Chapter 12: Effects of the Vitamins Cartels

The consuming public has a high regard for the benefits and efficacy of vitamins. There is something particularly reprehensible about price-fixing schemes that affect products destined for vulnerable populations. Children, pregnant or lactating mothers, the sick, and the elderly often need supplementary vitamins to achieve full health. These groups, as well as practically every household, ultimately paid the price of price fixing in vitamins. The purpose of this section is to document as precisely as possible the extent of these economic injuries.

Duration

Several factors explain cartel duration.[1] Among the most consistent hypotheses are that duration is positively affected by high market concentration or the degree of cartel control of production, product homogeneity, barriers to entry, information asymmetries between cartel members and fringe producers, steady market growth, simple channels of distribution, a prior history of collusion, helpful trade associations, low fringe capacity, and the absence of credible cartel policies. The few empirical studies of cartel duration have confirmed some of these hypotheses (Levenstein and Suslow 2004, Zimmerman 2005).

In the vitamins industries several of these factors appear to explain differences between short-lived cartels like the water-soluble vitamins and long-lived conspiracies like vitamins A and E (Figure 12.1). The more durable cartels had higher degrees of supply control, many buyers, high barriers to entry into manufacturing, capacity constrained fringe producers, and membership drawn from at most two business cultures. Most of the short-lived cartels were threatened from the outside by fringe production, and this in turn instigated internal dissention.

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[1] Hypotheses are generalized from Posner (2001), Scherer and Ross (1990), Carlton and Perloff (2004), Martin (2002), Grout and Sonderegger (2005), and Jacquemin and Slade (1989).
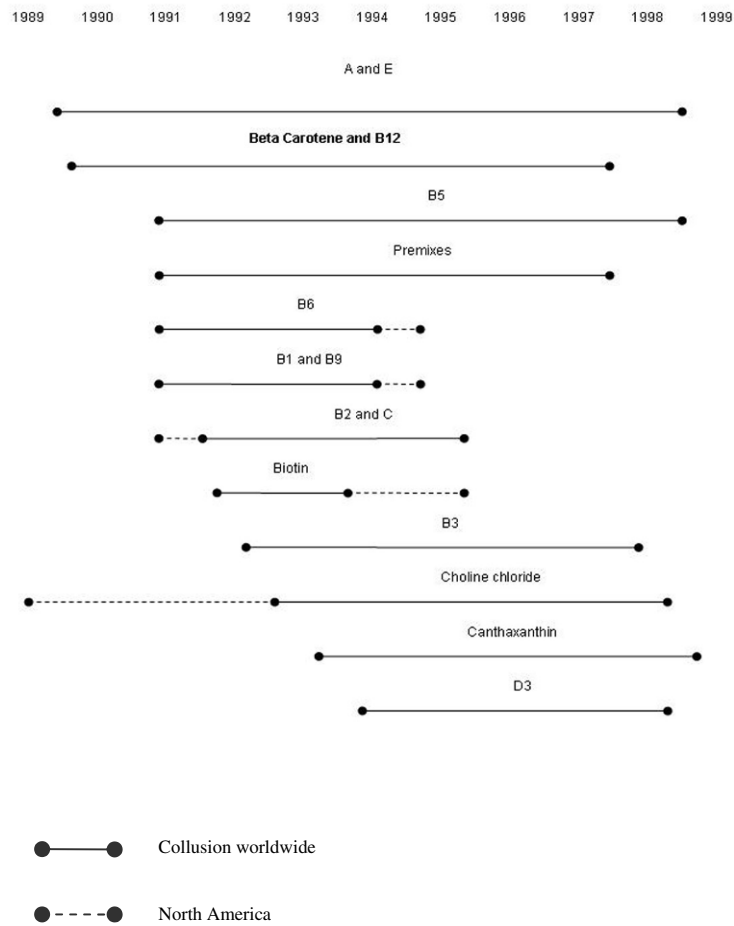
Figure 12.1 Collusion in the 1990s: The Long and Short of It

Price Effects

Bulk vitamins are homogeneous products with highly inelastic demand. Given the high concentration of sales in the hands of the cartel and the cartel's

elaborate methods for detecting cheating, the ability to raise buyer's prices would be expected to be very high (Connor 2006b).

