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WHAT CAN WE LEARN FROM THE ADM GLOBAL PRICE CONSPIRACIES?

by

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Abstract

ADM was at the center of two large global price-fixing conspiracies. Buyers were overcharged $116 to $378 million in the United States. Market structure and corporate management style facilitated these cartels. The criminal prosecutions and defendants' legal strategies were both laudatory, but civil plaintiffs were short-changed. ADM has undergone severe management restructuring, but the effectiveness of apprehending global cartels with national legal enforcement is questionable.

Keywords: Price fixing, global cartel, antitrust, citric acid, market structure, structural change, lysine, international trade, Archer Daniels Midland Co., welfare analysis

Outline

Introduction

The development of extensive industry case studies from court records was the first empirical method utilized by the new branch of economics called industrial organization. Beginning in the early 1930s, Chamberlin, Mason, and other Harvard economists encouraged their students to verify the usefulness of the emerging Structure - Conduct - Performance (SCP) paradigm by exploiting the typically extensive court records generated by major federal antitrust cases. Most of these early industry studies dealt with questions of monopolization or mergers. By the mid 1950s, as several of these cases were revisited by the second generation of IO economists, considerable disenchantment had set in because the hoped-for generalizations from cross-industry comparisons were not forthcoming. Bain's (1951) pioneering statistical testing soon became the most preferred method of empirical analysis in IO. While case studies never disappeared from the IO literature, they tended to be reserved for certain narrow applications such as explanations of structure-behavior relationships, the evolution of industry trade practices, and legal-economic studies.

I detect a resurgence of interest in case studies in the mid 1990s among empirical IO economists. Partly, this trend may be due to the reappraisal of the usefulness of the conjectural-variation (NEIO) studies that comprised a substantial share of the empirical IO work of the late 1980s. The NEIO approach represented an advance on SCP methods in that the gap between price and economic costs (the Lerner Index) is endogenously estimated from observed prices and outputs. One disadvantage of such studies is that the researcher must impose a structure or mode of conduct on the model *a priori*. "In the end, one cannot be sure whether the observed gap is generated by the game, is a consequence of the imposed *a priori* structure, or stems from measurement or mis-specification problems," (Azzam and Anderson 1996:44). NEIO models can only distinguish between industries composed of price-taking firms and those that set prices; the models do not identify the determinants of the price-cost gap, and thus are not useful in practical competition-policy settings.

Another reason for the renewed attention being given case studies is the magisterial study of the food industries given in Sutton's (1991) book. Like the earlier SCP tradition, Sutton engages in a cross-sectional comparison of industry histories in order to confirm a maintained hypothesis. However, his choice of industries and method of comparison was more strictly guided by formal theory. Sutton's example is likely to inspire a raft of case studies with greater use of quantitative sources and logical rigor.

The purpose of this paper is to present new information on the world citric acid industry, focusing on the period during which the four largest manufacturers have admitted to fixing the product's price worldwide. In particular, I hope to draw a number lessons from the study for structure-conduct relationships, consumer welfare impacts, corporate organization, and the effectiveness of the Sherman Act in deterring collusive behavior. While this study concentrates on citric acid, ADM was also at the center of a contemporaneous conspiracy to fix the prices of lysine. The lysine case was recently published (Connor 1997) and will serve as a model for the present case. Frequent comparisons will be made between lysine and citric acid.

The Market for Citric Acid

Citric acid is an acidulent, a class of additives that serve several functions: sterilization, bacteriological stabilization, flavor fixation, flavor enhancement, and standardization of acid levels. Acidulents may be chemically extracted from vegetable matter, synthesized, or produced from starches by fermentation. Approximately two-thirds of all synthetic or biotech acidulents are added to foods and beverages, and most of the remainder in detergents.(1) Although there are many acidulents (phosphoric, malic, fumaric, tartare, lactic, and others), citric acid accounts for more than 80 percent of the value of the U.S. market for acidulents. In some products, different kinds of acidulent are substitutable. Citric acid is sold in either liquid or anhydrous forms. The dry forms consist of sodium citrate, potassium citrate, or other salts of citric acid. Liquid acid is sold mixed with some water, but prices are always quoted in anhydrous-equivalents. Liquid forms are generally food-grade, usable in beverages and processed foods of all kinds. Citric salts are ideal for non-food industrial uses such as detergents where purity standards are not as high as for food uses.

In the 19th century and early 20th century, citric acid was produced chemically by treating calcium citrate, a by-product of citrus processing. In the early 20th century, citric acid production was an Italian monopoly. Widespread neglect of Italy's lemon groves during WWI caused citric acid prices to rise to very high levels through the 1920s. However, basic research on a mould (*Aspergillus niger*) published by J.N. Currie in 1917 revealed that copious amounts of citric acid were generated by the mould grown in a liquid mixture of sucrose, salts, and iron. Currie worked with Chas. Pfizer, Inc., a Brooklyn, New York chemical company, to develop large-scale production methods. Commercial production began in 1923.(2) This technology spread to England, Germany, Belgium, and Czechoslovakia in the 1930s with beet sugar molasses as the feedstock. After 1945, improvements involved superior yeast strains and the use of glucose bases. By the 1970s, many small-scale Asian factories were producing citric acid using molasses, cassava, or sweet potatoes.

About four-fifths of the demand for citric acid is derived from the beverage and food industries. While phosphoric acid is added to some strongly flavored soft drinks, citric acid is favored in lighter flavored soft drinks and in some alcoholic beverages. In the 1970s in the United States and a bit later in Europe, citric salts were in great demand by the detergent industry as an environmentally friendly replacement for phosphorus. World consumption is often cited as growing by 4 to 6% per year in the 1990s, somewhat slower than the growth rate in the 1980s.

The Structure of Production

In the 1980s, U.S. production was a duopoly. Pfizer, Inc. produced citric acid and citric salts in an older facility in Groton, Connecticut and a newer plant in Southport, North Carolina. Miles Laboratories, headquartered in Elkhart, Indiana produced citric acid in its Elkhart and Dayton, Ohio plants. Miles was acquired by the large European chemical firm Bayer AG of Basel, Switzerland in the 1980s. Marketing of citric products was handled by Bayer's New Jersey subsidiary, Haarmann and Reimer. In 1989, Pfizer and Bayer each had equal capacity shares in the U.S. market (Table 1). Total 1989 U.S. production capacity was 280 million pounds, of which about

235 million pounds (84%) was being utilized. Of this production, a small amount (17 million pounds or 7% of production) was exported, mostly to Canada. The domestically produced supply of about 218 million pounds was augmented by 65 million pounds of imported citric acid and salts (23% of total U.S. supply). In the late 1980s, imports were typically three or four times larger than exports.

Two large changes in the U.S. citric acid industry occurred in 1990. First announced in November 1987, the huge privately owned agribusiness company Cargill began production of citric acid at its Eddyville, Iowa plant in the spring of 1990. The highly automated plant cost $40 million to build next to Cargill's existing corn-refinery plant in Eddyville. Only 30 to 40 employees were required to operate the citric acid plant at its rated capacity of 55 million pounds, which added 17% to existing 1990 U.S. capacity. It was the first U.S. citric plant to be built as an integrated unit of a wet corn milling operation. Pfizer and Bayer had to purchase sweetener feedstock from independent suppliers, a situation that added to their costs of production. Cargill quickly garnered a large and increasing share of the U.S. market by sharply lowering its offer price and adding to plant capacity in 1991, 1993, and 1995 (Table 1).

The second change in the industry was the entry by acquisition of Archer Daniels Midland Co. (ADM). Just before Cargill opened its Eddyville plant, ADM announced its intention to enter into integrated citric acid production. This was not a great surprise, because ADM had already made entry into production of high valued, organic chemicals a high strategic priority: lysine, lactic acid, methionine, and others. Moreover, Cargill and ADM had a history of replicating each other's product portfolio for several years. What was a surprise was ADM's decision to acquire Pfizer's plants and technology rather than to enter *de novo*.[(3)] Announced August 1990 and completed in December 1990, the sale included Pfizer's Southport, North Carolina plant (100 million pound capacity) and its small Ringskiddy, Ireland plant. As part of the agreement, Pfizer agreed to sell ADM citric acid from its outmoded Groton, Connecticut plant for up to three years, by which time ADM would have time to expand and modernize the Southport plant to 180 million pounds capacity. Pfizer claimed that its 1989 citric-products sales were $180 million, but this appears to be too high given reigning prices (discussed below).

Thus, in December 1990 the U.S. citric acid industry consisted of three domestic producers, ADM, Cargill, and Bayer/Haarmann & Reimer. Bayer would soon become the only nonintegrated U.S. manufacturer. In addition, about one-fifth of U.S. demand was satisfied by imports from three large suppliers and a dozen small ones. The three large importers were Jungbunzlauer of Basel, Switzerland; Hoffmann-La Roche of Basel, Switzerland; and a large number of small Chinese chemical companies. Jungbunzlauer and Roche were, together with Bayer, the dominant producers in Europe's large citric acid industry. The Chinese suppliers were numerous, low-tech, but cheap (partly because of low-cost feedstocks and partly because of government subsidies). These three importers accounted for almost three-fourths of U.S. imports in the early 1990s. Godot Israel, Biocor of Italy, and Indonesian producers were steady but smaller sources of imports. Imports accounted for about 20% of U.S. consumption in 1989-91, 15% in 1992-92, and peaked at 29% in 1994 (Table 1). My calculations indicate that consumption volumes were growing about 8% p.a. from 1989 to 1995, quite a bit higher than trade sources guessed.

Despite Cargill's new plant capacity, utilization remained at levels close to what are generally considered optimal -- 85 to 90% -- during 1989-1991. Utilization reached a level in 1992 that might have signaled tight supplies in 1992, but expansions by both ADM (in 1993) and Cargill (1993 and 1995) soon brought excess capacity to the U.S. industry in 1993-1994. In ADM's case at least, building plants at the largest possible scales and consciously creating excess production capacities had long been a feature of its corporate strategy. Excess capacity raises the perception of entry risk by would-be entrants.

The United States was one of three main production zones for citric acid in the world.[(4)] U.S. production capacity accounted for about one-third of estimated global capacity during 1989-1992, but thereafter began to slip to about 21% by 1994-1996 (Table 2). Western Europe had five citric-acid manufacturers during 1989-1996, three of them quite large (Jungbunzlauer, Bayer, and Roche) and (ignoring ADM) two relatively small Italian

firms. Western Europe's production capacity ranged from 38 to 45% of global capacity throughout the period, with all five producers expanding their plants or adding new ones. The third major supply area was China. Its citric acid capacity grew by an amazing 23% p.a.; the volume of exports grew even more rapidly, about 35% p.a. Until recently all the Chinese manufacturers were government owned or controlled and their exports were somewhat coordinated. In volume terms, China had the second-largest national industry until 1995 when it surpassed the U.S. industry. However, in value terms, China's output is about equal to that of the United States today (1998). In 1989, Chinese companies made 17% of the world's citric acid, up to 28% in 1996. The vast size and rapid expansion of the Chinese industry play a key role in understanding the conspiracy's operation.

The Price-Fixing Conspiracy

Four manufacturers eventually pleaded guilty to fixing the prices and output levels of citric acid in the United States: Bayer, ADM, Jungbunzlauer, and Roche. The conspiracy also affected Canada and the European Union, but these cases are still under investigation. Cargill was charged as a defendant in the civil class-action suit, but it steadfastly denied any involvement. On January 24, 1998, Cargill was formally dismissed from the civil case by the U.S. District Court Judge supervising the class action in San Francisco.

Although not legally culpable, it was Cargill's 1990 entry into citric-acid production triggered the events leading up to the conspiracy. In the year prior to the start up of Cargill's new 55 mil lb. plant, list prices for citric acid had been about $0.81/lb. (Figure 1). In anticipation of 17% greater capacity overnight, prices plunged to $0.73/lb. just prior to Cargill's plant coming on stream (Table 3). To win new customers and reach high utilization levels quickly, Cargill announced a surprisingly low $0.63/lb. list price in July 1990 -- more than 20% lower than prices in the previous year. In fact, some buyers reported transaction prices as low as 53 to 57 cents/lb. in late 1990 (a 35% reduction). Industry sources believed that Cargill was barely profitable at such low prices; the high cost Bayer and Pfizer plants may well have been losing money at such prices. Pfizer's response was to shed itself of its citric-acid operations.

Late 1990 proved to be the nadir in citric acid prices. Cargill led the industry through the first two of six rounds of price increases, beginning with a 5 cent increase on list in February 1991. In August 1991, just as annual contract negotiations were to begin, Cargill pushed through another 5 cent increase to $0.73/lb. ADM and Bayer followed these increases passively. In January 1992, list prices jumped to on $0.76; however, in this instance it was Bayer's Haarmann & Reimer subsidiary that led the increase, with all the major sellers following in four weeks. Three more 3-cent price increases led by H & R took place in quick succession: April 1992, January 1993, and October 1993. *From October 1993 to late 1996 list prices of domestic producers and European importers were fixed at $0.85/lb.* Moreover, "favored customer" discounts were much smaller that normal.

