3

The History and Evaluation of Significant Commodity Cartels

The phenomenon of collusive international agreements became widespread in the 1930s. At that time, attempts to control production and prices were still mainly the prerogative of multinational firms operating in the developing world. The "modern era" of cartels began in the 1960s, when the governments of developing nations began to participate in commodity agreements. Although this participation significantly altered the institutional structure of cartels, the underlying goals of cartelization remained as they had always been: to increase and stabilize commodity prices.

The following analysis focuses on the role played by commodity cartels active primarily in the developing world. It is through the process of cartelization that exporting nations can attempt to manipulate the world supply and prices of key commodities. The agreements that involve corporations exclusively (notably, the DeBeers diamond empire) will not be discussed until chapter 5. Many of the nations involved in collusive arrangements are single-commodity exporters whose economic health is dependent on a single product. Ideally, commodity agreements offer a means of stabilizing prices and eliminating destructive competition between developing nations.

THE PRIMARY COMMODITY CARTELS OF THE POSTWAR PERIOD

The commodities chosen for examination—coffee, bauxite, cocoa, petroleum, sugar, rubber, and tin—are those for which modern cartel agreements were successfully implemented between 1953 and 1980. Each of

these cartels managed, to varying degrees, to secure meaningful participation by the key exporting countries and, sometimes, importing countries. In all but one instance (the bauxite cartel), mechanisms were put in place to eliminate excess production and stabilize prices. In contrast to these examples, other international collusive agreements, such as the banana cartel, unraveled before the institutional structures and market controls that characterize cartelization could be realized.

The International Coffee Organization

The International Coffee Organization (ICO) was founded in 1962 for the purpose of regulating coffee supplies and prices. With the International Coffee Agreement (ICA) of that year, the cartel specified a price range enforceable through export quotas. Two major producers, Brazil and Colombia, initiated the agreement in the hope of retaining their respective market shares. Interestingly, the ICA was a contract between both producing and consuming nations whose goal was to reduce prices and minimize supply fluctuations. The United States signed the agreement in the hopes of eliminating the volatility of prices that had long plagued the coffee market. When it became apparent that the target prices established by the cartel were too high, member nations (particularly Brazil) were forced to significantly curtail their production. Despite this gross overvaluation, the agreement was renewed in 1968. The coffee market then experienced a period of chronic oversupply (and declining prices) until a frost in the early 1970s devastated the coffee bean crop in Brazil and restored market equilibrium. The resulting higher prices caused coffee exporters to lose interest in price controls. Moreover, an attempt to forge a successor agreement in 1976 stalled because consuming nations balked at the price demands of producing countries. It was only in 1980 that the exporting nations returned to direct negotiations with the major importers and the provisions of the 1976 agreement were finally enforced. This pact necessitated the removal of a substantial quantity of coffee from the market so that prices would firm.

A more formalized cartel arrangement was put in place with the renewal of the ICA in 1983 (binding until 1986). Under this accord, all exporting countries agreed to sales quotas to be enforced at the borders of the importing nations. Unfortunately for the signatories of this ICA, the excess production resulting from the imposition of export limits was "dumped" on nonmember nations, thereby weakening prices. Consequently, although the system appeared to be functioning, the cartel price was, in reality, too high. With the expiration of the fourth ICA in October 1989 and the inability to negotiate a successor agreement, coffee was once again traded in an essentially free market.

The overall effectiveness of the cartel can be determined by examining the trends in coffee prices during the tenure of the various ICAs. In 1962, coffee prices stood at $42 per 60-kilogram (132.3-pound) bag (CRB, *Commodity Yearbook*). Between 1962 and 1968, when the second ICA was signed, the price rose to $44 per bag. Subsequently, there was little cooperation on prices and output between producing and consuming nations. Although prices rose rapidly from 1974 onward, increasing by over 15 percent per year until 1980 (Table 3.1), much of the increase owed to the general acceleration of inflation during the 1970s. Subsequently, coffee prices plummeted by over one-third between 1980 and 1981. Thus the cartel's ability to influence prices appears to have been very short-lived.