In the case of the short-lived cartels like vitamins B1 and C, prices peaked at 20 to 40% above their 1989 levels (Figures 12.2 and 12.3). Annual transaction prices in the U.S. and European markets move closely together over time. Only rarely do the dollar-based prices in the two regions depart by more than 10%. In both cases, prices rose and remained moderate high from 1985 to 1988; then, after dipping slightly, prices rose again for three to five years. When collusion stopped, prices crashed by 45 to 60% within three years, reaching levels lower than were ever observed in the 1980s. It is a safe assumption that international geographic arbitrage would ensure that prices in other parts of the world would track closely the movements in U.S. and EU prices.
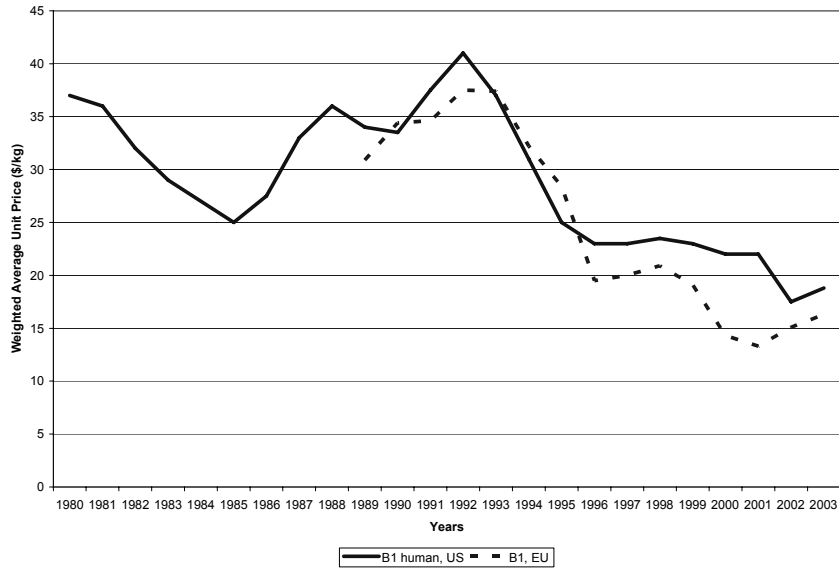

Figure 12.2 U.S. and EU Transactions Prices of Bulk Vitamin B1, Human Grade, Annual 1980-2003
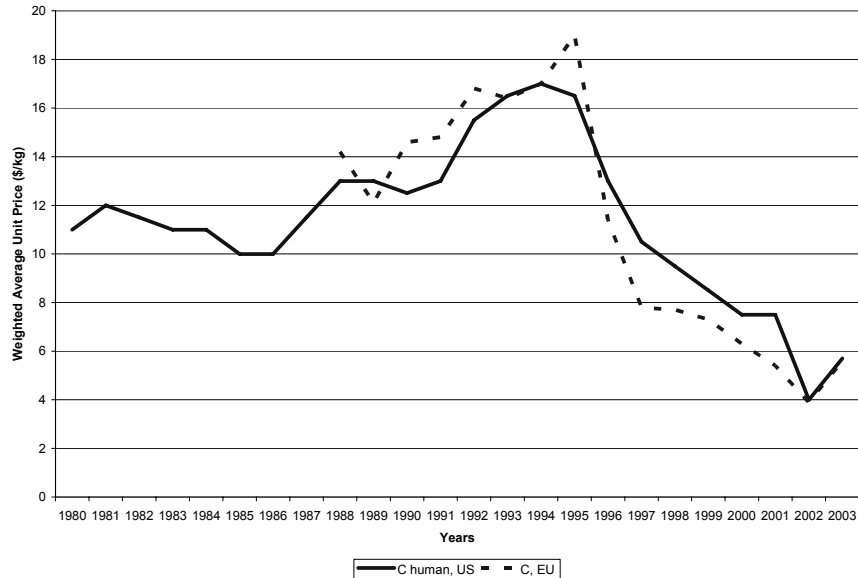
Figure 12.3 U.S. and EU Transactions Prices of Bulk Vitamin C, Human Grade, Annual 1980-2003

For the majority, more durable conspiracies peak prices were reached six to eight years after collusion began around 1990. These price increases typically were in the range of 50 to 90%. Figures 12.4 to 12.6 illustrate the transactions prices of three of the more disciplined and more durable vitamins cartels: vitamins E (human grade), A (feed grade), and B5 (human). Maximum U.S. prices were reached in 1997, and these apogees were 65 to 90% above the 1989-1990 starting points. EU prices traced similar, if slightly dampened paths.

