limit competition: either by blocking entry through the consolidation of sales networks or the establishment of high tariffs or by the accommodation of entry through joint ventures which allow new production facilities but limit their competitive effects.

I. Introduction

A. Recent International Cartel Activity

Recent prosecutions of international cartels in a wide range of industries demonstrate that cartels have pernicious effects on consumers despite the difficulties created by both law and internal incentives. The benefits to the lessening of competition seem to have been sufficient, as least in the cases discussed in this report, for firms to overcome both their own incentives to increase output and legal prohibitions on collusion.¹

The U.S. Department of Justice, the European Commission, and the Organization for Economic Cooperation and Development have all recently voiced concern about, and in the former two cases, increased their prosecution of, international cartels. While the OECD's report "Hard Core Cartels" argues that "international cartels often have particularly harmful effects on less developed countries," these reports have focused on the better-documented effects on wealthy, industrialized countries.²

From these recent international price-fixing cases, we have created a sample of international cartels on which the research in this paper is based (Table 1). We believe that this is close to the universe of international cartels that have been successfully prosecuted by the United States or the European Commission for fixing prices during the 1990s. More specifically, the sample is made up of firms that have been convicted of (or, in a few cases, are currently under investigation for) price fixing in either the United States or the European Union during the 1990s. Table 1 summarizes the dates of cartel operation, the legal entity (i.e., the U.S. or the EC) that prosecuted the case, the country of origin of the indicted (or investigated) firms, whether

¹ The classic presentation of firms' incentive to cheat on collusive agreements is George J. Stigler "A Theory of Oligopoly" *Journal of Political Economy* 72:1 (1964) pp. 44-61. For further discussion of cartel economics and a survey of empirical research on cartel stability, see Levenstein and Suslow, "What Determines Cartel Success?" forthcoming in *How Cartels Endure and How They Fail* edited by Peter Grossman (Edward Elgar, 2001).

² "Hard Core Cartels" Organisation for Economic Co-operation and Development (Paris, France 2000), p. 6. See also speech by Mr. Mario Monti, Member of the European Commission in charge of Competition, "Fighting Cartels: Why and How? Why should we be concerned with cartels and collusive behavior?" presented at the Third Nordic

firms from developing countries are known to be participants in the price-fixing arrangement, and, finally, which country or countries are known to be affected (as consumers) by the cartel. In order to appear in this table, a cartel must satisfy the following conditions: 1) it must involve more than one producer (otherwise, we consider it an extension of monopoly power case); 2) it must include firms from more than one country; and 3) it must have attempted to set prices or divide up markets in more than one country. This sample, like its intellectual antecedents, may be biased as a result of its dependency on prosecution as a sample selection criterion.³

Increasing liberalization of international trade may have inadvertently, by increasing competition in formerly protected national markets, increased the incentive for firms to participate in cartels. Such a response undermines the process of international integration, and decreases the benefits of economic integration to consumers around the world. It may also undermine political support for international liberalization if citizens believe that private barriers to trade will simply replace government-created ones. We should note that at least some of these cartels clearly pre-date recent moves toward international liberalization. Joel Klein, former assistant attorney general for the Antitrust Division of the U.S. Department of Justice said recently, "As a result of the increasing rapidity with which the economy is becoming globalized, worldwide cartels are looming as a major enforcement concern for us. It's almost as if private arrangements are replacing governmentally imposed market barriers."⁴

B. Effects On Developing Countries

Most of the cartels in our sample are made up of producers in industrialized, OECD countries. Therefore, it is not surprising that virtually all previous examination of the impact of these cartels focused on the industrialized, OECD countries. This appears to be true of both business and

Competition Policy Conference, Stockholm, September 11, 2000 and the U.S. Department of Justice International Competition Policy Advisory Committee "Final Report" (U.S. GPO Washington, DC 2000).

³ See Posner, Richard A. "A Statistical Study of Antitrust Enforcement." *Journal of Law and Economics* 13, 2 (1970): 365-419; Hay, George A., and Daniel Kelley. "An Empirical Survey of Price Fixing Conspiracies." *Journal of Law and Economics* 17(1974): 13-38 Asch, Peter, and Joseph J. Seneca. "Characteristics of Collusive Firms." *Journal of Industrial Economics* 23, 3 (1975): 223-37.

⁴Quoted in Robert D. Paul and J. Mark Gridley, "Price Fixing Begins to Hit Bottom Line," *Legal Times*, May 4, 1998.

public policy players, as there has been little activity on the part of developing country governments or developing country consumers to respond to these cartels even after they have been shown to exist. This contrasts with the actions of the Canadian government, which has consistently pursued anti-competition cases against firms who have been investigated first by either the U.S. Department of Justice or the European Commission. One exception to this generalization is Mexico, which took action against the lysine cartel, and is investigating the vitamins cartel.⁵ The Mexican government's anti-trust unit is also investigating Mexico's sole steel tube manufacturer, but this investigation appears to be unrelated to the price-fixing charges discussed below. The lack of action in response to these cartels also appears to hold true of private parties in developing countries, who have, with only a few exceptions, apparently not actively sought civil remedies against cartel participants to the extent that consumers in western, industrialized countries have. There are a variety of reasons – legal, political, and economic -- why this may be the case. But, as this report demonstrates, a lack of impact on developing countries is probably not one.

The extant research on the impact of cartels on developing countries focuses on commodity price stabilization schemes among developing country producers of primary products. In these studies, the analysis focuses on developing countries as producers and industrialized countries as consumers. In contrast, the cartels in our sample produce sophisticated manufactured goods or services; their members are largely international corporations based in industrialized countries. We examine two aspects of the impact of these cartels on developing countries: first, we look at developing countries as consumers and ask how price-fixing conspiracies may have affected them. Second, we look at developing countries as producers, either competitors to or collaborators with, these international cartels. We examine the creation of barriers to entry by cartels and their impact on developing country producers or potential producers. We also examine the methods that may be used to induce cooperation with the cartel by developing country producers. This two-pronged approach gives a more complete picture of the varied direct and indirect effects of international cartels on developing countries.

⁵ Brazil is also contemplating action against the lysine cartel. "European Commission Sets ADM Fine," Scott Kilman, *Wall Street Journal* June 8, 2000.

We begin by discussing our entire sample of international cartels, trying to gauge very broadly their impact on developing country producers and consumers. We then turn to an analysis of five in-depth case studies of the bromine, citric acid, graphite electrode, steel tube, and vitamin price-fixing conspiracies. For these case studies we have gathered price data, allowing a somewhat more refined analysis of the impact of cartels on developing country consumers. We have also analyzed industry structure and conduct in more detail and provide a preliminary analysis of the impact of these cartels on developing country producers.

II. Cross-Section Evidence: Developing Countries as Competitors or Co-Conspirators

One of the benefits of U.S. or EU cartel activity on developing country producers is that the cartel sets a price umbrella for the industry. There are, however, negative potential effects as well. A thorough study of the impact of international cartels on developing country producers would need to discuss the variety of ways that a cartel might engage in activity that blocks developing country entry:

- To what extent do cartel members use tariff barriers to prevent entry?
- To what extent do cartels use government-authorized, non-tariff barriers to prevent entry (quotas, regulation, surveillance and reporting) ?
- To what extent do cartels use private barriers to prevent entry?
- Does the prosecution of a cartel open up entry possibilities to developing country producers?

We address these issues throughout this paper, though, in part because of the secrecy surrounding cartel operations, we rely largely on anecdotal evidence from which only tentative conclusions can be drawn.

There are a variety of different techniques that cartels have used to block entry. These include the threat of retaliatory price wars, use of a common sales or distribution agency (i.e., vertical foreclosure), and patent pooling. For the most part the public record on recent price-fixing cartels does not discuss whether the cartel engaged in activities to block entry because such

evidence is not necessary for a criminal conviction, at least in the United States where price fixing is *per se* illegal. However, we have found descriptions of activities that may have been attempts to deter or block entry reported for some of the cartels in our sample.

For example, there was a price-fixing conspiracy in the EU steel beam market between 1988 and 1994 (Table 1). Steel makers who were colluding to fix the price of steel beams “restrict[ed] the flow of information . . . in order to freeze out any new competitors,” according to Karl Van Miert, the EU competition commissioner.⁶ It is not clear from the published record what type of information steel producers were trying to restrict in the steel beam case, but we do know that in many industries information about technology and more formally, patent pools, have been used by cartels in the past to create barriers to entry.⁷

Consider also the actions of graphite electrode producers from the U.S., EU, and Japan. The U.S. Department of Justice alleged that graphite electrode producers engaged in activity to disadvantage outsiders to their cartel, claiming that they “agreed to restrict non-conspirator companies’ access to certain graphite electrode manufacturing technology”.⁸ Again, while this charge appears in every individual indictment, indicating it was agreed upon by all cartel members, the details of the firms' actions are not given.

These kinds of activities might be particularly effective in limiting entry from developing country producers who are new to international trading. Such activities might encourage developing country entrants to participate in some sort of joint venture with an established producer who has the information, patents, or distribution network that developing country entrants lack. Such joint ventures could then function as a way for a cartel to accommodate developing country entry into a cartel under their own terms or to engage in an implicit cooperative pricing arrangement. In several of the case studies discussed below, joint ventures have been established in the years following the forced break-up of the cartel. In some cases, as,

⁶ "European Commission Fines Steel Makers \$116.7 Million" *Wall Street Journal Europe* February 17, 1994.

⁷ See, for example, Steven W. Usselman, "Organizing a Market for Technological Innovation: Patent Pools and Patent Politics of American Railroads, 1860-1900" *Business and Economic History* 19 (1990): 203-22 and Leonard S. Reich, "Lighting the Path to Profit: GE's Control of the Electric Light Industry, 1892-1941" *Business History Review* 66:2 (Summer 1992): 305-34.

⁸ "Japanese Subsidiary Charged with International Conspiracy to Fix Prices for Graphite Electrodes in the U.S." U.S. DOJ Press Release, February 23, 1998.

for example, an alliance among three Japanese steel tube manufacturers, the joint venture appears to be little more than the establishment of a joint sales agency. In most of the cases discussed below, incumbent firms have been willing to accommodate Chinese entry since the break-up of the cartel, but they have done so by establishing joint ventures between former cartel participants and Chinese producers. These arrangements give Chinese producers access to the world market, but may do so at some cost to the degree of competition that would otherwise obtain in the industry.

Of course, both developing country entrants and established producers could also have other, welfare-enhancing motives for establishing such joint ventures, such as sharing technology, local market expertise, or capital. It is important to note that these explanations for joint ventures are not mutually exclusive; a joint venture might well accomplish both welfare-enhancing and competition-reducing goals of the participating firms. Joint ventures (and mergers) in industries known to have a history of international price fixing should be scrutinized by regulatory authorities and structured so as to support the welfare-enhancing gains from cooperation while allowing consumers in both developing and industrialized countries the benefits of enhanced competition.

III. Cross-Section Evidence: Developing Countries as Consumers

In order to determine whether developing countries were consumers of one of the cartelized products in the sample, we matched the products in Table 1 with import-export data for the sample period. The trade data come from Robert Feenstra's, *World Data Flows, 1980-1997, With Production And Tariff Data* (Center for International Data, Institute of Governmental Affairs, University of California – Davis, 1999). The bilateral trade flows for all countries are classified according to the Standard International Trade Classification (SITC), Revision 2. The codes are, unfortunately, often broader than the products in question. We indicate discrepancies between the cartelized products and the SITC categories in Table 2 (see Appendix for details).

Tables 2 and 3 summarize the import data for sixteen of the cartelized products in Table 1 for 1997, the most recent year for which trade data are available.⁹ The sample size falls to sixteen products in Tables 2 and 3 from the 39 in Table 1 for two reasons. First, the data on trade flows excludes services, so cartels that fixed prices on services were ruled out for further analysis. Second, goods were dropped from the sample where the data appeared to be misclassified or aggregated to such a level that no reasonable match to the cartel product could be made. (See Appendix for details.)

In Tables 2 and 3 we report the size of imports for those products for which we were able to obtain reasonable trade data. In Table 2, we report 1997 imports of “cartel-affected” products as a percent of total imports to developing countries, with countries aggregated by income categories. Table 3 presents 1997 import data for these same products, showing them as a percent of total GDP in developing countries. Examining these sixteen products -- which were cartelized at some point during the 1990s and for which we were able to obtain reasonably reliable trade data -- the total value of such “cartel-affected” imports to developing countries was \$81.1 billion. This made up 6.7% of all imports to developing countries. It is equal to 1.2% of their combined GDP. These numbers do not represent the exact value of imports to developing countries by all international cartels. It is, on the one hand, biased downward because we include only sixteen price-fixing conspiracies. At the same time, it is an overestimate for many of these sixteen products because the categories, even for those that we include in Tables 2 and 3, are often broader than the products controlled by the cartel. (Note that 4 of these 16 conspiracies are still under investigation by anti-trust authorities; if these four are excluded from our analysis, the total value of imports drops to \$42.8 billion, and to 3.5% of imports and 0.64% of GDP.) Even with these qualifications, it is clear from the magnitude of these figures that cartels have adversely affected a not insignificant portion of the trade, and therefore the trade balance, and consumption of developing countries. Following the industrial organization literature, we focus on trade and consumption, though the impact on the trade balance is not an insignificant issue in a period in which some developing countries experienced severe currency crises.

⁹ These are the products for which we have been able to find minimally reliable data in international trade statistics. These data problems are discussed further below.

There are enormous difficulties in estimating the quantitative impact of cartels on developing country incomes because of both the secrecy under which cartels operate, the lack of anti-trust prosecutions in developing countries themselves (leading to a lack of information on the activities of cartels in developing country markets), and the general lack of data on individual transactions that might have been influenced by the existence of a cartel. Estimates of the increase in price resulting from these cartels vary from almost nothing for the aluminum phosphide cartel, which lasted for less than a year, and in which one "participant" never raised its price to the cartel's agreed upon level, to a price increase estimate of fifty percent in the graphite electrodes case.

IV. Case Studies

We selected several case studies based on (1) whether there was a good match for the product in the import-export data, (2) whether the cartel exported a significant percentage of the product to developing countries, and (3) whether price data were available for the product in question. The most common reasons for eliminating a product for in-depth study were: a) the conspiracy was still under investigation (e.g., aircraft); b) services and customized products have inadequate price and trade data (e.g., cable-stayed bridges); c) the cartel, although international in its membership, covered only a limited geographic scope (e.g., explosives); d) other reasons idiosyncratic to the product (e.g., diamonds). The five product markets chosen for case study are: bromine, citric acid, graphic electrodes, steel tubes, and vitamins.

A. BROMINE CASE STUDY

1. Description of Product

Bromine is today used primarily in two different types of applications, as a flame retardant or as a fumigant. TBBA or T-Brome, short for tetrabromobisphenyl-A, is used as a flame retardant in the manufacture of epoxy, phenolic, and polycarbonate resins. DECA (decabromodiphenyloxide) is a flame retardant used in the manufacture of thermoplastics and fibers. They are both used

primarily in the manufacture of consumer electronics. Methyl bromide is used in industrial fumigation, primarily against rodents.

2. Substitutes in Consumption

Some uncertainty exists about future demand for T-Brome because the EC and others have considered a ban on T-Brome in the manufacture of electronic products because of its ozone-depleting effects.¹⁰

Phosphate-based flame-retardants are the closest substitute for bromine-based flame-retardants. They currently make up about 65% of world demand, with halogen-based (i.e., bromine-based) products making up the other 35%. Demand for these substitutes has increased as a result of increasing concern about bromine's effects on the ozone, so that the price of phosphate-based flame-retardants has risen significantly. As a result, producers are increasing production capacity for phosphate-based flame retardants. There are some producers, such as Albemarle, that manufacture both bromine and phosphate-based flame-retardants.¹¹

Iodine-based products are potential substitutes for bromine-based herbicides (bromoxynil) used in the agricultural sector.¹²

3. Industry Structure

Three firms, Dead Sea Bromine, Albemarle, and Great Lakes, supply more than 80% of the \$800 million world bromine market. Together, Albemarle and Great Lakes have a 54% share of the U.S. flame retardant market.¹³ Israel Chemicals is in the process of taking over Dead Sea Bromine. There are a few smaller producers, mostly oil and gas producers who manufacture

¹⁰ Chris Jorgenson, "Is FR4 Running Out Of Gas?" *Electronic Engineering* November 1, 2000, p. 85.

¹¹ "Phosphate Flame Retardants Heat Up in Europe," *Chemical Week* September 22, 2000, p. 25.

¹² Lisa Jarvis, "Iodine Is Showing Signs of Strength, New Capacity Could Soften Market," *Chemical Market Reporter* August 28, 2000, p. 5.

¹³ "Flame retardant price increases show producer discipline," *Chemical Market Reporter* September 14, 2000.

bromine as by-product to their other operations. There are also new Middle Eastern entrants (discussed further below).

The industry is increasingly characterized by joint ventures among the small number of active participants and those firms on the periphery of the industry who are in a position to enter (such as oil or potash producers). Dead Sea Bromine and Great Lakes have a joint venture to extract bromine from the Israeli side of the Dead Sea. Albemarle, the Jordan Bromine Company, and the Arab Potash Company are jointly building a plant on the Jordan side of the Dead Sea. After the announcement of the anti-trust prosecutions, analysts speculated that the price-fixing conspiracy was connected to the joint venture between Dead Sea Bromine and Great Lakes.¹⁴ There are also at least two new joint ventures linking these large producers to Chinese entrants.¹⁵

4. Location of Production

Production of bromine can only take place in regions that have, either in their water supply (e.g., Great Salt Lake, Dead Sea) or underground, sufficient concentrations of bromine to make its extraction profitable. Bromine tends to be found in underground deposits in conjunction with potash or oil and gas. Thus it is often produced as a by-product to these other goods. Both potash and oil are industries with a history of cooperation among producers in the setting of prices and output levels, so, not surprisingly, the bromine industry has also been plagued by such activity.¹⁶

¹⁴ "Great Lakes Under Investigation" *Chemical Week* June 23, 1999.

¹⁵ Ian Young, "China: On the World Market" *Chemical Week* August 23, 2000.

¹⁶ Levenstein, Margaret, "Mass Production Conquers the Pool: Firm Organization and the Nature of Competition in the Nineteenth Century" *Journal of Economic History* 55:3, (September 1995), 575-611 and "Price Wars and the Stability of Collusion: A Study of the Pre-World War I Bromine Industry" *Journal of Industrial Economics* 45:2 June 1997, 117-138.

5. Buyers' Industry Structure

Consumer electronics producers make up the largest segment of bromine consumers. Some subset of these consumers feels that this conspiracy to raise prices has significantly adversely affected them as a class action suit against the conspirators has been filed. We have not yet been able to obtain more information about this complaint.¹⁷ Bromine produced in the Middle East is often shipped to the Far East for use by consumer electronics manufacturers in that region, while U.S. production satisfies North American and European manufacturers. All producers in the industry operate (produce and sell) globally. So while transport costs have led to some market segmentation, we believe that this is a fairly well integrated global market.

6. Entry or Exit

The Jordan Company is in the process of entering the industry, with the construction of a new bromine plant in Safi, Jordan. The Jordan Company is a joint venture of three incumbent firms: Arab Potash Company, Jordan Dead Sea Industries Company, and Albemarle Corporation, so while it will represent increased capacity it is unlikely to increase competition.

Turkmenistan is known to have large bromine deposits, but is not currently engaged in production for export (or any production at all as far as we have been able to determine).¹⁸

Ambar, a U.S. oil and gas firm, attempted to enter the industry with a production facility in Manistee, Michigan, but the venture was a failure, apparently largely because the brine in Michigan does not have a high enough bromine content to compete with the existing producers.

¹⁷ "Great Lakes Faces Price-Fixing Lawsuit Over the Mineral Bromine" *Dow Jones Business News* July 2, 1999.

¹⁸ "Turkmenistan: Country Profile" *Middle East Review World of Information*, September 28, 2000.

Firm Name	Location(s)	Cartel Participant	World Market Share
Great Lakes Chemical	Indiana	Yes	33 %
Albemarle	Arkansas		21 %
Dead Sea Bromine	Israel	Yes	29 %
Tetra	Texas	No	Small
Jordan Dead Sea Industries Company	Jordan		Joint venture with Albemarle

7. The Conspiracy

In July 2000 Dead Sea Bromine pled guilty to U.S. Department of Justice charges that it conspired to fix prices from July 1995 to April 1998. The charges were brought after Great Lakes Chemical reported price-fixing activity to the Justice Department. Published reports indicate that Albemarle, the other large bromine producer, was not a party to the conspiracy. (Great Lakes received amnesty in the case.)¹⁹ The conspiracy is currently under investigation by the European Commission.

The conspiracy fixed prices of all of the products described above, and so affected consumers of TBBA, DECA, and 100% methyl bromide. The U.S. charges described price-fixing in the United States, but as the European Commission is also investigating, and as the two firms are engaged in a joint venture in the Middle East, it is likely that worldwide prices were affected. Production in the Middle East supplies the consumer electronics producers of the Far East.

8. Effect on Developing Country Consumers

We have not been able to obtain reliable price data that we believe reflects transactions prices in bromine products. Figure 1 gives the prices as reported in the *Chemical Marketing Reporter*

¹⁹ Kara Sissell, "Dead Sea Pleads Guilty To Price Fixing," *Chemical Week* August 8, 2000, p. 14.

over the period of the conspiracy. Despite reports in the industry press of price fluctuations, these fluctuations are not reflected in this price series. These price data do indicate a twenty to thirty percent price increase at the time of the formation of the cartel. Published reports indicate that prices dropped 15 to 20 percent in 1999, after the conspiracy had ended. Prices have increased in 2000, which industry observers suggest indicates “producer discipline” in the face of increasing capacity, especially in the Middle East.²⁰

We have not been able to obtain bromine import data for developing countries because of reporting problems in international trade statistics. (This appears to be a problem for most finely categorized chemical products.) The industry presently has \$800 million in annual sales worldwide. Industry estimates divide the world plastic additives market as follows: North America, 28%; Europe, 25%; Asia-Pacific, 35%; Rest of the World, 12%.²¹ Demand is growing rapidly in some developing country markets. Over the next five years, it is expected to increase by six to eight percent per year in Latin America and seven to nine percent per year in Asia-Pacific markets.²²

9. Effect on Developing Country Producers

Existing producers appear to be accommodating the entry of developing country producers in this market. Their response has been to establish joint ventures which may provide them with some control over the extent of the increase in capacity and competition. In addition to the entry of Jordan, described above, China is also entering the market through two joint ventures. Shandong Haihua Shareholding and Dead Sea Bromine are building a plant in Weisang that is expected to produce 12,000 million tons per year of inorganic bromides. Jinhai Chemical and Albemarle have created a joint venture to produce flame-retardants in Ningbo.²³ There is also a recently announced joint venture between Dead Sea Bromine and a Japanese chemical producer,

²⁰ “Flame Retardant Price Increases Show Producer Discipline” *Chemical Marketing Reporter* September 14, 2000.

