Chapter 6: Economic Impacts of the Citric Acid Cartel

Market forces usually overwhelm any attempts by a firm to deviate from its assigned role in an industry. With a given plant in place, once a seller in a competitive market observes the market price and input costs, it passively sets its output level at the profit-maximizing point. If, as was the case in the global market for citric acid, food-grade product made by alternative sellers was viewed by buyers as perfect substitutes, sellers had few strategic options to try to improve their profitability. Efforts by a firm to distinguish itself on the basis of delivery terms or after-sales service can easily be imitated by rivals. Investing in a lower cost production technology might yield better profits for a few years but carries the danger of operating at inefficiently low levels of utilization or betting on the wrong technology. Price cuts can be quickly matched by other sellers and can lead to a price war that hurts everyone until it is abandoned. Price increases will simply lead to an erosion of a firm's market share and a build up in excess capacity that further squeezes margins.

While single-firm actions contrary to market forces are doomed to failure in most commodity markets, joint actions by a group of sellers large enough to dominate supply are another matter. For millennia, sellers have realized that collective action on prices or output levels can raise the profits of all suppliers in a market. The citric acid cartel met these criteria. It chose to raise selling prices simultaneously around the globe. With control of about two-thirds of the world's supply and a system for detecting and compensating for cheating by its members, the cartel clearly was efficacious in raising prices in North America, South America, and Europe. In this section, the effects of the cartel's collusive behavior on prices, international trade, profits, and consumer welfare in the U.S. market are detailed as precisely as possible.

Price Effects

When the G-4 began meeting in 1991, they made agreements to raise their list prices. In some industries, like retail grocery stores, the price listed on the item or shelf is the actual price a buyer will pay at check-out. However, in many other industries, like automobiles, most consumers regard the list price as simply the highest price a seller hopes to get for the product, whereas after searching for alternative offer prices most buyers will purchase an automobile at a negotiated discount. List prices for most industrial commodities like citric acid follow the automobile model of pricing.[1]

Citric acid prices are hard to find. Chemical-industry magazines occasionally published announcements of list prices of citric acid, particularly when fairly large increases were initiated and when all the major suppliers followed the movement in prices. Somewhat less frequently these magazines would summarize the transaction prices that buyers claimed to be paying (Connor 1998:55).[2] In December 1988, U.S. list prices of the most common type of citric acid were $0.81 per pound (i.e., full truckloads of acid delivered east of the Rockies at a 100% active-content strength). A year later, the list price had dropped to $0.75 per pound and kept falling to the summer and fall quarters of 1990 when it reached a low of $0.63 (see Figure 5.1). Press reports attributed this reduction in list prices by Pfizer and Haarmann & Reimer to the expectation that Cargill's new plant would pour vast quantities of citric acid onto the market. Throughout the latter half of 1990, Cargill fulfilled these expectations. Indeed, Cargill initiated the late 1990 price cuts as a way of quickly attracting new customers. A couple of trade magazine articles asserted that the largest buyers of citric acid were paying 6 to 10 cents per pound less than list price during this period. That is, by late 1990, U.S. manufacturers were selling citric acid to their most favored customers at $0.53 to $0.57 per pound. At those prices even Cargill's efficient operation was probably losing money.

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1 Technically, supermarket shelf prices are *posted* prices. A posted pricing system guarantees buyers can purchase all the supply available at the listed, nonnegotiable price. In the citric acid market, most sales were by contracts that were *private treaties*. The transaction price was privately negotiated with the list price simply the starting point of the negotiation. Actual prices varied according to the amount purchased and the bargaining abilities of the two parties (Marion *et al*. 1987).

2 Reports of prices paid by procurement managers must be treated with caution. Knowing that their remarks are likely to be printed, these managers would be tempted to understate their prices out of pride or in order to place pressure on sellers to lower their transaction prices. Alternately, procurement managers may inflate reported prices if they believe they received an extraordinary discount so as to hide the fact from other buyers who would be tempted to demand such discounts for themselves.