Like an exciting roller-coaster, the decline in vitamin prices observed after the government announced the guilty pleas in May 1999 was much more precipitous than the earlier increases. This suggests that the post-conspiracy period was far more competitive than the pre-conspiracy period. The major members of the convicted cartels may have been trying to repair bruised customer relations and retain their market shares the old-fashioned way – cutting prices to the bone.
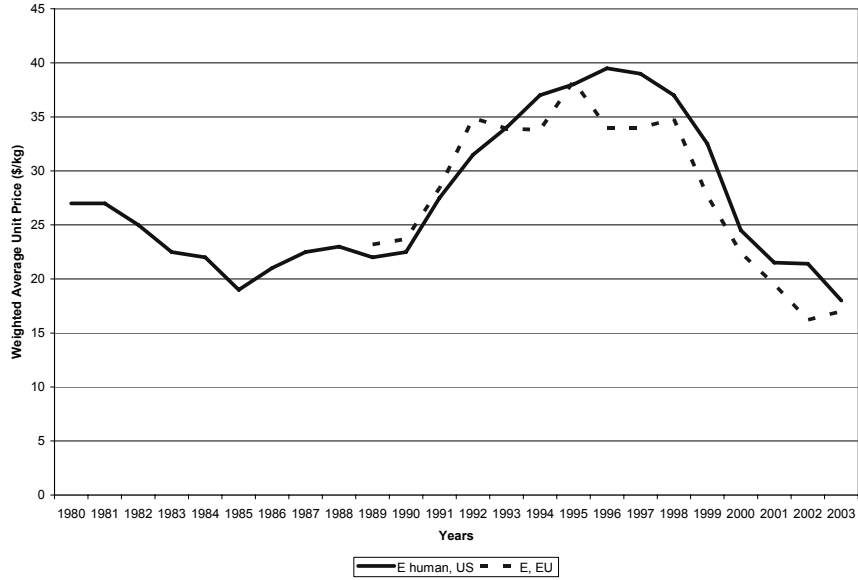
Figure 12.4 U.S. and EU Transactions Prices of Bulk Vitamin E, Human Grade, Annual 1980-2003

Figure 12.5 U.S. Transactions Prices of Bulk Vitamin A, Feed Grade, Annual 1980-2001
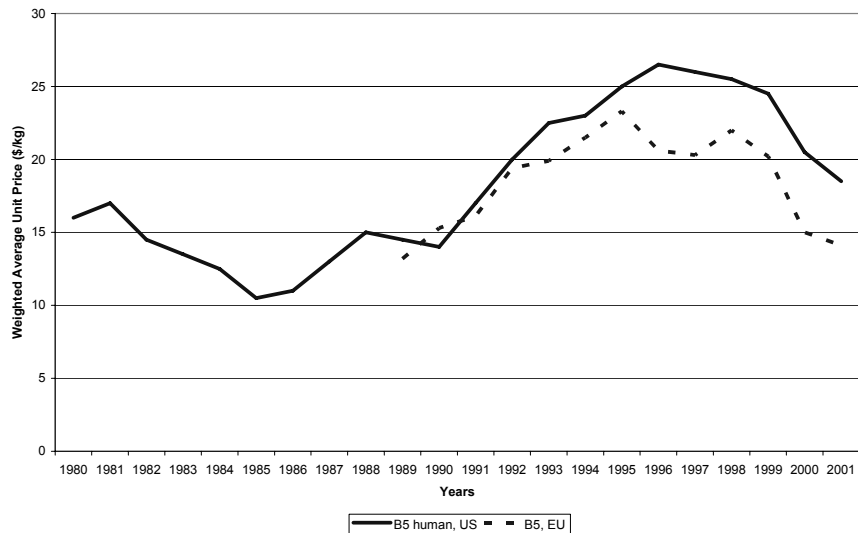
Figure 12.6 U.S. and EU Transactions Prices of Bulk Vitamin B5, Human Grade, Annual 1980-2001

There were just two exceptions to the roller-coaster price pattern in prices. Beta Carotene and the other carotinoids were unique among all the cartelized vitamins in that they were manufactured by a true duopoly, Hoffmann-La Roche and BASF. The two-firm structure persisted after formal collusion ceased at the end on 1998. The highly cooperative, indeed monopolistic behavior cemented during the lengthy collusive period seems to have continued after 1998, a result predicted for small-firm industries by dynamic game theories (Tirole 1990: 245-253).

Lags in downward adjustment of prices after the end of formal collusion were characteristic of all the other vitamins cartels, durable and fragile. Arriving at the low prices that signaled a new, more competitive equilibrium took from 12 to 36 months for all but the two carotenoid duopolies (Kovacic *et al.* 2006). The carotinoids were unique because there were no signs of a slackening of monopolistic pricing behavior a full three years after the cessation of collusive meetings. After 1998, the three largest manufacturers (Roche, BASF, and Rhone/Aventis) continued secretly to

exchange sales data for the purposes of monitoring "the previously agreed market shares" and avoiding "price deterioration."[2]

For several reasons, the increase in U.S. market prices from the initiation of price fixing in 1990 or 1991 may not measure accurately the effect of collusion *alone*. This may be true even if the managers of Vitamins Inc. truly believed that their agreements were the primary cause of the rise in prices. One reason derives from international financial considerations. The price changes just discussed were measured in U.S. dollars, but multinational companies generally seek to maximize the company's global profits. Over time profits accumulating abroad are repatriated to the company's home country and converted into the home country's currency. Because the principal members of the vitamins cartels were based in Europe or Japan, they would want to set local prices from the point of view of their home-country's currency. For example, Hoffman-La Roche is owned mainly by Swiss stockholders who would want to maximize profits in Swiss francs.