The relationship of delivered list prices to f.o.b. transactions prices is just what one would expect (Figure 1). Contract prices are at or below the list prices in every quarter from 1987 to 1997. When list prices fell in 1989-1990, contract prices adjusted almost simultaneously. When list prices increased in 1990-1992, contract prices adjusted with a lag of one to three quarters (see also Appendix Table 1). Transactions prices typically stayed from 1 to 5 cents lower than list prices prior to and during the conspiracy. Soon after the cartel was exposed in late June 1995, buyers started to get larger and larger discounts off of list. After June 1995, sellers began giving their larger (contract) customers discounts in the 10-cent range. Yet, the effects of the cartel's restraints on output lingered on transaction prices for several months after formal meetings ceased -- until at least January 1996 and possibly several months more.

Another indicator of the price-effects of the citric-acid cartel can be seen in Table 3. Spot prices are for purchases made when immediate delivery is desired by buyers. Spot purchases relieve buyers of the risk that future prices may be higher (contract buyers lose the option of buying at lower future prices). Spot buyers often are too small to contract, or they may be contract holders that underestimated their usage requirements. Like grocery shoppers in convenience stores, spot buyers are willing to pay a few cents more for the convenience of

last-minute, fill-in shopping.

Prior to the cartel's effective operation (1990-1991III), spot prices were always higher than contract prices. However, from 1991IV until 1995I (the last full quarter of the formal conspiracy), the spot/contract price relationship was often abnormal. In 8 of the 14 quarters, the spot price was not higher than the contract price. After 1995II, in every quarter but one, the spot price returned to its normally higher position. All cartels have problems with members cheating on the agreed-upon price, but it is easier to hide a price cut with occasional buyers than with the larger, contract buyers. It may be that cartel members were trying to hide price cuts from their regular customers as well.

[a]List Prices are bulk purchase delivered to Midwest points. Contracts are for bulk orders covering at least 3 months' supply needs of the buyers, f.o.b. plant transactions, average for the quarter.

We now know from tape recorded evidence collected by the FBI that the price increases of in late 1991 marked the beginning of cartel pricing in North America and Western Europe (Connor 1997, 1998a). ADM's vice president in charge of corn refining, Terrence Wilson, together with the active cooperation of executive vice president Michael Andreas and Barrie Cox, head of citric acid operations, met about four times per year with officials representing its three largest rivals: Bayer, Jungbunzlauer, and Roche. Meeting in luxury hotels in various U.S. and European cities under the cover of an "international citric acid association," leaders of the four companies met secretly to set prices in the North American and Western European markets. They agreed to restrain their mutual output growth and export levels to boost prices in both zones. A complicated system of reimbursing companies that failed to achieve their assigned shares was developed; a Swiss accounting firm was hired to examine citric acid production figures supplied by the four co-conspirators.

The citric acid cartel was operating in the context of a homogenous oligopoly. Except for the lower quality product made in Third World countries, citric acid and its salts were highly homogenous. Sales concentration was high in the relevant markets. In North America and West Europe combined, four firm capacity concentration (CR4) was 82% in 1991 and 74% in 1995 (Table 4). In North America alone, CR4 was 84% in 1991 but declined to 58% in 1995 because of Cargill's sales gains and net imports increased up through 1995.

Cargill's role was ambiguous. It appears that during 1992-1995 Cargill was not an overt participant in the cartel, but neither did it attempt to undermine the higher prices instigated by its four rivals by means of aggressive price cutting. Indeed, in retrospect, Cargill's strategy gave it the best of both worlds: monopoly profits without antitrust liability.(5) If Cargill's production costs were about $0.50/lb. as reported by anonymous trade sources, then Cargill's sales at list prices would have generated about $130 million in 1992-1995 monopoly-induced profits. Yet, under U.S. antitrust laws it is the four cartel members that are legally responsible to pay the treble damages of $390 million to Cargill's citric acid buyers (Connor 1997).

The effectiveness of the cartel is revealed by the members' steady production (sales) shares in the US market (Table 4). From 1991 to 1995, the four co-conspirators' shares varied little, each

increasing by a percentage point or so. In the lysine case, the cartel adopted members' shares just prior to the cartel's formation as a guideline to future shares. While there are no sources confirming this approach in the citric acid case, the sales data are certainly consistent with such a rule.

The citric acid cartel had to contend with a problem the lysine group never had to worry about, namely uncontrollable U.S. imports from Italy, Israel, and especially China. The large Chinese industry was especially worrisome because of its historically wide price discounts and substantial production capacity. The higher cartel-induced US prices did indeed encourage increased Chinese imports. In 1988-1989, Chinese citric acid delivered prices were 15 cents lower than domestic producers' list prices, but by 1994-1995 the gap had doubled to 30 cents (35% lower). The chemical trade press began to contain numerous articles about rising Chinese citric imports -- a 50% increase from 1992 to 1994.

The cartel's solution to rising Chinese imports was masterful. One of the two US owned citric acid manufacturers (probably ADM) lobbied the office of the U. S. Trade Representative, which was embroiled at the time in a most contentious dispute with the Chinese on the issue of protection of intellectual property rights. The rumored lobbying was highly effective. On February 4, 1995 the US government announced that it would be imposing prohibitive tariffs of 100% on $1.1 billion of Chinese exports to the US in retaliation for Chinese government intransigence. Prominent on the list was citric acid. Although last-minute Chinese concessions prevented final imposition of the tariffs, the move had the desired effect. In 1995, Chinese imports of citric acid fell substantially, allowing the cartel another year's lease on life.

The party came to an end in June 1995. With the aid of a mole, Mark Whitacre, and a grand jury subpoena, some 70 FBI agents swooped down on ADM's corporate headquarters in tiny Decatur, Illinois on the night of June 27, 1995. Within days this scenario was repeated at the U.S. headquarters of Haarmann & Reimer, Hoffmann-LaRoche, Jungbunzlauer, and at least seven more corn-products companies. Thousands of incriminating documents were seized, particularly lists of monthly "sales targets" and reports of actual monthly sales for the four citric acid cartel members. These documents, together with hundreds of audio and video tapes of price-fixing meetings of the so-called lysine trade association (at which frequent mention is made of the parallel citric acid activities), made a strong case for prosecution of criminal price fixing by the Department of Justice (DOJ).

The one weakness in the government's case is the requirement that it must prove that the co-conspirators *intended* to affect citric acid prices and quantities. (Intention is not required in civil cases, but the DOJ felt that the lysine and citric acid conspiracies warranted a more serious criminal charge). To prove intent, the government needed at least two participants to testify as to the state of mind of the companies' representatives at the price-fixing meetings. By late 1995, it had become apparent that Whitacre would make an unimpressive witness, because he had been embezzling $9.5 million from ADM at the same time he was working for the FBI. The DOJ needed one credible corroborating witness, and none of the managers involved would agree to cooperate until 16 months after the FBI raid. For most of 1996, the government's criminal case was stalled.

Events in the lysine case finally came to the help of the DOJ's prosecutors. Throughout 1996, ADM's management came under increasing pressure from a special committee of ADM's Board of Directors to settle the

case quickly and cheaply. By May 1996, ADM had more than 90 civil antitrust suits filled against it, a number that would eventually climb to more than 125. These were hurting the company's stock value and perhaps some of its operations as well. Dozens of similar suites were filled against Bayer, Roche, and Jungbunzlauer as well.

A shocking setback for ADM occurred on August 27, 1996 when the three largest co-conspirators in the lysine case agreed to cop a plea. In return for leniency in sentencing, the three companies admitted to criminal price fixing, three of their officers pled personally to criminal transgressions, and the three companies promised to cooperate fully with the DOJ in its investigation. Now, prosecutors had all the witnesses they needed in the lysine case. Recognizing its precarious legal position, ADM too finally agreed to plead guilty on October 15, 1996. In return for its cooperation in the citric acid and alleged fructose syrup cases, ADM also was granted leniency in the assessment of fines. Except for two ADM officers still facing trial (M. Andreas and T. Wilson), all other ADM officers were granted immunity and began divulging details of the conspiracies to prosecutors. The key individual was Barrie Cox, ADM's vice president in charge of citric acid sales and operations. His information and pledges to testify placed unbearable pressures upon Bayer, Roche, and Jungbunzlauer to settle.

Criminal Antitrust Fines

On January 29, 1997, Haarmann & Reimer, the New Jersey-based subsidiary of Bayer, pleaded guilty to criminal price-fixing in the world citric acid market. Bayer agreed to pay a fine of $50 million to the U.S. Treasury; although the second largest antitrust fine every paid, Bayer in fact paid less than its maximum exposure because it agreed to provide evidence against Roche and Jungbunzlauer. (6) A DOJ press release characterized the citric acid conspiracy as"...one of the largest, if not the largest, conspiracies ever prosecuted by the Department of Justice." Private antitrust lawyers called the new fine structures "a staggering development for business."

In addition to the corporate fine, Hans Hartmann, a German citizen and senior executive of Haarmann and Reimer, was arraigned in U.S. District Court in San Francisco for criminal antitrust conspiracy charges. Hartmann had been an employee of Bayer for more than 40 years and had served as vice president and president of H&R for more than a decade. He faces sentences of up to three years in prison and $350,000 in fines. (Ironically, it was Hartmann's testimony in the same court a year later that exonerated Cargill from all charges against it in the citric acid cases).

The final chapter in the criminal phase of the citric acid cartel was closed on March 26, 1997. The two largest U.S. importers of citric acid, Hoffmann-LaRoche and Jungbunzlauer, pleaded guilty. Because they were the last to settle, they received the harshest fines relative to their size in the U.S. market, a total of $25 million. Two of their executives pleaded guilty and were each fined $100,000. Clearly, Hartmann together with ADM's Terrance Wilson were the prime movers in the citric acid cartel. The total corporate fines of $105 million in the citric-acid case were the largest ever assessed; the lysine fines totaled merely $92.5 million because the lysine market was smaller and perhaps because the percentage of overcharge was lower.

Private Antitrust Settlements

Calculating the size of monopoly overcharges requires accurate information on the size of the relevant market, the length of the conspiracy-effects period, actual selling prices, and the price that would have reigned "but-for" the actions of the conspirators. These data are subject to estimation errors. The two major sources of data on the size of the U.S. citric (acid and salts) market are not perfectly consistent. The last survey of the U.S. international Trade Commission on the organic chemical industry reported that total 1994 sales of the three domestic manufacturers were 312.3 million lb. that generated f.o.b. manufacturers' revenues of $251 million (USITC). Net imports of citric products were 54.9 million lb. worth $26.8 million at border prices ($0.651/lb. for imports and $0.816/lb. for exports). *Delivered* prices for citric products would raise the price of imports in the eastern United

States to $0.81/lb,; moreover, delivery charges of about 3 cents per pound for average truckload would raise the f.o.b. domestic price from $0.804 to about $0.834 (comfortingly close to the export border price).(7) Thus, the ITC data imply a U.S. buyers' purchase value of $215 million for domestic product (domestic production less export volume) and $89 million for imported material, or $304 million total.

On the other hand, 1994 consumption estimates from seemingly reliable trade sources shown in Table 1 indicate a much higher 440 million lb. level; using delivered prices U.S. buyers paid $350 million for citric acid and its salts. There being no way to reconcile the two sources, we can only present both figures as a range of probable sales. For the alleged conspiracy-effects period July 1991-December 1995, total U.S. sales were in the range of $1,290 to $1,450 million. If the competitive price (marginal cost) was $0.60/lb., buyers paid $205 to $378 million in overcharges, or some 21 to 24% of purchase value (Table 5). The market size and this estimated overcharge are both significancy larger than the lysine case (Connor 1997).

The "two-times" felony fine levied by the DOJ allows a sort of cross-check on this estimate. Because both ADM, and to a lesser extent Bayer, received discounts for their cooperation, the best indication of the DOJ's calculations lies with the $25 million in fines imposed on Roche and Jungbunzlauer. These two companies held a mere 5 to 7% of the U.S. market for citric acid during 1991 - 1995 (Table 4). That is, their combined sales were in the range of $66 to $110 million during 1991 - 1995. If the fines were fully applied, then the DOJ's data (much of it confidential) must have indicated an overcharge in the 10% to 29% range (Table 5). A similar exercise using Bayer's fine as a guide reveals an even higher implicit overcharge.