By early 1991 conditions had changed. Pfizer had retreated from the industry, only to be replaced by Cargill's old nemesis, ADM, which was busy learning the new business and upgrading its acquired plant. More importantly, Cargill's plant was approaching its optimal level of utilization, so attracting a lot more market share was no longer such a high priority.[3] Thus, Cargill successfully led a list-price increase in February 1991 and another in August 1991. After that the cartel took over arranging price increases. List prices spiraled upward from February 1991 to October 1993, rising on average every six months by 3 cents per pound. From late 1993 to late 1996, U.S. list prices remained stuck at $0.85 per pound. The cartel was responsible for all the price changes during 1992-1993, and it was responsible for keeping the list price at $0.85 for a couple of years beyond that. Reported transaction prices were not far below list at this time, despite what the trade press called "ample supplies."

Conditions in Europe were similar (EC 2002). Transaction prices fell from DM3.7 per kg. in 1985 to DM2.0 in 1990 – a tumble of 45%. With Cargill's entry, prices fell a further 45% in the first six months of 1991 to DM1.1 per kg. The G-4 boldly announced an increase in European list prices that was 12.5% above 1990 levels. After two more increases, list prices remained at DM2.8 from June 1992 to June 1995 – 40% above pre-cartel prices.

Although the citric acid cartel's crime was the agreement to fix *list* prices, the economic injuries inflicted on buyers must be assessed using *transaction* prices.[4] In a market like citric acid where there is no public price reporting, often only the sellers themselves know for sure what transaction prices really are. Fortunately, a quasi-public source of quarterly average transaction prices was obtained, and there are good reasons to believe that these prices closely track the proprietary price information known to the sellers. U.S. transaction prices for contract buyers of citric acid are shown in Figure 5.1.

The relationship between (delivered) list prices and (f.o.b.) transaction prices is just what would be expected. Contract prices are equal to or below list prices in every quarter from 1987 to 1997. When list prices fell during November 1989 to July 1990, contract prices fell below list prices within four months, and usually quicker. When list prices climbed

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3 In addition to press reports to this effect, the fact that Cargill increased its plant size by 45% in 1991 confirms that it was approaching full utilization in early 1991.

4 The courtroom testimony by Barrie Cox confirms that the list prices reported by the trade press were also ADM's list prices and that the G-4 was responsible for all but the first two increases (Tr. 2679-2685). Of course, the cartel knew that changes in transaction prices would follow their agreements to fix list prices. The agreements on volume shares and discount policies reinforced the tendency of transaction prices to follow the lead of list prices.

from their low in January 1991 to the $0.85 plateau beginning October 1993, contract prices duly responded in the same direction with a short time lag. During the peak period of the cartel's operation in 1994, contract transaction prices hovered just 5 to 7 cents below list, just as had been previously reported by the trade press. The DOJ indictment specifies June 1995 as the end of formal collusion. Although transaction prices slipped slightly in the first quarter of 1995 (to $0.76 or 9 cents below list), they recovered in the second quarter (to $0.79 per pound). However, after June 1995, transaction prices slid slowly downward through 1997 as the power of the cartel faded.

It seems unrebuttable that from some time in 1991 (probably the summer) to at least as late as June 1995, the G-4 had its way with U.S. citric acid prices. Given the large amount of international trade in citric acid, prices in Canada, Mexico, and Western Europe responded closely in sympathy with those in the United States. The G-4 set EU target prices at DM2.25/kg. in April 1991, a 12.5% increase from 1990 prices; from June 1992 to June 1995 list prices were 40% above the 1990 price (EC 2002). Bayer was the sole manufacturer of citric acid in Latin America, and U.S. exports supplied much of the continent's needs, so it seems highly likely that the cartel was able to effectively raise prices to Latin American buyers as well. The situation in Asian markets is murkier. Here, China was a strong, low cost, and growing source of supply for citric acid, and no Chinese producers were cooperating with the G-4. It is unlikely that buyers in Asia were much affected by the cartel-induced high prices in North America and Europe, save for a few food manufacturers concerned about the levels of impurities found in some citric acid made in Asia.