Another reason revolves around the pricing of imported bulk vitamins and the inputs needed to manufacture vitamins. More than half of the bulk vitamins sold in the United States in the 1990s were imported from Europe and Japan. When the U.S. dollar strengthened against the home-country currencies of the cartel participants, higher vitamin prices observed in the U.S. market could be due in part to currency-rate changes. For example, if a cartelized U.S. vitamin price rose by 70% and if the product was imported from Switzerland, a rise in the value of the Swiss franc of 20% over the same period would imply that collusion was responsible for raising the U.S. price by only 42%. A relatively rapid increase in Swiss manufacturing costs could further moderate the size of the collusive effect as measured by U.S. prices.

The vitamins defendants proffered three principal arguments to support their position that U.S. prices rose largely because of natural, competitive market forces (Bernheim 2002a: 122-150). The most frequent competitive explanation of ballooning prices in the 1990s was rising prices of raw materials, intermediate materials, transportation, or manufacturing expenses. In some cases the proximate causes of the putative cost increases were claimed to arise from government regulations concerning product quality or environmental standards. Second, the defendants argued that in the 1990s the U.S. dollar generally weakened against the Yen and most European currencies. Third, the vitamin manufacturers proposed that rapid increases in demand resulted in insufficient production capacity.

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2 Quotations from deposition testimony of Dr. Thomas Wehlage, a BASF representative made on January 10, 2002 (Bernheim 2002a: footnote 139).

Bernheim (2002a: Chapter 9) demolishes these arguments by confronting them with market data and facts contained in the defendants internal records. First, with the possible exception of vitamin B1, variable costs did not vary significantly during the collusive periods for any of the vitamins. Costs were generally flat or slightly declining. More tellingly, variable costs were not relatively low in the years before or after the collusive periods. Second, the defendants' foreign-exchange arguments were not supported.[3] After adjusting for foreign-exchange movements, variable costs expressed in dollars were even closer to being constant before, during, and after collusion than was the case before such adjustments.

Third, there is no relationship between surges in the quantity of vitamins demanded and increases in U.S. vitamin prices. The major increases in consumer demand were the result of publicity about the health benefits of mega doses of vitamins E, C and beta carotene. Annual increases in global consumption of these three vitamins reached 15 to 20% in the early 1990s. While these rates of increase are quite high, similarly high increases in demand had occurred in the mid to late 1980s. Price increases from shifts in demand would only be observed if the demand shifts were unexpected. Moreover, when aggregated over species, changes in the demand for animal-grade vitamins were exceedingly steady throughout the 1980s and 1990s.[4] Nor were there significant shifts in the ratio of human to animal uses of vitamins.

In general, one observes a highly predictable demand environment for bulk vitamins, a situation that lends itself to accurate planning for capacity expansions well in advance of needs. Shortages that drive up prices are unlikely to develop in such markets. In fact, the defendants' own estimates of global capacity utilization tended to decline during the collusive periods for the major vitamins.[5] Therefore, surges in demand were predictable,

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[3] Two features of international trade tend to suggest that fluctuations U.S.-dollar exchange rates have little explanatory power. First, it is generally accepted that the pass-through of changes in the prices of imported inputs to changes in domestic prices is generally around 50%. Second, many of the raw materials purchased for foreign production of vitamins were in fact denominated in U.S. dollars.

[4] The principal basis for estimating the demand for animal grades was changes in the slaughter rates for meat animals. There are notable production cycles for hogs and cattle, but these cycles were not positively correlated. Some species have experienced alterations in genetic types that could absorb high intensities of vitamins in feed rations, but such alterations were gradual.

[5] Capacity is an elusive concept. It depends on engineering estimates of maximum possible output, and assumptions about operating days of production per year, maintenance schedules, substitutability among plants for alternative outputs, and strategic decisions about optimal excess capacity. An interesting comment by a deposed Hoffmann-La Roche expert is: "…[A]ctual output is a fact. Capacity is an opinion." (Bernheim

and changes in capacity constraints do not correlate with price changes in the 1990s.

The U.S. average price increases of the vitamin cartels are summarized in Figure 12.6. The method of calculating the overcharges are predictions from richly specified econometric models that explains monthly variation in prices of 37 vitamin products from 1980 to 2001. The list of proxies for demand and supply shifters is quite extensive and tailored to the specific vitamin product. Except for the two duopolies in carotinoids, the model was fitted to prices prior to the conspiracy period and for the periods one year after the conspiracy periods. Then the estimated parameters for these relatively competitive periods were used to predict the conspiracy-period "benchmark prices," the prices that would that have been observed absent explicitly collusive conduct. The difference between the benchmark price and the actual price is the estimated cartel overcharge for each month.