Overcharge estimates are sensitive to a number of assumptions, most notably the "but-for" price -- the market price that would have been observed had there been no cartel. Perhaps $0.60/lb. is too low a but-for price. For the seven months prior to the cartel's formation, the contract prices for citric acid ranged from $0.60 to $0.62/lb. Cargill's new plant was already operating nearly at full capacity, so the period January - June 1991 seems like a reasonable one to choose for a pre-cartel equilibrium. However, about 18 months after the conspiracy ended, spot transactions prices had drifted only down to $0.67 to $0.68/lb., so the post-cartel period prices may hint that production costs had risen slightly during the cartel-effects period (Appendix Table 1). Thus, average production costs could have been $0.64/lb. At $0.68, the overcharges would be reduced to a bit over half of the estimates made previously (Table 5). Under an array of cost assumptions, the citric overcharge estimates vary from $161 to $309 million, or 11% to 21% of purchase value. For lysine the range is $70 to $166 million, or 13% of sales.(8)

The dates of the conspiracy are also crucial to determining the extent of overcharges imposed on buyers of citric products. In ADM's plea agreement (whose terms were negotiated with the DOJ prior to filing with the Court in October 1996) the period is vaguely identified as commencing "at least as early as January 1993" and ending June 1995. This claim allowed ADM *et al.* to assert that the pre-conspiracy price in December 1992 (hence, arguably the but-for price) was $0.79/lb. (see Appendix 1, Table 3). With transaction prices around $0.82/lb. and volume sold of only about 1.3 billion lb., the cartel overcharge would be only $39 million. Thus, ADM's share of the market (30%) would imply a treble-damages liability of $35 million -- which is exactly what ADM offered to pay civil plaintiffs in September 1996! Because civil procedures do not allow plaintiffs access to DOJ files and the plea agreement is considered unimpeachable evidence, most of the members of the federal class action suit had no choice but to accept the settlement offered by ADM *et al.*

But Mark Whitacre has said that FBI video tapes show that in a 1992 Paris meeting of the "lysine association," Terrance Wilson said that the citric-acid conspiracy had already been going on for some time. In fact, the DOJ indictments later (1997) filed against ADM's three European co-conspirators, the beginning date for the conspiracy is given to be July 1991. Moreover, it is likely that the price-fixing conspiracy's *effects* on the market lingered well beyond June 1995 even though the conspiracy itself had ended. The longer period July 1991 - December 1996 produces very different estimates, because then the but-for price is lower and the quantity purchased rises (Table 5). The implied overcharge then is from $190 to $378 million, and treble damages of $570 to $1,134 million are five to ten times greater than ADM's favored position.

The role of the DOJ is most curious. After an investigation lasting almost five years, its impatience to settle quickly is understandable. Besides, the DOJ was focused on the criminal case and the extraordinary publicity that the unprecedented fines would bring. ADM's wily lawyers knew full well how huge was the monetary liability involved in a four-year effective conspiracy as compared to the plea agreement's two-and-a-half-year period. Plaintiffs' lawyers were unrestrained in their wrath concerning the DOJ's complicity. One such lawyer, Kenneth Adams, stated that "The Justice Department has allowed the facts to be covered up.." As the Bloomberg News Service put it: "ADM has been accused of lots of things in the .price-fixing scandal [but] hiring dumb lawyers isn't one of them."

These sorts of estimation exercises are essential to the recovery of antitrust damages through civil suits under the Sherman and Clayton Acts. For civil suits the burden of proof is on the plaintiffs who are entitled to "treble damages," that is, triple the value of the monopoly overcharges imposed on direct buyers (Connor 1997). Many hundreds of food, beverage, and chemical companies banded together in a class-action antitrust suit with ADM *et al.* as defendants. This suit was eventually consolidated as "multi-district litigation" in U.S. District Court in San Francisco in the summer of 1996.

ADM made the first move; it offered $35 million to members of the class in October 1996. Later the same month, LaRoche, Jungbunzlauer, and Bayer offered $7.6, $5.7, and $46 million, respectively. The four offers were proportional to the companies' market shares. Lawyers for the plaintiffs claim that the appropriate overcharge damages are about $400 million, or treble damages of $1,200 million (of which plaintiffs' lawyers will ask for 25% as fees). Obviously, the defendants' offer of $94 million was a pittance compared to what the plaintiffs believe is fair. (Like the lysine case, defendants were in a rush to settle the civil case before the size of the criminal fines is known).

Plaintiffs are not required to remain in a class if they believe the compensation being offered is inadequate. Indeed, four of the world's largest buyers of citric acid did withdraw from the class. June 1997, Proctor & Gamble, Quaker Oats, Kraft Foods, and Schreiber Cheese sued ADM *et al.* in a private (non-class) suit. In July 1997, the class-action suit's overseeing judge approved a slightly reduced, treble-damages amount of $86.2 million, even though the criminal fines already announced by that time suggested far larger damages ($450 to $750 million) ought to be paid.

The four op-out firms had their patience amply rewarded. In March 1998, because it is a public company, ADM was forced to reveal that it paid the four opt-out firms a whopping $36 million. Because they are not public companies under United States' law, Bayer, Roche, and Jungbunzlauer are not required to reveal their share of this damage payment. However, it is a fair guess that their proportional assessment was $52.7 million. The four opt-outs purchased 19 to 24% of all U.S. citric acid, thus, their settlement ($89 million) was from *2 to 3.5 times more generous* than what was received by the members of the federal class less than a year before.

While these settlements completed the last remaining federal suits against the cartel in the United States, ADM *et al.* are not yet out of the woods. All four co-conspirators face additional government investigations and prosecutions in Canada, Mexico, the European Union, and perhaps additional antitrust jurisdictions (Connor 1988b). The Canadian federal case is the most advanced, having been partially settled in May 1998 (*Journal of Commerce* May 29, 1998:3A). ADM pleaded guilty to price fixing on exports of lysine and citric acid to Canada during 1992-1995. The Federal Court of Canada, upon the recommendation of the federal Bureau of Competition, fined ADM Can. $16 million (U.S. $11.04); the fine was 6.4 times the previous record fine paid in Canada (*The Gazette* (Montreal) May 28, 1998:E10). The fine consisted of $9 million for price fixing alone, $5 million for lysine, and $2 million for citric acid. During the conspiracy period total lysine sales in Canada were $89 million (of which $48 million ADM's sales) and citric sales $105 million ($17.3 million ADM's). The Bureau of Competition is continuing its three-year investigation against three other lysine and three citric acid companies with ADM's cooperation.

On June 12, 1997 investigators for DG-4, the European Commission's directorate for competition law, raided the

European offices of ADM and Kyowa Hakko and seized documents related to lysine and citric acid. The Commission said that Ajinomoto, one of the lysine conspirators, is cooperating. Under EU law, cooperating companies can receive reduced fines. In both Canada and the EU, there were no leaks of information (unlike the U.S.), but one wonders why the EU was so slow to react to events.

International Trade Effects

The operation of the lysine cartel caused striking changes in the size and pattern of U.S. lysine exports and imports (Connor 1998a). Soon after ADM built its huge U.S. lysine plant, U.S. exports of lysine jumped from the virtually nil to about $100 million in 1992, the year before the conspiracy took full effect. During the conspiracy period, exports were flat, but after the conspiracy ended exports shot up by 200% (1997 compared to 1992-1995). Import volume was unaffected. Even more striking was the change in the pattern of destination countries: the export areas were clearly being allocated to individual members of the cartel. Moreover, these territorial allocations were accompanied by strong price discrimination.

Unlike the lysine cartel, the citric-acid cartel did not control world production. It did account for 75% to 85% of sales in North America and Western Europe, but outside these areas the cartel held less than half of consumption of citric acid. Thus, one would expect trade effects to be quite different in the citric products case than the lysine case, and they were.

U.S. imports had been large and growing throughout the 1980's (Figure 2). When Cargill's new U.S. plant began production in 1990 and stepped up production in 1992, imports fell. This episode would prove to be an aberration from the trend. As the cartel forced up U.S. prices in 1992 and 1993, imports rebounded, more than doubling from 1989 to 1994. In 1995, 1996, and 1997, imports declined slightly each year, but this was due almost entirely to the U.S.-China trade dispute and China's withdrawal of citric-acid export subsidies. The widening gap between domestic and import prices caused total U.S. imports to rise well above any long term trend during 1993-1995 (Table 6).

Exports seem to have been restrained by the cartel during its 1993-1995 heyday, even though Cargill did not overtly cooperate with the cartel. Exports were flat at about $50 million during the 1993-1995 period, but in 1997, well after the cartel's break-up, exports jumped by 50% above that level. Thus, the cartel induced elevations of domestic prices inflated imports above levels that would have occurred under competitive conditions, and the cartel restrained both domestic production and export volumes during the conspiracy. Although rough and speculative, I estimate that during 1993-1995, the citric acid cartel added about $120 million to the U.S. merchandise trade deficit.

There were some large effects on the geographic pattern of exports and imports as well that warrant more detailed research. U.S. exports to the eight largest Western European countries amounted to only 526 mt during 1993-1995, or 1.02% of total citric-acid exports. During three post-conspiracy years 1996-1998, U.S. exports to Western Europe jumped to 10,944 mt. or 13.30% of total U.S. exports.[(9)] That is, export volume to Europe increased by an extraordinary 1,981% and the export share by 1,204% in only three years; moreover, of the eight countries, only Belgium registered no increase in U.S. exports. This sea-change in Western European export offers compelling evidence that ADM and Bayer demonstrated great deference to the two European-based producers in the cartel by curtailing sales in their assigned territory. Once the cartel broke up, Western Europe became a contestable market.

On the other hand, U.S. exports to Latin America, Canada, Mexico, Japan, Australia, and New Zealand were hardly affected by the cartel's demise. Volumes to these destinations grew slightly and the share of U.S. exports

declined a bit. Perhaps La Roche and Jungbunzlauer had few exports to these countries prior to the cartel's formation (so their reduction in exports during the conspiracy would not noticeably affect U.S. exports), or perhaps the citric-acid cartel held little sway outside North America and Europe.

Whether the cartel took further advantage of its market power by pricing discriminately across export destinations is not clear in the citric acid case. During the conspiracy average U.S. export prices were $0.77, $0.78, and $0.81/lb. for citric acid. Exports to Canada, which absorbed 39% to 56% of all such exports, were priced at or below the average price (as much as 9% below in 1995), a pattern that continues after the cartel's demise. As these are border prices and the Canadian border was closer to the centroid of U.S. production that the average ocean port, the 2-to-4-cent discount on Canadian export may well be explained by transportation costs. Ignoring very small shipments (less than 10 mt p.a.), U.S. exports to Western Europe were priced very high by the cartel (and by "nonmember" Cargill), about $1.35/lb. or almost double the average price. After the cartel disbanded in 1996-1997, the average price to Western European destinations was much less, $0.86/lb., but still higher than the average global export price of $0.72/lb. Although these averages support the idea of price discrimination between Canada and Western Europe, the practice was not uniform across European destinations. Exports to Mexico, Australia, and New Zealand (all large customers) follow the low-priced Canadian pattern, whereas exports to most Latin American destinations resemble the Western European (very high to slightly high) pattern of prices. What is clear is that the variation in export prices across export destinations was much less after the cartel's break-up than during the conspiracy period. This is not, of course, proof of price discrimination, but it is highly suggestive of geographic third-degree price discrimination, for which market power is a necessary condition.

Corporate Restructuring

ADM is the only publically traded company among the four members of the citric-acid cartel and, therefore, the only one required to report material developments to its stockholders. The fall out from the lysine and citric-acid conspiracies has been considerable for ADM's management and strategic direction.

After 30 years at the helm, it is difficult to disentangle Dwayne Andreas' managerial style from ADM's management practices. ADM has a very flat decision structure for implementing major decisions. The Chairman and CEO D. Andreas was the strategist, visionary, and foreign minister in charge of building networks business and political favors. ADM President Randall was in charge of manufacturing operations and investments. Executive VP M. Andreas was in day-to-day charge of everything else. These three, together with the president of the appropriate division (T. Wilson for corn products) would make any and all decisions involving more than a few million dollars. No committees or long-term study groups were generally used. Decisions were made informally and with no memos. ADM didn't believe in having extensive R&D or in-house experts; technology was licensed or purchased and consultants were hired short term as necessary. Vice Presidents like Whiteacre had extraordinary discretion.

connor2.jpg (32708 bytes)

Dwayne Andreas created a tight network of loyal friends, relatives, mentors, and sycophants that cemented his near total control over the company. He extended this notion to the large, old, well paid Board of Directors. Prior to the FBI raid, no Board members were thoroughly independent of Andreas or ADM. Suppliers and rivals were enticed into cozy joint ventures, only customers were seen as exploitable. The company was well known to its tendency to employ "rough tactics."

Andreas and ADM worked hard at developing external networks to support the company's objectives. ADM was an influential member of several farm, trade, and lobbying groups. Andreas cultivated politicians of every stripe through favors too numerous to mention (money, planes, condos, and more). ADM "underwrites" all four of the premier U.S. political-discussion programs on NBC, ABC, CBS, and PBS -- programs watched intently by the Nation's political elite. Andreas was the most prominent icon of Western capitalism in the former Soviet Union. ADM profited more than any agribusiness firm from regulatory interventions in its markets.

ADM has suffered significantly from its convictions as a corporate criminal. I estimate that the financial costs alone (finds, settlements, fees) are approaching $350 million. These antitrust expenses accounted for 70% to 80% of ADM's after-tax profit declines in both FY 1996 and FY 1997. While more antitrust costs are yet to be imposed by the European Commission, they are nothing close to the $2.4 billion loss in stock-market value that the company suffered in the days after the FBI raid. As if to prove that it is alive and kicking, the new CEO, G. Allan Andreas, has launched a series of spectacular acquisitions.