²¹ Kristin Nail, “Plastic Additive Makers Regroup” *Chemical Marketing Reporter*, June 19, 2000.

²² “Flame Retardant Price Increases Show Producer Discipline” *Chemical Marketing Reporter* September 14, 2000.

²³ Ian Young, “China: On the World Market” *Chemical Week* August 23, 2000.

Daiichi Kogyo Seiyaku, with its headquarters in Hong Kong. Given its location, it is possible that this firm is also planning to be active in mainland China.

10. Summary of Industry Trends Post-Conviction

Prices fell in the period immediately following the reporting of the cartel to the U.S. Justice Department, but have increased in the past six months.

Developing countries are entering this market, and incumbent producers appear to be accommodating the entry. Participation in joint ventures may assure developing country entrants that prices will not fall in response to their entry as well as providing them with investment capital and access to marketing and distribution channels. The small number of dominant firms and their long history of collusion suggest that this is an industry where such joint ventures could be a means to limit competition, and competition authorities would be well-advised to provide rigorous scrutiny in such circumstances. Unfortunately, it is not clear whether any regulatory body currently exists that has the political and legal authority to monitor these potentially competition-reducing arrangements. There is currently no competition authority that considers it their purview to assure that developing country producers have access to markets uninhibited by restraints from private agreements by established producers.

B. CITRIC ACID CASE STUDY

1. Description of Product

Citric acid is used primarily as a flavor enhancer and preservative. It comes in the form of a colorless translucent crystal or as a white granular crystalline powder. It is produced in both a hydrous form, which contains about nine percent water, and an anhydrous (dry) form. The anhydrous form consists of sodium citrate, potassium citrate or other salts of citric acid.

Citric acid falls into a category of chemicals called acidulants, a class of additives used in food and beverages, as well as in some industrial uses. Acidulants are naturally occurring acids that inhibit the growth of bacteria and can offset product sweetness with their tart flavor. The acidulant class includes citric acid and well as lactic, fumaric, malic and tartaric acids. Citric acid is the most widely used acidulant, accounting about two-thirds of the total acidulant market.

In general, the main uses for citric acid are in soft drinks, processed food, detergents, and pharmaceuticals and cosmetics. The beverage market is its largest end use, with a current global market share of about 43 percent. Soaps and detergents make up the second largest end use (where citric acid is used as a “builder” to increase cleaning effectiveness, and decrease the quantity of detergent required), accounting for about 24 percent of the citric acid produced.²⁴

2. Substitutes in Consumption

There are a myriad of potential substitutes for citric acid in its various uses. Here we describe a few of its most significant substitutes. Fumaric acid competes with citric acid as a preservative. It is generally cheaper, but has certain chemical characteristics (e.g., a stronger acid taste than citric acid), that make it an inferior substitute for many processed foods.²⁵ Citric acid has been increasing its market share in the detergent market relative to phosphates, due to citric acid’s more environmentally friendly characteristics. Citric acid has also been one of the replacements for chlorofluorocarbons (CFC-113, in particular) as a solvent used in the manufacture of electronics.²⁶ Finally, citric acid competes with tartaric acid, also used as a natural additive in food and beverages, and in wine to control the pH balance. In 1990 there was a tartrate shortage and the price rose high enough so that citric acid, although not as effective, became a viable substitute. When the price of tartaric acid returned to normal, companies switched back.²⁷

²⁴ Christopher Reilly, “Pricing Flat with Supply/Demand Balance” *Purchasing*, September 7, 2000.

²⁵ “Fumaric Acid” *Chemical Marketing Reporter*, July 24, 2000.

²⁶ Miller, Alan, Pamela Wexler and Susan Conbere “Commercializing Alternatives for CFC-113 Solvent Applications,” Office of Technology Assessment, Summer 1995, p. 10 (from website printout).

²⁷ Joy LePree “Tartaric Acid Price Falls as U.S. Imports Increase” *Chemical Marketing Reporter*, April 25, 1994.

3. Cost Structure

The manufacturing method used today was first developed by Pfizer in 1880. Producers today use one of two alternative processes: shallow pan or deep tank fermentation. The fermentation process begins with dextrose or sucrose as a fermenting organism. In Brazil, for example, citric acid is made from sugar, while in the U.S. it is made from corn. In the shallow pan process the base mixture contains beet or cane molasses (primarily used in Europe). Citric acid producers in China use a base made from sweet potato powder.

The deep tank (or “submerged culture”) process is preferred in most industrialized countries due to its lower labor requirements and better quality control. This process does, however, require high energy input.²⁸ Connor estimates the marginal cost of production at \$0.60 per pound during the conspiracy period.²⁹ The shallow pan process is more labor intensive and less capital intensive, and therefore operates on a smaller scale.

4. Industry Structure

The U.S. and world markets for citric acid are highly concentrated in the hands of several major players. Table 4 provides a summary of the key firms in the industry, their capacity, market share, and locations.

The U.S. industry in 1990, just prior to the start of the conspiracy, had three players: ADM, Cargill, and Bayer AG (a German firm whose U.S. marketing was handled by Haarmann & Reimer, its U.S. subsidiary). Cargill entered the industry in 1990. In Europe in the early 1990s there were five producers in the citric acid market, with the three largest being Bayer, Hoffmann-La Roche (a division of Switzerland's Roche Holding), and Jungbunzlauer International AG

²⁸ Petition for the Imposition of Antidumping Duties: Citric Acid and Sodium Citrate from the People’s Republic of China, filed by Akin, Gump, Strauss, Hauer, & Feld, L.L.P. with the U.S. International Trade Commission, December 15, 1999, p. 15. (Public version of document obtained from ITC website: <http://dockets.usitc.gov>.) Hereinafter referred to as “ITC Petition”.

²⁹ John M. Connor, “What Can We Learn From the ADM Global Price Conspiracies?” Dept. of Agricultural Economics, Purdue University, Staff Paper #98-14, August 1998, p. 11. Much of our discussion of the industry is drawn from this paper, hereinafter referred to as “Connor.”

(Switzerland). These European companies, as well as smaller Chinese importing companies, supplied most of the U.S. imports during the mid-1990s.

Other citric acid suppliers to the U.S. in the early 1990s were Palcitric SpA from Italy (which had just entered the market), Biocor SpA (Italy), Gadot Israel (Israel), and Takeda USA Inc. (Japan). Lower levels of imports came from Mexico, Turkey, and Indonesia.³⁰ India has also become a noteworthy producer of citric acid. Finally, there is a Czech Republic producer, Aktiva. Aktiva exports most of its citric acid to EU countries, although it also sells to firms in the U.S., Mexico, and Eastern Europe.³¹

Chinese producers have presented the most vigorous competition to U.S. and European manufacturers. Up to one hundred small firms entered the industry in the mid-1990s with the help of the Chinese government. Estimates are that only twenty-five Chinese firms remain in the market, after the recent withdrawal of government subsidies.³² China exported 183,000 tons of citric acid in 1999, of which 43,000 tons came to the U.S..³³ The Chinese producers as a group currently hold about 15% of the U.S. market share. The largest citric acid producer in China is Fengyuan Biochemical Co. Ltd, with a capacity of 50,000 tons annually.³⁴ This is smaller than the average size of most major U.S. and European plants, which range from about 65,000 to 90,000 tons per year.

Chinese citric acid generally sells in the U.S. for 10 to 20 cents less per pound than the domestic and European product. Some consumers consider China's product to be lower quality and do not consider buying it. For others, particularly industrial users, price is the major decision variable.

Chinese exports peaked around 1994 and then dropped off as the Chinese government withdrew its subsidies and raw materials prices increased. Figure 2, taken from *Beverage World*, shows the dramatic rise and sharp fall in Chinese citric acid exports. Exports from China rebounded

³⁰ Cheryl Cullinan Lewis "Citric Acid" *Purchasing*, May 4, 1995 and Alice Naude, "Citric Acid's List Price Drops," *Chemical Marketing Reporter* May 30, 1990.

³¹ Katka Krosnar "Czech Firm Aktiva Posts 1999 Loss But Sees Profit in 2000" *Chemical News & Intelligence*, July 19, 2000 and "Aktiva Pays For Exchange-rate Losses" *Chemical Business Newsbase*, July 17, 2000.

³² Clay Boswell "Pucker Up: A Taste for Tartness Drives Acidulants" *Chemical Marketing Reporter*, May 29, 2000

³³ Li Xiangjun "Fine Chemical Industry in China" *China Chemical Reporter*, June 6, 2000 and "Citric Acid Antidumping Case Lodged by U.S. Enterprises Ended" *Chemical Business Newsbase*, March 30, 2000.

³⁴ "East China Firm Raises Capital on Shenzhen Bourse" *Xinhua News Agency*, June 22, 1999.

after the cartel was broken apart. In 1996 for example, citric acid imports into the U.S. from China were on the order of 22 million pounds (about 27.5% of total U.S. imports). In contrast, Chinese exports to the U.S. for January through September of 1999 rose to approximately 61 million pounds (about 49% of total U.S. imports).³⁵

The industry trend is toward larger firms and greater concentration. Almost all of the major producers are vertically integrated back into feedstock production. (Haarmann & Reimer is the only exception.) It appears as though the trend to vertically integrate took off with the entry of Cargill into the U.S. market in 1990. One industry insider recently said that “[t]o control your own destiny, you must be back integrated.”³⁶

The U.S. Department of Justice opposed ADM’s acquisition in the 1980s of corn-sweetener facilities. (Corn-based products manufactured by ADM include high-fructose corn syrup, lysine, and citric acid.) The government lost the case in 1991. According to a *Wall Street Journal* article, “[t]he judge noted in that case that a continuing consolidation among purchasers of high-fructose corn syrup was ‘an effective means of counteracting any potential market power that might be exercised by sellers,’ and that ‘price collusion among [syrup] suppliers would be very difficult to administer.’”³⁷ Although theory suggests that large buyers should be able to frustrate the efforts of sellers to fix prices, it is clear from recent global price fixing conspiracies that this is not always the case. In particular, if the buyers, in this case large food processors, also have market power and are able to pass along raw material price increases, concentration among consumers may not provide adequate countervailing power.

5. Location of Production

Production is concentrated in the U.S., Europe, and China, although there are citric acid producers scattered throughout the world. In the late 1990s Western Europe, the U.S., and China

³⁵ ITC Petition, Table 1 and Table 2, p. 47.

³⁶ Matthew Lerner “Citric Acid Competitive in Wake of Big Changes” *Chemical Marketing Reporter*, March 17, 1997.

³⁷ Scott Kilman and Viveca Norvak “U.S. Conducts Antitrust Probe of Corn Millers,” *Wall Street Journal*, June 29, 1995.

together had an 88% market share of world capacity, estimated at approximately 1.2 billion pounds in 1994.

6. Distribution Mechanism

Citric acid producers sell both directly and through distributors and brokers.

7. Entry or Exit

The primary barriers to entry into the main commercial process – deep tank fermentation – are capital requirements and the need for backward integration. The industry consolidated in the 1990s: Pfizer was purchased by ADM (in 1990). Bayer AG of Germany acquired Miles, and its subsidiary Haarmann & Reimer. Cargill entered the U.S. industry in 1990 as the first vertically integrated producer. This left the U.S. industry in 1990, just prior to the start of the conspiracy, with three players: ADM, Cargill, and Bayer/Haarmann & Reimer.

8. Buyers' Industry Structure

Our assessment is that this is a world market, given what appears to be an active flow of world trade. Buyers can be large or small, but large customers account for the bulk of citric acid sales. Given that the greater part of citric acid production goes to beverage companies, such as Coke and Pepsi, the buyers are very large indeed. Procter & Gamble is also one of the largest U.S. consumers of citric acid. In fact, in the United States, approximately 70 percent of citric acid and sodium citrate sales go to 10 to 15 end users.³⁸

³⁸ ITC Petition, p. 17.

9. The Conspiracy

According to U.S. Department of Justice documents, firms in this industry fixed prices from approximately July 1991 to June 1995.³⁹ The dates cited vary somewhat, depending on the particular firm charged and the antitrust authority or private plaintiff bringing the suit. Connor, for example, notes that DOJ indictments filed against the European participants in the conspiracy list July 1991 to December 1996 as the cartel dates.⁴⁰ The citric acid firms have been the subject of a number of investigations:

- 1) United States: The convictions are detailed in Table 5. ADM, Bayer, Jungbunzlauer, Hoffmann-La Roche (HLR), and Cerestar Bioproducts BV were convicted of DOJ charges.
- 2) Canada: The convictions are detailed in Table 5. ADM, Haarmann & Reimer (H&R) and Jungbunzlauer pleaded guilty and were fined in 1998. The conspiracy dates are given as 1991-1995.
- 3) European Union: Connor states that the EC was investigating this case as of 1998. No decision has yet been issued (although the EC did announce fines for lysine this year).
- 4) Civil Suits in the United States: There have been several follow-on suits. One civil suit filed by bottlers and food processors was settled in 1996 for a total of \$94 million (ADM, H&R, HLR, and Jungbunzlauer were defendants). Cargill was named in this civil suit, but exonerated. In the court opinion of September 1, 1999 the judge wrote: "It is true that between 1990 and 1997 ADM, H&R, and Cargill always changed list prices within a month of one another and generally did so in the same month...Although there appears to have been little competition in citric acid list prices, Cargill did price aggressively in actual contracts." This difference between list and transactions prices is important to keep in mind when we look later at the price trends in the industry in the past decade. In particular, large customers generally pay less than list price.

³⁹ "Justice Department's Ongoing Probe Into the Food and Feed Additives Yields Second Largest Fine Ever," DOJ Press Release, January 29, 1997.

⁴⁰ Connor, p. 11.

Indications are that the effects of the cartel were felt world wide, although we do not have price data outside the United States. Connor states that although the citric acid cartel did not control world production, it did account for 75-85% of sales in North America and Western Europe.⁴¹ The effect of the cartel outside of those two regions is unclear.

A DOJ press release from January 29, 1997 states that the conspirators 1) fixed prices and allocated sales in the citric acid market worldwide, 2) issued price announcements in accordance with their agreement, and 3) monitored prices and sales volumes. In addition, the cartel members recognized the importance of policing and enforcing the agreement. They shared monthly sales figures and took stock at the end of the year of each company's total sales. A company selling more than its quota was required the next year to purchase citric acid from a cartel member that was under quota.⁴²

The structure put in place by the citric acid cartel members was quite elaborate. The senior executives responsible for determining the broad outline of the cartel agreement were nicknamed "the masters." The lower-level executives responsible for the day-to-day workings of the cartel were "the sherpas." The members also apparently agreed on market share figures to a tenth of a decimal point.

The U.S. price trend from 1990 through 1999 is shown Figure 3. Two price series are plotted: *Chemical Marketing Reporter (CMR)* and *Purchasing Magazine (PM)*. The bulk of the data (1987-97) are taken from Connor's Appendix Table 1, which presents price data compiled from various issues of *CMR* and *PM*. We have updated the data series from the same two sources through 1999.

One can see from the graph that the *CMR* data is more representative of a list price, while the *PM* data reflects, at least to some degree, true transactions prices. Prior to the conspiracy, during the time when the industry was adjusting to Cargill's entry and Pfizer's exit, there was a price war. Prices in early 1991 were driven down to the high-50 cent range.⁴³ The price war ended in early

⁴¹ Connor, p.13.

⁴² Kurt Eichenwald "U.S. Wins A Round Against Cartel," *New York Times*, January 30, 1997.

⁴³ Melissa Shon *Chemical Marketing Reporter*, "Cargill, Jungbunzlauer Slate Citric Acid Additions," March 30, 1992.

1991. List prices rose steadily after that, stabilizing at 85 cents per pound between 1993 and 1996 (this is reflected in the *CMR* line). According to Connor, actual transactions prices, as reflected by the *PM* line in Figure 3, stayed from 1 cent to 5 cents lower than list prices. For example, in 1991 *CMR* reported that “despite the 68-cent list price, agreements are currently settled at about 63 cents.”⁴⁴

Although the transaction price increase is slightly less dramatic, both price series in Figure 3 show a steady increase in price and then a decline after the conspiracy ended. EU Competition Commission Mario Monti reported that citric acid prices rose by 50 percent during the conspiracy.⁴⁵ One has to be careful, of course, about drawing strong conclusions from such statements or from the price charts included in this paper, since they do not control for other factors affecting price. For example, there are seasonal fluctuations in pricing due to increased demand from the beverage market in late spring and early summer. (These seasonal fluctuations may be flattening due to “new age” year-round beverages that contain citric acid, such as sports drinks and bottled teas.)

More generally, charges of increased cartel prices must be interpreted with care because some portion of the increase may reflect other factors such as rising raw materials costs or increases in demand. The price charts are purely descriptive and do not purport to control for other relevant factors that may have affected prices during the conspiracy period. In addition, we do not estimate what the price would have been in the “but-for” world. That is, although it is clear that there was a conspiracy and that firms have admitted their guilt, we have not attempted to estimate the competitive price. It is entirely possible that, if the cartel were formed at the bottom of a cyclical downturn, price would have increased without the cartel. Similarly, declining prices after the demise of the cartel may also reflect fluctuations in demand or input costs. Any conclusions, therefore, about the true damages or overcharges resulting from cartel activity, must be drawn with great care.

⁴⁴ David Axinn “Citric Acid Marks Rise as Market Settles Down,” *Chemical Marketing Reporter*, July 22, 1991.

⁴⁵ “Competition: Monti Calls for Higher Fines on Cartels,” *European Report*, September 13, 2000. Unfortunately, Monti does not specify whether he is referring to US or European price increases (or whether they were the same).

10. Effect on Developing Country Consumers

We have not been able to obtain accurate international trade data for citric acid. As with other narrowly specified chemicals, we suspect that this reflects misclassification problems. These import measures, even if reported, would in any case understate the true impact of the cartel on developing country consumers who pay higher prices not only for raw citric acid, but also for a wide range of citric-acid containing goods.

Our very rough estimate of the price effects of the cartel is taken from Connor, who estimates that buyers in the U.S. paid an extra 21-24% during the conspiracy, using marginal cost as the “but-for” or counterfactual price.⁴⁶ If, in order to obtain a very rough estimate of the order of magnitude of the effect of this cartel on developing country consumers, we assume that prices increased 20% on an approximately 300,000 million pound per year market outside the United States and Europe, and that the prices charged were ten cents per pound above the competitive level (which is substantially less than the observed price increase), this would amount to a cost of \$30 million per year.

11. Effect on Developing Country Producers

It is possible that developing country producers may have received an increased price during the conspiracy period by riding on the coattails of the major producers. Conversely, developing country producers may have been damaged if the cartel was able to somehow prevent imports into its territory. We have some evidence of attempts to limit entry from two anti-dumping cases that were filed during the conspiracy period.

⁴⁶ Connor, p. 10. Lawrence J. White disputes Connor’s use of marginal cost as the “but for” price for the lysine conspiracy. White argues that the true “but-for” price was higher, based on the fact that the market was a four-firm oligopoly that probably would not have converged on an equilibrium of price at marginal cost. Lawrence also argues for a shorter cartel period than Connor. (See Lawrence J. White “Lysine and Price Fixing: How Long? How Severe?” forthcoming in *Review of Industrial Organization*.) Of course, from a policy perspective, the relevant question is what is necessary to achieve a competitive price that assures an efficient allocation of producers’ resources and individual consumption decisions. Thus, for our purposes, the marginal cost price is the relevant comparison.

The first, from India, appears not to relate directly to the cartel, but could be an indirect consequence. India imposed anti-dumping duties on citric acid imports from China in November 1998. Before the duties were imposed, China had captured close to 40% of the Indian market for citric acid. If China was being kept from the U.S. and European markets, either through anti-dumping cases or private restraints, they may have turned to India as an outlet for their product. It is even possible that the multi-national firms that participated in the cartel were able to influence Indian policy toward Chinese imports.⁴⁷

U.S. producers have tried twice to use the government to help protect the domestic industry from Chinese imports. First, in 1995, *while the cartel was still intact*, producers lobbied the Office of the U.S. Trade Representative to include citric acid on the list of various Chinese imports to be hit with a high tariff. A last-minute agreement prevented the sanctions from being imposed.⁴⁸ The second anti-dumping allegation was brought in 1999 (discussed further below). Chinese exports to the United States increased dramatically after the demise of the cartel, lending credence to the idea that the cartel was able to limit such exports during its existence.

Finally, Connor reports that U.S. exports to Western Europe increased after 1995, but exports to Latin America, Canada, Mexico, Japan, Australia, and New Zealand were not affected by the end of the cartel agreement.⁴⁹

12. Summary of Industry Trends Post-Conviction

There has been rapid consolidation in the industry since the price-fixing conspiracy was revealed. In 1998 Tate & Lyle, the British sweeteners firm, acquired the citric acid plant of Haarmann & Reimer. Tate & Lyle owns A.E. Staley, the second ranking U.S. corn refiner; thus

⁴⁷ There are other examples of attempts by international cartels to use anti-dumping laws to sustain collusion. The ferrosilicon price-fixing conspiracy lasted from 1989-1991 and involved producers from the U.S. and Norway. Five of the six major US manufacturers pleaded guilty and were fined. These same firms asked for, and received, anti-dumping duties that were placed on Brazil, China, and other countries. When the International Trade Commission found out about the U.S. firms' involvement in a cartel, it reversed the tariffs.

⁴⁸ Cheryl Cullinan Lewis, "Citric Acid" *Purchasing*, May 4, 1995.

⁴⁹ Connor, p. 14.

the last remaining vertically dis-integrated producer has now vertically integrated. The citric acid industry in the U.S. is now a three-firm oligopoly consisting of Cargill, ADM, and Staley.

Hoffmann-La Roche completed its sixth joint-venture facility in China in 1997. Its partner, Wuxi Zhongya, is one of China's three largest producers.⁵⁰ Jungbunzlauer is constructing a new production facility in Canada, due to come onstream in 2002, with a capacity of about 40,000 tons per year. (HLR's other citric acid plant, located in Austria, is the largest plant in the world, with a capacity over 300 million pounds per year.) Cerestar closed a 20,000 metric ton plant in Italy in 1999.