Price increases in the 1990s averaged 44% and varied from 16 to 80% across the 16 vitamins cartels. Many factors explain the height of the overcharges, duration being one. There is a difference between the six cartels that were under stress and fell apart fairly quickly (about four years) and the ten more durable agreements. Duration does not only result from a failure of fringe producers to mount serious challenges to cartel control but also seems to signal the cohesiveness and discipline among the members of some of the cartels. On the one hand, the six more fragile coalitions achieved mean overcharges of only 27.4% during the plea-periods of the 1990s; for the extended, dual-episode conspiracy period the mean was a similarly below-average 30.3%. On the other hand, the ten long-lasting cartels achieved significantly higher mean overcharges of 43.3% and 51.0% for the plea-period and extended-period, respectively. The greater price effects of the durable cartels are important, because they accounted for 79% of plea-period affected sales.

There were 14 cartels alleged to have had collusive periods in the late 1980s. Except for vitamins E and B6, the overcharge rates in the late 1980s were higher than in the 1990s. Thus, the 16-product average price effect that includes the 14 extended conspiracy periods (roughly mid 1985 to the beginning of1999) was one-tenth higher: 48.2%.

2002a: 145). Roche's own estimates of global capacity utilization for vitamins A, E, and C tended to average 75 to 80% in the 1990s (*ibid.* 148-150).

Figure 12.7 Average U.S. Cartel Mark-Ups, 1990-1999
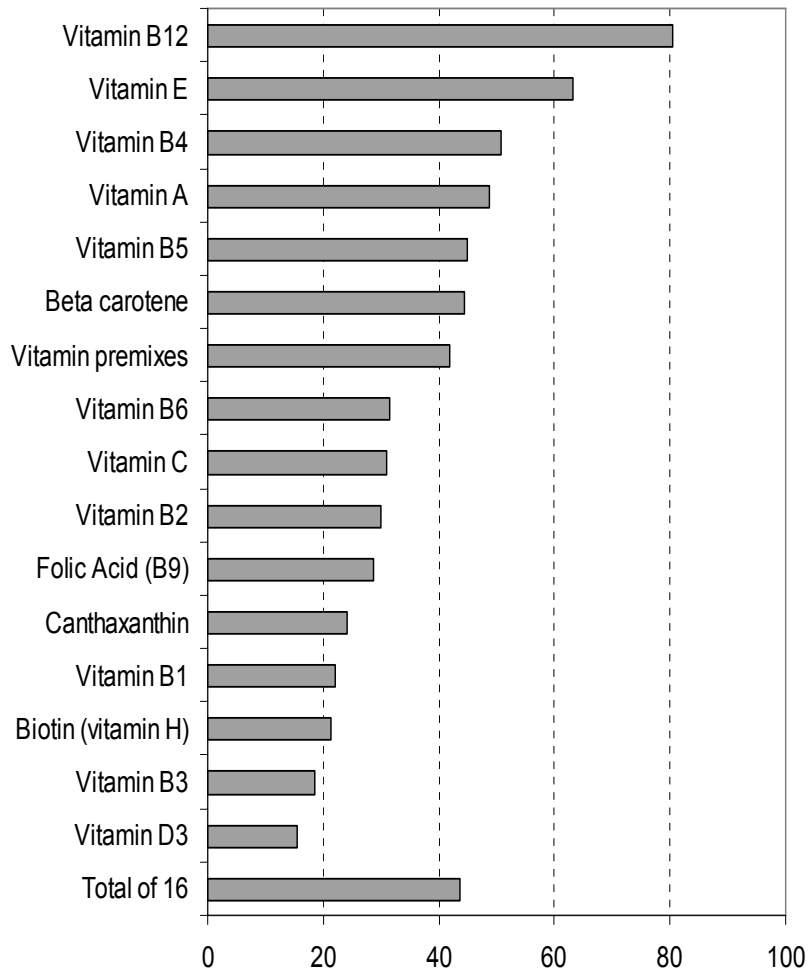
Source: Connor (2006b: Table 12)

    The econometric estimates were cross-checked by using two sim-
pler methods that are accepted by U.S. courts (Connor 2006c). One
method is called the cost-based or constant-margin approach. To obtain
benchmark prices, the analyst assumes that the ratio between price and
variable costs during non-conspiracy periods would stay the same during

the cartel period (absent explicit collusion) as they were before and after the conspiracy. Costs are taken from the internal production records of the defendants; if members of a cartel fail to minimize costs, this approach would tend to result in under-estimates. The constant-margin analysis generally produces reasonable price-cost patterns in the post-cartel periods. That is, when costs fall, so do prices, and prices usually stop falling when they approach costs.