Did the benefits from collusion possibly outweigh the financial costs? Using the upper-end estimates of cartel-generated profits for lysine ($160 million) and citric acid ($500 million), and applying ADM's market shares to those extraordinary profits (50% and 30%, respectively), ADM's monopoly profits in its U.S. markets were as

high as $230 million. So costs are about 1.5 times the largest likely benefits. [In legal theory, the cost/benefit ratio should be 5.0]. However, much of ADM's lysine was sold abroad, some in markets with no antitrust sanctions likely to be applied.

The major changes evident are in ADM's management structure and reputation. The company has lost several gifted, if unscrupulous, managers. Since 1995, top management has been greatly distracted by legal actions, and this will continue for some years. Dwayne Andreas, though stripped of his official titles, still influences ADM's decisions through the remaining pieces of his family-and-friends network. The Board, though largely reconstituted, still does not have a majority that is independent of management. Customers and suppliers have a more negative view of ADM's corporate mentality and ethics.

Industry Restructuring

Before the new Cargill plant came on stream in mid 1990, the two U.S. manufacturers (Pfizer and Bayer/Miles) made citric acid from purchased dextrose or glucose. Cargill's Eddyville, Iowa plant was the first to be able to pipe in liquid feedstock directly to its citric-acid facility. The principal European manufacturers, Roche and Jungbunzlauer also had plants that were backward-integrated. It is likely that integrated production provided economies that reduced costs of production by 5 or 10% over the traditional system. Moreover, Pfizer and Bayer/Miles had to buy feedstock from a highly concentrated U.S. corn refining industry that may have been able to raise glucose or dextrose prices from time to time.

When Cargill stepped up its production in late 1990 and early 1991, it sent a clear signal to its U.S. rivals when it cut prices by more than 30% that it was now the low-cost producer of citric acid. This lesson was not lost on arch-enemy ADM. Instead of building a new citric-acid facility in Decatur, as it had announced in early 1990, ADM decided to buy Pfizer's most modern plant and the technological expertise along with it in August 1990. Buying rather than building saved ADM as much as three-year's delay, though it spent a year or two modernizing and expanding the North Carolina plant. This plant was the largest in the world when brought on stream and is still the largest in North America. James Randall, President of ADM, had a long-standing reputation for building the biggest plants possible, not only for efficiency reasons, but also to discourage potential entrants through the creation of excess capacity.

Thus, during the conspiracy period 1992 - 1995, only Bayer's Haarmann & Reimer subsidiary was manufacturing citric acid from purchased feedstock (supplied by A.E. Staley's Lafayette, Indiana plants). That, and the fact that its Elkhart, Indiana plant was small and quite old put H&R at a distinct cost disadvantage. In light of the fines imposed on Bayer and H&R's Hans Hartmann in 1996, it requires no great leap of the imagination to surmise that Hartmann initiated the conspiracy, with ADM's Terrance Wilson an eager partner. Hartmann, a German businessman with long experience in European chemical industries, was ideally positioned to approach the big citric-acid manufacturers in Vienna and Basel about forming a cartel. Bayer was the only manufacturer with citric plants in both the United States and Europe. H&R's high costs may have been the proximate cause of the cartel's formation.

The huge costs of the antitrust cases and the dim prospects for cost competitiveness in the U.S. market made Bayer decide to sell its citric-acid business. In June 1997, two years after the FBI raid, Bayer publically offered its worldwide citric-acid business for sale. The assets included three U.S. plants (Elkhart, IN; Dayton, OH; and Duluth, MN); one plant in Selby, UK; one wholly-owned plant in Brazil (Mercocitrico Fermentacos, SA); and two majority-owned subsidiaries in Mexico (Mexama, SA) and Columbia (Sucromiles, SA). These plants employed 1,310 people and had global sales of $293 million in 1996; the vast majority of these sales were citric products, but a few other food ingredients were included.

In May 1998, Bayer announced the impending sale of these assets to the huge UK sweeteners firm Tate & Lyle. Tate & Lyle paid only $219 million for six plants whose book value was $203 million (the Elkhart, IN plant was

not sold and will be destroyed). Why so little for the only citric-acid business that spans more than two continents and that has a 20% global market share? The UK operation has a monopoly in the British Isles and is an integrated (beet molasses-dextrose) operation, but it is an old plant at about half the optimal size. The three Latin American plants will give Tate & Lyle a dominant share of that continent's market for citric acid, but Cargill is building a new, state-of-the-art plant in Brazil that will come on stream in 1999. While there operations are likely to be profitable, the U.S. business must be in pretty bad shape. Bayer's business grew only 1.7% in dollar terms from 1996 to 1997, and 1997 pre-tax profits were a mere 2.8% of sales. Nevertheless, Tate & Lyle was the most logical buyer because it owns A.E. Staley, the second-ranking U.S. corn refiner. Staley, it will be recalled, supplied Bayer's U.S. citric operations with their feedstock. Moreover, Staley has some experience in citric-acid technology through a joint venture with Bharat Sugar in India. Staley will doubtless upgrade the Dayton plant.

Thus, the 1990s has witnessed a complete make-over of the structure of ownership and production in the U.S. citric-acid market. In 1990, the U.S. industry was a duopoly, with each company operating two nonintegrated plants of exactly the same size. Pfizer and Bayer each held 40% of the market.

Then, Cargill shook things up with a spiffy new integrated plant that quickly reached production capacity through low-ball pricing -- briefly. ADM trumped Cargill with a bigger plant, but took a much more "cooperative" stance in pricing that by 1992 turned into a full-blown cartel. The cartel was only a brief reprieve for Haarmann & Reimer's inability to compete in the U.S. market, and the cartel's unmasking turned it into a debacle. The acquisition of H&R's citric acid assets by Tate & Lyle/A.E. Staley completes the industry's transformation. The old duopoly of Pfizer and Bayer has exited, to be replaced by the three leading U.S. corn refiners: Cargill, ADM, and Staley. Each of these corn biotech firms is well positioned to apply the most efficient forms of logistics and fermentation technology to citric acid production and marketing. The new triopoly will likely co-exist comfortably with one another in the citric-acid industry, just as they have done in so many other industries where they meet as rivals.

The only ray of sunshine on the horizon is the possibility of increased import competition from China, Indonesia, India and other Asian nations with ample sources of low-cost starch or sugar-industry by-products. In the last few years, China's citric-acid producers have been making great strides in modernizing production. A decade ago, the largest Chinese citric plant had a mere 4 million pounds capacity. In the last few years, frequent announcements of new joint ventures with capable French, Austrian and Japanese chemical companies have confirmed the building of high-tech plants with 22 to 44 million-pound capacities. New filtering equipment will ensure food-grade citric acid for export to the most advanced countries. Staley's new joint venture in India also plans large exports. The 1997-98 Asian currency crises may spur additional exports of favorably priced citric products.

Conclusions

ADM was at the center of two concurrent international price-fixing conspiracies that had huge, and in some ways unprecedented, economic and legal consequences. The present case study delved deeply into the details of the four-company citric-acid cartel, but the citric-acid case reinforces the principal conclusions reached from the five-company global lysine story (Connor 1997, 1998a). There are seven major conclusions.

1. The international cartels were able to be formed and to operate undetected for three or four years because they were leading firms in highly concentrated, homogenous-product oligopolies with substantial entry barriers into the relevant markets. The lysine cartel controlled more than 95% of global production, and the citric-acid cartel accounted for 55% to 85% of sales in each of the relevant markets (No. America and W. Europe). Despite the failure of the citric-acid cartel to secure the *active* participation of the newest U.S. manufacturer, Cargill's passive or tacit cooperation contributed to the cartel's ability to sustain monopolistic U.S. prices. Overcharges

imposed on U.S. buyers of lysine and citric acid were at least $116 million but could have reached as high as $378 million. Market structure matters.

2. The effectiveness of the two cartels came about in spite of significant differences in geographic location and business cultures. Bayer's U.S. subsidiary doubtless smoothed such differences when forming the citric-acid cartel, but in the lysine case companies producing in the United States, France, Italy, Mexico, Japan, Korea, and Indonesia were apparently able to develop harmonious working relationships. Geographic/cultural propinquity may well facilitate joint profit maximization, but it should not be regarded as a necessary condition.

3. Corporate restructuring was extensive for ADM, the one company among the eight co-conspirators that must reveal such changes. Two able executives left the company, and two more (D. and M. Andreas) were officially stripped of their duties. ADM's Board of Directors, once the tool of its powerful chairman, now includes at least a few independent or "outside" directors, but not a majority as ADM's major institutional investors have demanded. Yet, Dwayne Andreas, 80, continues to wield an unknown degree of influence on the company's decisions through his nephew (now CEO) and crones on the Board. My view is that ADM is at most chastened, not in any sense reformed. Moreover, there is precious little evidence of significant organizational changes in any of the other seven members of the two cartels. Except for Bayer's exit from citric-acid production, industry structures remain much the same today as they were in 1992-95.

4. ADM *et al.* were well served by their top-flight legal advisors. Given the government's vast storehouse of taped and written evidence and the prisoners' dilemma faced by the defendants, their lawyers' delays, attacks against Whitacre's credibility, and swift settlement of the civil suits were very effective in minimizing civil damages. Even after ADM's position became untenable when three of the lysine co-conspirators agreed to cop a plea, the cartels' civil settlements in U.S. courts amounted to only an estimated $321 million, whereas their treble-damages liability was at least $450 million and possibly has high as $1.1 billion (Connor 1998a; Table 4).[(10)]

5. Despite some reservations about the way the FBI handled the investigations, the DOJ's criminal prosecutions were a great victory that will do much to restore the Department's reputation for effective enforcement of price fixing laws in the context of international conspiracies. The imposition of $199 million in criminal fines on eight companies ($100 million on ADM alone) and nine top executives of those companies together with the attendant publicity ought to generate a long-lasting deterrence effect. Equally important was the new rule applied to ADM and all its citric-acid co-conspirators in calculating the corporate fines; the "two-times the harm caused" rule for felonies gives the DOJ an important new weapon in large antitrust cases. Prosecution of these cartels has alerted the DOJ and FTC to the existence of many other international commodity cartels, of which guilty pleas and fines were announced in four cases recently (sodium gloconate, graphite electrodes, and two marine services). However, by focusing almost exclusively on the criminal sanctions for the two cartels, the DOJ may have short-changed the private parties that sought treble damages.

6. Private plaintiffs in Sherman Act suits bear a heavy evidentiary burden of proof. Congress intended that evidence gathered in criminal proceedings should be used as evidence in follow-up civil suits, but the plea agreements negotiated by the DOJ with ADM *et al*. gave precious little guidance to civil litigants. The agreements were vague on the sizes of the markets, the length of the conspiracies, and the appropriate but-for price. Moreover, the size of the "two-times" felony fines that ought to have provided needed information on what private plaintiffs should demand for compensation in fact masked the defendants' true liabilities because of unknown "discounts" given to cooperating companies.

It is clear that direct buyers of lysine and citric-acid settled for pennies on the dollar, only 20 to 50% of the maximum amount allowed by the Sherman Act. Because ADM had to reveal the amounts it paid to buyers of citric-acid that opted out of the federal class action suit, we know that these big, patient buyers received from 2 to 3.5 times more damages (per dollar of acid purchased) than did the members of the federal class. The fact that

lysine and citric-acid buyers received settlements totaling about $245 million sounds impressive (this was the fourth largest nominal amount in history), but in reality ought to have been two to five times more. The putative harshness of the public penalties netted out to ADM *et al*. was overcompensated by the softness of the *private* penalties.

7. The criminal trail that began July 9, 1998 in Chicago, Illinois against three former officers of ADM may reveal even more about the details of the lysine conspiracy, but much is known already about the fascinating *international* dimensions of the two cartels. Given the high profits that were generated, it is impressive how such small numbers of managers (a dozen or fewer) meeting a few times each year could pull off complex allocations of outputs and prices for several large geographic markets around the world. In lysine especially, profits were boosted by finely tuned second-or third-degree price discrimination in export markets. In citric-acid, the cartel operated despite the nonparticipation of one large U.S. producer and substantial U.S. imports from Asia.

Former cartel members are scrambling to cooperate with non-U.S. antitrust agencies (ADM in Canada, Ajinomoto in EU). However, so far only Canada, Mexico, and EU authorities are belatedly investigating the cartels' activities. It seems that buyers outside North American and Western Europe will receive little judicial relief, even though most countries have formal antitrust laws these days (Connor 1998b). Sharing of information on international cartels among national antitrust agencies has begun only recently, but this is merely a small first step in the type of full scale cooperation that will be needed to prosecute such crimes effectively.

Table 1. U.S. Production Capacity and Consumption of Anhydrous Citric Acid, 1989-1995.

Company: Plant	1989	1990	1991	1992	1993	1994	1995
	million pounds per year						
Pfizer/Archer Daniels Midland:[a]	140	140	140	140	200	180	180
Southport, NC	100 40	100	100	100	180	180	180
Groton, CT		40	40	40	20	0	0
Bayer/Haarmann & Reimer:	140	140	150	150	150	150	150
Dayton, OH	100	100	110	110	110	110	110
Elkhart, IN	40	40	40	40	40	40	40
Cargill: Eddyville, IA[b]	0	55	80	80	130	130	160
U.S. plant capacity	280	335	370	430	480	460	490
U.S. consumption estimates	300	320	340	390	420	440	475
U.S. exports	17	21	48	77	50	55	52
U.S. imports	65	61	50	59	91	129	125
Implicit U.S. production	252	280	338	408	379	366	402
Implicit U.S. plants utilization rate (%)	84	84	91	95	79	80	82

Source: Chronology Appendix.