There is one more price effect that seems to confirm the cartel's grip on market prices during 1991-1995. Recall that there are two kinds of transaction prices, spot and contract. During periods of normal competition, sellers are under pressure to give price concessions to contract buyers because they have time to shop around and because they buy in larger quantities than spot purchasers. That is, competition causes a significant gap between spot and contract prices while collusion shrinks the gap. In citric acid, this is precisely the case. During every quarter of the preconspiracy period in 1990 and early 1991, spot buyers paid 4% more than contract buyers (Connor 1998:11). However, as soon as the cartel had begun exercising its collective power, the gap between the two prices practically disappeared. That is, contract buyers stopped getting discounts compared to spot buyers. Cartel discipline was such that searching for a lower price was a fruitless enterprise from late 1991 to early 1995. After the cartel stopped affecting prices, contract prices fell below spot once again.

The cartel lost control of prices in June 1995. The precise causes for the failure to cooperate are not known, but rising Chinese imports and

disagreements about volume allocations are good guesses.[5] U.S. contract prices briefly rose to $0.82 in November 1994; this was peak monthly cartel price. Basically, prices slowly declined each quarter starting in late 1994, reaching $0.70 by early 1997. How long the effects of the cartel's price increases lingered beyond the end of formal collusion is a matter of debate, but the effects seem to have diminished throughout 1995 and vanished by late 1996.

The G-4 accomplished what it set out to do. Instead of observing a highly dispersed pattern in citric acid prices as one expects in a competitive market, the monopoly power of the cartel raised prices above competitive levels and made price movements over time immune to the forces of demand and supply (Connor 2004c). List prices were held fixed in the U.S. and EU markets for an unprecedented 37 months, and contract prices hovered closely below list for much of that time. Instead of equally balanced contest of bargaining power over price, buyers were emasculated because the outcome was rigged.[6]

Effects on Production

When a monopolistic group is successful in raising selling prices, most buyers bite their lips and continue buying at the higher prices. Buyers who remain in the market at the elevated price levels simply transfer income they would have earned themselves to the sellers. Most continue to buy because the quantities used of citric acid are relatively fixed. While no published studies of the elasticity of demand can be found, it stands to reason that after price increase for a minor ingredient among many food inputs is likely to continue to be purchased by food processors, particularly as citric acid helps preserve foods. Because demand is highly inelastic, the effects of monopoly pricing on industry efficiency are very small compared to the income-transfer effects (Chapter 2). Analyses of monopoly pricing in the food industries show that effects of power over price are typically at least ten times bigger than the effects on allocative efficiency (Connor and Peterson 1996).

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5 Jungbunzlauer in particular must have chaffed at the restrictions placed on its sales by the cartel. The company, it will be recalled, had the most ambitious expansion in the G-4 in the early 1990s, and as a result was probably operating at the lowest utilization rate. Moreover, by 1993, its new vertically integrated plant in France was producing low cost feedstock for all of its European plants. Typically, the lowest cost member of a cartel if it has some excess capacity, will have the greatest incentive to cheat or leave a cartel

6 My apologies to modern professional women for apparently sexist terminology. However, I am not aware of a gender-neutral term with comparable emotive connotations.

Production was affected by the volume quotas allocated to each member of the G-4. The effective monthly monitoring of sales volumes by Mr. Huari of Hoffmann-La Roche, coupled with annual checking by independent Swiss auditors, left little room for cheating by the conspirators. In May 1991, each member of the G-4 agreed to accept an annual tonnage quota expressed by percentage of global sales volume by the cartel. Bayer/Haarmann & Reimer was awarded the largest share of 34%. The other three companies got 27.5% (ADM), 24% (Jungbunzlauer), and 14.5% (Hoffmann-La Roche) of total cartel sales.[7] Actual production by each member adhered very closely to the cartel's planned production (EC 2002, Tr. 2642-2645). Inefficiencies result with fixed quotas of this kind, because lower cost members of the cartel are unable to expand their shares over time at the expense of their less-efficient co-conspirators.

Using percentages of global sales volume as an allocative device was clever from the point of view of preserving cartel harmony. By assigning market shares on a global level, the cartel avoided the discord that would arise from having to negotiate national or regional shares. Any producer is likely to react negatively to an invasion of its traditional home markets by an outsider. Such actions by a fellow member of a cartel would be even more intolerable. However, the G-4 explicitly avoided assigning such territorial shares. Not only was needless friction avoided, but also the chance of detection by national antitrust authorities was reduced. With exclusive territories, buyers are more likely to complain about refusals to deal by suppliers that had reached their cartel-granted regional limits.