In Brazil, a high quality and low cost sugar supply is attracting citric acid manufacturers. Cargill has a new plant in Brazil that is expected to come online in 2000. Tate & Lyle is investing \$60 million in Brazil to increase its citric acid production from 30,000 metric tons per year to roughly 90,000 over the next three years.⁵¹

Prices have fallen, both in the U.S. and in Europe since the demise of the cartel. Figure 3 shows the general downward trend in U.S. prices since late 1995. *CMR* and *PM* both report that prices are lower and stable, despite strong demand. European prices, which tend to be lower than U.S. prices, have followed a similar pattern: the average price per kilogram ranged from \$1.68 - \$1.82 in 1995, \$1.04 - \$1.39 in 1997, and \$1.06 - \$1.17 in 1999.⁵²

While U.S. prices in early 2000 averaged around 63-66 cents per pound, citric acid from China was selling for about 53 cents per pound.⁵³ At the end of 1999, ADM, Cargill, and Tate & Lyle reacted to the rise in imports of citric acid from China by filing a petition with the Department of Commerce and the International Trade Commission seeking anti-dumping duties of 350% on Chinese imports. According to claims made in the case, the filing was prompted in part because two of the largest consumers of citric acid, Proctor & Gamble and Ashland Chemical Inc. (a distributor) switched to Chinese citric acid for their raw material needs. Conflicting testimony

⁵⁰ "Keeping the Faith," *Pharmaceutical Executive*, January 1, 1998.

⁵¹ Kiernan Gartlan, "Tate & Lyle To Expand Brazilian Citric Acid Operations," *Dow Jones Commodities Services*, October 19, 2000.

⁵² "Citric Acid," *European Chemical News*, March 6-12, 2000.

⁵³ Feliza Mirasol, "DOC Investigates Possible Dumping of Citric Acid," *Chemical Marketing Reporter*, January 17, 2000.

was given regarding whether the quality of citric acid from China met U.S. standards. One Chinese supplier tried to qualify to supply Quaker Oats, for example, and was turned down (although this same supplier is able to sell to small U.S. food manufacturers). The ITC dismissed the case in February of 2000, after deciding that there was no material injury.⁵⁴

The fact that these same producers had just been convicted and fined of cartel behavior certainly weighed against them in the hearings. U.S. and European governments must be extremely wary of such attempts by firms to use the state as a tool for creating barriers to entry and higher prices.

C. GRAPHITE ELECTRODES CASE STUDY

1. Description of Product

Graphite electrodes (GE) are large carbon columns used by electric arc furnaces (EAF) or “mini-mills” in the making of steel. These mini-mills use graphite electrodes to generate the enormous heat necessary to melt scrap metal and convert it back into a marketable steel product. GEs are made from synthetic graphite, for which the primary raw materials are petroleum coke, coal tar and petroleum pitch. The petroleum coke is crushed and mixed with the pitch into a paste, which is then extruded through a press. The electrodes are baked and undergo a series of refinements. The electrodes are then machined to meet the customer’s specifications in terms of length, diameter, and so on.

2. Substitutes in Consumption

GEs are the only material that can generate sufficient heat to melt scrap steel. There is no competitive substitute, other than traditional methods of making steel (i.e., open hearth and basic oxygen). If the price of GEs were to rise sufficiently high, EAF steel producers would eventually be at a competitive disadvantage versus other production methods. However, GEs

⁵⁴ Clay Boswell, “Pucker Up: A Taste for Tartness Drives Acidulants,” *Chemical Marketing Reporter*, May 29, 2000

make up only 6-7 percent of the cost of converting scrap to steel. EAFs could thus absorb significant price increases before being forced to shut down.

3. Cost Structure

Almost fifty percent of GE costs are raw materials costs, the bulk of which is petroleum coke (also called needle coke for electrodes applications). Labor costs represent about twenty percent of total costs.⁵⁵ The production process is highly electricity intensive, and therefore the electricity portion of the cost varies by location within a country and across countries.

4. Industry Structure

Table 6 provides a summary of the major firms in the industry, their capacity, market share, and location. In this highly concentrated market, UCAR International of the United States and SGL Carbon Corporation of Germany dominate, with a combined world market share of roughly two-thirds. Both firms manufacture electrodes in many countries (including such developing countries as Brazil, Mexico, South Africa, Russia, and Poland) and sell throughout the world.

According to the Department of Justice, the U.S. market shares of the \$275 million per year graphite electrode market in 1992 were as follows: UCAR 34%, SGL Carbon 23%, Showa Denko 18%, Carbide/Graphite 18%, Tokai Carbon 1%, and other firms 6%. We do not have market share data for two other firms fined by the DOJ for participating in the price fixing: SEC (Showa Electrodes Corporation) and Nippon Carbon, both of Japan.⁵⁶

There are also a number of smaller producers. The major producers from India are HEG Ltd., Carbon Everflow Ltd., and India Graphite Electrodes. China is also a major exporter, although not all of its product is of the highest quality (there are three standard grades of GE).

⁵⁵ Barbara Martinez, "Robert Krass Chairman CEO and President of UCAR International" *Dow Jones Investor Network*, October 6, 1995.

⁵⁶ "Government's Sentencing Memorandum and Government's Motion for a Guidelines Downward Departure (U.S.S.G. §5K1.1)," U.S. Department of Justice, Filed October 19, 1999.

5. Location of Production

While some firms have plants in only their home country, most companies in the graphite electrode industry are truly multinational in the location of their production facilities. UCAR, for example, has plants in the U.S., Mexico, Canada, Brazil, France, Italy, South Africa, Russia, Germany, and Spain. SGL, the other major multinational, has facilities in the U.S., Germany, Italy, Belgium, France, Spain, Austria, Poland, and Canada.

The remaining firms, including those from India and China, are not global producers, but they sell their product globally. The C/G Group, for example, has plants only in the United States, but sells throughout the world. Nippon and SEC have plants in Japan, and Showa Denko has plants in both the U.S. and Japan.

6. Distribution Mechanism

The major multinational companies have a direct sales force that handles domestic and worldwide sales, as well as independent sales agents that distribute their products.

7. Entry or Exit

A new plant takes 3-4 years to build. However, barriers to entry in the GE market are higher than those numbers suggest. In a legal complaint against the GE manufacturers, steel producers claimed, “The production of GEs is a mature, capital-intensive business that requires detailed product and process know-how. It takes approximately four years to build a new plant with a 20,000 ton capacity. No significant new player has entered the industry since 1950.”⁵⁷

⁵⁷ Ferromin International Trade Corporation, et. al. Vs. UCAR, et. al. In the United States District Court for the Eastern District of Pennsylvania, Second amended complaint, filed May 1, 1999, at paragraph 47. Hereinafter referred to as the “Ferromin” case.

There was a shakeout and consolidation in the industry in the late 1980s and early 1990s, just prior to the price-fixing conspiracy. The consolidation was precipitated by slumping steel production. In fact, GE industry capacity has shrunk by one-third since the mid 1980s.⁵⁸ The number of producers has since stabilized.

8. Technological Change

There has been no major technological advance in the production of GEs in the 1990s, although there is continuous improvement in quality and innovation in the production process.

9. Buyers' Industry Structure

The share of EAF production as a percentage of total world steel production has grown rapidly over the past two decades. Mini-mills now comprise about one-third of total steel production. The table below shows how EAF production was distributed around the globe in 1999:⁵⁹

Region	Production (million metric tons)	Oxygen %	Electric %	Open Hearth %
EU	155.2	61.9	38.1	0
Other Europe	42.5	59.3	39.1	1.6
Former USSR	86.1	56.6	11.9	31.5
NAFTA	128.8	52.2	47.8	
Central & South America	35.7	64.6	35.4	
Africa	12	55.1	44.1	
Middle East		9.6	22.2	77.8
Asia		307.5	63.0	28.7
<i>WORLD</i>	<i>786.4</i>	<i>59.8</i>	<i>33.4</i>	<i>4.2</i>

⁵⁸ "New Issues -- UCAR International IPO," *Standard & Poor's Emerging and Special Situation*, November 14, 1994.

⁵⁹ International Iron and Steel Institute website: http://www.worldsteel.org/trands_indicators/figures_6.html

Electrode consumption used to be over 10 pounds per ton of finished steel, but technological advances in EAF production have reduced this figure to 3-4 pounds per ton. Despite this reduced consumption per ton, GE demand continues to grow as a result of the increasing number of EAF plants.

The evidence appears to point to a world market for GE supplies, which are dispatched from the plant to the customer primarily by truck or ship. Consider, for example, that C/G is one of the “second tier” of major producers, with plants only in the United States, yet half of C/G’s sales go to buyers outside the U.S. Similarly, India and China produce primarily for export. Supporting this world market are fairly low transportation costs, generally less than 5% of the cost of the electrodes.⁶⁰

10. The Conspiracy

Firms in the industry conspired to fix prices between 1992 and 1997, although the cited dates vary somewhat, depending on the particular firm charged and the country or private plaintiff bringing the suit. According to reports in the press, the investigation began after a complaint from a steel manufacturer.⁶¹ There are a variety of charges and lawsuits that have taken place since 1997:

- 1) United States: The convictions are detailed in Table 7. There were seven firms involved in the conspiracy (UCAR, SGL, C/G, Showa Denko, Tokai, SEC, and Nippon) and six firms fined (C/G was granted leniency by the Department of Justice).
- 2) Canada: The convictions are detailed in Table 7. In Canada there are only two major suppliers, UCAR and SGL, and both were convicted of price-fixing. The dates of the conspiracy are approximately the same as in the United States.
- 3) European Union: The case is under investigation by the European Commission (offices of GE producers were raided in 1998), but there has been no decision issued.

⁶⁰ Ferromin case, paragraph 50.

- 4) Japan: The Japanese Fair Trade Commission issued a warning to Japanese GE firms in March of 1998. There was no conviction or fine, apparently due to a lack of evidence.
- 5) Civil Suits in the United States: After the GE firms pled guilty to the U.S. charges, dozens of civil suits followed. Almost forty U.S. steel producers sued for damages. The manufacturers have settled many of these suits. One civil lawsuit brought by a group of non-U.S. steel producers has yet to be settled or come to trial. The “Ferromin” antitrust suit was filed in February 1999 by 27 international EAF steel producers, many of them from developing countries. (One of the plaintiffs is the Ferromin International Trade Corporation, which is a U.S. company that purchased graphite electrodes on behalf of its Turkish affiliates.) The plaintiffs’ firms reside in Turkey, Thailand, Australia, China, Australia, and Sweden. The defendants named are UCAR, SGL, Tokai, C/G, Nippon and SEC. In total, the 27 plaintiffs claim that they purchased GEs in the U.S., Europe, Australia and Asia and that they paid approximately \$180 million for these electrodes over the relevant period (1992-1997). They claim that price increases resulting from the conspiracy averaged over 45%. Of the five case studied here, this is the only private lawsuit filed in the United States by plaintiffs from developing countries. Although manufacturers in developing countries must also have been damaged by the bromine, vitamin, citric acid, and steel tube conspiracies, they have apparently not yet sued in U.S. courts.

In summary, although we have no direct evidence of the effects outside of the United States, it is safe to assume (or to suspect) that the GE conspiracy had global effects. The charges outlined by the DOJ include a statement that this cartel was “a wide-ranging international conspiracy to fix prices and allocate market shares worldwide...”⁶² Firms have been convicted in the U.S. and Canada, were warned in Japan, and are under investigation in Europe. Also, the Ferromin case makes claims (as yet unproven) that EAF manufacturers in other parts of the world were directly damaged.

⁶¹ Adam Jones, "Blowing the Whistle - American-Style," *The Times*, February 24, 2000.

⁶² "Japanese Subsidiary Charged with International Conspiracy to Fix Prices for Graphite Electrodes in U.S.," DOJ Press Release, February 23, 1998.

The information that we have on the cartel structure and organization comes almost exclusively from DOJ press releases. Cartel members agreed to: 1) increase and maintain prices, 2) eliminate price discounts,⁶³ 3) allocate volume among conspirators, 4) divide the world market among themselves and designate the price leader in each region, 5) reduce or eliminate exports to members' home markets, 6) restrict capacity, 7) restrict non-conspirator companies' access to certain graphite electrode manufacturing technology, 8) exchange sales and customer information in order to monitor and enforce the cartel agreement, and 9) issue price announcements and price quotations in accordance with the agreement.

Each of the provisions listed above would be considered "normal" (necessary, but not sufficient) for the successful operation of a cartel. One of the most interesting aspects of the conspiracy is the agreement to restrict access to technology, although no details are given. One of the most noteworthy absences, though, is a provision of penalties for cheating on the agreement. This may have been implicit and discussed in the meetings, but never formalized. Since they did collect and share information on sales for the purposes of enforcing the agreement, there presumably would have been a discussion (or implicit threats) of what would happen if someone cheated.

The alleged price increases by the cartel were significant. In the United States, graphite electrode prices increased over 50% from May 1992 through February 1997. The Ferromin antitrust claimants allege that the price increases they suffered averaged over 45%. In Canada prices rose by more than 90% over 1992-97.⁶⁴ The Canadian market is much more concentrated and consists only of UCAR and SGL, whose combined market share during the conspiracy years was over 90 percent.

The U.S. price trend from 1980 through 1999 is shown Figure 4. The chart captures the fall in prices during the steel slump of the late 1980s, a clear increasing trend in the nominal price of GEs during the cartel period, and a decline after the firms were convicted by the DOJ. (The

⁶³ More specific information on this point is given in "Government's Sentencing Memorandum and Government's Motion for a Guidelines Downward Departure (U.S.S.G. §5K1.1)" U.S. Department of Justice, Filed October 19, 1999. It says that all forms of discounts were to be eliminated, including rebates and consumption guarantees

⁶⁴ "Foreign Corporation Fined \$12.5 million for Price Fixing," Industry Canada, Competition Bureau, News Release, July 20, 2000.

dotted line indicates missing data for the mid-1980s.) *Purchasing Magazine* reports that the last price trough was \$2,100 per metric ton in early 1992.⁶⁵ In May 1992 the U.S. price was \$3,123, and by February 1997 it had risen to \$3,439.

There are a few details worth noting about the prices used for Figure 4. From 1992-97 they reflect prices in the United States, as laid out in the DOJ Sentencing Memorandum of October 19, 1999. Outside of that time period, prices are taken from a variety of sources, including *Forbes*, *Oil and Gas Journal*, *Dow Jones Commodity Service*, UCAR earnings reports, and C/G SEC filings. It is unclear whether the price quotes given before 1992 and after 1997 reflect world prices or U.S. prices. For example, sources will say such things as “high-performance graphite electrodes are approaching \$2,100 per metric ton” or “In 1990, prices were as low as...”, or “Carbide/Graphite’s electrodes now sell for...”, without specifically stating whether these prices hold only for the U.S. or more broadly. There is anecdotal evidence that some EAF producers in developing countries were able to buy below the cartel price. In India, for example, GEs in mid-1997 were selling at roughly Rs 71,000 per ton compared with GEs from Japan selling at Rs 99,000 per ton.⁶⁶ This price quote is given after the cartel was broken up in the United States. Thus, the fact that price differences across countries are sporadically mentioned in the press implies that there is some ambiguity in the data and therefore also in the interpretation of the price chart.

11. Effect on Developing Country Consumers

We have no data specifically pertaining to prices for GEs paid by developing country consumers (primarily EAF producers), except for the complaint filed by the Ferromin plaintiffs that alleges an average 45% price increase.

Tables 2 and 3 show that graphite electrodes constitute a significant fraction of developing country imports (at least within the cartelized products in the sample). However, in interpreting

⁶⁵ *Purchasing*, October 19, 1995.

⁶⁶ "Rajesh Shirsat and Samata Dhawade, "Graphite Electrode Sector: Huge Export Potential Waiting to be Tapped," *Business Standard*, June 3, 1997.

the trade data it must be kept in mind that this cartel product-SITC match is poor. Graphite electrodes are important to developing countries that manufacture steel using the EAF process, but the data that we present here include imports not only of graphite electrodes, but all otherwise unclassified electrical equipment, thus significantly overstating the volume of direct imports. On the other hand, the cartelized product is an intermediate good that is also imported into the developing country in a more processed state. To the extent that the graphite electrode cartel increased the price of steel imports to developing countries, focusing on graphite electrode imports understates the impact of the cartel. Therefore, the data must be analyzed with a degree of skepticism.

12. Effect on Developing Country Producers

Developing country producers may have been able to increase their prices under the rising cartel price umbrella between 1992-97. That does not mean that developing country producers would have set exactly the same price; there may be quality differences or other differences in transportation costs, supply assurance, contract terms, and so on. Although this is a reasonable conjecture, given profit maximizing behavior on the part of developing country producers, we have no data to corroborate this hypothesis,

Alternatively, developing country GE producers may have been damaged if the cartel was able to prevent imports into its territory. Indian graphite electrode producers have made exactly this claim. The chairman of HEG, one of India's major GE producers, said, "the growth of Indian exports is not being liked by the American/European and Japanese producers. In order to counter India's growth in exports, they are resorting to large scale dumping in India, and have cornered more than 30 per cent of the domestic market. While Indian exporters are selling their products at over \$2800, international producers are dumping the same product in India at less than \$2200."⁶⁷ In response to complaints from HEG and other GE producers in India, the government imposed anti-dumping duties in 1997 on imports from the U.S., several European countries, and China. Since the anti-dumping claims were filed in 1996, while the conspiracy

⁶⁷*Ibid.*

was still operating, it is possible that these low-priced imports were a strategic tool on the part of conspiring GE producers intended to discipline Indian producers.

13. Summary of Industry Trends Post-Conviction

There has been a clear downward price trend since the conspiracy ended, as shown in Figure 4. This reflects in part the Asian financial crisis that hit the steel industry and therefore the graphite electrode industry in late 1998. There is some evidence, albeit anecdotal, that points to readjustment to a new equilibrium in the industry since the cartel ended. One recent article mentions a “market share-driven price war” that has cut prices by five percent.⁶⁸ In addition, individual companies have restructured in the face of mounting fines. Joint ventures are also taking place. In 1999, for example, UCAR entered into a production and marketing joint venture with Jilin Carbon, the largest Chinese producer of graphite electrodes.⁶⁹ The emergence of joint ventures following the break up of an international cartel in this industry, as in the other case studies, points to the need for some international body with jurisdiction to monitor their potentially anti-competitive effects.

D. SEAMLESS STEEL TUBES (OIL COUNTRY TUBULAR GOODS) CASE STUDY

1. Description of Product

Seamless steel tubes, pipes, and casings are used in the construction of wells in the oil and gas industry. They are often referred to in the trade literature as Oil Country Tubular Goods (OCTG). Steel line pipes are used in the transmission of oil and gas from wells.

⁶⁸ "Purchasing Hotline," *Purchasing*, June 1, 2000.

⁶⁹ John E. Sacco, "Ucar Enters Joint Venture with Jilin Carbon," *American Metal Market*, October 17, 2000.

2. Substitutes in Consumption

Demand is extremely variable. It is closely related to the amount of drilling currently being undertaken by oil and gas firms, which in turn depends on the price of oil and gas. This means that there is excess capacity in the industry during periods of low oil prices. During periods of increasing oil prices, oil producers seem to accept price increases in OCTG, but OCTG prices also seem to come quickly down when the price of oil does, as steel producers try to make use of existing fixed capacity.

Natural gas creates greater demand for OCTG than does oil drilling, because natural gas wells are deeper. Thus, consumer substitution of natural gas for oil increases demand for OCTG (and the reverse). OCTG costs are not a large enough portion of the cost of production to lead to a shift between natural gas and oil in response to fluctuations in the price of OCTG.

Stainless steel tubes represent new competition for the traditional product. They are made by other established steel producers. Otherwise there are no substitutes.

3. Industry Structure

There are a large number of firms in the industry, but the industry structure is both more complicated and much more concentrated than a simple count of the number of firms would suggest. (See Table 8)

In the U.S., there are a small number of firms that produce a full line of steel tubes, casings, and line pipes, and sell that line to the industry. These firms are often vertically integrated steel producers. There are a large number of smaller firms that produce less than a full line of OCTG products. These firms are usually not vertically integrated and instead purchase semi-finished steel inputs. They often also purchase some OCTG or line pipe products from other manufacturers in order to offer a full line to their customers. These firms often customize (with specialized coatings, etc.) products for their customers. The U.S. firms sell primarily or

exclusively to the North American market, which includes the Gulf of Mexico. Otherwise, U.S. firms do not seem active in the export of OCTG.

In the rest of the world, three large alliances, including all of the members of the former cartel, dominate world trade. These alliances include third-world steel producers; the largest alliance is controlled by an Italian-Argentine firm (Techint).

These various relationships among steel tube producers, either as suppliers and customers, or as owners or partners in a joint venture, provide many opportunities for cooperation and may substantially lessen competition in the industry from where one would expect it to be if these various industry participants were all independent competitors.

4. Location of Production

U.S. producers seem to produce mostly (if not entirely) for the North American (including Gulf of Mexico) market. Other leading producers are located in Japan, Germany, France, Italy, Argentina, Mexico, Brazil, and Sweden. These producers sell to both U.S. and worldwide markets. There are Chinese seamless steel tube producers, but while they have increased exports in recent years they are not yet at a technological level in either process or product that would enable them to compete effectively in world markets.

5. Distribution Mechanism

Some producers in this industry are vertically integrated into distribution, providing a range of sales services to their customers. There are also a significant number of brokers and agents in the industry. It is probably the case that certain segments of consumers rely more heavily on brokers. Smaller, independent oil and gas producers may rely on brokers while larger firms have in recent years been more likely to establish direct, long term relationships with OCTG producers.

For example, Pemex, the Mexican state-owned oil producer, entered into a long term arrangement with Techint, which controls OCTG producers in Mexico, Argentina, Italy, and Canada. The Techint (DST) group provides just-in-time supplies of OCTG allowing Pemex to reduce its inventories to near zero.

This kind of relationship, which has grown more prominent since the demise of the cartel in 1995, has changed the structure of distribution in the industry. In doing so, it has increased the competitive advantages associated with vertical integration and horizontal size, because being large and diversified is necessary to being able to guarantee supplies to customers in an industry with such high variance in demand. It also has increased barriers to entry as customers are tied to long-term relationships.

Internationally, the creation of alliances among major producers has also meant the consolidation of their sales forces. In fact, in the case of the alliance among Nippon, Kawasaki, and Sumitomo Metal it appears that the alliance is essentially the creation of a joint sales agency to distribute their goods worldwide.⁷⁰ The opportunity to combine its sales force with the existing international sales network of Techint (DST) was apparently central to NKK's decision to spin off its OCTG unit to NKK Tubes, which is now jointly owned by NKK and DST.⁷¹

In the United States during the 1990s, there was "significant consolidation in the OCTG distribution segment." Independent distributors and vertically dis-integrated producers also moved toward longer term relationships with customers and suppliers as a way to gain competitive advantage. "The distributors ... were forced to concentrate on inventory management and reducing operating costs. ... For many distributors this meant mergers and 'restructuring' ... Stocking programs and purchasing alliances – between users and distributors – were strategies for improving inventory management in the 1990s."⁷²

⁷⁰ Audrey McAvoy, "Japan Steel Companies Discussing Seamless Steel Pipe Tie-Up" *Dow Jones International News* August 18, 1999.