[a]ADM acquired Pfizer's North Carolina plant in December 1990, and Pfizer continued to supply additional citric acid from Groton until mid-1993 when the plant was closed.

[b]Cargill made only liquid acid until early 1993 when production of sodium citrate began.

Table 2. Non-U.S. Production and Consumption of Anhydrous Citric Acid, 1989-1996.

Company: Plant	1989	1990	1991	1992	1993	1994	1995	1996
	million pounds per year							
Jungbunzlauer (Basel, Switzerland):	132	132	132	176	306	463	463	463
Pernhofen, Austria					88	88	88	88
Ladenburg, Germany						44	44	44
Marckolsheim, France				0	0	0	0	88
Sumatra, Indonesia (JV)								
Bayer (Basel, Switzerland):[a]	90	90	134	134	134	160	160	160
Selby, Yorkshire, UK						46	46	46
3 Latin American affiliates						44[e]	44[e]	88
Hoffmann-La Roche (Switz.): Tienen, Belg	77[e]	77[e]	154	154	154	154	154	154
Biocor: Padova, Italy[b]	53	53	53	53	53	88	88	88
Palcitric: Naples, Italy[b]	0	0	0	0	77	77	77	77
ADM: Ringskiddy, Ireland[c]	20	20	20	0	0	0	0	0
China: many companies[d]	151	186	230	284	351	433	535	661
Czech Republic: unknown company	0	0	0	0	66	66	66	66
Godot Israel: Haifa, Israel	20[e]	20[e]	20[e]	40[e]	40[e]	40[e]	40[e]	40[e]
Total U.S. capacity	280	335	370	430	480	460	490	490
Total non-U.S. capacity[e]	597	640	817	925	1,300	1,630	1,740	1,880
World Capacity, except former USSR	877	975	1,187	1,355	1,780	2,090	2,230	2,370
U.S. and Canada Consumption	320	340	361	412	443	464	500	525
Europe consumption	339[e]	364[e]	390[e]	450	485[e]	510[e]	555[e]	583[e]
World consumption[f]	850	900	1,080	1,200	1,330	1,460	1,560	1,700

Source: Table 1 and Appendix. e = Estimate by author

[a]Purchased the UK plant from Rhône-Poulenc in 1990. The three Latin American affiliates of La Roche are in Mexico, Columbia, and Brazil. Their plant capacities were derived from a report on Roche's global capacity of 300 million pounds in 1990.

[b]Palcitric is part of Gruppo Palma of Naples, Italy. Biocor was owned by UK's Sturge Biochemicals until March 1990. In 1991, Biocor was resold to Italy's Ferruzzi-Montedison, now named Eridania.

[c]A fire was reported at this plant in the early 1990s, and it is presumed that ADM did not rebuild the plant.

[d]Annual estimates of capacity are based on constant geometric growth from government capacity figures given for 1987 and 1996. In 1994, China had 103 factories, most of them quite small (74% less than 6.6 mil. lb.), using sweet potato or cassava as the feedstock. Because of low quality, Chinese citric acid sells for 30-40% lower prices than the best quality, but the newest plants are being equipped with modern filtration equipment to improve purity. Some Chinese citric acid is refined and re-exported from Japan.

[e]This line is the total of the non-U.S. plant capacities shown above plus an arbitrary 10% to account for unreported production. Citric-acid plants, some quite large, are known to exist in Turkey, India, Indonesia, Korea, Japan, and Latin America. No information is available on the former USSR.

[f]Based on total world capacity with an assumed 75-90% capacity utilization and consistent with reported 3-7 % p.a. volume growth.

Table 3. Relationship of Spot to Contract Prices of citric Acid, 1987-1997.

Period		Reported Transactions Prices, Chemical Buyers		Spot-Contract Difference	Spot/Contract Ratio
		Spot	Contract		
		Cents per pound			*Percent*
1987	II	79.0	79.5	-0.5	-0.6
	III	--	77.0	--	--
	IV	--	74.5	--	--
1988	III	84.0	--	--	--
1989	III	--	79.0	--	--
	IV	--	81.0	--	--
1990	I	76.0	74.0	+ 2.0	+ 2.7
	II[a]	70.0[a]	68.5[a]	+ 1.5	+ 2.2
	III	69.7	66.7	+ 3.0	+ 4.5
	IV	64.0	63.0	+ 1.0	+ 1.6
1991	I	64.7	61.3	+ 3.3	+ 5.4
	II	63.7	61.0	+ 2.7	+ 4.4
	III[b]	67.3[b]	63.0[b]	+ 4.3	+ 6.9
	IV	69.0	69.0	0.0	0.0
1992	I	72.0	70.3	+ 1.7	+ 2.4
	II	72.7	71.0	+ 1.7	+ 2.4
	III	74.7	75.7	- 1.0	- 1.3
	IV	80.0	78.7	+ 1.3	+ 1.7
1993	I	78.0	78.3	- 0.3	- 0.4
	II	77.3	79.3	- 0.2	- 2.5
	III	79.7	78.7	+ 1.0	+ 1.3
	IV	79.3	79.3	0.0	0.0
1994	I	78.7	80.3	- 1.7	- 2.0
	II	82.7	80.0	+ 2.7	+ 3.3
	III	81.0	79.0	+ 2.0	+ 2.5
	IV	77.3	78.0	- 0.7	- 0.9
1995	I	76.0	76.3	- 0.3	- 0.4
	II[b]	80.0[b]	78.3[b]	+ 1.7	+ 2.1
	III	78.7	76.0	+ 2.7	+ 3.5
	IV	77.0	74.3	+ 2.7	+ 3.6
1996	I	78.0	73.0	+ 5.0	+ 6.9
	II	79.0	72.0	+ 7.0	+ 9.7
	III	74.7	73.3	+ 1.3	+ 1.8
	IV	73.3	71.0	+ 2.3	+ 3.3
1997	I	67.7	71.0	- 3.3	- 4.7

Source: Appendix Table 1.

[a]Cargill's new large citric-acid plant begins production May-June 1990, but was anticipated for at least a year. (Before Cargill's entry, U.S. production was a duopoly).

[b]The U.S. Department of Justice indictment of the members of the cartel states that the conspiracy *meetings* began on or about July 1991 and ended in late June 1995. It is likely that the *effects* of the conspiracy did not begin until August or September 1991 and that the effects of output contraction continued to affect prices until at least January 1996, possibly lingering to as late as September 1996 (see Appendix Table 1).

Table 4. Market Shares of the Four Citric-Acid Price Conspirators, 1991 and 1995

Market Definition, Year	Bayer (H&R)	ADM	Roche[a]	Jungbunzlauer[a]	Total Cartel
			Percent		
Global capacity, 1991	24	12	13	11	60
Global capacity, 1995	14	8	7	21	50
U.S.-European capacity, 1991	33	16	18	15	82
U.S.-European capacity, 1995	21	12	10	31	74
U.S. capacity & imports, 1991	41	38	3[a]	3[a]	85
U.S. capacity & imports, 1995	24	29	2[a]	3[a]	58
U.S. production & imports, 1991	23	28	2[a]	2[a]	55
U.S. production & imports, 1995	24	29	3[a]	4[a]	60
W. European capacity, 1991	27	0	31	27	85
W. European capacity, 1995	17	0	16	49	82

Source Tables 1 and 2.

[a]Assumed sales by Roche equal Belgian imports and by Jungbunzlauer imports from Germany and Austria. In 1995, Chinese imports into the United States accounted for 35 million lb. of U.S. supply, or about 7%.

Table 5. Estimates of Citric Acid Overcharges in the U.S. Market.

Alternative Periods	"But For" (Competitive) Price Assumption			Implicit Overcharge from DOJ's Criminal Fines[a]
	$0.60	$0.64	$0.68	
			Million Dollars[b]	
Short (1/93 - 6/95)	205	160	116	150-250
Medium (9/93 - 12/95)	309	233	161	150-250
Long (7/91 - 12/96)	378	281	190	150-250
			Percent of Sales	
Short	24	19	14	17-29
Medium	21	16	11	10-17
Long	21	15	10	8-14

Source: Author's computations, see text.

[a]Fines on the most uncooperative cartel members, Bayer, Hoffmann-LaRoche and Jungbunzlauer. The DOJ probably used the short cartel period.

[b]Range is due to uncertainty about the effective cartel period assumed by the DOJ and the existence of discounts on criminal fines awarded to "cooperating" members of the cartel.

Table 6. U.S. Imports and Exports of Citric Acid and Citric Salts, 1991-1998.

Product[a]	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998[b]**
				Million dollars				
Exports (F.O.B. prices):								
Acid	32.7	43.7	27.7	31.1	31.4	38.5	44.3	46.8
Salts	10.0	17.3	11.6	13.4	11.2	12.5	15.7	12.4
Totals	42.7	60.9	39.2	44.4	42.6	50.7	60.0	59.2
Imports (c.i.f. prices):								
Acid	--	--	60.5	67.7	66.2	51.4	58.4	60.0
Salts	--	--	3.9	3.5	4.1	14.8	15.2	19.2
Total	--	--	64.4	71.2	70.3	66.2	73.6	79.2
				Millions of pounds				
Exports:								
Acid	46.8	57.8	35.7	39.6	38.6	54.4	60.1	61.6
Salts	10.4	18.6	14.1	14.8	12.8	14.0	18.0	14.8
Imports:								
Acid	50.0	59.0	91.2	106.0	104.7	79.7	96.3	100.8
Salts	--	--	3.7	3.3	4.1	14.8	22.7	29.2
				Price(Implicit) in dollars				
Exports:								
Acid	0.68	0.76	0.77	0.78	0.81	0.71	0.73	0.76
Salts	0.97	0.92	0.82	0.90	0.87	0.89	0.87	0.84
Imports:								
Acid	--	--	0.66	0.64	0.63	0.64	0.61	0.59
Salts	--	--	0.72	0.79	0.75	0.69	0.67	0.65

Source: U.S. Census Bureau, *Stat-USA*, on line service.

-- = Not available.

[a]Citric acid is identified under the Harmonized Trade System by number 2918140000. Salts and esters of citric acid (including sodium citrate and potassium citrate) are identified by HTS 2918150000.

[b]Projected from January-March 1998 trade data.

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APPENDIX:
CITRIC ACID CHRONOLOGY*

The chronology uses an abbreviated citation system: *WSJ* (*Wall Street Journal*), *CMR* (*Chemical Marketing Reporter*), *Chem. Wk.* (*Chemical Week*), *NYT* (*New York Times*), or newswire services followed by the date.

Early History: One source states that the U.S. citric acid industry began with Pfizer, Inc. manufacture in 1880, (*CMR* 7/9/90). Pfizer is also credited with developing the "shallow pan, deep tank fermentation process" that became the industry standard by the 1980s.

According to one source, commercial manufacturing of citric acid began in 1826 in Selby, Yorkshire, UK by John and Edmund Sturge. They treated calcium citrate chemically. Shortly after 1900, citric acid production in Europe became an Italian monopoly, because calcium citrate was extracted from Italian lemons and limes. World War I interfered with Italian citrus production, leading to very high citric acid prices through the early 1920s.

In the late 19th century, it was discovered that the Penicillium mold grown in sugar solutions produced citric acid, but amounts were too small to justify commercial production. However, in 1917, J.N. Currie published a paper in the Journal of Biological Chemistry that reported on research with the mold Aspergillus niger. This mold produced relatively large amounts of citric acid when grown in a liquid of sucrose, salts, and iron. Charles Pfizer, Inc. worked with Currie to scale up the process and began commercial production in its Brooklyn plant in 1923, thus breaking the Italian monopoly. In the UK, John & E. Sturge, Ltd. Implemented Currie's process in 1930. Production spread to Germany, Belgium, and Czechoslovakia using beet sugar molasses as the base. After 1945, a few improvements occurred (submerged cultures, improved yeast strains, and glucose bases). In the 1960s, a new technology applying yeasts to petroleum-derived n-alkanes was proved to be technologically feasible, but was never commercially successful. (*The Independent* 3/9/92).

Miles Laboratories of Elkhart, Indiana was manufactuirng citric acid in the early 1970s and probably earlier (*Chemical Week* 12/3/75). In 1975, Miles formed a marketing joint venture with Liquichemica Biosintensi, a subsidiary of Italy's Liquigas. The Liquigas plant built in Reggio Calabria, Italy was to produce 50,000 mt of citric salts from petroleum-based carbohydrates' fermentation. (*Chemical Week* 11/12/75).

Citric acid production began in China in the early 1970s. Most factories fermented sweet potatoes on a small scale (*Agri Pulse* 9/16/97). Some use cassava.