In general, the constant-margin approach produces estimates that are quite close to the econometric-model estimates (Connor 2006b: Table 12A). The mean cartel mark-up for the 1990s is 42%, and the mark-ups most of the individual vitamins are within a few percentage points of the econometric results.[6] The constant-margin approach also verifies that the six less durable cartels had mean overcharges that were less than half the overall average.

A second alternative method for calculating overcharges is the simplest. It is called the before-and-after method. A straight line is drawn between the price in the month before the first collusive price increase is announced and the price 12 months after collusion ceases. The vertical differences between the actual market prices and this line are the overcharges. Normally, the before-and-after method is of suspect accuracy because it fails to take account of changes in costs of production and demand shocks. Also, the choice of the end points of the line is a matter of judgment. However, because supply and demand conditions for vitamins were so steady in the 1990s, the results of this before-and-after analysis appear to be quite similar to the econometric estimates for most products (Connor 2006b: Table 12B). The mean price effect in the 1990s is 48% and most individual estimates are within a few percentage points of the econometric computations in Table 12.[7] The mean of the overcharges for the six short-lived cartels is much lower than the all-products average.

The before-and-after method can be applied to price data taken from public sources. Estimates were prepared for 12 bulk vitamins from data on U.S. list prices or import prices (Connor 2001: Table 12.1). List and spot prices are derived from announcements in *Chemical Market Report,* the chemical industry's main source of trade news. International trade

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[6] Excluding vitamin D3 and premixes, the simple correlation of the plea-period overcharges is strongly positive (0.93).

[7] Bernheim (2002a:250-251) judges that the before-and-after method actually produces superior and more conservative estimates for beta carotene and the other carotenoids because of spurious correlations in the data caused by strong pre-cartel and post-cartel trends in prices. The simple correlation between the econometric and before-and-after estimates of overcharges is positive and large (0.80).

data provide a fairly good proxy for U.S. transaction prices for vitamins B3 and B4. In most cases only pre-cartel but-for prices were available.

Book prices are crude substitutes for transaction prices. Generally, when a cartel is formed transactions prices will tend to rise proportionally to but greater than list prices (Connor 2001). That is, as industry pricing discipline rises during a cartel, the gap between list and actual prices narrows, partly because overt collusion eliminates discounts and rebates. Nevertheless, such surrogates may be the only sources of price data in the immediate period after a cartel is unmasked. Thus, it is of some interest to examine whether preliminary estimates are comparable to more polished numbers that have the benefit of time, detailed analysis, and access to true transaction-price data.

The public-data estimates of average conspiracy-period mark-ups in have a simple mean of about 31%. As expected, the cartel mark-ups calculated from list-price changes are lower than the estimates from transaction-price changes. Also as expected, the price increases calculated from the two data series positively correlated (r = 0.74). The pairs of estimates are very close for the seven more durable cartels, but the public-data overcharges are underestimated by about 40% for the five short-lived cartels. What this pattern of list-price changes seems to indicate is the cartelists were overly pessimistic their abilities to raise prices when the collusion proved to be fragile. On the other hand, list price announcements were realistic predictions of actual price effects for the cartels that lasted a decade or so.

What about price effects in Europe? Annual 1988-1999 transaction prices for the EU are shown in the European Commission's vitamins decision (EC 2003). These price series are shorter than those available for the United States, but tend to track U.S. prices closely. Before-and-after estimates were made for price effects for 12 of the bulk vitamins (Connor 2006c: Table 13). Price increases are quite sensitive to the choice of benchmark years. When the benchmark is price before or in the first year of collusion, the cartel mark-ups are generally not dissimilar from comparable U.S. estimates. However, the collapse in vitamin prices after collusion stopped in Europe was more drastic than in the U.S. market. Therefore, benchmarks derived from post-cartel prices result in much larger overcharge estimates than pre-cartel prices, and the estimates rise with the distance from the terminal year.

The last source of information about price effects of the vitamins cartels is empirical studies by academic economists and economic historians. Suslow and Levenstein (2002) cited North American overcharge figures of 20% and 30% in their survey of modern cartels. An econometric model of world trade in bulk vitamins also yielded similar conclusions

about collusive price effects (Clarke and Evenett 2002). What is of special interest about this study is that the authors are able to calculate overcharges for the 19 countries outside the EU and North America with the strictest antitrust laws separately from those countries with weak antitrust enforcement; the former had overcharges averaging 13% while the latter incurred a 33% overcharge. Therefore, it seems likely that monopoly profit rates from collusion in the rest of the world were higher than in the United States, Canada and the EU. Finally, a dynamic simulation model fitted to parameters drawn from the vitamin C industry predicted the U.S. price during fully collusive and non-collusive regimes (de Roos 2001). The main result is that U.S. vitamin C prices were 22% to 26% higher during the cartel period, which is quite remarkable given that this is was one of the weakest and most fragile of the vitamins cartels.[8] This figure is comparable to the overcharge for vitamin C seen in Figure 12.7.