Despite the inability of the ICAs to maintain coffee prices above their pre-cartel levels, evidence tends to support their effectiveness in reducing price variability. As shown in Table 3.2, the coefficient of variation of coffee prices was lowest from 1976 to 1979 and from 1980 to 1986, that is, during the periods when the cartel was functioning. The greatest price variability took place between 1989 and 1996, after the cartel had dissolved. Thus, although the cartel was largely ineffective in firming the price of coffee, it appears to have achieved at least some improvement in price stability.

Like most cartel agreements, the ICO managed to affect coffee production and prices only sporadically. In contrast to most arrangements, the ICO enlisted both producing and consuming nations in its attempt to stabilize prices, a tactic that failed when it became clear that exporters were actively selling to nonmember countries at below cartel prices. The cartel's demise is attributable to the characteristics of the market itself, for coffee fulfills only three of the five requirements of successful collusive agreements.

First among the requisites of effective cartelization present in the coffee market is the product's nonsubstitutability. During the rapid prices increases of the mid-1970s, for example, attempts to promote coffee substitutes such as chicory in the United States met, understandably, with extreme consumer resistance. The second factor supporting cartelization of the coffee market is the significant barriers to entry into the

Table 3.1

Coffee Production and Prices, 1974–1997 (in millions of 60-kg. bags and in dollars per 60-kg. bag of Colombian beans)

Year	Total Production	New York Price
1974	62.5	102.8
1975	81.7	107.7
1976[a]	73.5	206.8
1977	60.9	318.9
1978	70.9	244.5
1979	78.9	242.1
1980[a]	81.9	254.0
1981	86.3	169.1
1982	98.1	184.4
1983[a]	81.9	173.8
1984	88.8	190.4
1985	90.4	192.1
1986[a]	95.8	256.8
1987	79.4	148.2
1988	103.2	178.3
1989	94.2	141.2
1990	97.0	117.7
1991	100.2	112.2
1992	103.7	84.0
1993	92.9	95.0
1994	93.3	174.2
1995	98.2	214.3
1996	89.9	173.5
1997	100.9	—

Source: Production figures are taken from CRB, *Commodity Yearbook*; prices are derived from IMF, *International Financial Statistics*.

[a]Years in which an ICA was signed or reinstituted.

market, for proper cultivation requires a tropical climate. In addition, the protracted life cycle of coffee trees prevents entry in the near term. Finally, unlike some other critical export crops, coffee can be readily stored across a growing season, enabling cartel members to temporarily remove excess production from the market to support prices.

The two criteria for successful cartelization not met by the coffee market are concentration of production and product homogeneity. The four-country concentration ratio stood at 46.2 percent in 1974 and rose only slightly to 51.9 percent in 1997, percentages below those of an oligopolistic market. (See Tables 3A-1 and 3A-2 for the concentration ratios of key commodity markets.) In 1997, there were fourteen exporting nations with harvests totaling 1 million or more 60-kilogram bags. Given

Table 3.2

Variation in Coffee Prices, 1974–1996

Years	ICA Functioning?	Coefficient of Variation
1976–79	Nominally	0.161
1980–86	Yes	0.168
1976–86	Yes/Nominally	0.198
1989–96	No	0.303

the difficulty of enforcing a quota system among this many producers, it is not surprising that secondary shipments to nations outside the ICO precipitated a breakdown of cooperation among the exporting and importing members. The other major difficulty facing the cartel is the distinction between the various qualities of coffee beans. While the policies of the ICO effectively eliminated any surplus production of higher-quality arabica beans, they stimulated production of lower grade robusto coffees, resulting in a total surplus that caused a permanent disequilibrium.

Were the various ICAs successful in raising the export earnings and welfare of the producing nations? Considering this question for the years from 1982 to 1983, a period during which the ICO's quota system was fully functioning, Herrmann et al. (1993, 136–142) found a significant rise in prices, export revenues, and welfare for the producing nations, and a commensurate reduction in welfare for the importing nations. Although this result tends to support the potential of commodity agreements to increase welfare, it must be recognized that the ICAs were inherently unstable and seldom fully in force. Indeed, the authors noted that one of the ICA's stated goals, increasing world coffee consumption to ensure future demand, was not met, for price increases suppressed demand and reduced the cartel's power in the long run.