⁷¹ "NKK Merges Seamless Pipe Operations into JV with Grupo Technit" *Dow Jones International News*, November 2, 1999.

⁷² Charlie Perkins, *World Oil*, July 2000.

There are also a number of brokers and agents based in developing countries such as Pakistan, India, Singapore, and Egypt. It is not clear whether these brokers have long-term relationships with multi-national producers.

6. Entry or Exit

Entry in to the industry is, in principle, fairly easy, as “all the infrastructure needs are readily available from local agents and contractors. Since all the international mills make pipe to API specs, market acceptance is usually not a problem. The result was that there were 20 countries that exported at least 10,000 tons of OCTG to the U.S. market in the last decade.”⁷³ This was the case despite the presence of substantial tariffs faced by several countries.

Instability in the market has apparently led several well-established producers to exit in the last decade. British Steel (now part of Corus) exited the market 1994. Mannesmann, the inventor of seamless steel tubes and the long time world leader, has significantly reduced its “exposure” to steel tubes by selling essentially all of its steel tube capacity to a joint venture with Vallourec, a French steel producer. It is not clear whether this has led to real exit from the industry or simply a reorganization of ownership and managerial responsibility as Mannesmann has continued its shift in orientation toward the telecommunications industry.

7. Technological Change

Significant technological change by both producers and consumers is reported to have increased demand for the product, but does not appear to have led to re-alignment in the industry or changes in its competitive structure.

⁷³ Charlie Perkins, *World Oil*, July 2000.

8. Buyers' Industry Structure

Consolidation in distribution is mirrored by consolidation among consumers. The number of individual buyers has decreased and their average size increased over the 1990s due to exit by many independent oil and gas producers.⁷⁴ This has created fears among independent OCTG producers and distributors about their own vulnerability. For example, Scott Sheffield, chairman and CEO of Pioneer Natural Resources “predicted that in five years there will be just five to six super independents drilling 70 percent of the wells in the U.S., giving them huge purchasing power with the mills.”⁷⁵ In the United States, consumers are represented by the International Association of Drilling Contractors. Obviously many large oil producers cooperate within OPEC, but we have no indication of cooperative activity in the purchasing of seamless steel tubes.

9. The Conspiracy

In December 1999, the European Commission fined four European and four Japanese steel manufacturers over \$100 million, charging them with fixing bids on seamless steel tubes and line pipes between 1990 and 1995. The European manufacturers included the inventor of steel tubes, Mannesmann; British Steel, now Corus, which exited the industry in 1994; Dalmine, indirectly owned at the time by the Italian government but privatized in 1996; Vallourec, a French steel producer who specializes in tubular products. The Japanese conspirators were NKK, Kawasaki, Nippon, and Sumitomo Metal. These eight independent firms created something that they called the “Europe Japan Club.” Under the auspices of the Europe Japan club they agreed, “that the domestic markets of the different producers ... should be respected” so that producers refrained from selling in the home countries’ of the other members of the Club.⁷⁶ In order to prevent price competition in shared markets, the Club met regularly and designated which company was to win a particular job by bidding an agreed upon price, with the others to submit higher bids.

⁷⁴ *World Oil* July 2000.

⁷⁵ *American Metal Market*, December 7, 1999.

⁷⁶ “Commission fines cartel of seamless steel tube producers for market sharing” European Commission press release, 8 December 1999.

The European Commission decision covered restrictions on sales and pricing agreements in Europe. The cartel agreement also apparently restricted competition in “certain third markets.” The fines issued by the EC did not reflect these non-European markets because, the Commission concluded, there was no evidence that they had a restrictive effect on the European Union. Further details on this agreement have not been made public by the European Commission pending appeals by some of the accused. Because the EC has not included these other “third markets” in its decision, it is likely that details regarding this aspect of the agreement will never be made public. This points up an important weakness in international competition policy. The competition authorities in Europe may well have information regarding restrictions on competition in developing countries (or developed countries), but under current law and agreements there is often not permission, let alone responsibility, to share that information with the affected parties.

It is unlikely that the cartel agreement had a direct impact on the U.S. market where prices are above world levels because of anti-dumping tariffs currently in effect.

10. Effect on Developing Country Consumers

We have been able to locate detailed and accurate data for OCTG prices in the United States over the period in question.⁷⁷ However, because of the substantial tariffs in place during this period, these may not be a good proxy for worldwide prices. Average prices of OCTG are presented in Figures 5 and 6. The OCTG price falls during most of the period of the conspiracy. However, this was also a period of low and declining oil and gas prices. Thus the observed prices, even in the U.S. where the cartels effect was, we presume, only indirect, may have been higher than they would have been under competitive conditions. Further analysis, controlling for the price of oil and gas, is necessary to obtain a quantitative estimate of the effect of the cartel on prices.

⁷⁷ We are extremely grateful to Charlie Perkins of Pipe Logix for providing us with this data.

The share of worldwide seamless tube exports coming from Germany, France, England, and Japan stayed roughly the same during the period of the cartel (Figure 9), actually increasing slightly toward the end of the period. As the cartel included the major producers from each of these countries, this measure is a reasonable estimate of cartel exports. To the extent that there were alliances between the cartel participants and producers in other countries, this measure actually understates the market share of the cartel. The fact that their market share does not decline suggests that entry (or expansion by non-participants) was not a viable source of increased competition during this period.

During the period of the cartel, developing countries imported an average of \$276 million iron and steel tubes annually, representing .03% of their imports over those years. This category is much broader than the oil and gas goods that were included in this particular conspiracy. However, there have been recent European Commission decisions convicting an overlapping set of steel producers for fixing the price of steel heating pipes during the 1980s, steel beams during the 1980s, and stainless steel during the mid-1990s.⁷⁸ Thus it is possible that the prices of the other steel pipe products included in these import data have been affected by these various activities. Some imports included in these figures were certainly produced by firms who were not a party to these agreements. However, given the substantial market shares of the firms in the cartel, it is likely that their behavior changed the prices charged by firms who were not a party to and not even aware of the price fixing of their larger competitors. Without more information about the secret activities of cartels, it is impossible to determine the quantitative effect of these cartels on developing country incomes.

Just to get a sense of the quantitative impact of these cartels, assume that the price of steel pipes was increased by 1% as a result of collusive behavior.⁷⁹ This would mean a cost to steel consumers in developing countries of approximately \$28 million each year.

⁷⁸Charles Goldsmith and Martin DuBois, "European Commission Fines Steelmakers \$116.7 million" *Wall Street Journal Europe* February 17, 1994, Emma Tucker, "European Commission Ten Companies Penalised for Fixing Prices of Insulated Steel Heating Pipes" *Financial Times* October 22, 1998, and Philip Burgert, "EC Issues Fines for Stainless Price Fixing" *American Metal Market* January 26, 1998.

11. Effect on Developing Country Producers

No evidence was found indicating that steel producers blocked entry or potential entry into the OCTG market from developing country steel producers. Several of the participants have production facilities in developing countries, including Brazil, Mexico, and Argentina. Several of the cartel participants have, since the breakup of the cartel by the European Commission, entered into joint ventures with firms based in developing countries, so that the largest steel tube producing alliance is now led by an Italian-Argentinean family and its steel producers in Argentina and Italy. Several of the producers in the cartel also have production facilities in the transition economies of Eastern Europe. It appears that any participation in this market that will be done by producers from that region will be done through cooperation with one of these alliances.

China is the most significant potential new entrant into this industry from the developing world. It is not yet clear whether China will be integrated into one of the three alliances that now dominate this trade or will represent new competition for the industry.⁸⁰

12. Summary of Industry Trends Post-Conviction

Price trends in the industry continue to mirror oil and gas prices. U.S. prices fell during the early 1990s, reaching a trough in mid-1995. They then increased for three years until declines in oil prices in 1998 led to a 41% drop in U.S. OCTG demand and declining prices of OCTG. By the middle of 1999, OCTG prices were again increasing, as they continued to do for most of 2000.

Since the demise of the cartel, the industry has undergone a fairly substantial reorganization, in which all parties to the cartel have joined in one of three international alliances. The largest of these, with a 25% market share of world consumption of OCTG is led by the Techint, an Italian–Argentinean firm controlled by the Rocca family. Techint controls Dalmine, the Italian

⁷⁹ A recent OECD report, “Hardcore Cartels” suggests that cartels raise price on average ten percent, but did not explain how this figure was derived. In comparison, the 1% hypothetical figure presented here is quite conservative.

⁸⁰ Korea is a significant player in international steel markets. We were not able to document a significant role in this particular market.

member of the cartel, Tamsa, a Mexican tube producer, and Siderca, an Argentine steel producer. They are known jointly as the DST group. The Rocca family has been in the steel tube business since before World War II. Tamsa is currently under investigation by the Mexican Federal Competition Commission for taking advantage of its position as the sole seamless tube producer in Mexico. There is no indication in published reports that this investigation is linked to the European Commission charges.⁸¹ NKK, also a member of the Europe-Japan club, has now formed an alliance with DST, as has a Canadian producer.

The other three Japanese producers who were members of the cartel have formed an alliance in which they use a single sales agency to represent all three. Mannesmann and Vallourec, the other two firms in the Europe-Japan Club have formed a joint venture to which they have transferred all their OCTG production. They are also engaged in steel tube joint ventures with Corus, another member of the Club that has exited the OCTG market.

China's exports of seamless steel tubes have increased significantly, but the current focus of its steel tube producers is improving manufacturing technology and product quality rather than expansion of capacity for export.⁸² This suggests that, at least in the short run, China will not represent significant competition for established producers.

Tariffs continue to play a significant role in this industry and may well limit the entry of developing country firms not aligned with one of the three groups that dominate the industry. They have been maintained in U.S. since 1995 against Mexico (whose only producer is part of DST). U.S. firms have requested anti-dumping action against Japanese producers, but no decision has yet been made.⁸³ Imports of pipe into the United States have increased in part because tariffs on steel sheets have encouraged foreign producers to export finished products into the U.S.

The European Union imposed anti-dumping duties on Ukraine and Croatia in February 2000. It has had anti-dumping tariffs in force against six other East European countries since 1997.

⁸¹ "Mexico: Investigation into Tamsa" *Metal Bulletin* August 21, 2000.

⁸² "Chinese Steel Industry Will Mainly Develop Flat Products" *Asia Pulse* September 20, 2000.

⁸³ *Journal of Commerce*, October 14, 1999.

This case study highlights three potentially anti-competitive tactics which appear in other cases discussed in this report: mergers, joint-ventures, and protective tariffs. While all three may be appropriate and even pro-competitive under certain circumstances, their appearance in an industry which has so recently attempted to collude should raise concern about possible anti-competitive effects. It also points to the lack of any international body with jurisdiction and responsibility for monitoring these behaviors.

E. VITAMINS CASE STUDY

1. Description of Product

There are a large number of vitamins used in the food-processing industry. This case study covers only those that were the subject of the decade-long international price-fixing conspiracy that was made public in 1999. The following vitamins were controlled by the cartel: A (retinol), B2 (riboflavin), B3 (niacin and niacinamide), B4 (choline chloride), B5 (calcium d-pantothenate or "calpan"), B6 (pyridoxine), Beta-carotene (a precursor to vitamin A), C (ascorbic acid), E (the collective name for tocopherols and tocotrienols), and vitamin premixes (used to enrich processed foods).

In 1999, global sales of vitamins reached \$2 billion, with 70 percent of the sales accounted for by vitamins A, C, and E.⁸⁴ The vitamins affected by the cartel are some of the most commonly used nutritional supplements. These vitamins are purchased at the retail level by individual consumers and by human and animal food producers to add to food and feed in order to enrich the product.

2. Substitutes in Consumption

There are natural sources for many of these vitamins, but these sources are not economically viable substitutes for many of the high-volume uses (be it human consumption in daily single vitamin tablets or multivitamins or animal feed consumption at high doses). There is one

instance, though, of competition within the category: beta-carotene competes directly with vitamin A and has captured some of the traditional part of that market.

3. Cost Structure

No details on the cost structure for production of the variety of vitamins could be found. We suspect that, at least for the major multinational companies, it is a capital-intensive technology.

4. Industry Structure

In 1999 Hoffmann-La Roche, Ltd. (Switzerland), BASF AG (Germany), and Rhone-Poulenc SA (France) had nearly 75% world market share for bulk vitamin sales. Hoffmann-La Roche (HLR) was the leader with 40%, next came BASF with 20%, and Rhone-Poulenc (RP) had approximately 15% of the market.⁸⁵ These three firms are also the largest sellers in the U.S. vitamin market.

It is difficult to obtain capacity figures for individual firms disaggregated by specific vitamin sub-markets. The examples given in the literature show the market leader to be either HLR or BASF. In the European market for vitamin C, for example, HLR was the market leader in 1996 with 40 percent, while Merck KGaA (a German firm not affiliated with the U.S. pharmaceutical company of similar name) and BASF together accounted 18 percent market share.⁸⁶ Similarly, in the late 1990s, HLR, BASF, and Daiichi Pharmaceutical Co. Ltd. (Japan) held the majority of the B5 market, while in vitamin B6 the trio at the top was HLR, Daiichi, and Takeda Chemical Industries Ltd. (Japan).⁸⁷ In most cases the major manufacturers have plants in both the U.S. and in Europe, and many have production facilities in Asia as well.

⁸⁴ Cynthia Challener, "Vitamins Market Seeks to Recover," *Chemical Marketing Reporter* November 6, 2000.

⁸⁵ Clay Boswell, "What's Next in Vitamins," *Chemical Marketing Reporter*, July 19, 1999.

⁸⁶ European Commission decision on joint venture of Cerestar, Merck, and BASF. Case IV/E-2/36.949-KGS, published in the Official Journal: OJC 247 of 7.08.1998.

⁸⁷ Federal Court of Canada, Trial Division (at Toronto), Court No. T-1664-99, between Her Majesty the Queen and Daiichi Pharmaceutical Co., Ltd., Agreed Statement of Facts, September 17, 1999.

The U.S. Food and Drug Administration recently conducted a study of the economics of the “dietary supplement industry” which includes vitamins, herbal supplements, sport nutrition products, meal supplements, minerals, and specialty supplements. In their analysis they conclude that it is difficult to determine the exact structure of the market from published data because the dietary supplement products are scattered across numerous SIC codes. However, from the October 1996 issue of the *Nutrition Business Journal* they are able to construct concentration indices for the U.S. vitamins raw material market using 1995 data. They find that the eight-firm concentration ratio, made up of firms with sales of more than \$50 million, is 73 percent. The remaining twenty-seven percent of the market is made up of thirty-two firms, each with annual sales of less than \$50 million. The study concludes that: “Thus, the vitamin raw material market is much more concentrated than either the DS [dietary supplements] manufacturing market or the herbal and botanical raw material market.”⁸⁸

As illustrated above, the exact mix of major competitors varies by vitamin type. RP (now Aventis, upon RP’s merger with Hoechst⁸⁹), BASF and HLR are the main vitamin A producers. Major B3 (niacin/niacinamide) producers are Nepera Inc. (a U.S. firm that is part of the Cambrex Corporation), Lonza (Switzerland), and HLR. The leading beta-carotene producers are HLR and BASF. Choline chloride, or vitamin B4, is produced by Chinook (Canada), as well as BASF, Bioproducts Inc. (U.S.), DuCoa (U.S.), UCB (U.S.), and Akzo Nobel (Netherlands). Thus, while the particular firms that dominate each product market differ, each market is highly concentrated and there is significant multi-market contact, both of which can facilitate collusion.

HLR, BASF, Merck KGaA, and Takeda dominate the market for vitamin C, but China has become a significant competitor in recent years. The largest Chinese vitamin C manufacturers are Northeast Pharma Group, Jiangsu Jiangshan, Ganjian Pharma, North China, Shijiazhuang Pharma, and Shanghai Sunve.⁹⁰ China also produces B1 and B6, and vitamin E production is growing.⁹¹ In the market for vitamin E, the leaders are HLR, BASF, and RP, along with Eisai Company from Japan. Eastman Chemical has been a major player in the natural vitamin E

⁸⁸ “Economic Characterization of the Dietary Supplement Industry, Final Report” US Food and Drug Administration, Center for Food Safety and Applied Nutrition, March 1999. See Table 5-9 for relevant data.

⁸⁹ “Roche, BASF Face European Fines and Censure,” *Chemical Marketing Reporter*, May 31, 1999.

⁹⁰ Cynthia Challener, “Vitamins Market Seeks to Recover,” *Chemical Marketing Reporter* November 6, 2000.

⁹¹ Clay Boswell, “What’s Next In Vitamins,” *Chemical Marketing Reporter*, July 19, 1999.

market for many years. HLR is the leader in vitamin premixes, although BASF has been establishing its position over the past few years. BASF entered the human nutrition premix market in 1997, having been in the animal feed market for many years. BASF recently announced its intention to purchase Takeda Kagaku Shiryo, the animal premix subsidiary of Takeda.

5. Location of Production

As discussed above, production is located worldwide.

6. Distribution Mechanism

We have no direct information on vitamin distribution although vitamin producers most likely sell both directly and through distributors and brokers. The Japanese companies, such as Daiichi and Takeda, own marketing organizations in the U.S. that help to distribute their products.

7. Entry or Exit

The post-conviction "era" is seeing both significant expansion and restructuring of production in the various vitamin sub-markets. This is discussed in detail below.

8. Technological Change

There have been no recent major advances, with one exception. Genencor and Eastman Chemical announced in 1999 that they had developed a new process for manufacturing vitamin C that would yield substantial cost savings.⁹²

⁹² "A Better Way to Make Vitamin C," *Chemical Business NewsBase*, October 22, 1999.

9. Buyers' Industry Structure

Vitamin consumers span the range from individual purchasers at the retail level to large multinational beverage, food additive, and food processing manufacturers.

This is a world market. A European Commission investigation into a joint venture request from Cerestar, Merck and BASF to produce vitamin C concluded that the relevant geographic market is the world market. In particular, they found that transportation costs do not constitute a barrier to trade.⁹³

10. The Conspiracy

The dates vary, depending on the particular vitamin sub-market and the firm charged, but in general the conspiracies lasted from January 1990 until February 1999. Tables 9 and 10 outline the firms convicted and fines levied in both the U.S. and Canadian cases. The three European (HLR, BASF, Aventis) and three Japanese (Takeda, Eisai, and Daiichi) companies who were the major cartel members together controlled about 80 percent of the global vitamin market. There have been dozens of lawsuits filed since this far-reaching cartel was investigated and prosecuted by the DOJ:

- 1) United States: See Table 9. In addition to the company fines, various executives pled guilty, paid criminal fines, and are serving time in U.S. prisons. HLR was hit with a particularly high fine of \$500 million. The story behind the unprecedented fine relates in part to the citric acid cartel. The Department of Justice investigated and convicted HLR in 1997 for the citric acid conspiracy and fined the company \$14 million. HLR was informed that Justice officials were investigating a vitamin cartel and asked if it had an interest in cooperating. They declined, disavowing any knowledge of a price-fixing conspiracy in vitamins. The company then continued to be an active participant

in the vitamin cartel. Scott Hammond, Director of Criminal Enforcement at the DOJ's Antitrust Division, mused about the deterrent effect of the eventual fine assigned to HLR in a 2000 speech: "Clearly, the \$14 million fine in the citric acid prosecution was not nearly enough to deter HLR or its top executives from continuing to participate in the vitamin cartel. Time will tell if the \$500 million fine and jail sentences for the HLR executives will."⁹⁴

- 2) Canada: Five vitamin companies (HLR, BASF, RP, Daiichi, and Eisai) were fined a record \$88.4 million. Detailed fines are given in Table 9 and a listing of the particular companies involved in each individual vitamin conspiracy are given in Table 10. According to the Commissioner of Canada's Competition Bureau, the prices of some vitamin products were raised to 30% above competitive price levels.⁹⁵ In addition to the fines, the Federal Court "also ordered the five companies not to engage in competition offences for a period of 10 years."⁹⁶ The story behind the vitamin B4 Canadian conspiracy shows the power and effect of this agreement outside of the United States. According to the Canadian Federal Court filing, there were two meetings in late 1992 between executives from Akzo Nobel (Netherlands), UCB (Belgium), Bioproducts Inc (U.S.), Chinook Group (Canada), DuCoa (U.S.), and BASF (Germany). At these meetings the companies agreed that the European producers (BASF and Akzo Nobel being the major manufacturers of B4 in Europe) would terminate their sales to North America and that the three North American producers would in exchange withdraw from Europe. In effect, this left Chinook with the Canadian market to itself. During the conspiracy period, Chinook supplied approximately 90% of the Canadian market with vitamin B4.⁹⁷

⁹³ European Commission decision on joint venture of Cerestar, Merck, and BASF. Case IV/E-2/36.949-KGS, published in the Official Journal: OJ C 247 of 7.08.1998, at paragraph 9.

⁹⁴ "Fighting Cartels -- Why and How? Lessons Common to Detecting and Deterring Cartel Activity" speech by Scott D. Hammond to the 3rd Nordic Competition Policy Conference, September 12, 2000.

⁹⁵ Address to the Canadian Bar Association, Competition Law Section Annual Meeting (Ottawa), by Konrad von Finckenstein, Q.C., September 30, 1999. <<http://strategis.ic.gc.ca/SSG/ct01616e.html>>

⁹⁶ Leonard Zehr, "Five Vitamin Giants Hit with Record Fines for Price Fixing in Canada," *The Globe and Mail*, September 23, 1999.

⁹⁷ Superior Court of Justice (at Ottawa), Court File No. 99030978, between Her Majesty the Queen and Russell E. Cosburn, Agreed Statement of Facts, September 14, 1999.