Finally, the pattern of capacity expansions suggests that the cartel's members decided to slow down their rates of investments during 1991-1995.[8] In the U.S. industry, both ADM and Bayer essentially froze in their capacities. Even Cargill's capacity investments were modest. In Europe, Jungbunzlauer implemented at most one expansion project among its three plants; Bayer may have slightly raised the capacity of one of its six plants; and Hoffmann-La Roche stood pat. To summarize, the four cartel members expanded capacity by about 20% from 1993-1997, whereas all other producers of citric acid in the world expanded by 67% (of which Chinese companies grew by 110%). As often happens to companies in monopolized industries, they grow fat on profits but lose their dynamism and agility. Moreover, unable to blockade entry, the high cartel-induced prices prompt hungry outsiders to do more than merely nibble from the crumbs that fall from the cartel's table.

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7 When Ferruzzi (now Eridania) joined the cartel, it was given a 5% share and the G-4 members' shares were reduced accordingly.

8 Allowing for the usual two-year lag between the start of capacity expansion and production, this shows up in annual capacities during 1993-1997.

Effects on International Trade

The pattern of trade among nations was notably altered by the cartel's operations. In the United States, just before the cartel was launched the drop in citric acid prices surrounding Cargill's entry in 1990 caused a long-term upward trend in imports to be reversed. At the same time, the vast expansion of capacity created production in excess of domestic needs and prices favorable to a marked jump in exports. However, during the heyday of the cartel, the brief export surplus turned to a huge export deficit for the United States. The deficit was much larger than would have occurred in the absence of the cartel. In addition, there is some evidence that the cartel divided export markets between the European and North American producers and extended their power by price discriminating among destinations for exports. The G-4's attempt to cow Chinese producers into voluntarily reducing exports to the West seems to have had only a temporary impact. The demise of the cartel in early 1995 led to a restoration of pre-cartel trends in overall imports and exports.

One reason for dwelling on trade patterns is because they are among the few truly transparent pieces of economic activity consistently available before, during, and after the conspiracy. Governments dutifully collect data on traded quantities and values of goods and publish these data even if only one company is responsible for all the imports into or exports out of the country. Sellers in concentrated industries usually follow trade trends carefully to alert them to changes in the locations of production, in pricing policies of rivals, or cheating on quota allocations.

Imports

Imports of bulk citric chemicals (citric acid, sodium citrate, potassium citrate, and other citric salts) rose throughout the 1980s (Figure 6.1). The two domestic producers continuously lost market share to imports, partly because Pfizer and Bayer's U.S. subsidiary were collusively raising domestic prices during the decade. By 1989, the last year that the U.S. industry was a duopoly, imports accounted for 22% of U.S. demand (Connor 2001: Table 4.A.1).

In 1988, for example, imports were arriving at U.S. ports from nine major countries. Imports were undercutting U.S. producers by selling at $0.30 per pound (Connor 2001: Table 4.A.2). However, 90% of imported citric acid was imported from five companies with plants located in eight countries. The Chinese challenge became a major problem when the G-4 successfully raised prices in North America and Europe. High U.S. prices were a bonanza for exporters to the United States. The volume of Chinese