Profits

Price increases of the type just described were bound to increase seller profits to extraordinary levels. What profit rates were prior to collusion is impossible to learn with any precision because the cartel members did not report operating profits separately for their vitamins lines of business. Vitamins were usually part of some broader corporate division called specialty or fine chemicals. Whole-company profits are not particularly useful indicators because they were affected by the high profits normally found in pharmaceutical businesses or the lower profit rates associated with commodity chemicals. Similarly, although during fiscal years 2001-2005 monopoly profits will have disappeared, these years are not useful benchmarks because of the impacts of large fines and civil settlements on profit statements.

Roughly speaking, for the largest publicly listed chemical firms operating profits on vitamins in the 1980s were in the range of 5 to 15% of sales (Connor 2000: Appendix F). Production costs were generally stable before, during and after the cartel periods of the 1990s, and the additional management costs of operating "Vitamins, Inc." were small. It is likely

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[8] The study's author is reluctant to apply his model for the purpose of deriving a cartel overcharge. In a personal communication from Dr. de Roos, the method I used to derive an overcharge he describes as "…a comparison of two counterfactuals, i.e., the difference between a world described by my model with collusion, and a world described by my model without collusion."

that in the mid 1990s vitamin profit rates rose two to six times the profit rates in more competitive times.

Customer Overcharges

Profits generated by price fixing are a transfer of income from customers to the stockholders of the companies in the cartel. With no available substitutes, vitamin buyers had no choice but to continue making purchases at the cartel-inflated prices. The amount of this overpayment is called the customer overcharge. The absolute size of the vitamin overcharges can be vitally important information for assessing felony fines in the United States and for judging the adequacy of civil antitrust settlements in the United States and Canada.[9]

Pronouncements by public prosecutors about the economic injuries spawned by the vitamins cartels were vague. On the day the DOJ announced the guilty pleas it had obtained from the three leading price fixers, the head of the DOJ's Antitrust Division was asked how large the U.S. overcharges were. He said that they were "hundreds of millions of dollars." At the sentencing hearing in federal court in Dallas, Texas the same day, the DOJ was required to be more precise when it submitted its sentencing memorandum to the court. The government's indictments specified price fixing on seven vitamin products. With information on Roche's U.S. market shares for the seven products covered in the guilty-plea agreement and the sales of other vitamin products for which guilty pleas were later made, it is possible to infer the DOJ's estimate of Roche's overcharges (Connor 2006b: 105). The total implied is $850 to $1,350 million or 15 to 25% of U.S. affected commerce.

The size of the vitamin overcharges was a major issue during settlement talks between the Big Six defendants and private plaintiffs. In November 1999, these defendants offered to pay members of the federal class

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[9] In those vitamin markets where fringe production existed, purchases from non-participants can also harm buyers because of umbrella pricing effects. Such sales reached 40% of the market in the last years of a few of the short-lived cartels. Even if fringe firms were aggressively seeking increases in their market shares, their prices were elevated above competitive levels. Under U.S. law such purchases are not compensable harms because the fringe firms were not explicitly parties to the cartel, but as a matter of economic welfare theory these buyers do sustain losses.

$1.17 billion to settle the treble-damages suit brought as a federal class action. In public statements the lead counsel for the class opined that the recovery amounted to about 20% of U.S. purchases of vitamins during the affected periods. He stated that the $1.17 billion "somewhat exceeds" the overcharges paid by direct buyers.

There were differences of opinion between the federal class counsel, who ended up representing mostly smaller claimants, and attorneys for the larger buyers in the class. Counsel for the latter group asserted that the vitamins overcharges by the Big Six defendants were considerably larger: $2.3 billion or 33% of affected sales. Extrapolating the two plaintiffs' estimates to defendants beyond the Big Six and to all 16 products, the total U.S. overcharges amount to $1.6 or $3.1 billion. In sum, the government's and the plaintiffs' estimates fall within the range of 15 to 33% of affected sales.

More detailed calculations of U.S, Canadian, European, and world-wide overcharges are given for the cartels of the 1990s (Connor 2006b: Table 14). For all 16 vitamins products, the global total is about $7.6 billion.[10] The overcharges were allocated geographically roughly in proportion to affected sales. Buyers in North America paid 32% of the global price of price fixing, Europeans 37%, and the rest of the world 31%. Nearly half of the overcharges are accounted for by two products – vitamin E and premixes – and vitamins A and C for another quarter of the total.