- 3) European Union: In July 2000 the EC issued a "statement of objections" to thirteen vitamin manufacturers. The companies receiving this legal warning were HLR, BASF, Aventis (then Rhone-Poulenc), Solvay Pharmaceuticals, Merck KGaA, Lonza, Daiichi Pharmaceutical, Eisai, Congo Chemical, Sumitomo Chemical, Sumika Fine Chemicals, Takeda Chemical Industries, and Tanabe Sieiyaku.⁹⁸
- 4) Other Countries: Australia's competition authority recently announced that it was considering a settlement with the major vitamin manufacturers. Roche Vitamins Australia Pty Ltd, BASF Australia Ltd, and Aventis Animal Nutrition Pty Ltd (formerly Rhone-Poulenc) agreed that respective penalties of \$15 million, \$7.5 million, and \$3.5 million were to be recommended to the court for consideration. The charges concern vitamins A and E over 1994-96 for the three producers and a continuation of the cartel through 1998 between BASF and Roche Vitamins. There are other Australian vitamin producers, such as Blackmores, that were not part of the conspiracy. These penalties, if approved, would be the highest ever imposed by the Australian Competition and Consumer Commission.⁹⁹ Antitrust officials in Brazil, Japan and Mexico are also reported to be investigating.¹⁰⁰ Brazil is said to be targeting the top three firms (HLR, BASF, and Aventis).¹⁰¹
- 5) Civil Suits in the United States: The three main vitamin suppliers, as well as the Japanese producers, faced dozens of class-action claims for damages in the United States. The settlements for some of the more noteworthy suits have been reported in the press. In November of 1999 a \$1.17 billion settlement was reached between vitamin purchasers (primarily animal feed companies and food processors) and HLR, BASF, Aventis, Hoechst, Daiichi, Eisai, and Takeda. The total award was based on an estimate that prices were 20% higher than they would have been without the cartel. This is the settlement that received the most attention in the news. However, the actual

⁹⁸ "EC Identifies Firms in Vitamin Cartel Probe," *Nutraceuticals International*, August 1, 2000.

⁹⁹ "Court Hearing on Vitamins Price-Fix Case – ACCC Seeks Record \$26M Penalty Against International Vitamin Suppliers" *M2 Presswire* December 5, 2000.

¹⁰⁰ See "Roche on Verge of Paying \$600 Million to Settle Vitamin Lawsuits in the USA?" *Nutraceuticals International* November 1, 1999 and Robert Westervelt and Claudia Hume, "Antitrust Enforcement Efforts Go Global," *Chemical Week*, June 2, 1999.

award fell as more than 200 companies, several of them very large vitamin purchasers (e.g., Tyson Foods and Quaker Oats) opted out of the settlement in hopes of negotiating a better deal.¹⁰² Not quite a year later, in October 2000, the same six firms settled another case for \$225 million. (In this case 21 states also put in claims on behalf of consumers who had bought over-priced vitamins. The proceeds that went to the states were donated to various charities, since it would be impossible to identify the individual consumers.) A similar suit in California settled shortly after for \$80 million.

The conspiracies covering different distinct vitamins had many similar elements: 1) agreement to fix prices and allocate customers, 2) agreement to divide the world market among the conspirators, 3) sharing of information in order to monitor and enforce the agreement, and, in some cases, 4) rigged bids for contracts to supply the vitamin. The DOJ charges against the vitamin companies identify the scope of the cartel as “U.S. and elsewhere,” but the U.S. documents never specifically state where the non-U.S. effects were felt. The fact that antitrust authorities in several other countries around the world are investigating is a good indicator that there were wide-ranging effects from the cartel.

For each vitamin, the U.S. price trend from 1985 to 2000 is shown in Figures 10 through 16. The data were collected from various issues of *Chemical Marketing Reporter* (CMR). Note that in some cases we show prices for several forms in which the vitamin is sold (e.g., drums versus bags). In other cases there was only one form given or only one form with a consistent price series throughout the relevant period.

CMR data most often reflect the list price, rather than the transactions price, of a commodity. For example, vitamins A and E sold for about 20 percent below list in 1990, before the conspiracy took hold.¹⁰³ Therefore, the price levels depicted in the charts should not be taken too literally, but should instead be used to get a general feel for the trend in prices, presuming that list prices eventually adjust to significantly lower or higher transactions prices.

¹⁰¹ “Brazil Govt. Mulls Fines for 3 Companies in Vitamin Price Fixing,” *Dow Jones Newswires*, May 16, 2000.

¹⁰² Carlos Tejada, “Companies: Over 200 Plaintiffs Choose to Leave Vitamin Settlement,” *Wall Street Journal Europe*, February 18, 2000.

¹⁰³ Alice Naude, “Vitamin Prices Seek Stability,” *Chemical Marketing Reporter*, March 19, 1990.

As can be seen in several of the charts, prices did take a turn upward in the early 1990s, particularly in 1992, although not all of the price increases are continuous. Vitamin A, in particular, had a downturn in 1994. Once again, it is important to keep in mind that these price charts are purely descriptive, and do not control for other changes in the economic environment or in the industry that might have occurred at the same time.

11. Effect on Developing Country Consumers

There is no direct evidence of price trends in developing countries. There is evidence, however, that the U.S. price does not necessarily reflect prices throughout the world. Prices of vitamin C in Europe, for example, apparently trended downward in the early 1990s, due primarily to the entry of China into the market. Prices began to turn up in the late 1990s, possibly because of the exit of many of the smaller vitamin producers in China.¹⁰⁴

Developing country imports of vitamins appear to be quite small, averaging \$622 million per year to all developing countries during the cartel years. However, in addition to these imports, reported as raw vitamins, developing countries also import vitamin-enriched foods for human and animal consumption. The prices of these vitamin-containing products were probably also raised as a result of the vitamin cartel.

12. Effect on Developing Country Producers

There are developing country producers of vitamins who represent potential and actual competition for the firms who were cartel members. These producers are in China, Korea, and India. There is no direct evidence on how they might have benefited or been harmed by the cartel.

¹⁰⁴ Sean Milmo, "Vitamin Prices Start to Edge Up" *Chemical Marketing Reporter*, March 9, 1998.

India seems active in imposing anti-dumping duties to protect its producers. As with graphite electrodes and citric acid, India recently recommended that anti-dumping duties be imposed on vitamin C from Russia and the European Union.¹⁰⁵

13. Summary of Industry Trends Post-Conviction

The market appears to be reeling from the price-fixing convictions, as well as suffering from overcapacity. Prices of vitamins A and C have dropped most significantly. In the restructuring, HLR and BASF look like the eventual winners. Merck KGaA is expected to exit from the vitamin C and biotin markets. Aventis is also poised to exit, and is looking for a buyer.

Most noteworthy is the proposed acquisition of Takeda by BASF, two of the convicted conspirators. According to one UK consultant “Takeda realizes they’re not in a position to compete with the high cost of production in Japan and the low volumes they’re facing.”¹⁰⁶ German antitrust authorities approved the merger in December. The U.S., Japanese, and several other European antitrust authorities approved the merger several months ago.¹⁰⁷ The two companies will form a joint venture within Japan, and BASF will have sole responsibility for the product outside Japan. In addition, BASF will acquire both Takeda’s process technology and its patents.¹⁰⁸ Altogether, BASF’s market share will be an astounding 30% worldwide.

Joint ventures between former cartel members and firms outside the cartel are also occurring. Roche Taishan (Shanghai) has opened a new joint venture facility in China for vitamin A production. The partnership itself is not new, but was started in 1995 (with a company called Shanghai Number 6 Pharmaceutical Factory). According to a 1999 report, HLR has invested approximately \$200 million in production facilities in China for vitamins and other

¹⁰⁵ “Anti-dumping Duty Imposed on Vitamin-C, Metronidazole,” *India Business Insight*, September 25, 2000.

¹⁰⁶ Lisa Jarvis, “Vitamin Makers Consolidate to Counter Weaker Margins” *Chemical Marketing Reporter*, September 11, 2000.

¹⁰⁷ “German Antitrust Authorities Approve Takeover of Takeda’s Vitamin Business” *M2 Presswire*, December 4, 2000.

¹⁰⁸ Cynthia Challener, “Vitamins Market Seeks to Recover,” *Chemical Marketing Reporter* November 6, 2000.

pharmaceuticals.¹⁰⁹ HLR has also opened a vitamin B6 production facility in China as a joint venture with Shanghai New Asiatic Pharmaceuticals Ltd. This is the largest vitamin B6 plant in China.¹¹⁰ In addition, Cerestar Deutschland GmbH, Merck KGaA and BASF have set up a joint venture for an intermediate product, ketogluconic acid, that is an input to vitamin C production. The European Commission approved the joint venture in 1998.

Expansion is also underway by some companies, as the restructuring of the industry takes place. HLR is aggressively investing and building to capture a larger share of the bulk vitamins market. In 1998 HLR modernized and lowered costs through technological advances at its vitamin C plant in Scotland. It also built a modern animal feed vitamin premix plant in Poland, where it had previously established a strong sales and marketing subsidiary.¹¹¹ HLR is expanding the production of vitamin B2, with a new plant in Germany, and vitamin E, with a new plant in Switzerland (although this more modern plant will replace two older plants). It is also increasing its vitamin premix operations with new plants being built in South Africa and Mexico. BASF also completed a new vitamin premix facility in June of 2000 in Malaysia.¹¹²

As in some of the other case studies discussed above, the break up the vitamin cartel by anti-trust authorities has been followed by a series of mergers and joint ventures among the co-conspirators. This suggests that a more comprehensive approach to promoting competition and a level playing field may be necessary. Current regulatory institutions are neither international enough nor sufficiently focused on promoting competition rather than simply prohibiting particular anti-competitive techniques to assure that global markets will be competitive and open to new producers.

V. Conclusion

In this investigation of the effects of international cartels on developing countries we have addressed both developing countries as consumers, as well as developing countries as competitors or co-conspirators. The cases discussed show the potential for an international cartel

¹⁰⁹ "Roche on Verge of Paying \$600 Million to Settle Vitamin Lawsuits in the USA?" *Nutraceuticals International* November 1, 1999.

¹¹⁰ Cynthia Challener, "Vitamins Market Seeks to Recover," *Chemical Marketing Reporter* November 6, 2000.

¹¹¹ "Major Vitamins Makers Launch Global Expansions," *Chemical Marketing Reporter*, November 2, 1998.

made up of producers from industrialized countries to have harmful effects on developing country consumers. Their impact on developing country producers is more complicated. International cartels may provide a price umbrella for new entrants, or they may provide a mechanism for established firms to block the entry of new participants in world markets.

In addition, we raise the issue of the multi-dimensional role of the U.S. and EU government responses to these cartels in how they might affect developing countries. The vigorous prosecution of international cartels by the U.S. and EC may well open up entry possibilities to developing country producers. On the other hand, these governments are also susceptible to manipulation by domestic producers using tariff barriers and anti-dumping duties to protect the home market, either during or after the conspiracy.

Finally, there is the role of the antitrust authorities. In general, although U.S. and EC decisions often mention that the cartel had effects "in the U.S. and elsewhere" or in "certain third markets," those effects are never included in the decisions. Details regarding the effects of the cartels outside of U.S. and EU markets will never be made public. This points to an important weakness in international competition policy as it affects developing countries. The competition authorities may well have information regarding restrictions on competition in developing countries, but under current law and agreements there is often not permission, let alone responsibility, to share that information with the affected parties.

¹¹² Ibid.

TABLE 1
RECENT INTERNATIONAL CARTELS INVESTIGATED BY
THE U.S. DEPARTMENT OF JUSTICE AND THE EUROPEAN COMMISSION

Products in italics are under investigation.

Industry	Start¹	End	Conviction	Country of Origin of Indicted Firms	Developing Country Participants	Country(ies) Known To Be Affected²
<i>Aircraft</i>	na	na	<i>Under investigation (FTC & EC)</i>	European consortium (Britain, France, Germany, Spain), US	No	na
Aluminum Phosphide	Jan-90	Nov-90	DOJ	Brazil, Germany, India, US	Brazil, India	US
Bromine Products	Jul-95	Apr-98	DOJ; <i>Under Investigation by EC</i>	Israel, US	No	US
Cable-Stayed Bridges	Sep-96	Dec-97	DOJ	France, US	No	US
Carton-board	1986	1991	EC ³	Austria, Canada, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, UK, US (via European subsidiaries)	No	Europe
Cement	1983	Aug-94	EC	33 European firms, 8 national cement trade associations, and the European Cement Association	No	Europe
Citric Acid	1991	1995	DOJ; <i>Under Investigation by EC</i>	Austria, Germany, Netherlands, France, Switzerland, US	No	International
Diamonds (Industrial)	1992	1994	DOJ (went to trial, government lost)	South Africa, US	South Africa	International
Explosives (Commercial)	1987	1992	DOJ	Norway, UK	No	US
Ferrosilicon	late 1989	mid-1991	DOJ	Norway, US	No	International
Ferry Operators (Adriatic Sea)	1987	1994	EC	Greece, Italy	No	Greece, Italy

Industry	Start ¹	End	Conviction	Country of Origin of Indicted Firms	Developing Country Participants	Country(ies) Known To Be Affected ²
Ferry Operators (Cross-Channel Freight)	Aug-92	Dec-92	EC	France, Netherlands, Sweden, UK	No	Europe
Graphite Electrodes	Jun-92	Jul-97	DOJ	Germany, Japan, US	No	International
Isostatic Graphite	Jul-93	Feb-98	DOJ	US and unnamed firms	na	International
Laminated Plastic Tubes	1987	1996	DOJ	Switzerland, US	No	US
Lysine	Jun-92	Jun-95	DOJ, EC	Germany, Japan, South Korea, US	S. Korea	International
Maltol & Sodium Erythrobrate)	Maltol: 1989 SE: 1992	Maltol: 1995 SE: 1994	DOJ	US + unnamed firms	No	International
<i>Methionine</i>	1985	1996	<i>Private lawsuit ongoing in U.S.; Under Investigation by EC</i>	France, Germany, Japan, South Korea, US	China	US
<i>Natural Gas</i>	na	na	<i>Under Investigation by EC</i>	na	na	na
<i>Newsprint</i>	1989	1995	<i>Under Investigation by EC</i>	Austria, Finland, France, Germany, Italy, Sweden, UK; subsidiary of South African firm	South Africa	
Pigments	1984	1992	Private class-action lawsuit ongoing in Canada	Canadian division of UK firm, Canadian subsidiary of German firm, US	No	na
<i>Plasterboard</i>	na	na	<i>Under Investigation by EC</i>	France, Germany, UK	No	Europe
Plastic Dinnerware	Nov-91	Apr-92	DOJ	Canada, US	No	US
Ship Construction Services (Heavy-Lift)	1993	May-97	DOJ	Belgium, Netherlands, US	No	International
Ship Transportation Services (Heavy-Lift)	1990	May-95	DOJ	Japan, South Korea, US	South Korea	International

Industry	Start ¹	End	Conviction	Country of Origin of Indicted Firms	Developing Country Participants	Country(ies) Known To Be Affected ²
Shipping (Central West African)	1972	1992	EC (conviction, but fine overturned)	Zaire, Angola, Northern part of continental Europe, excluding UK	Zaire, Angola	International
Shipping (North Atlantic)	1994	1996	EC	29 countries	e.g., Malaysia	International
Shipping (Far Eastern)	1990	1994	EC	Denmark, France, Germany, Ireland, Japan, Korea, Malaysia, Singapore, Taiwan, UK	Malaysia, S. Korea	International
Shipping (West African)	1975	1992	EC	12 countries	e.g., Senegal, Cameroon	
Sodium Gluconate	Aug-93	June-95	DOJ	France, Japan, Netherlands	No	International
Sorbates	1979	1996	DOJ	Germany, Japan, US	No	International
Stainless Steel	Jan-94	Mar-95	EC	Belgium, France, Germany, Italy, Spain, Sweden, UK	No	Europe
Steel Beam	1988	1994	EC	Belgium, Britain, France, Germany, Luxembourg, Spain	No	W. Europe
Steel Heating Pipe (pre-insulated)	Late 1990	1995	EC	Austria, Denmark, Finland, Germany, Italy, Switzerland	No	Europe
Steel Tube, Seamless	1990	1995	EC	France, Germany, Italy, Japan, UK	No	Europe and "certain third markets"
Sugar	Jun-86	Jul-90	EC	Denmark, Ireland, UK	No	UK
Tampico Fiber	Jan-90	Apr-95	DOJ	Mexico, Netherlands, US	Mexico	US
Thermal Fax Paper	1991	1992	DOJ: 5 Japanese firms pleaded guilty; 1 Japanese firm went to trial and won	Japan, US	No	US
Vitamins	Jan-90	Feb-99	DOJ; <i>Under investigation by EC</i>	Canada, Germany, Japan, Switzerland, US	No	International

Notes to Table 1:

1. Cartel dates are approximate. In particular, indictments of different firms may list different conspiracy dates.
2. Information on "Country(ies) Known To Be Affected" reported in this table comes from DOJ and EC press releases, indictments, and rulings, as well as articles in the press. These documents, of course, focus on the effects in either the United States or Europe. In most cases there is no information from these sources on who purchased from the cartel.
3. Companies appealed, but Court of First Instance confirmed the basic decision, although annulling minor parts of the decision.

TABLE 2
IMPORTANCE OF CARTELIZED PRODUCTS
IN DEVELOPING COUNTRY IMPORTS, 1997¹

	Low Income Countries	Lower Middle Income Countries	Upper Middle Income Countries	
Product	Percent of total imports	Percent of total imports	Percent of total imports	Total Imports by Developing Countries (\$000)
Aircraft	2.10	2.05	2.21	\$25,835,454
Aluminum Phosphide ²	0.05	0.02	0.03	364,793
Carton-board ³	0.13	0.13	0.23	2,202,345
Cement*	0.35	0.10	0.11	1,629,418
Diamonds*	2.86	0.30	0.09	5,756,550
Ferrosilicon ⁴	0.08	0.03	0.09	799,699
Graphite Electrodes ⁵	0.45	0.85	1.17	11,743,334
Methionine ⁶	0.14	0.11	0.15	1,576,979
Natural Gas	0.12	0.58	1.05	9,341,085
Newsprint*	0.22	0.12	0.12	1,600,536
Ship construction ⁷	1.46	0.38	1.51	13,104,961
Steel Heating Pipes ⁸	0.23	0.22	0.48	3,101,856

	Low Income Countries	Lower Middle Income Countries	Upper Middle Income Countries	
Product	Percent of total imports	Percent of total imports	Percent of total imports	Total Imports by Developing Countries (\$000)
Steel Mesh ⁹	0.07	0.09	0.08	953,710
Steel Tubes ¹⁰	0.03	0.02	0.01	247,878
Sugar*	0.24	0.22	0.11	1,990,169
Vitamins*	0.07	0.08	0.07	856,262
Total	8.84	5.29	7.28	81,105,029

Notes to Table 2:

¹ The list of developing countries is taken from *World Development Report 2000/2001: Attacking Poverty* (World Bank), pp. 334-35. As stated on p. 335 “Low income and middle-income economies are sometimes referred to as developing countries.”

² Data include all imports in SITC classification for “inorganic chemicals, not elsewhere classified.”

³ Data include all imports in SITC classification for “boxes, bags, and other containers of paper.”

⁴ Data include all imports in SITC classification for ferroalloys.

⁵ Data include all imports in SITC classification for “other electrical machinery and equipment, not elsewhere classified.”

⁶ Data include all imports in SITC classification for animal feed.

⁷ Data include all imports in SITC classification for “ships, boats, and floating structures.”

⁸ Data include all imports in SITC classification for “other tubes and pipes of iron and steel.”

⁹ Data include all imports in SITC classification for “iron and steel wire.”

¹⁰ Data include all imports in SITC classification for “tubes and pipes of iron and steel.”

* Product is an exact match for SITC classification.

TABLE 3
CARTELIZED PRODUCTS AS A SHARE OF
DEVELOPING COUNTRY GDP, 1997¹

	Low Income Countries	Lower Middle Income Countries	Upper Middle Income Countries	All Developing Countries
Product	Percent of GDP	Percent of GDP	Percent of GDP	Percent of GDP
Aircraft	0.261	0.350	0.463	0.386
Aluminum Phosphide ²	0.006	0.003	0.007	0.005
Carton-board ³	0.016	0.022	0.048	0.033
Cement*	0.044	0.018	0.023	0.024
Diamonds*	0.355	0.05	0.019	0.086
Ferrosilicon ⁴	0.010	0.005	0.019	0.012
Graphite Electrodes ⁵	0.056	0.144	0.246	0.176
Methionine ⁶	0.017	0.018	0.031	0.024
Natural Gas	0.015	0.098	0.221	0.140
Newsprint*	0.027	0.021	0.026	0.024
Ship construction ⁷	0.181	0.065	0.315	0.196
Steel Heating Pipes ⁸	0.059	0.038	0.049	0.046
Steel Mesh ⁹	0.009	0.015	0.016	0.014
Steel Tubes ¹⁰	0.004	0.004	0.003	0.004
Sugar*	0.029	0.037	0.023	0.030
Vitamins*	0.008	0.014	0.014	0.013
<i>Total</i>	1.099	0.902	1.522	1.2121
<i>Total Value of Imports</i>	\$12.0 billion	\$23.4 billion	\$45.7 billion	\$81.1 billion

Notes to Table 3:

¹ The list of developing countries is taken from *World Development Report 2000/2001: Attacking Poverty* (World Bank), pp. 334-35. As stated on p. 335 “Low income and middle-income economies are sometimes referred to as developing countries.”

² Data include all imports in SITC classification for “inorganic chemicals, not elsewhere classified.”

³ Data include all imports in SITC classification for “boxes, bags, and other containers of paper.”

⁴ Data include all imports in SITC classification for ferroalloys.

⁵ Data include all imports in SITC classification for “other electrical machinery and equipment, not elsewhere classified.”

⁶ Data include all imports in SITC classification for animal feed.

⁷ Data include all imports in SITC classification for “ships, boats, and floating structures.”

⁸ Data include all imports in SITC classification for “other tubes and pipes of iron and steel.”

⁹ Data include all imports in SITC classification for “iron and steel wire.”

¹⁰ Data include all imports in SITC classification for “tubes and pipes of iron and steel.”

* Product is an exact match for SITC classification.