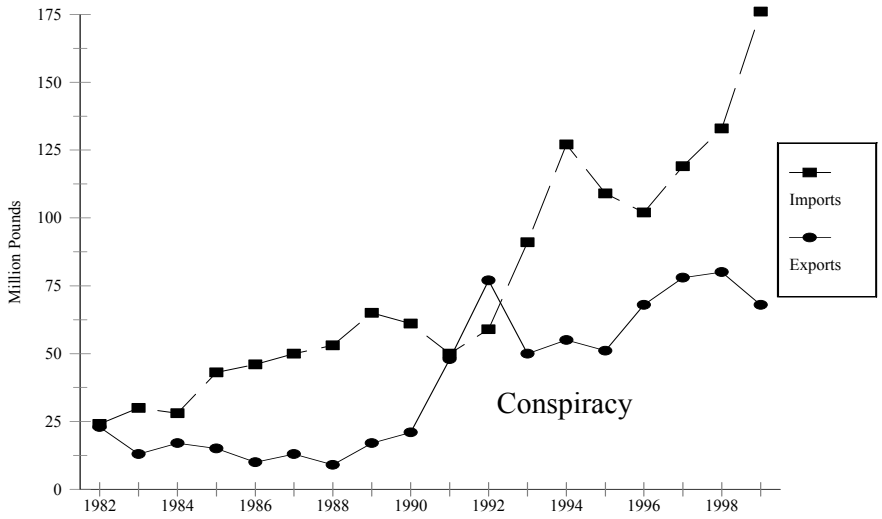

Figure 6.1 U.S. Imports and Exports of Citric Acid and Its Salts, 1982-1999

imports exploded, rising by 150% from 1988 to 1994. In 1994, Chinese imports were selling at prices 19 cents lower than imports from the cartel. The share of U.S. imports accounted for by cartel members' plants shrank to less than 45% in 1994 from over 70% in 1988.

As recounted earlier in this chapter, one of the cartel's U.S. members lobbied the office of the U.S. Trade Representative, which announced proposed prohibitive tariffs on Chinese imports of citric acid. Last minute concessions by the Chinese government prevented final implementation of this punishment, among which was cancellation of export subsidies for its citric acid makers. The mere threat of tariffs may have been enough because Chinese imports fell substantially from 1994 to 1996.

Exports

The effects of the cartel on U.S. exports of citric acid and salts were even more profound than its impact on imports. The last "normal" year for the U.S. industry seems to be 1990, the first year of operation for Cargill's new plant and the last year before collusion began. In 1992, the United States enjoyed its first export surplus in citric acid and salts (Figure 6.1). However, this renaissance of American international competitiveness was

cut short by the G-4's success in raising prices. U.S. exports during 1992-1995 dropped back to the same quantity as the base year 1990.

As soon as the cartel ceased to operate, U.S. exports once again took off. Export volume during 1996-1998 was *six times* higher than the volume during 1993-1995. Thus, through its indisputable impact on U.S. prices, the citric acid conspiracy restrained the volume of exports and artificially stimulated imports. Without the cartel its seems that during the years 1992-1995 the U.S. balance of trade was adversely affected to the tune of about $200 million (Connor 1998:24). This was a significant additional burden on the chronic U.S. merchandise trade deficit.

Additionally, U.S. exports may have been distorted. The geographic pattern of trade is consistent with the idea that U.S. producers reduced exports to areas historically supplied by Bayer and Jungbunzlauer from their European plant locations. In 1990, at least 21% of the U.S. exported volume of citric acid destined to Western Europe. However, during the three high years of the cartel, only 1% of U.S. exports ended up in Western Europe; moreover, the small amounts of citric acid that did dribble into Germany, France, and the Netherlands were priced way above the average export price, as though U.S. companies were imposing some kind of private export tariff. As soon as the cartel died, exports to Western Europe resumed forcefully.[9]

The Customer Overcharge

The principal measure of economic harm caused by an effective price-fixing conspiracy is the consumer (or customer) overcharge. This is a monetary measure of the extra costs incurred by buyers as a direct result of the actions of the conspiratorial group. The overcharge is conceptually identical to the extra profits generated for all sellers in the affected market, save for any extra costs incurred by sellers in operating the cartel. It is doubtful that the managerial costs of operating the cartel amounted to more than a couple of million dollars. Note that the overcharge essentially equals the additional profits of *all cooperating suppliers in the market*, not just those that were in the cartel.[10] As mentioned in Chapter 3 calculating

9 African exports also fit the pattern of export-forbearance behavior. In 1990, Africa was destination of 7.5% of U.S. citric acid exports. During the conspiracy years, they dropped to less than one-tenth of 1% of the total exported, but after 1995, African exports bounced back to measurable levels.

10 Under U.S. antitrust law in some U.S. court districts, guilty conspirators are legally liable for their own ill-gotten gains as well as the monopoly profits of non-conspirators who merely followed the cartel's lead by raising prices independently of any agreement. In the case of the U.S. citric acid market the monopoly profits of Cargill are part of the injury caused to buyers, even if it was not part of the conspiracy.

the size of monopoly overcharges requires accurate information on the volume sold in 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.