October 1982: China's largest citric acid plant doubles its annual output to 4,000 mt/yr. The plant, Nantong Fermentation Factory in Nanjing, expects to reach 7,000 mt in a few years; it exports 30% of production (*Xinhua* New Service 10/28/82).

February 1986: La Citrique Belge, a subsidiary of Hoffman La Roche, will spend Bfr. 800 million expanding its citric-acid plant in Tienen, Belgium (*Reuters* 2/12/86).

November 1987: Cargill announces plans to build a citric acid plant at a cost of $25 million or more next to its existing Eddyville, Iowa corn refinering plant. The plant will produce 60 mil. lb. with 25 to 30 new employees added to the 100 already employed. (*UPI* 11/2/97).

January 1988: In 1987, China's citric acid production reached 45,000 mt (*Xinhua* New Service 1/15/88). World production capacity reported to be 550,000 tons.

June 1988 Construction begins on Cargill's plant now to cost $40 million. Capacity will be 25,000 mt of liquid citric acid made from liquid dextrose (*UPI* 3/17/88). Production scheduled to begin in 1990.

March 1990: Backer, Italy's sole citric acid producer (25,000 mt), is sold by UK's Sturge Biochemicals to Cremonini, a unit of Consorgio Imprenditoriale Ligure Padano (C.I.L.P.) (*Reuters* 3/7/90). In October, 1991, Biacor is sold again to the Cerestar subsidiary of Ferruzzi-Montedison of Milan. Biacor has about 10% of the European citric acid market of 200,000 mt (*Chemical Week* 10/2/91). Biocor's plant is in Casei Gerola, Italy, near Pavia. Ferruzzi is now named Eridania.

August 1990: ADM agreed to buy Pfizer's citric acid business. The transaction, completed in December 1990, includes Pfizer's technology and two plants: Southport, NC (100 mil. lbs.) and Ringaskiddy, Cork, Ireland (20 mil. lbs.). In addition, Pfizer's plant in Groton, CT will supply up to 40 mil. lbs. To ADM until 1993. Pfizer's 1989 citric acid sales were $180 million.

In late August, Bayer AG bought the Selby, Yorkshire, UK citric acid plant of Rhône-Poulenc (Lyons, France) for $100 million. The UK plant has 46 mil. lbs. capacity, but with "minor adjustments" can be raised to 72 mil. lbs. Bayer's Miles Labs subsidiary (now part of Haarmann & Reimer Corporation of Springfield, NJ) owns 2 U.S. plants (Elkhart, IN and Dayton, OH) with 140 mil. lbs. capacity. In addition, Bayer's joint ventures in Mexico, Columbia, and Brazil give it a total of 300 mil. lbs. capacity or 30% of global consumption. (*Chem. Wk.* 8/90).

Cargill's Eddyville, IA plant has 55 mil. lbs. capacity. Production began in the spring; added 17% to U.S. capacity.

The Montana AG subsidiary of Jungbunzlauer Spiritus und Chemische Fabrik AG of Vienna operates a citric acid plant in Ladenberg, Germany and plans a new French plant of 45, 000 mt.

World consumption is growing 4% p.a., but was growing faster in the early 1980s (*Chem. Wk.* 8/90).

1990: Citric acid accounts for 75% of total U.S. acidulant volume consumed and 83% of value. Total U.S. capacity (including Cargill) is about 325 mil. lbs. In late 1990, Cargill's plant was near capacity, so prices firmed. In 1989, citric acid was priced at 75¢ - 85¢/lb., but in 1990 fell to 60¢ - 65¢/lb., which was unprofitable for all producers. [However, see the later *CMR* article for July 1991 which contradicts this statement]. In June, 1990 prices were about 68¢/lb. Imports fell from 65 mil. lb. in 1989 to 61 mil. lb. In 1990, while exports increased from 16.5 to 21.3 mil. lb.

The total U.S. market for all acidulants is about 450 mil. lb. Citric acid growth in the 1980s was fueled by soft drinks and detergents (phosphorus replacement). Phosphoric acid accounts for 48 mil. lb. of acidulant use, mostly in soft drinks. Processed foods utilize about 33% of all acidulants, most citric and lactic acids. Lactic acid is useful in frozen foods and is growing 8-10% p.a. ADM will join Sterling as the only lactic acid producers in late 1991. ADM's will be the first fermented, "natural" product.

Malic acid made solely by Haarmann & Reimer, accounts for 4% of demand; its flavor profile makes it popular in candy and tea mixes.

Fumaric acid, with 2% of U.S. consumption, is mostly used in nonfood products. H&R and Pfizer are the sole U.S. producers.

Adipic and tartaric acids sales are only $5 mil. (and 5 mil. lb .) (*CMR* 6/3/91).

July 1991: Cargill announces a price increase from $0.68 to $0.73/lb., effective 8/15/91 for truckloads delivered; below 24,000 lbs. $0.77 and below 9,600 lb. $0.81. Cargill introduced its new production in 7/90 at $0.63/lb., $0.10 below industry list at the time. By 11/90, transaction prices fell to about $0.55 --slightly above production costs. Prices began rising throughout early 1991. Buyers say that prices will take another year (to mid 1992) to reach $0.73; contracts are usually signed in September or October at a discount of 3 to 5 cents from list.

Jungbunzlauer has 3 European plants; a 50,000 mt citrates plant in Ludenburg; a recently expanded citric plant near Vienna; and a 45,000 mt plant being built near Strasbourg, France.

ADM is "following" market prices, avoiding aggressive pricing. Imports are down.

U.S. citric demand is 335 - 340 mil. lbs./yr. With 3% growth; Canada demands 20 - 22 mil. lbs. more. (*CMR* 7/22/91).

October 1991: Jungbunzlauer of Vienna and Sungai Budi group (Jarkarta) agreed to build a 10,000 mt citric acid plant in Sumatra, Indonesia. (*Chem. Wk.* 10/16/91).

November 1991: The Austrian government is lending China $50 million for 5 citric plants, each about 3,000 mt, using technology from Vogelbusch Company of Austria (*Xinhua* 11/29/91).

December 1991: Cargill and the U.S. import agent for Gadot Israel raised list prices for anhydrous citric acid from $0.73 to $0.76 as of early January for full truckloads delivered ($0.80 and $0.84 for smaller loads). Earlier, Cargill added a 3 cent premium for deliveries west of Denver. This price increase was led by H&R on 12/1/91 and followed by ADM (12/31/91), Roche (1/1/92) and Jungbunzlauer (1/1/92). Citric growth is about 5% p.a. this year.

ADM appears to be expanding its NC plant, to "wean itself" from Pfizer's Groton, CT plant. (*CMR* 12/23/91).

March 1992: Cargill plans IA expansion from present 80 mil. lb. to 160 mil. lb.; will add citrates to the liquid acid now made.

Junbunzlauer is building an integrated starch/citric acid plant of 88 mil. lb. capacity in Marckolsheim, France, to begin production fall of 1993. Its Pernhofen, Austria plant will be expanded to 220 mil. lb., and Ludenberg will be at 133 mil. lb. by the summer, up from 44 mil. lb. at present.

Prices are to rise in U.S. to $0.79/lb. effective 4/92, for all major sellers. Citrate will rise to $1.08/lb. Exports in 1991 doubled to 22,000 mt. (*CMR* 3/30/92).

December 1992: A new citric acid plant of 35,000 mt. capacity will start production in Calitri, Italy in 1/93, owned by the Palma Group. The world market is about 500,000 mt; Europe's is 200,000 mt., with 3% to 5% growth p.a. The only other Italian producer is Biacor (Padova) with one 24,000 mt. plant. (*Reuters* 12/11/92, *Chem. Wk.* 12/23/92).

January 1993: List prices reached $0.82/lb., large orders $0.80. Exports in 1992 were steady at 22,000 mt. U.S. consumption is 35 mil. lb. (*CMR* 1/11/93).

July 1993: Total acidulents market in U.S. is about $225 million to $260 million. U.S. citric capacity estimated to be 460 mil. lb. In 1993; demand is 415 mil. lb. up from 400 in 1992, of which beverages take 45% and foods 23%. U.S. capacities are ADM 180 mil. lb., Cargill 130, H&R 150. Global growth about 4% p.a. In France, Jungbunzlauer will gelt to 40,000 mt. capacity with AUSTRIA & Germany adding 120,000 mt more; its Indonesian JV will come on line in late 1993. An unknown Czech. facility has 30,000 mt capacity. Current U.S. list prices $0.82. (*CMR* 7/12/93).

Cargill plans to build a 20, 000 mt. Citric acid plant in India for $30 million (*Asian WSJ* 7/19/93).

September 1993: Effective 10/93, ADM, Cargill, and H&R will increase posted prices on acid and citrate to $0.85/lb for a truckload, delivered. U.S. growth is 4% p.a. and global 5 - 6%. Cargill will increase capacity to 160 mil. lb.; Jungbunzlauer's French plant (88 mil. lb.) will be in production 10/93; H&R has 150 mil. lb. capacity ; ADM got its NC plant up to 180 mil. lb. last year. Chinese supplies sell at 10 cents lower. Total U.S. demand is 450 - 500 mil. lb. In 1993. (*CMR* 9/20/93).

May 1994: Cargill spokesperson estimates U.S. consumption at 400 mil. lb. in 1993, with growth at 3% p.a. Imports rose to 59 mil. lb, in 1992 to 91 mil. lb. in 1993. Capacity is 460 mil. lb. U.S. list prices are $0.82 - $0.85/lb. today.

Pfizer closed its CT plant when ADM expanded its NC plant to 180 mil. lb. Cargill has 130 mil. lb. Capacity; Roche has 70,000 mt in Belgium. Jungbunzlauer recently added 40,000 mt. to its existing 80,000 mt. plant capacity; has 20% of world demand. (*CMR* 5/?/94).

August 1994: The Chinese government news agency claims that China produced 163,000 mt. of citric acid in 1993, of which 110,000 mt. Was exported. Country s now second in world after U.S. (*Xinhua* 8/9/94).

February 4, 1995: The U.S. government announced prohibitive tariffs on $1.1 billion of Chinese imports, including citric acid, in retaliation for failure to protect U.S. intellectual property rights. (*Reuters* 2/4/95). To become effective 2/26/95.

February 1995: Why citric acid? Some suggest that the 50% increase in Chinese imports from 1992 to 1994; others claim that ADM or Cargill pressured the U.S. Trade Representative through Congress. Price increases are predicted if tariff is imposed. (*CMR* 2/27/95).

Chinese concessions and citric production problems meant that the tariffs were never implemented. Among the concessions (see March 1997) are the elimination of government subsidies to citric-acid exporters.

June 1995: Citric acid first mentioned as target of federal grand jury after FBI raid on ADM headquarters. Documents on prices and volumes of citric acid producers worldwide are found in ADM files. [*WSJ* 7/28/95:A1].

July 1995: As it was expanding into lysine 1991-1995, ADM also considered many other feed-additives options. In 1/93, rumors that ADM would build a Mexican methionine plant circulated. Instead, ADM formed a joint venture with Rhône-Poulenc to make it in Rhône-Poulenc's new $44 million, 50 mil. lb. Institute, WV plant. ADM got 25% of the plant. Rhône-Poulenc is the world leader, with 300 mil. lb. global capacity.

ADM added theonine and tryptophan production at its Decatur plant in the early 1990s. ADM also built 100 mil. lb. capacity in sorbitol in 1990, now much larger, displacing in 1994 Pfizer. In all cases, ADM dropped prices temporarily upon entry.

ADM announced entry into lactic acid in 1990, but 40 mil. lb. capacity only available in 1993, beating a ConAgra-Dupont JV to that market. In 1994, the JV was put up for sale. Speculation that ADM may be producing only 10 mil. lb. of lactic in 1993, the only "natural" lactic source in U.S.

In 1994, ADM began "hoarding' supplies of deodorized distallates, the primary feedstock for vitamin E, forcing Eastman Chemicals to stop production and agree to market ADM's natural vitamin E on an exclusive basis!

ADM entered production of monosodium glutamate (MSG) and distilled monoglycerides in Decatur in 1994, but this is one case where prices failed to fall and rivals exit. Ajinomoto opened a new 20,000 mt. MSG plant in Eddyville, Iowa in the spring of 1993 and world demand stayed high.

ADM may enter production of biotin, ascorbic acid, and gluconates. (*CMR* 7/24/95).

Terrance Wilson reported to have met European conspirators in London & Paris hotels. Bayer AG makes citric acid in Europe and in Miles Labs' Elkhart, Indiana plant; says it is cooperating with DOJ. Hoffman-LaRoche is a big importer into the USA from European plants. [*WSJ* 7/28/95:A1].

September 1995: *CMR* reports that citric demand is strong despite the antitrust probe! [*CMR's* economic literacy often leaves much to be desired]. Business as usual is the watchword. No price reductions are being offered by manufacturers. "...large customers in this business tend to be loyal [to] suppliers" (p.

16). Chinese production problems and reduced government subsidies have forced import prices to rise 10% since January 1995. However, some large customers say that domestic prices are as low as $0.80/lb. -- lower than imported prices and 5 cents below list. In 1994, Chinese imports of 34 mil. lb. accounted for about 7% of the U.S. market's 475 mil. lb. consumption. Production was about 490 mil. lb., some of it exported.