TABLE 4
PRODUCTION OF ANHYDROUS CITRIC ACID

Firm Name	Capacity - 1990 (million pounds per year)	Capacity - 1995 (million pounds per year) ⁺	U.S. Capacity - 1999 ^d (million pounds per year)	Cartel Market Share – Global, 1991/1995 (%)*	Cartel Market Share – US and imports, 1991/1995 (%)**	Plant Location(s)
Pfizer/ADM ^a	140	180				US
ADM			200	12 / 8	38 / 29	US, Ireland
Bayer/Haarmann & Reimer	140	150		24 / 14	41 / 24	US, UK, Mexico, Colombia, Brazil
Cargill	55	160	165			US, Brazil
A.E. Staley (a division of Tate & Lyle)			135			US, UK, Mexico, Colombia, Brazil
Jungbunzlauer	132	463		11 / 21	3 / 3	Austria, Germany, France; joint ventures in Indonesia
Bayer	90	160				UK, 3 Latin American affiliates
Hoffmann-La Roche	77 ^b	154		13 / 7	3 / 2	Belgium
Biocor (Italy)	53	88				Italy
Palcitric (Italy)	0	77				Italy
Citurgia Biochemicals						India
China (various companies)	186	535				China
Aktiva	0	66				Czech Republic
Godot Israel	20 ^b	40 ^b				Israel

Firm Name	Capacity - 1990 (million pounds per year)	Capacity - 1995 (million pounds per year) ⁺	U.S. Capacity - 1999 ^d (million pounds per year)	Cartel Market Share – Global, 1991/1995 (%)*	Cartel Market Share – US and imports, 1991/1995 (%)**	Plant Location(s)
World Capacity, except for former USSR	877	2,230				
World consumption ^b	850	1,560				
Europe consumption ^b	339	555				
U.S. consumption estimates ^b	300	475				
U.S. exports ^b	17	52				
U.S. imports ^b	65	125				
<i>TOTAL CARTEL CAPACITY MARKET SHARE 1991 / 1995</i>				60 / 50	85 / 58 ^c	

Notes for Table 4:

⁺The numbers in the first two columns are from Connor, Table 1. There are always differences in estimates of capacity. For example, a 1994 *Chemical Marketing Reporter* article "Citric Acid Market Grows with 'New Age' Drink Sales" contains different estimates for U.S. production capacity: ADM is reported at 180 million pounds instead of Connor's 140, Haarmann & Reimer at 150 (same as Connor), and Cargill at 130 instead of Connor's 160.

*Global market share based on capacity. (Connor)

**US market share based on US production capacity plus imports. (Connor)

^a ADM acquired Pfizer's North Carolina plant in December 1990, and Pfizer continued to supply citric acid from its Groton plant until mid-1993 when the plant was closed. (Connor, p. 22)

^b Estimate by Connor (Connor, p. 23)

^c Connor estimates that the cartel's share of U.S. capacity and imports in 1991 was 85% and by 1995 was 58%. The cartel's market share of U.S. production and imports in 1991 was 55% and by 1995 was 60%. (Connor, p. 26)

1999

^d *Purchasing Magazine* September 7, 2000.

TABLE 5**CITRIC ACID: CARTEL MEMBERS AND GOVERNMENT FINES**

Firm Name or Region	Cartel Participant	Fine
ADM (U.S.)	Yes	\$30m (DOJ); \$2m (Canada)
Bayer/Haarmann & Reimer (Germany/U.S.)	Yes	\$50m (DOJ); \$4.7m (Canada)
Cargill (U.S.)	No	
Jungbunzlauer Intl. AG (Switzerland)	Yes	\$11m (DOJ); \$1.9m (Canada)
Hoffmann-La Roche (Switzerland)	Yes	\$14m (DOJ)
Cerestar Bioproducts BV (Dutch subsidiary of the French agricultural products firm Eridania Beghin-Say SA)	Yes	\$400,000 (DOJ)

TABLE 6**GRAPHITE ELECTRODES: CAPACITY AND MARKET SHARES OF MAJOR FIRMS**

Firm Name	U.S. Market Share (at time of conspiracy, as reported by DOJ)	World Market Share (current, as stated in Ferromin complaint)	Location(s)
UCAR	34%	31%	Worldwide
SGL	23%	27%	Worldwide
Carbide/Graphite Group	18%	6%	US
Showa Denko	18%	6%	Japan and US
Tokai Carbon	1%	11%	Japan
SEC Corp		5%	Japan
Nippon Carbon		4%	Japan

TABLE 7

GRAPHITE ELECTRODES: CARTEL MEMBERS AND GOVERNMENT FINES

Firm Name	Fine
UCAR	\$110m (DOJ), \$11m (Canada)
SGL	\$135m (DOJ), \$12.5m (Canada)
Carbide/Graphite Group	Granted leniency (DOJ)
Showa Denko	\$32.5m (DOJ)
Tokai Carbon	\$6m (DOJ)
SEC Corp	\$4.8m (DOJ)
Nippon Carbon	\$2.5m (DOJ)

TABLE 8
WORLDWIDE OCTG PRODUCERS

Corporate Name	Location(s) (of seamless or OCTG goods only)	Cartel Participant	Market Share
<i>Grupo DST (Techint)</i>			25% of world market 1,730,000 tons of seamless tubes in 1999-2000 fiscal year
NKK (allied with DST)	Japan	Yes	
Dalmine (part of DST group) Formerly owned by Ilva SpA	Italy	Yes	
Siderca (part of DST group)	Argentina	No	
Tamsa (part of DST group)	Mexico	No	
NKKTubes (joint venture of NKK and Siderca)			
Algoma Seamless Tubulars	Canada	No	
<i>Vallourec-Mannesmann Alliance</i>			
Mannesmann AG			
Mannesmann Rohren-Werke	Germany	Yes	
Mannesmann Handel	Germany	Investigated, but not fined	Now owned by Thyssen
Mannesmann SA Brazil	Brazil		
Vallourec	France	Yes	

Corporate Name	Location(s) (of seamless or OCTG goods only)	Cartel Participant	Market Share
Vallourec & Mannesmann Tubes (V&M Tubes or V&M do Brasil, joint venture of Mannesmann and Vallourec)	Brazil	No	
Europipe	Germany and France (US)	Investigated, but not fined	Welded gas line producer, jointly owned by Mannesmann, Usinor, and Corus to whom they transferred their large diameter welded tube producing business
Thyssen Stahlunion	Germany	Investigated, but not fined	Owns small share of Mannesmann Ruhrenwerke
<i>“Japanese” Alliance</i>			
Kawasaki	Japan	Yes	
Nippon Steel	Japan	Yes	
Sumitomo Metal (Sumitomo Deutschland)	Japan	Yes	
Sandvik Steel	Sweden (US, UK, Canada, Czech, France, Germany)	No	Very small; sells stainless steel seamless tubes, which it has marketed to the oil industry since 1990
Corus (formerly British Steel)	UK	Yes	0 (exited market in 1994)

TABLE 9**VITAMINS: MAJOR CARTEL MEMBERS AND GOVERNMENT FINES**

Firm Name	Vitamin Conspiracy	Fine	Comment
Chinook Group Limited (Canada)	B4	\$5 million (DOJ), \$2.25 m (Canada)	
F. Hoffmann-La Roche (Switzerland)	Various	\$500m (DOJ); C\$50.9m (Canada)	A, B2, B5, C, E, beta carotene, vitamin premixes
BASF Aktiengesellschaft (Germany)	Various	\$225m (DOJ); C\$19m (Canada)	A, B2, B5, C, E, beta carotene, vitamin premixes
Takeda Chemical Industries Ltd (Japan)	Various	\$72m (DOJ)	
Eisai Co Ltd (Japan)	Various	\$40m (DOJ); \$2m (Canada)	
Daiichi Pharmaceutical Co., Ltd. (Japan)	Various	\$25m (DOJ); \$2.5m (Canada)	
Lonza AG (Switzerland)	Various	\$10.5m (DOJ)	
Rhone-Poulenc SA (France)	Various	\$0 (DOJ); \$14m (Canada)	Granted leniency (DOJ)
Merck KGaA (German)	C	\$14m (DOJ)	At least in early 1991-Fall 1995
Degussa-Hüls AG (German)	B3	\$13m (DOJ)	As early as Jan 1992 until March 1998
Nepera Inc. (U.S.)	B3	\$4m (DOJ)	Jan 1992 until July 1995
Reilly Industries Inc. (U.S.)	B3	\$2m (DOJ)	Sept. 1994 until conspiracy ended in March 1998

TABLE 10**CANADIAN PROSECUTION OF VITAMINS CARTEL**

Vitamin	Conspiracy Period	Cartel Participants
A	Jan 1990 - Feb 1999	BASF, HLR, R-P
E	Jan 1990 - Feb 1999	BASF, HLR, R-P, Eisai
B2	July 1991 - Fall 1995	BASF, HLR, Takeda
B4	1992 - June 1995	BASF, Bioproducts Inc (subsidiary of Mitsui & Co, USA), Chinook Group Ltd (Toronto), DuCoa (division of DCV Inc, USA), Akzo Nobel Chemical BV (Netherlands), UCB S.A. (Belgium),
B5	Jan 1991 - Dec 1998	BASF, HLR, Daiichi
C	Jan 1991 - Fall 1995	BASF, HLR, Takeda, Merck
Beta-carotene	Fall 1991 - Dec 1998	BASF, HLR
Premixes	1991 - Dec 1997	BASF, HLR

FIGURE 1

Semi-Annual Bromine Prices, 1990-2000

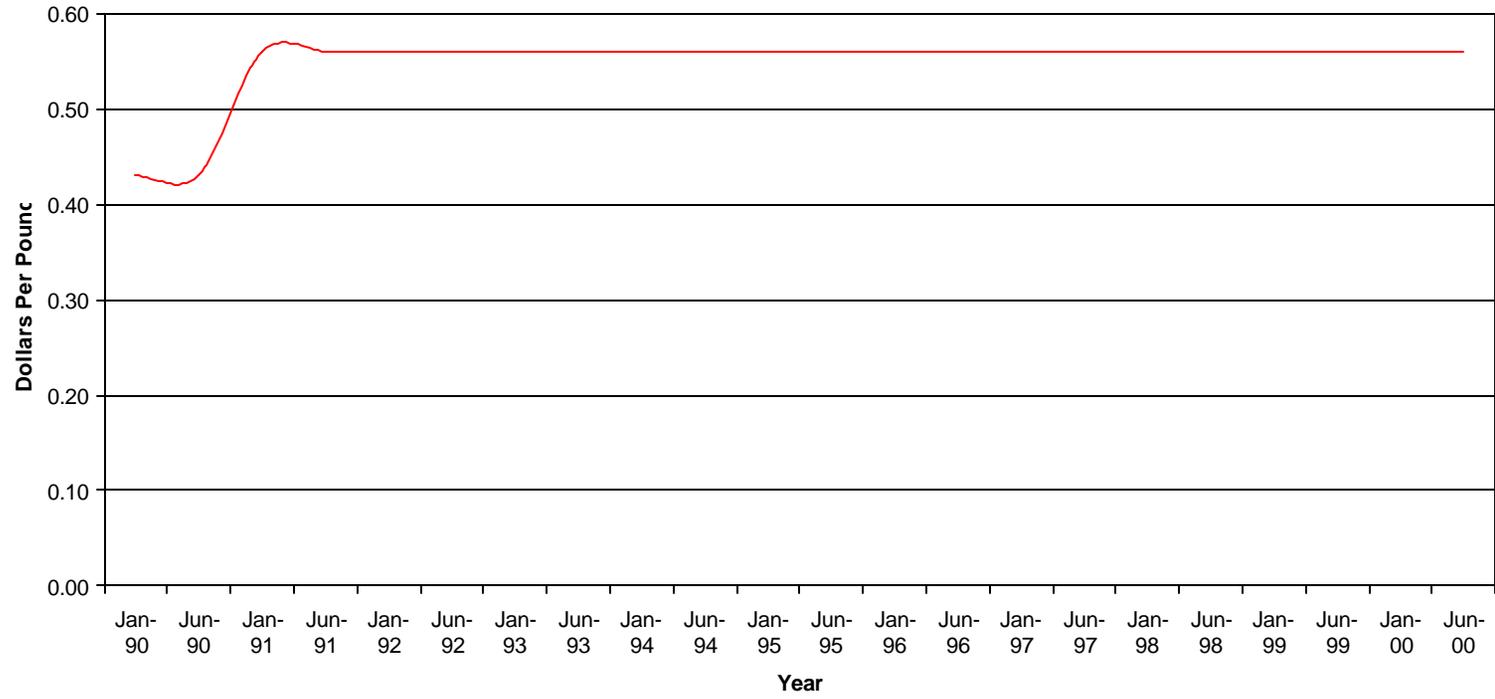
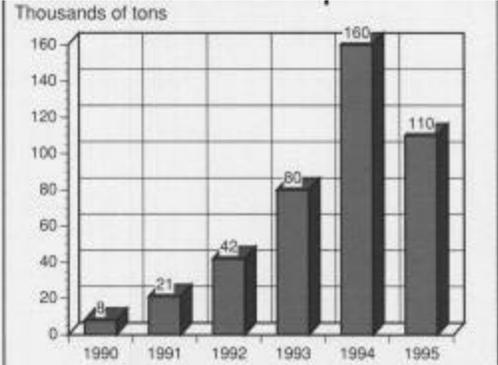


FIGURE 2

CHINESE CITRIC ACID EXPORTS

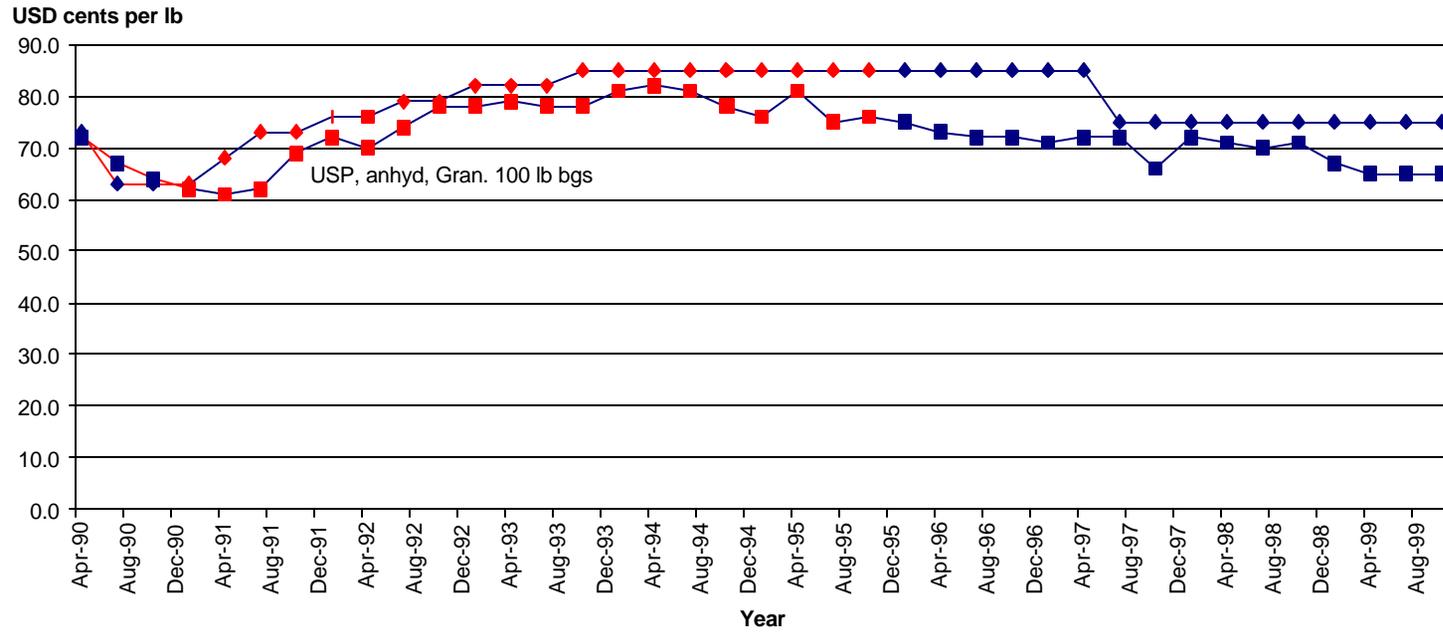


Source: Eric Sfiligoj, "The China Syndrome," *Beverage World*, April 1996.

FIGURE 3

Citric Acid Prices, 1990 - 1999
(Cartel: 1991 - 1995)

Comparison: CMR v PM Spot Avg Price



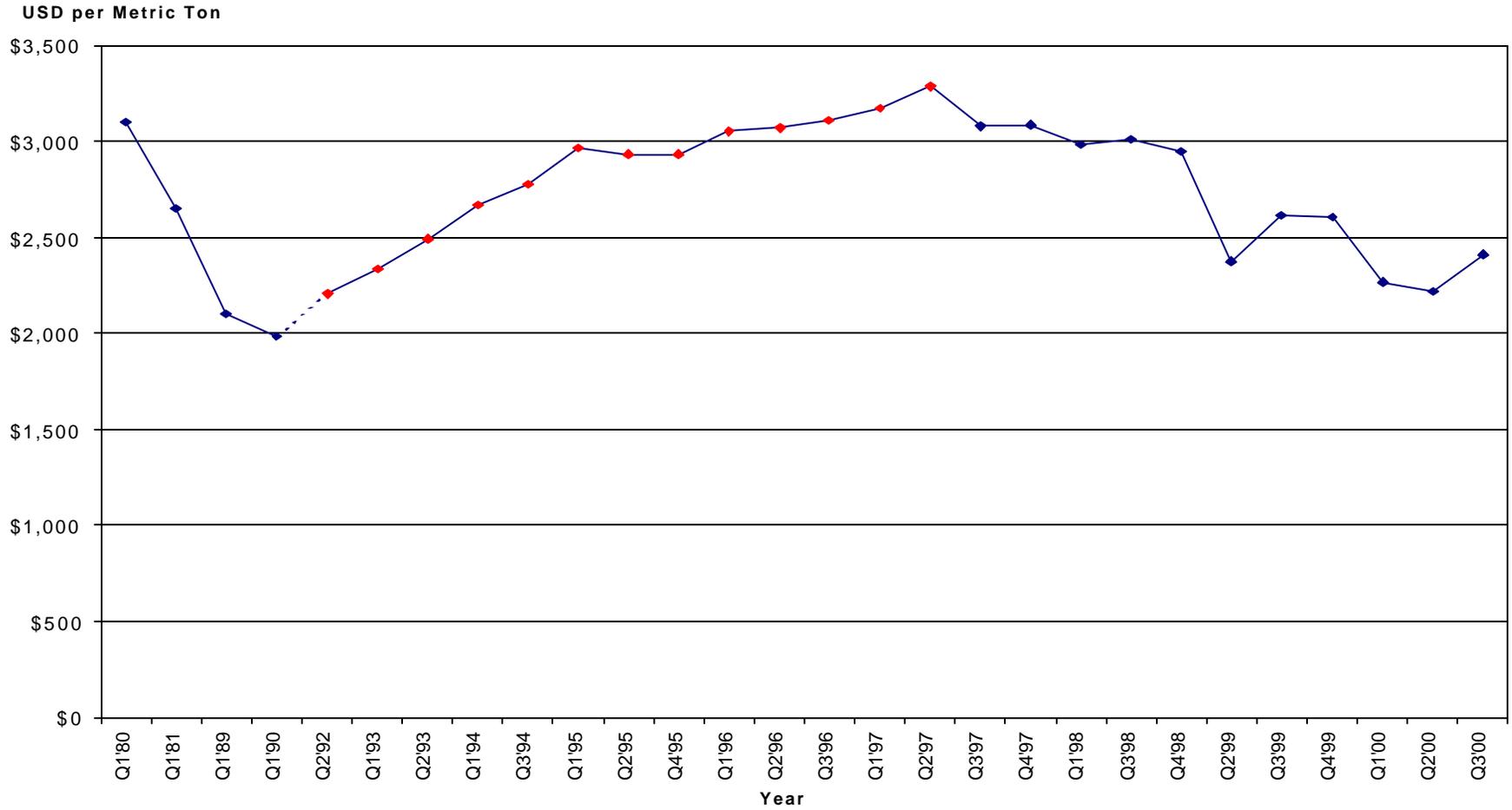
Sources: Chemical Market Reporter (CMR), Purchasing Magazine (PM)

—◆— CMR Price —■— PM Spot Avg Price

Cartel years indicated in red.

FIGURE 4

Graphite Electrode Prices, 1980 - 2000
(Cartel: July 1992 - June 1997)



Cartel years indicated in red.