Table 12.1 converts the overcharges from nominal currency (in the years the fines were imposed or the settlements paid) to a common year, 2005. Even though inflation was fairly low from 1990 to 2005, this adjustment makes quite a difference. Measured in 2005 dollars, the damages from the vitamins cartels of the 1990s amounts to $15.6 billion – a figure about double the "old dollars" of 1999-2003.

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[10] These data exclude the probable vitamins cartels of the late 1980s. Connor (2006b: Table 14A) repeats the overcharge calculations for the 12 shorter cartels that operated in the late 1980s. Total overcharges in nominal U.S. dollars were $2.3 billion. Thirty percent of these damages were imposed on North American consumers and 39% on Western Europeans.

Table 12.1 Real Global Overcharges by the Vitamins Cartels, 1990-1999

Product	United States [a]	Canada [b]	Western Europe [c]	Other [d]	World [f]
	2005 million U.S. dollars				
Beta carotene	138.4	9.92	193.4	82.2	423.9
Canthaxanthin	25.95	1.73	104.4	274.6	406.7
Biotin (H)	30.4	2.19	21.4	45.0	98.9
Choline chloride (B4)	192.0	16.40	159.4	267.6	635.4
Folic acid (B9)	3.16	0.60	8.89	2.1	14.8
Vitamin A	319.9	24.05	417.0	246.0	1007.0
Vitamin B1	11.1	1.58	7.62	14.2	34.5
Vitamin B2	38.2	3.02	55.75	28.1	125.1
Vitamin B3	49.4	2.73	43.14	45.8	141.0
Vitamin B5	67.5	5.09	101.7	29.7	204.1
Vitamin B6	15.8	4.37	25.4	39.8	84.6
Vitamin B12	60.8	1.58	54.3	110.1	226.7
Vitamin C	294.0	20.66	266.7	435.7	1017.2
Vitamin D3	11.2	0.81	9.8	10.8	32.4
Vitamin E	760.7	54.50	795.4	385.6	1996.1
Premixes	713.3	47.39	856.2	813.5	2430.4
Total 16 products	2731.7	196.6	3120.5	2830.2	8879 0

Source: Connor (2006b: Table 14B); includes umbrella effects. To allow for the opportunity cost of capital, adjusted by the U.S. prime rate of interest plus 1% from the midpoint of the conspiracy to the year the cartel was first fined; then from the latter year, the figure is raised to $2005 using the producer price index of the appropriate region.

Table 12.2 summarizes the overcharges for 16 products and four geographic regions relative to a conventional metric – affected commerce. On average, vitamins overcharges were 29% of global affected commerce.

Keep in mind that overcharges are measured at the producers' level. Mark-ups in vitamins sold for human use at *retail* tend to be very high. Thus, there is often a great discrepancy between vitamin sales at the manufacturers' "bulk" level and sales at retail. By the time consumers buy packaged vitamins in their grocery and drug stores; the mark-up on manufacturers' prices is more than 1000%. Put another way, only about 7% of

Table 12.2 Global Overcharges Relative to Affected Commerce, 1990-1999

Product Market	United States	Canada	Europe	Rest of the World	World
	Percent of current U.S. dollars				
Beta carotene	30.7	30.7	30.7	37.1	31.7
Canthaxanthin	19.4	19.4	19.4	23.4	21.9
Biotin (H)	17.5	17.5	14-15	19.2	17.3
Choline chloride (B4)	33.7	33.7	33.7	41.1	36.5
Folic acid (B9)	22.3	22.3	38-39	36.0	33.2
Vitamin A	32.8	32.8	20-22	33.3	28.9
Vitamin B1	18.1	18.1	5-8	15	12.2
Vitamin B2	23.0	23.0	20-22	26	22.9
Vitamin B3	15.6	15.6	15.6	15.8	15.7
Vitamin B5	31.0	31.0	29-31	37.7	31.1
Vitamin B6	24.0	24.0	29-31	32	29.8
Vitamin B12	44.7	44.7	31	46	40.9
Vitamin C	23.6	23.6	17-23	26	30.8
Vitamin D3	13.5	13.5	7-12	14	12.1
Vitamin E	38.7	38.7	31-35	43	36.8
Premixes	29.5	29.5	29.5	28.7	29.2
Total	30.4	30.4	23-24	28.3	28.5

Source: Connor (2006c:Table 15)

the retail purchase price of vitamins by consumers can be attributed to the cost of the raw vitamins, the rest being accounted for by advertising, packaging, assembly, and distribution costs. Assuming that the overcharges on bulk vitamins in the 1990s were passed on 100% to consumers, they were bulk vitamins in the 1990s were passed on 100% to consumers, they were overcharged only about 2% the value of retail purchases.