Data on the size of the U.S. citric acid market are 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 million pounds that generated f.o.b. manufacturers' revenues of $251 million (USITC 1996). Adjusting for international trade, these data imply a U.S. buyers' purchase value of $304 million total. Alternative 1994 consumption estimates report 390 million pounds (EC 2002). At average transaction prices in 1994, U.S. buyers paid $310 million for citric acid and its salts.

For the seven months prior to the cartel's formation, the contract prices for citric acid ranged from $0.60 to $0.62/pound. Cargill's new plant was already operating nearly at full capacity, so the period January-June 1991 seems like a reasonable one to choose to find a pre-cartel equilibrium price. The post-cartel period prices suggest that the but-for price could have been as high as $0.68/lb. At $0.68, the overcharges would be a bit over half of the estimates made using $0.60. Under an array of full economic cost assumptions, the citric overcharge estimates vary from $161 to $309 million, or 12% to 26% of purchase value (Table 6.1).

The dates of the conspiracy are also important in determining the extent of overcharges imposed on buyers of citric products. In ADM's negotiated plea agreement, the period is vaguely identified as commencing "at least as early as January 1993" and ending June 1995 or a minimum of 2.5 years.[11] However, in DOJ indictments later (1997) filed against ADM's three Swiss co-conspirators, the beginning date for the conspiracy is given to be July 1991. Moreover, the EC concluded that collusion by the G-4 began in March 1991 and continued to May 1995. All in all, factoring in lags, the longer period July 1991 to December 1995 seems more reasonable.

[11] 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 per pound. With transaction prices averaging around $0.82 per pound and volume sold out of about 1.3 billion pounds, the ADM overcharge would be only $39 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 in a civil trial for damages, the members of the federal class action suit (accounting for two-thirds of purchases) had little choice but to accept the settlement offered by ATM *et al*.

Table 6.1 Estimates of Citric Acid Overcharges in the U.S. Market.

Alternative Conspiracy Periods	"But-For Price" (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	180-250
Long (7/91-12/95)	309	233	161	180-250
	Percent of Sales			
Short	26	21	15	23-32
Long	23	17	12	13-18

Source: Connor (2001: Table 4.A.2)
[a] Based on fines paid by the most uncooperative cartel members, Hoffmann-La Roche 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.

The likely U.S. overcharge then is from $161 to $309 million. The criminal fines paid by the conspirators result in similar magnitudes. In sum, the citric acid cartel imposed a monopoly tax on buyers that caused prices to rise from 12 to 23% of sales.

Conclusions

The story of the legal battles that erupted when the citric acid cartel was unmasked is the subject of Chapters 13, 14 and 16. However, the economic side of the story told in this chapter provides a number of important lessons.

First, the citric acid cartel was able to be formed and to operate undetected for three or four years because its members were leading firms in highly concentrated homogeneous-product oligopolies with substantial entry barriers into the relevant markets. Despite the failure of the citric acid cartel to secure the *direct* participation of the newest U.S. manufacturer, Cargill's indirect cooperation contributed to the cartel's ability to sustain monopolistic U.S. prices. Overcharges imposed on U.S. buyers of citric acid were at least $116 million but could have reached as high as $309 million. Market structure matters.

Second, the effectiveness of the cartel 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. Geographic and cultural propinquity may well facilitate joint profit maximization, but it should not be regarded as a necessary condition.

Third, in the late 1990s there were ample signs that the world citric acid industry was becoming less concentrated. While the producers that had been members of the conspiracy continue to announce expansion of capacity in their home markets in North America and Western Europe, the rate of expansion is higher elsewhere (Connor 1999a). The greatest rates of growth in production of citric acid are now being observed in the larger, newly industrializing countries: Brazil, India, Indonesia, Thailand, and above all China. In a few cases these new plants are being constructed with leading Western firms as partners. However, in the majority of cases the investors are new players. Thus, both the location of production and the ownership of capacity are slowly becoming more dispersed. The formation of naked cartels in the global citric acid industry is becoming correspondingly less likely.