FIGURE 5

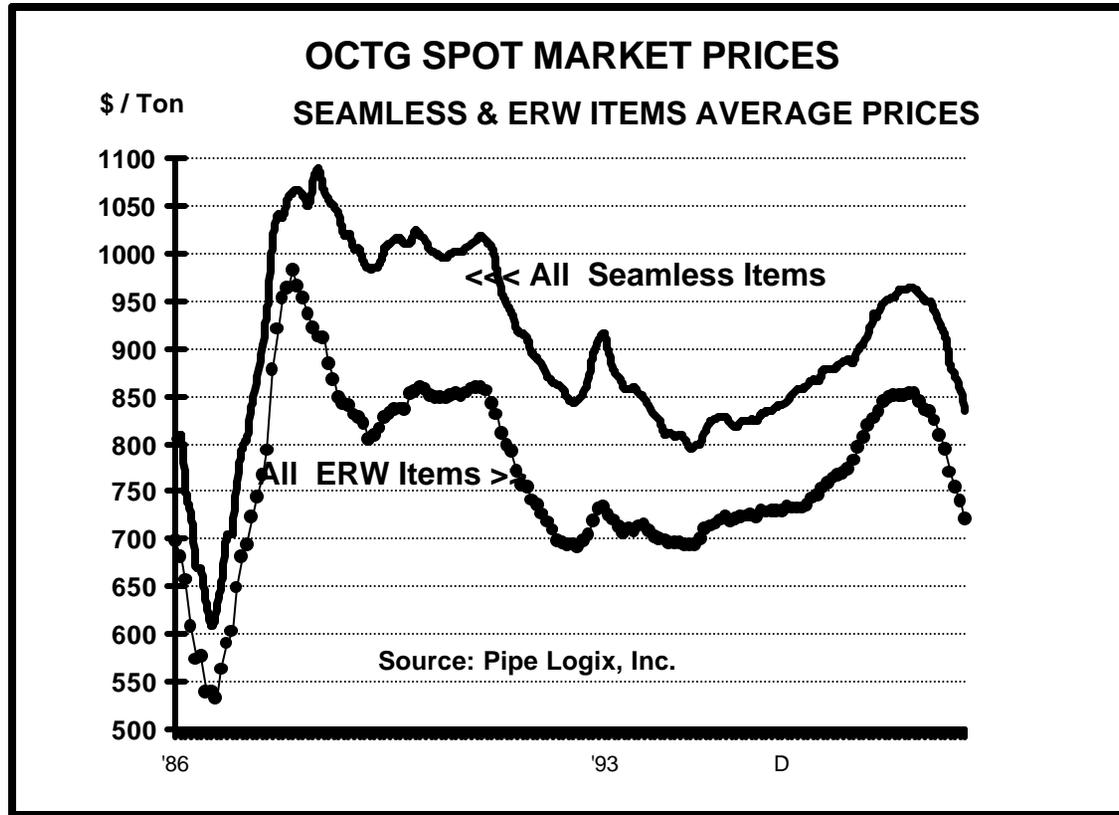


FIGURE 6

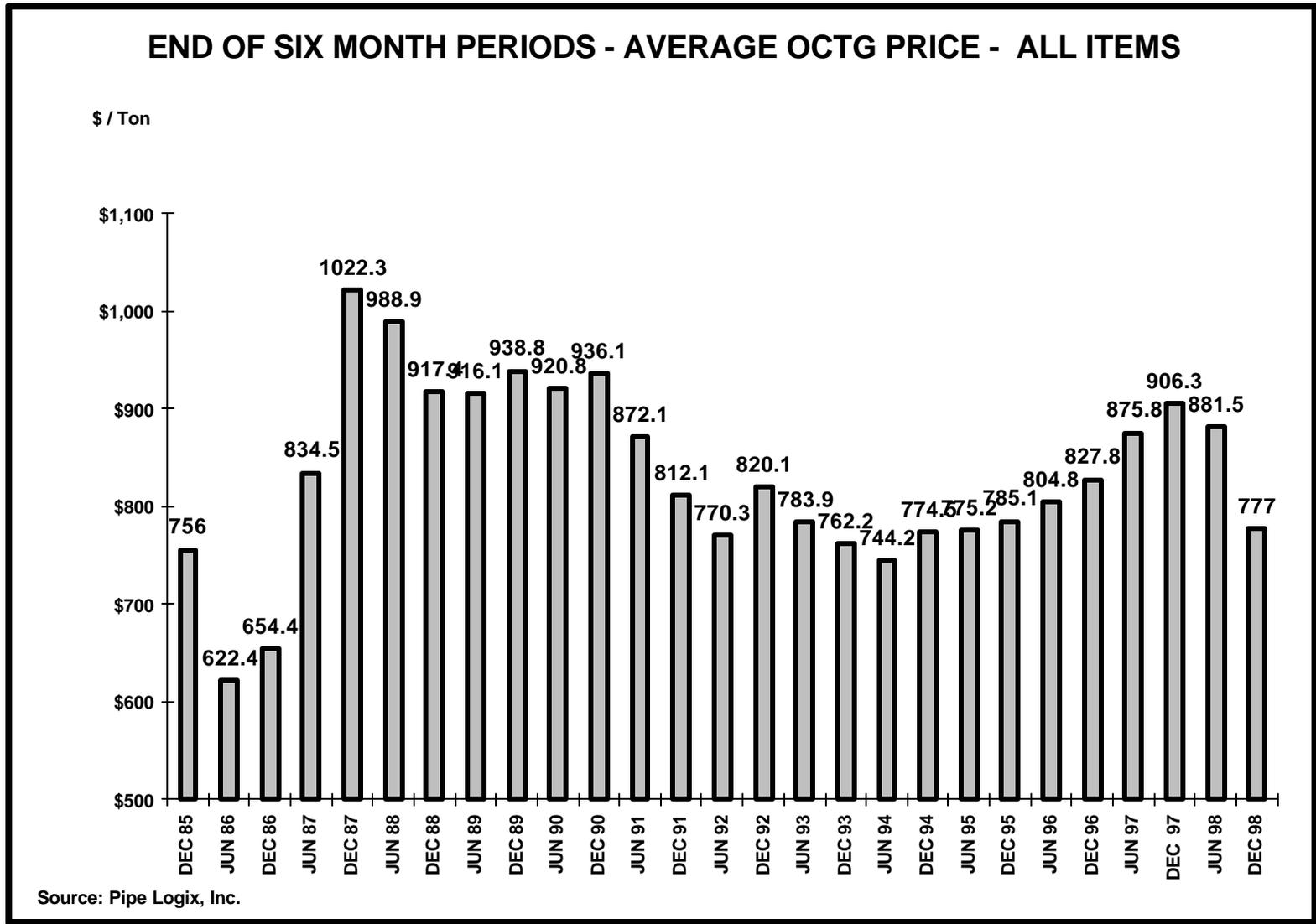


FIGURE 7

Steel Tube Exports by Developing Countries

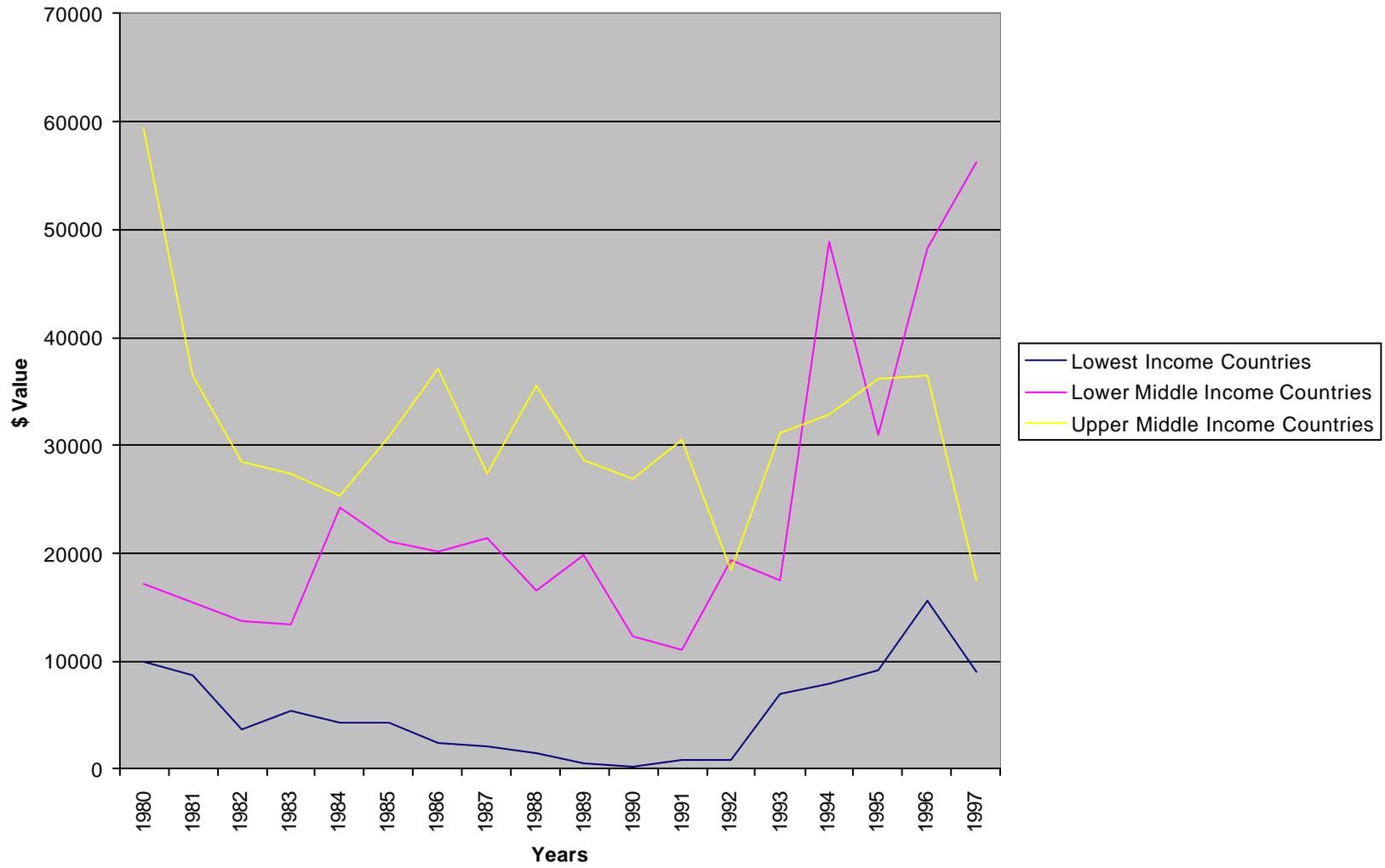


FIGURE 8

Steel Tube Imports by Country Category

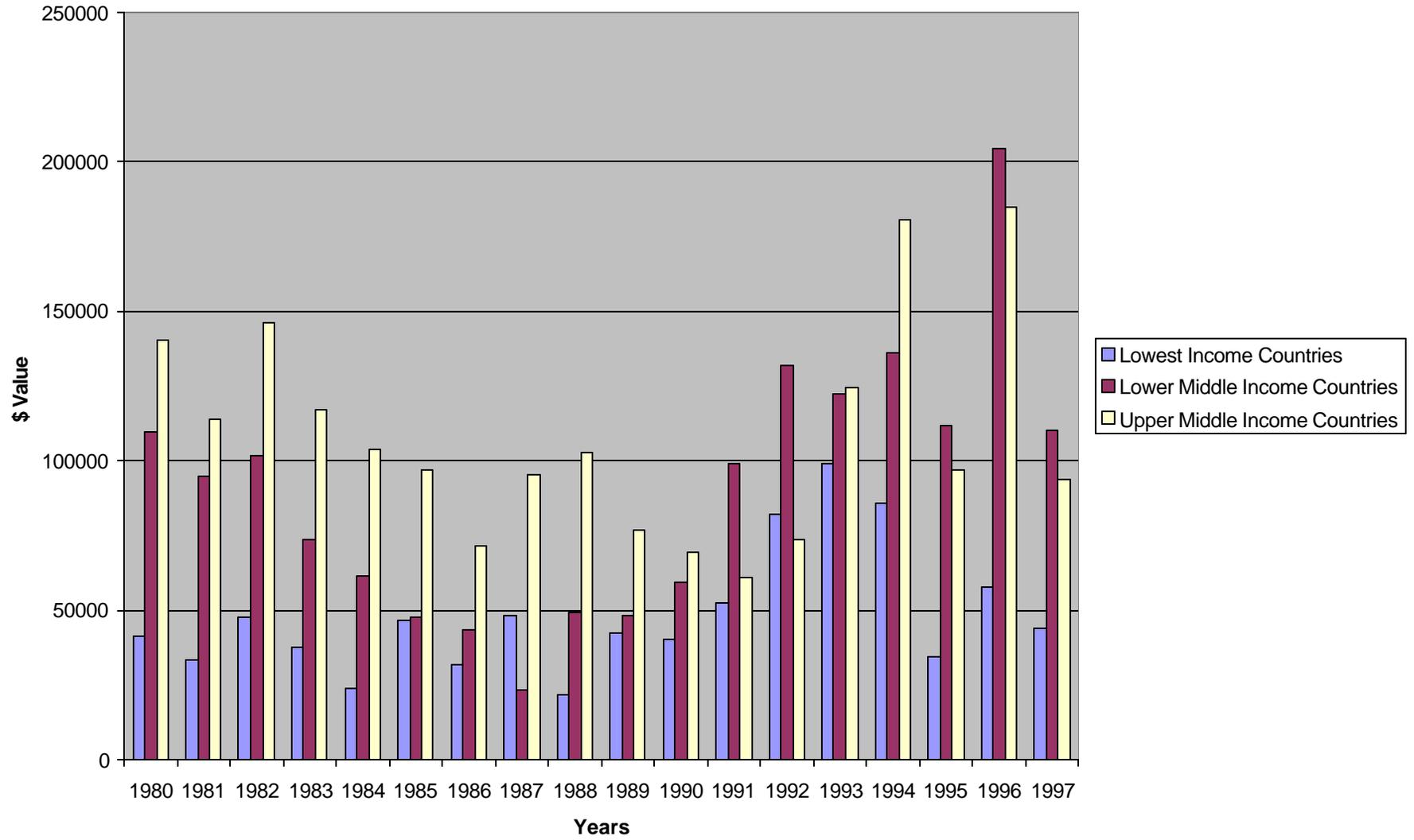


FIGURE 9

Cartel Share of Steel Tube Exports

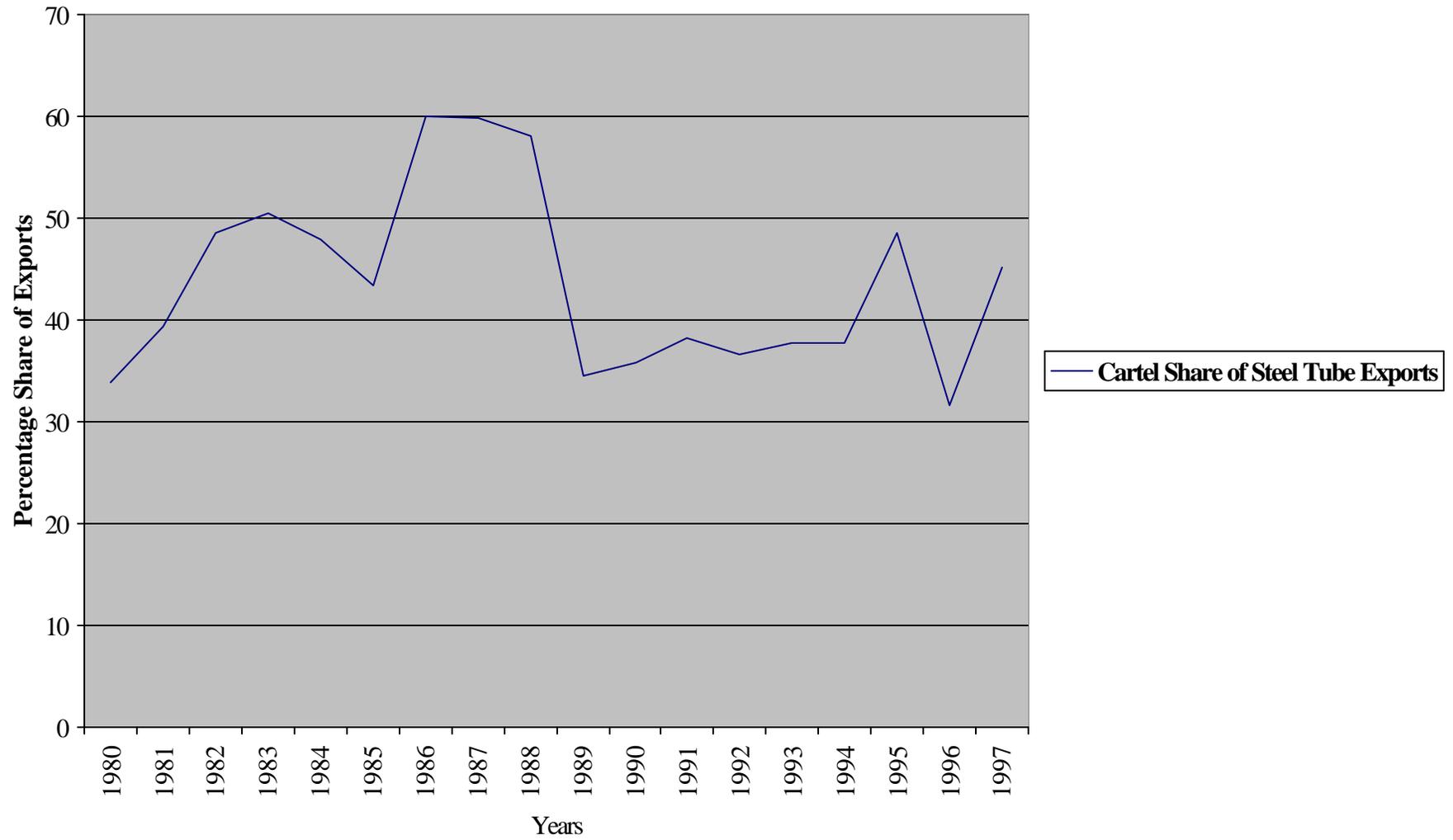
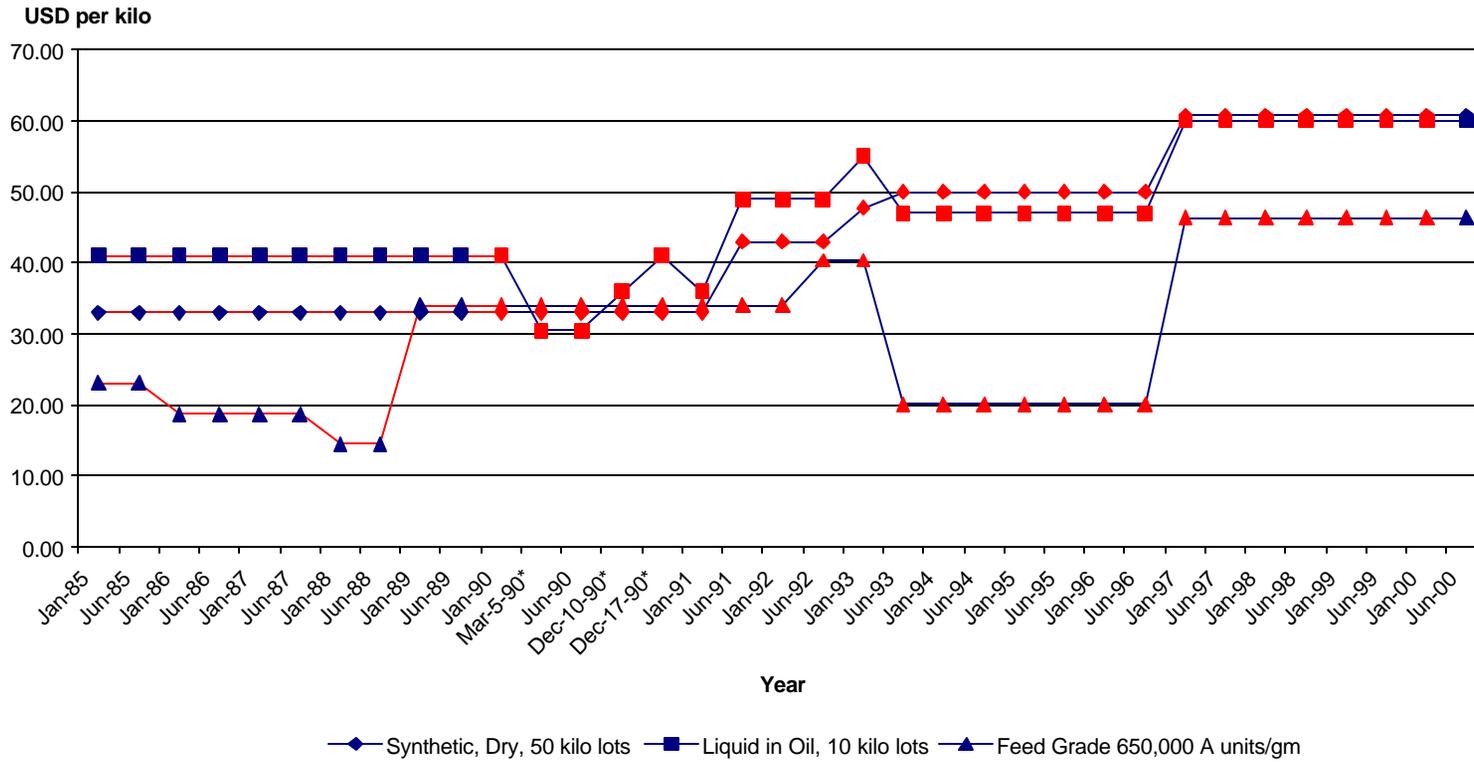


FIGURE 10

Vitamin A Prices, 1985 - 2000
(Cartel: 1990 - 1999)

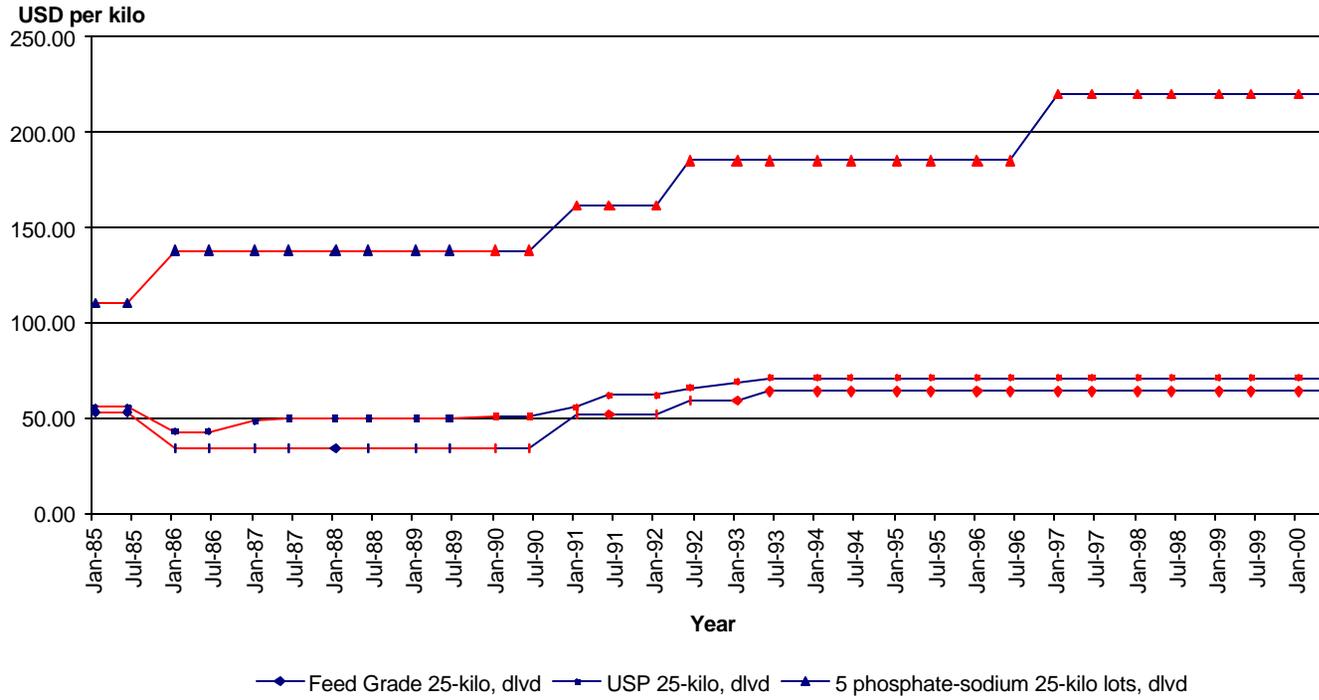


*Units reported by CMR for liquid oil change on March 5, 1990 and then changed back to original units as of December 17, 1990.

Cartel years indicated in red.