U.S. capacities are 180 mil. lb. (ADM), Cargill 160, and H&R 150. (*CMR* 9/4/95).

November 1995 ADM faces four private price-fixing suits; rises to seven by February 1996. [*WSJ* 11/17/95].

January 1996: Japan's Fuso Chemical Company is building a 20,000 mt citric plant in Qingdao, China to begin operations 2/96. Fuso has been importing citric for 10 years, refining it in Japan. (*COMLINE* 1/31/96).

March 1996 DOJ investigation, centered in U.S. Attorney's San Francisco office, said to be moving slowly. No videotapes of price-fixing meetings exist. Documents in ADM offices show that ADM shared detailed sales figures with several European and Asian producers, but ADM will argue that conspiracy arose outside USA without ADM's participation. [*WSJ* 3/27/96:A1].

June 1996: Tate & Lyle, through its A.E. Staley subsidiary, is acquiring 20% of India's Bharat Starch Industries Ltd. (BSIL). The investment will expand BSIL's existing citric acid plant from 30,000 to 50,000 mt and upgrade starch and sweetener production. The Indian citric market is growing 5% p.a. (*Developing World* 6/1/96).

Sept. 27, 1996 With surprising suddenness, ADM offers to settle the class-action suit for $35 million. Plaintiffs had not yet received class-action status in the San Francisco District Court. ADM did not admit guilt in price fixing, but it signals intent to settle the DOJ cases as well. [*WSJ* 9/30/96:A3].

October 1996: Cargill will build a plant in Brazil for $50 million for start-up in early 1999. (*Chem. Wk.* 10/30/96).

Oct. 15, 1996: It is revealed that a committee of 7 "outside" ADM directors was authorized to make any plea agreements necessary with the DOJ as early as October 1995. On October 15th, ADM announces a guilty plea agreement with the DOJ in the lysine and citric acid cases. Fines of $100 million are seven times larger than ever previously paid. ADM also agrees to help prosecute its own managers, Michael Andreas and Terrance Wilson. In return, DOJ agrees not to prosecute ADM for price-fixing in corn fructose (which has $3 billion in world sales vs. $1.5 billion for the other two). In addition, Barrie Cox,VP for citric acid is given immunity if he will testify for the prosecution against Haarman and Reimer (U.S. subsidiary of Bayer) and Hoffman-LaRoche.

The DOJ states that ADM and Barrie Cox, VP for citric acid, "did cooperate" in its citric-acid case and "it is substantial." This cooperation led to a *lower* fine for ADM. In it's plea agreement, filed in Chicago District Court, ADM admitted for the first time that its "representatives" attended meetings in the U.S. and overseas in which "...agreements were reached as to the prices the firms would charge for citric acid... and the volume of citric acid each firm would sell." ADM's Comptroller Steven Mills states for the legal record that "The Company does not dispute the facts as presented." The names of the co-conspirators were not revealed at this time.

All criminal charges against ADM as a company are resolved, but criminal indictments against M. Andreas and T. Wilson are still pending as are scores of civil injury suits. [*WSJ* 10/15/96:A3].

Dec. 9, 1996 Haarmann & Reimer Corp., based in Springfield NJ, becomes the fourth company to file a proposed settlement agreement in the citric-acid class-action civil suit. H & R, a wholly-owned subsidiary of Bayer, AG of Basel, Switzerland, offers to pay $46 million to citric-acid buyers. A federal judge in San Francisco must approve the proposed settlement.

The first offer from ADM of $35 million came in October. Later in October, two citric-acid importers also made offers to settle: Hoffmann-LaRoche of Basel, Switzerland offered $5.68 million, and Jungbunzlauer AG of Vienna Austria offered $7.57 million. The fifth defendant in this case, Cargill Inc., refuses to negotiate with plaintiffs.

Attorneys representing plaintiffs in the citric-acid class-action suit state that damages in this market could be as high as $400 million, yet they settle for $94 million. Of the total $117.5 million settlement, 25 percent represents proposed legal fees.

The DOJ is continuing its criminal investigation of citric acid producers with the cooperation of ADM. The investigation is focusing on the coordination of restrictions in output by U.S. and European manufacturers as the method for lifting citric acid prices in major markets. [*WSJ* 12/10/96:B12].

Jan. 29, 1997 Haarmann & Reimer GmbH, the New Jersey subsidiary of Bayer AG pleaded guilty to criminal price fixing in the world citric acid market. The company will pay a fine of $50 million, the second-largest antitrust fine ever assessed. The DOJ stated that the conspiracy was "one of the largest, if not the largest, conspiracies ever prosecuted by the Department of Justice." Officials repeated their assertion that the ADM and Bayer fines would have been much larger had the firms not cooperated with investigators, but they declined to state the size of the overcharges. Private lawyers call the new fine structures "a staggering development for business."

In addition to fines, a senior executive of Haarmann & Reimer, Hans Hartmann, a German citizen, was arraigned in U.S. District Court in San Francisco for criminal conspiracy charges. He can be sentenced up to 3 years and $375,000. The DOJ will not seek civil penalties against Bayer because of the likely class-action settlement, but investigations continue in lysine and citric acid in Asia, Europe, and the United States. [*WSJ* 1/30/97:B6].

March 26, 1997 The two largest U.S. importers of citric acid, Jungbunzlauer and Hoffmann-LaRoche, plead guilty to criminal price-fixing and pay fines of $25 million. These fines bring the total U.S. corporate criminal fines for lysine and citric acid to $195 million, several times the previous highest fines. Two executives of these companies also plead guilty and pay fines of $150,000 each. [*WSJ* 3/27/97:A5].

March, 1997 Plaintiffs' attorneys in the civil class-action case claim that damages from overcharging may be as high as $400 million. They are asking the judge to approve legal fees of 25% (i.e., $23.5 million of the $94 million in payments to plaintiffs). The case against Cargill continues.

Cuts in Chinese government subsidies have reduced citric exports to the U.S. for all but the most efficient manufacturers. Exports to U.S. are sporadic and 30-40% lower in 1996 than in 1995.

Prices have slid to $0.80 list, with large customers getting $0.76-$0.78/lb.

Observers say that vertically integrated manufacturers (ADM, Cargill) have cost advantages over nonintegrated (H&R). Bayer (H&R) moved its citric acid headquarters from NJ to the UK and removed several executives. There is speculation that A.E. Staley might buy H&R's citric business. Staley has greatly expanded capacity for polydextrose and announced plans for a large lactic acid plant. [*CMR* 3/17/97].

June 10, 1997 Four large buyers of citric acid filed a lawsuit in San Francisco charging that ADM conspired with others to fix the price of citric acid. (See the March 1998 entry below for more information). [*Des Moines Register*, 6/12/97:8].

June 1997 Fuso Chemical's Qingdao plant is completed and is running at 10,000 mt., using sweet potatoes as the feedstock. High purity filtration is being used. (*COMLINE* 6/30/97).

Haarmann & Reimer division of Bayer announces its intention to sell its citric acid business. The unit employed 1,310 people and sold $293 million of acid in 1996 from seven plant sites: 3 in U.S., 1 in UK, 1 in Brazil, and 2 majority-owned subsidiaries in Mexico and Columbia. The article claims that H&R is the only U.S. manufacturer that is not integrated into corn refining [*Chem. Marketing Reporter* (6/9/97):1].

July, 1997 Judge Smith in Federal District Court in San Francisco gives final approval to the (slightly reduced) citric acid class action suit for $86.2 million (ADM $35 million, Bayer $38, Jungbunzlauer $7.6, and Roche $5.7). Settlement reduced because four large buyers opted out and are seeking $1 billion or more in damages (incl. P&G, Kraft, Quaker, Unilever, Schreiber Cheese). Opt-outs bought $350 million from 1991 to 1995. Cargill still fighting suit. Pepsi and Coca Cola have joined neither suit.

The DOJ ordered the FBI to turn over tape recordings to plaintiffs suing ADM *et al.* in Peoria for price fixing in fructose. [*Chicago Tribune* 7/6/97]. The FBI and Whitacre made 1400-1600 audio or video tapes of the price conspiracies, according to one source [*Ag Biz* 4/7/97]. A January 28th DOJ memo written by James Griffen, Chicago field office chief, says that 237 tapes were made and will be turned over to defense attorneys [*Corporate Crime Reporter* 3/17/97]. The 237 tapes appear to be audio tapes only made by Mark Whitacre.

Sept. 1997 ADM reported that the EU antitrust authorities begin investigating ADM *et al*. for citric acid price fixing [ADM].

Official statistics show that China's current citric capacity is about 300,000 mt.; in 1994 production hit 200,000 mt., "the highest in the world." Exports grew by 33.7% p.a. from 1977 to 1994.

However most of China's 103 factories are small: 74% are 3,000 mt. or less. Only 6 factories are 10,000 mt. or more. Small scale producers make lower quality acid, that sells for 30-40% lower prices than major companies in the West. (*Asia Pulse* 9/16/97).

December 1997 Bajrai International of Yanbu, Saudi Arabia will spend $140 million to build a citric plant using "Lurgi technology." (*Chem. Wk.* 12/3/97).

Roche Holding (60%) formed a joint venture with Wuxi Chemical Company (40%) to produce citric acid at 20,000 mt., 80% exported. (*AFX News* 12/16/97).

January 24, 1998 Cargill was dismissed from the federal, civil, class-action suit in U.S. District Court in San Francisco. Testimony by the former Bayer official who was convicted of criminal price fixing exonerated Cargill. [*Omaha World Herald* 1/25/98:8M).

January 1998 U.S. Judge Fern Smith in San Francisco ruled that no reasonable jury could find that Cargill was a participant in the citric acid conspiracy. Cargill was dismissed from the federal class-action law suit. (*PR Newswire* 1/28/98). [Judge Fern's decision seems to have been based on the fact that Cargill did not send representatives to the face-to-face meetings held to fix prices. Cargill did cooperate with the "citric acid association" by sending monthly reports of its production for auditing purposes.]

March 4, 1998 Kenneth Adams, lawyer for P&G, Kraft, Quaker, and Schreiber, announces that ADM is the last of four companies to settle with his clients. Bayer, Jungbunzlauer, and Roche Holdings settled earlier for amounts that must remain confidential. [*Chicago Tribune* 3/5/98: business p.1].

March 1998 ADM stated that it had agreed to pay $36 million to four citric-acid customers that had opted out of the July 1997 civil class-action antitrust settlement. The four recipients are Procter & Gamble Co., Quaker Oats Co., the Kraft Food unit of Philip Morris Companies, and Schreiber Foods, Inc., a cheese company located in Green Bay, Wisconsin. Although not reported, it is highly likely that Bayer, Jungbunzlauer, and Roche paid an additional $52.7 million to the four buyers.

It appears that on the basis of Unilever's size in the U.S. (See July 1997 above) market that the four sellers probably paid Unilever about $25 million. Because the five opt-out firms accounted for 19% to 24% of citric-acid sales by the four defendants, the total civil settlement of $113.7 million is considerably more advantageous than the March 1997 class-action settlement (measured as a percentage of sales). The two largest U.S. buyers of citric acid (Coca-Cola and Pepsico) declined to sue, perhaps because the defendants sold citric acid to these two companies on a preferential basis (i.e., with little or no overcharge). If Coke and Pepsi account for 30% to 40% of citric acid purchases, then the class held about 36% to 51% of the U.S. market. The class settlement of $86.2 million represented an assumed overcharge of $1.7 to $2.4 million per percentage point of the market. However, the opt-out firms received $4.7 to $6.0 million per percentage point, or *from 2 to 3.5 times* more than the federal class. [ADM].

May 1998 Bayer AG will sell its world citric acid business to Tate & Lyle for $219 million. Haarmann & Reimer will focus on flavors and fragrances. Tate & Lyle will get plants in Dayton, OH; Duluth, MN; Selby, UK; and joint ventures in Sucromiles (Columbia); Mexama de CV (Mexico); and Mercocitrico Fermentacos (Brazil). Sales in 1997 were $298 million. H&R's Indiana plant will close. (*CMR* 5/11/98).

Sources say that H&R's operations have been low in profitability, even though its 150 mil. lb. U.S. capacity gives it a 33% share of U.S. capacity. Pre tax profits were $8.3 mil. (or 2.8% of sales) on book assets of $203 mil. A.E. Staley already supplies H&R will its feedstockes, molasses and dextrose. Now all 3 U.S. citric producers will be fully integrated operations. (*Chem. Wk.* 5/13/98, *European Report* 5/21/98).

END

Appendix Table 1. U.S. Citric Acid Prices, Various Periods 1987-1997.