FIGURE 11

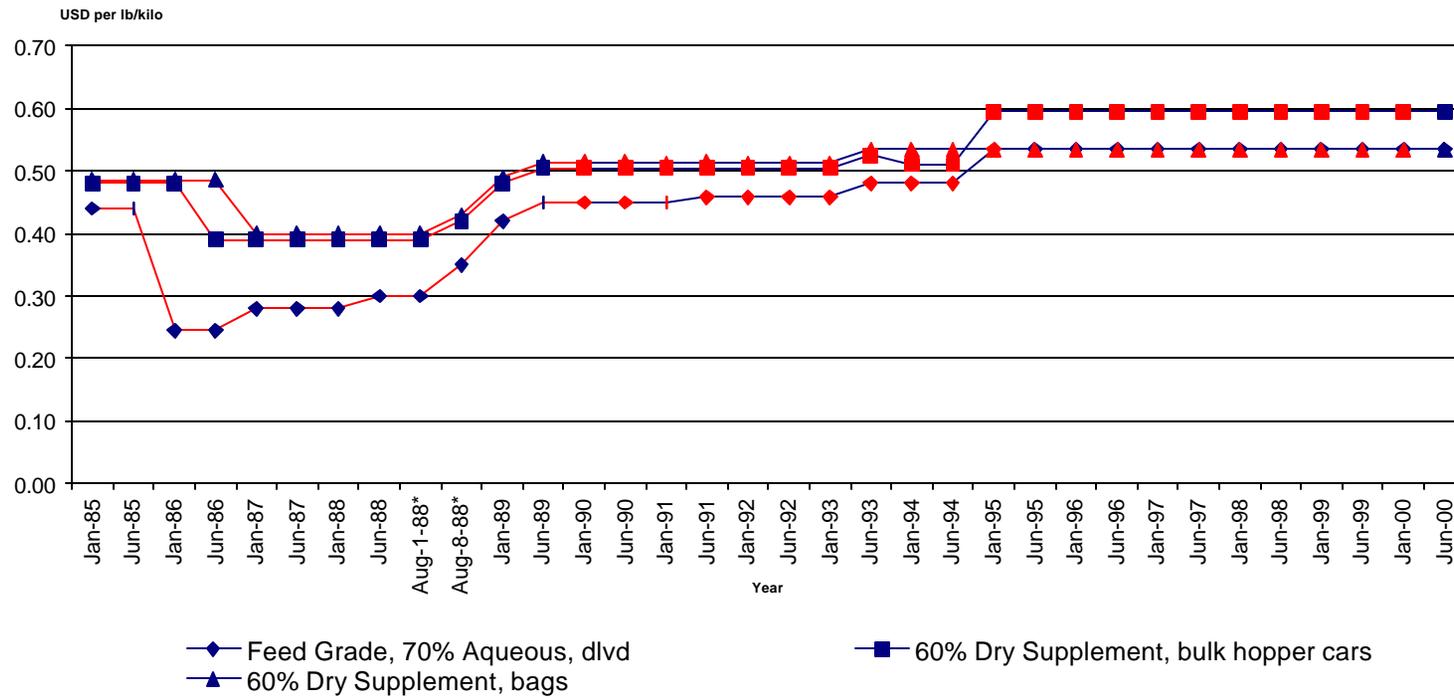
Vitamin B2 Prices, 1985 - 2000
(Cartel: 1990 - 1999)



Cartel years indicated in red.

FIGURE 12A

Vitamin B4 Prices, 1985 - 2000
(Cartel: 1990 - 1999)

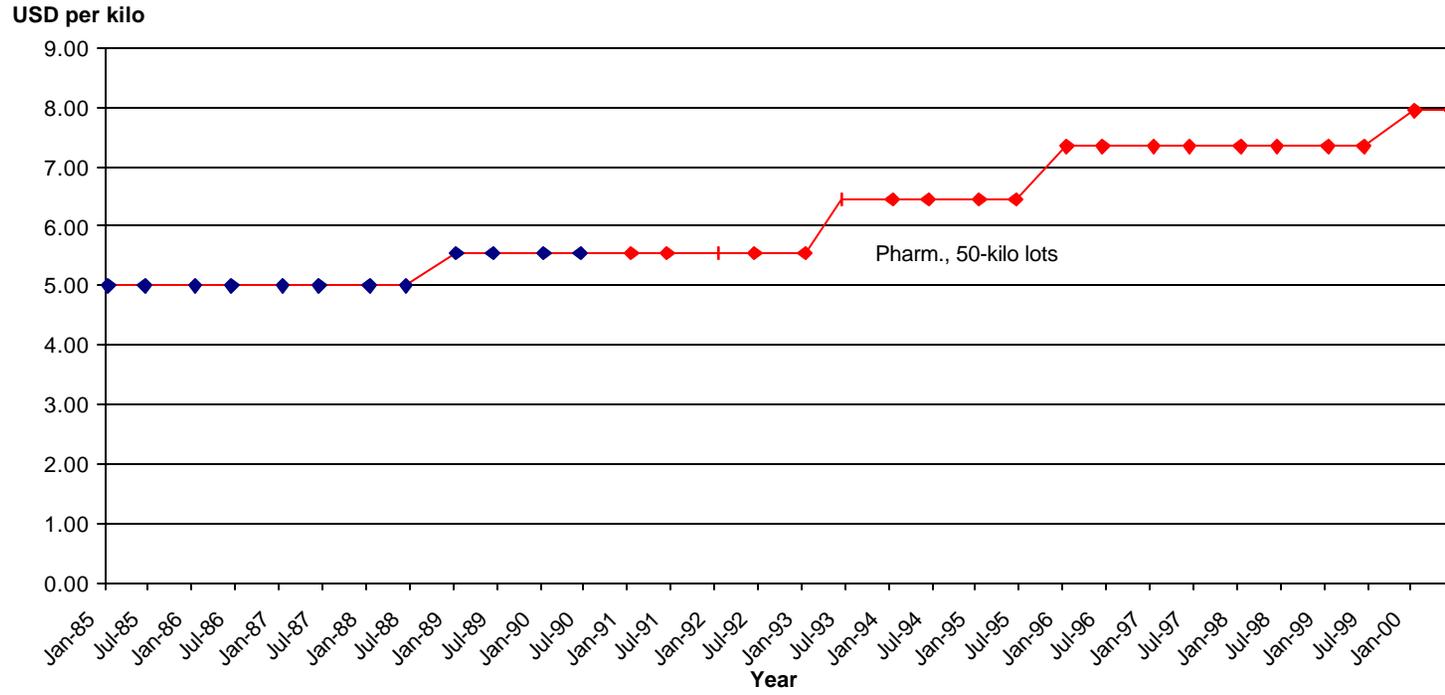


*Units reported by CMR changed on August 8, 1988 for 60% dry supplement from bags of 50,000 lbs. minimum, to bags of 40,000 lbs. min.

Cartel years indicated in red.

FIGURE 12B

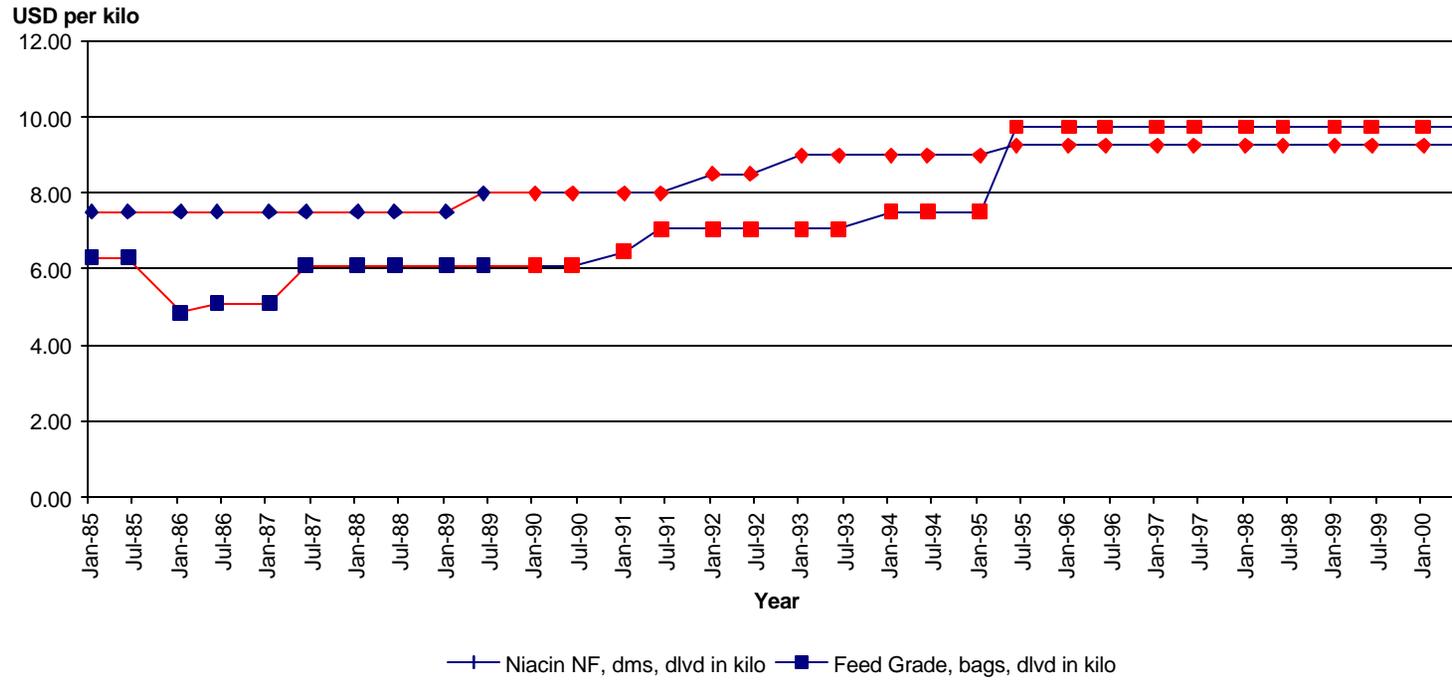
Vitamin B4 Prices, 1985 - 2000
(Cartel: 1990 - 1999)



Cartel years indicated in red.

FIGURE 13

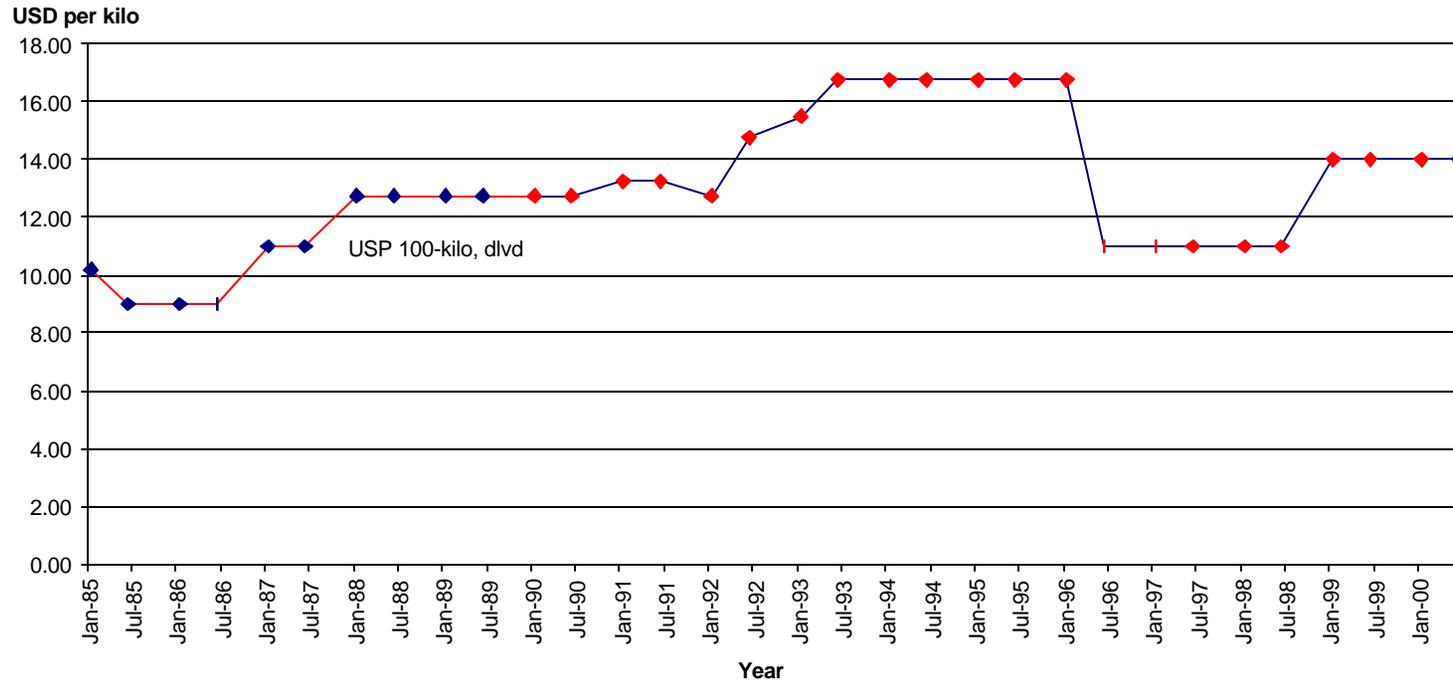
Vitamin B3 Prices, 1985 - 2000
(Cartel: 1990 - 1999)



Cartel years indicated in red.

FIGURE 14

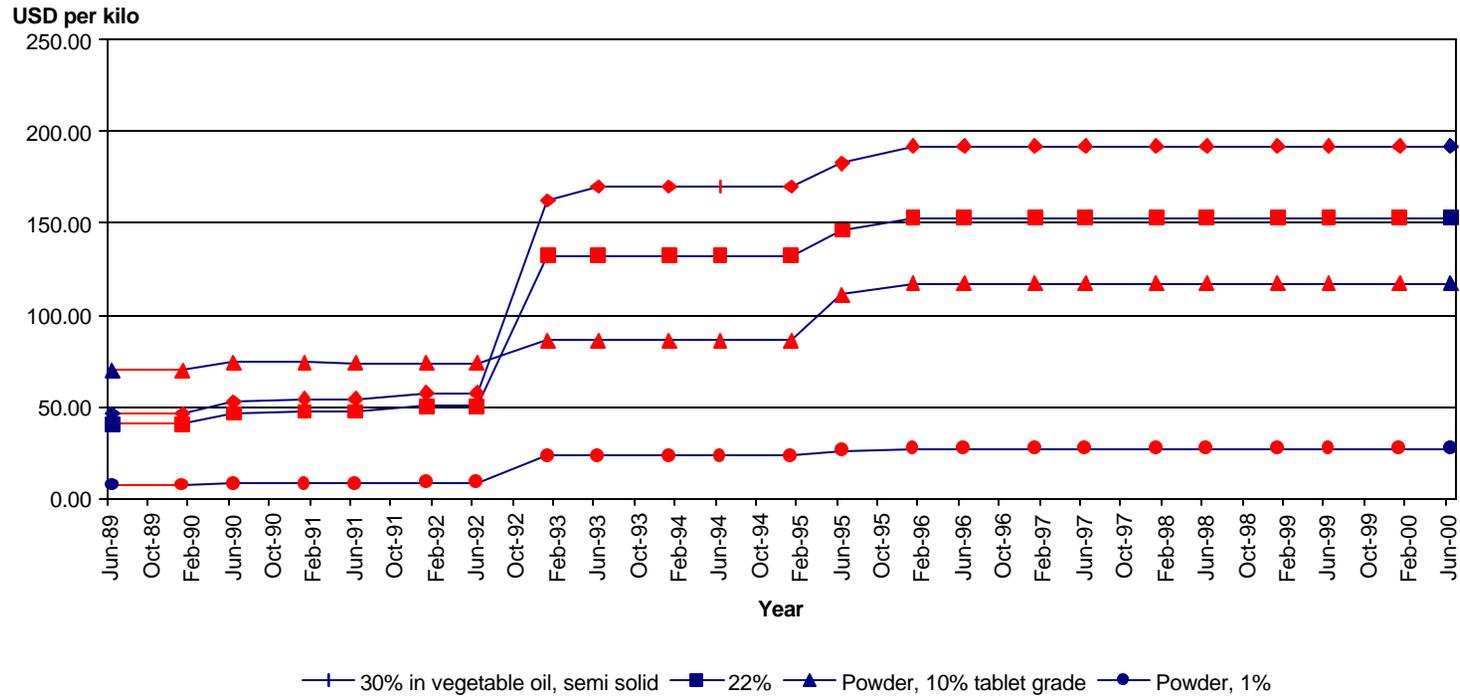
Vitamin C Prices, 1985 - 2000
(Cartel: 1990 - 1999)



Cartel years indicated in red.

FIGURE 15

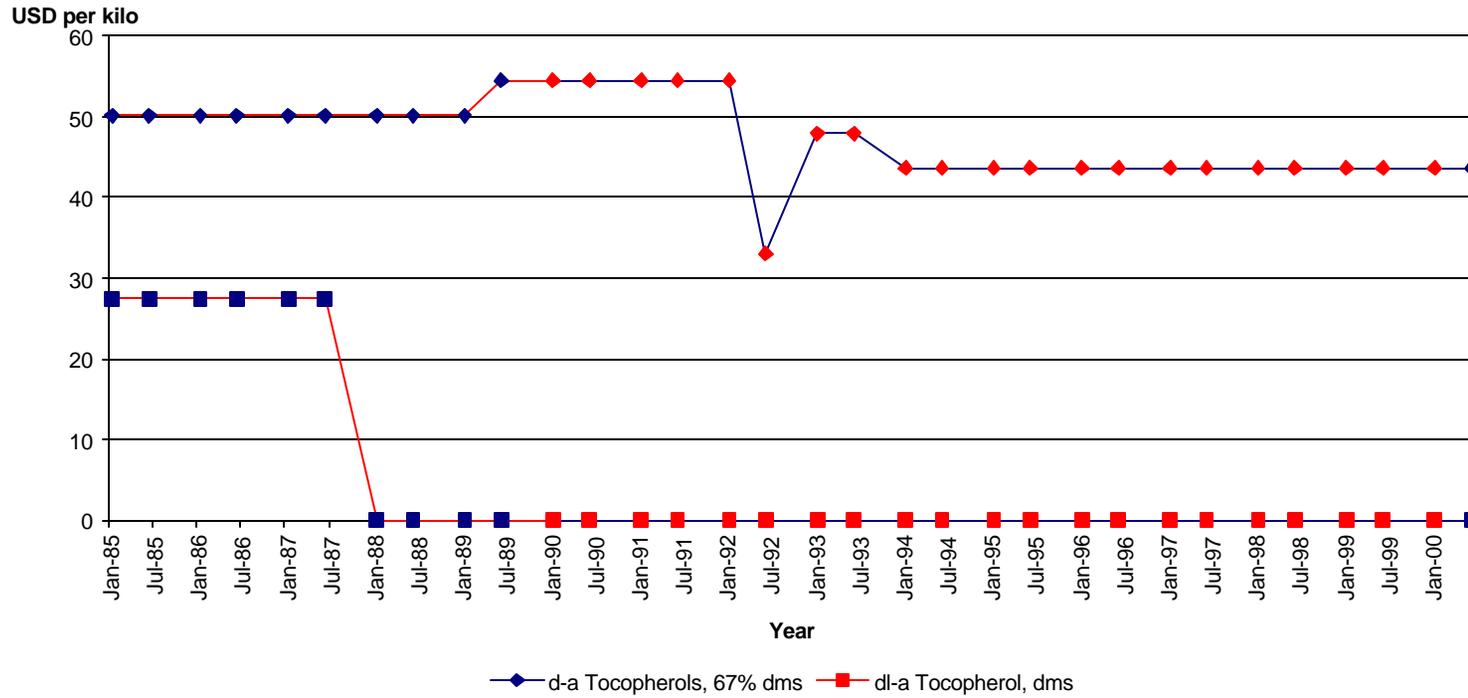
Beta-Carotene Prices, 1989 - 2000
(Cartel: 1990 - 1999)



Cartel years indicated in red.

FIGURE 16

Vitamin E Prices, 1985 - 2000
(Cartel: 1990 - 1999)



**dl-a Tocopherol price series is discontinued in 1988.*

Cartel years indicated in red.

APPENDIX

Description of Data Sources

Worldwide import and export data were obtained from the Center for International Data at the University of California at Davis: *World Trade Flows, 1980-1997, with Production and Tariff Data*, compiled and edited by Robert Feenstra. The data include trade flows (imports and exports) by Standard International Trade Code (second revision) and by country. The data include only trade in goods. Each of the goods in Table 1 was matched to its corresponding SITC code. We were able to obtain data for the following products:

PRODUCT	PRODUCT DESCRIPTION (WORLD TRADE FLOWS DATA)	SITC CODE
Aircraft	Aircraft and Associated Equipment and Parts	792A
Aluminum Phosphide	Inorganic Chemical Products Not Elsewhere Classified	5239
Carton-board	Boxes, Bags and Other Packing Containers of Paper, Paperboard	6421
Cement	Portland Cement, Slag Cement, etc.	6612
Diamonds	Diamonds	6672
Graphite Electrodes	Other electrical machinery and equipment	7788
Ferrosilicon	Ferro - Alloys	6716
Marine Construction	Ships, Boats and Other Floating Structures	793A
Methionine	Food , Wastes and Prepared Animal Feed	0819
Natural Gas	Natural Gas	341A
Newsprint	Newsprint	6411
Steel Heating Pipe (pre-insulated)	Other Tubes and Pipes of Iron and Steel	6783
Steel Mesh	Iron and Steel Wire Products	6770
Steel Tubes	Tubes of Iron and Steel	6781
Sugar	Sugar	0611
Vitamins	Vitamins	5411

For the goods listed below, the matching SITC codes yielded zeros for the corresponding trade data in every year.

Product	SITC code
Citric Acid	5139
Explosives	572A
Lysine	5146
Pigments	5311
Plastic Dinnerware	8933

For the following products no suitable SITC match could be found. These products were excluded altogether from the analysis.

Product
Maltol
Soda Ash
Sodium Erythorbate
Sodium Gluconate
Sorbates
Tampico Fiber
Thermal Fax Paper
Cable-Stayed Bridges

Countries that were formerly part of the Soviet Union are conspicuous by their absence from *World Trade Flows*. Thus the data on imports, exports, and GDP presented here simply exclude those developing countries that were formerly part of the Soviet Union. There are also cases where *World Trade Flows* grouped smaller countries together (especially smaller island countries). We do not believe that this leads to any substantial misclassification in the data presented here. Countries are categorized according to the World Bank's (2000) classification of lower income countries, lower-middle income countries and upper-middle income countries. Gross Domestic Product figures are calculated from World Bank data (www.worldbank.org/data/countrydata/countrydata.html). The World Bank provides detailed data on its website with country specific statistics. The figures for total GDP by country categories are based on the same set of countries as those in the *World Trade Flows* sample.

The information presented in Table 1 on individual cartels was gathered from various industry and government sources including:

- 1) The US Department of Justice (www.usdoj.gov/atr) which lists legal and public documentation for all specific companies, their country of origin and individuals charged with price fixing in the United States since the early 1990's.
- 2) The European Court of Justice (<http://europa.eu.int/cj>) , which contains legal documentation for violation of European laws of competition (article 84 in the charter). It lists the companies involved and countries of origin.
- 3) Industry and Business News, such as:

American Metal Market
Chemical Marketing Reporter
EU Business
European Business Week
International Cement Magazine
News Line
Oil and Gas Journal
Rocks and Mineral Market
Wall Street Journal