Period	List Prices			Transactions Prices Purchasing Magazine[c]		
	SRI[a]	CMR[b]	CMR[b]	Spot	Contact	**Total & Quarterly**
1987	81.0	--	--	79.0	77.0	77.3
May	--	--	--	79.0	80.0	79.5 II
June	--	--	--	--	79.0	
Aug	--	--	--	--	79.0	77.0 III
Sept	--	--	--	--	75.0	
Nov	--	--	--	--	74.0	74.5 IV
Dec	--	--	--	--	75.0	
1988	83.5	81.0	--	84.0	--	84.0
Oct	--	--	--	84.0	--	--
Dec	--	81.0	--	--	--	84.0 III
1989	83.5	80.5	--	--	80.0	80.0
Jan-Sept	--	81.0	--	--	--	
Oct	--	81.0	--	--	79.0	79.0 III
Nov	--	81.1	--	--	81.0	81.0 IV
Dec	--	75.0	--	--	--	
1990	73.5	68.1	--	68.6	67.6	67.8
Jan	--	75.0	--	--	--	
Feb	--	75.0	--	--	72.0	73.3 I
March	--	75.0	--	76.0	74.0	
April	--	73.0	63-73	--	72.0	
May	--	73.0	63-73	71.0	70.0	69.7 II
June	--	68.0	--	69.0	67.0	
July	--	63.0	53-57[f]	72.0	67.0	
Aug	--	63.0	53-57[f]	71.0	68.0	67.2 III
Sept	--	63.0	53-57[f]	66.0	65.0	
Oct	--	63.0	53-57[f]	65.0	64.0	
Nov	--	63.0	53-57[f]	63.0	63.0	63.2 IV
Dec	--	63.0	53-57[f]	64.0	62.0	
1991	68.0	69.7	--	66.2	63.6	64.0

Jan	--	63.0	--	64.2	62.0	
Feb	--	68.0	63.0	65.0	62.0	61.9 I
March	--	68.0	63.0	65.0	60.0	
April	--	68.0	63.0	63.0	61.0	
May	--	68.0	63.0	63.0	61.0	61.4 II
June	--	68.0	63.0	65.0	61.0	
July	68.0[d]	68.0[d]	63.0[d]	63.0[d]	62.0[d]	
Aug	--	73.0	--	66.0	60.0	63.7 III
Sept	--	73.0	--	73.0	67.0	
Oct	--	73.0	--	68.0	69.0	
Nov	--	73.0	--	68.0	67.0	69.0 IV
Dec	--	73.0	--	71.0	71.0	
1992	79.0	78.3	--	74.8	73.9	74.1
Jan	--	76.0	--	71.0	72.0	
Feb	--	76.0	--	73.0	69.0	70.6 I
March	--	76.0	--	72.0	70.0	
April	--	76.0	--	71.0	70.0	
May	--	79.0	--	70.0	71.0	71.3 II
June	--	79.0	--	77.0	72.0	
July	--	79.0	--	73.0	74.0	
Aug	--	79.0	--	75.0	75.0	75.5 III
Sept	--	79.0	--	76.0	78.0	
Oct	--	79.0	--	82.0	78.0	
Nov	--	79.0	--	79.0	78.0	78.9 IV
Dec	--	79.0	--	79.0	80.0	
1993	82.0	82.8	80.0	78.6	78.9	78.9
Jan	--	82.0	80.0	79.0	78.0	78.3 I
Feb	--	82.0	80.0	81.0	79.0	
March	--	82.0	80.0	74.0	78.0	
April	--	82.0	80.0	75.0	79.0	
May	--	87.0	80.0	77.0	80.0	79.0 II
June	--	82.0	80.0	80.0	79.0	
July	--	82.0	80.0	79.0	78.0	
Aug	--	82.0	80.0	79.0	79.0	78.8 III
Sept	--	82.0	80.0	81.0	79.0	
Oct	--	85.0	--	78.0	78.0	
Nov	--	85.0	--	82.0	82.0	79.3 IV
Dec	--	85.0	--	78.0	78.0	
1994	85.0	85.0	--	79.9	79.3	79.4
Jan	--	85.0	--	80.0	81.0	
Feb	--	85.0	80-83	76.0	80.0	80.1 I
March	--	85.0	80-83	80.0	80.0	

April	--	85.0	80-83	86.0	82.0	
May	--	85.0	80-83	80.0	78.0	80.4 II
June	--	85.0	80-83	82.0	80.0	
July	--	85.0	80-83	82.0	81.0	
Aug	--	85.0	80-83	83.0	79.0	79.4 III
Sept	--	85.0	--	78.0	77.0	
Oct	--	85.0	--	78.0	78.0	
Nov	--	85.0	--	77.0	77.0	77.9 IV
Dec	--	85.0	--	77.0	79.0	
1995	85.0	85.0	80-83	77.9	76.3	76.6
Jan	--	85.0	--	77.0	76.0	
Feb	--	85.0	80-83	75.0	76.0	76.3 I
March	--	85.0	80-83	76.0	77.0	
April	--	85.0	80-83	80.0	81.0	
May	--	85.0	80-83	80.0	77.0	78.6II
June[e]	--	85.0[e]	80-83[e]	80.0[e]	77.0[e]	
July	--	85.0	80-83	76.0	75.0	
Aug	--	85.0	80-83	81.0	77.0	76.4 III
Sept	--	85.0	80-83	79.0	76.0	
Oct	--	85.0	77-80	79.0	76.0	
Nov	--	85.0	77-80	76.0	73.0	74.8 IV
Dec	--	85.0	77-80	76.0	74.0	
1996	--	84.2	76-80	76.3	72.3	73.0
Jan	--	85.0	77-80	76.0	75.0	
Feb	--	85.0	77-80	77.0	71.0	73.8 I
March	--	85.0	77-80	81.0	73.0	
April	--	85.0	77-80	81.0	73.0	
May		85.0	77-80	78.0	72.0	73.2 II
June	--	85.0	77-80	78.0	71.0	
July	--	85.0	77-80	75.0	72.0	
Aug	--	85.0	77-80	75.0	74.0	73.6 III
Sept	--	85.0	77-80	74.0	74.0	
Oct	--	85.0	76-78	73.0	72.0	
Nov	--	80.0	76-78	73.0	72.0	71.4 IV
Dec	--	80.0	76-78	74.0	69.0	
1997	--	--	--	69.0	71.3	70.9
Jan	--	80.0	76-78	68.0	71.0	
Feb	--	--	--	68.0	71.0	70.4 I
Mar	--	--	--	67.0	71.0	
April	--	--	--	73.0	72.0	

-- = Not available

Sources: *SRI Report of Citric Acid* (January 1996), *Chemical Marketing Reporter* (various issues), *Purchasing*

Magazine, Connor (1998a), and personal communication from Dr. Robert T. Harris.

[a]Annual average list prices, f.o.b. plant, tanker-car lots of anhydrous liquid citric acid. Possibly from *CMR*.

[b]Occasional articles in *CMR*. For details see Connor (1998a).

[C]Based on monthly surveys of up to 500 chemical purchasing agents and buyers of bulk purchases (truck or tanker-car loads), f.o.b., USP grade citric acid. Contract prices are for supply contracts in force for 3 months, or more (usually one year). Spot transactions are for immediate sale or delivery. Harris states that these prices track the (confidential) selling prices reported by the four largest U.S. sellers very closely. Total column assumes contract sales volume is five times spot volume.

[d]The DOJ indictment states that the conspiracy began July 1991.

[e]The DOJ indictment states that the conspiracy ended June 1995.

[f]These prices were reported to be at or slightly above the costs of production of the most efficient U.S. integrated manufacturers (ADM, Cargill).

Appendix Table 2. Alternative U.S. Overcharges Estimates, Citric-Acid Cartel, 1991-1996.

Period		Quarterly Transactions Prices[a]	Quarterly U.S. Consumption[b]	Overcharges at But-For Prices:[c]		
				$0.60/lb.	**$0.64/lb.**	**$0.68/lb.**
		Cents/lb.	*Mil. lb.*	*Million dollars*		
1991	III	63.7	85	3.15	0.00	0.00
	IV	69.0	90	8.10	4.50	0.90
1992	I	70.6	94	9.96	6.20	2.44
	II	71.3	98	11.07	7.15	3.23
	III	75.5	98	15.19	11.27	8.33
	IV	78.9	100	18.90	14.90	10.90
1993	I	78.3	100	18.30	14.30	10.30
	II	79.0	105	19.95	15.75	11.55
	III	78.8	105	19.74	15.54	11.34
	IV	79.3	110	21.23	16.83	12.43
1994	I	80.1	110	22.11	17.71	13.31
	II	80.4	110	22.44	18.04	13.64
	III	79.4	110	21.34	16.94	12.59
	IV	77.9	110	19.69	14.74	10.34
1995	I	76.3	115	18.75	14.15	9.55
	II	78.6	115	21.39	16.45	11.45
	III	76.4	120	19.68	14.88	10.08
	IV	74.8	125	18.50	13.50	8.50
1996	I	73.8	125	17.25	12.25	7.25
	II	73.2	125	16.50	11.50	6.50

III	73.6	125	17.00	12.00	7.00
IV	74.1	125	17.63	12.63	8.25
Conspiracy:					
'93I-'95II			204.94	160.45	116.45
'93III-'95IV			309.49	232.85	160.83
'93III-'96IV			377.87	281.23	189.83

[a]From last column of Appendix Table 1.

[b]Smoothed quarterly comsumption from annual data in Table 1.

[c]See text discussion on but-for prices and Appendix Table 1.

Appendix Table 3. Reported Prices of Citric Acid Sold in the United States, 1989-1996.

Dates	Major U.S. Manufacturers		Importers' Prices (*C.I.F.*)[c]	
	List Price, Truckload[a]	Transactions, Largest Buyers[b]	European	Chinese
12/88	81	--	79	75
12/89	75	--	73	69
4/90	73	63-73	73	--
6/90	68	--	--	--
7/90-11/90	63	53-57[d]	--	--
2/91 - 7/91	68	63	--	--
8/91-11/91	73	65-68	--	--
1/92 - 3/92	76	--	--	--
4/92 - 11/92	79	--	--	--
1/93 - 9/93	82	80	--	--
10/93 - 11/94	85	--	74	64
2/95 - 7/95	85	80-83	72	65
9/95 - 12/95	85	77-80	72	65
10/96	80	76-78	74	69
1997	--	--	74	66

-- = Not available.

Source: Chronology Appendix, STAT-USA

[a]Price for liquid citric acid, anhydrous equivalent, delivered in truckloads of 24,000 lb. or larger. In the early 1990's truckloads of 9,600 to 23,999 lb. sold at a 4 cent premium, and truckloads smaller than 9,600 lb. at an 8 cent premium. Furthermore, deliveries west of Denver carried an additional premium of about 3 cents per pound.

[b]Reported discounted prices for the largest, oldest or most favored customers. Industry practice is to contract for most of a large buyer's expected annual volume in September or October. Additional spot purchases can be made at list price if demand expands unexpectedly, such as hot weather that affects beverage sales. Reported quantity discounts vary according to capacity utilization and volume imported, but some buyers may exaggerate their discounts for strategic reasons.

[c]Although unstated, these appear to be prices for large truckloads delivered east of Denver. Prices in the 1990s are derived from c.i.f. border prices plus the same 14 to 17 cent markup applied to deliveries in the 1980s.

[d]These prices are reported to be only slightly above the production costs of the most efficient US manufacturer

(ADM and Cargill). Thus production costs may be about 50 cents per pound for integrated producers.

Footnotes:

1. Facts mentioned in this paper and additional bibliographic citations can be found in Appendix A of Connor (1998a).

2. Apart from commercialization of prehistoric processing methods using yeast (bread, beer, soy sauce, etc.), this may be the earliest example of a successful "biotechnology based" industry.

3. Ten years earlier, takeovers by *potential* entrants would have triggered rigorous reviews by federal antitrust authorities, and evidence from marketing plans that the acquiring firm had actively considered *de novo* entry would have blocked the merger. ADM's public announcement in early 1990 made it a *blatant* potential entrant and, thus, competitively unsuitable even by the relaxed antitrust standards of the 1981-1993 period.

4. A fourth region, Latin America, had three plants accounting for at most 7% of global capacity. Production was a monopoly of Bayer (Table 2). The region was mostly self sufficient.

5. Under U.S. antitrust law only the active participants in a price-fixing conspiracy are liable for *all* the damages to buyers who are over charged. By *passively* following increases in citric-acid prices, Cargill and all but two importers enjoyed excess monopoly profits during the conspiracy. However, the four conspirators are liable for the treble damages on both their own sales and the sales of nonparticipants.

6. The largest antitrust fine ever was $70 million paid by ADM for its lysine role; ADM also paid $30 million for its citric acid activities. The $100 million total was nearly seven times the previous record fine and ten times the so-called "statutory" maximum specified in the Sherman Act. ADM was the second (Bayer the third) firm to pay a fine calculated under a relatively new felony sentencing rule based on "twice the harm caused."

7. The actual transaction prices for citric acid were revealed by the four defendants to plaintiffs during the pretrial discovery phase. The transactions prices in Table 3 track the confidential defendants' prices very well.

8. Prior to the two conspiracies, ADM earned only 5% after taxes on sales.

9. Annual 1998 exports are estimated from reported first quarter U.S. exports. Although quite small (about 600 mt per year 1996-1997), U.S. exports to three African destinations parallel those to Western Europe.

10. I exclude the civil damages paid to shareholders for mismanagement and failure to divulge material information, which cost ADM $38 million.