The International Bauxite Association and Its Predecessors

Although the International Bauxite Association was founded only in 1974, the market for the metal ore has been subject to some form of cartelization as far back as the 1890s. Prior to that time, the three major producers of aluminum—Alcoa, AIAG of Switzerland, and Froges of France—competed to some degree in the world market. In 1896, Alcoa and AIAG agreed not to export to each other's markets. In 1901, the agreement was expanded to include Froges, Pechiney (another French firm), and British

Aluminium. With this accord, all home markets were effectively closed to competition. In addition, a world price of aluminum was established and each firm was assigned a share of total world demand. Nonetheless, in spite of subsequent agreements made in the years between 1906 and 1911, the bauxite cartel was weakened as new companies entered the market. A further blow was dealt when the Justice Department pressured Alcoa to abandon its participation in any further cartel agreements with its European rivals. The worldwide aluminum industry then entered an extended period of competition that continued into the 1920s.

In 1923, the European aluminum firms informally agreed to limit their exports to the United States. Alcoa responded in kind and prices immediately began to firm. By 1924, prices had risen over 42 percent in the U.S. market and approximately 25 percent in the European market (Holloway 1988, 25). Then, in 1926, a much more strident agreement was created, one that not only established quotas and uniform prices, but also imposed penalties for overproduction. Faced with growing pressure from the Justice Department, Alcoa participated through its Canadian subsidiary, Alcan. In the years following the 1926 agreement, the cartel adopted a number of new provisions that further divided the world aluminum market into proprietary shares. It was only years later, in 1950, that the Justice Department finally forced Alcoa to fully abide by antitrust laws, which resulted in the company's divesting itself of Alcan. (For additional details on the cartelization of the aluminum industry prior to 1950, see Stocking and Watkins 1991.)

A new page in the history of aluminum production was turned in March 1974 with the formation of the International Bauxite Association (IBA). Founded by the prime minister of Jamaica, Michael Manley, and the prime minister of Guyana, Forbes Burnham, the IBA's other member countries were Australia, Guinea, Sierra Leone, Suriname, and Yugoslavia. These nations collectively sought to increase their profits on the exportation of bauxite at the expense of the multinational firms that were extracting the mineral within their borders. Jamaica took the lead by imposing a higher levy on producers, a move that was matched by the cartel's other members. The profitability of bauxite mining among the host countries soon increased significantly.

The peculiar characteristic of the bauxite market that makes it unique among cartels is the fact that there are virtually no integrated aluminum smelting facilities within the bauxite-producing countries of the IBA. Cartel members impose a tax on the raw ore extracted by multinational

firms. Thus the IBA's impact on pricing occurs through its tax rather than through the manipulation of world aluminum prices. The integrated aluminum producers acquiesced to the bauxite tax because it represented only a small fraction of the total cost of producing aluminum. Although the price of processed aluminum has risen dramatically since 1974 (Table 3.3), this is mostly the result of rising energy prices. The average levy per metric ton of raw ore, which stood at between five and fifteen dollars in 1974, did not increase again significantly until 1981 (Table 3.4). The most dramatic increases in the per-ton tax occurred in the 1990s, a period characterized by falling aluminum prices. Thus, unlike the other cartels examined here, no connection exists between the increased power of the cartel, the rise in the rate of taxation, and increased prices. It is the nature of the bauxite cartel itself that ensured its success.

The bauxite market was, in fact, well suited to the formation of a cartel, for it conforms to all requirements for collusive agreements. The four-country concentration ratio, which stood at only 54.6 percent in 1974, rose dramatically to 70.3 percent by 1996, a figure well above the level necessary for successful cartelization. Although a total of six "fringe" producers also contributed to the market, their individual shares of total world production were small. A number of substitutes exist for aluminum, but none with the metal's unique properties of malleability combined with low weight. Both the aluminum ore and the finished metal are easily stored if excess supply must be withdrawn from the market. Finally, the recent history of aluminum production has been one of exiting producers (premier among these being the United States), a trend that has reduced competition and kept prices stable.

The defining characteristics of the bauxite market were more relevant for the period preceding 1950 than for subsequent years. The levy system in place since the early 1970s essentially precludes the "producing" countries from utilizing their market power, since all processing and marketing is conducted by the multinational corporations. Nations with significant bauxite deposits benefit from the ability of the major international aluminum firms to pass the prices through to end-users without significantly affecting demand.

The International Cocoa Agreements

In 1963, negotiations began on the establishment of an international cocoa producers organization. These initial talks failed to bring about

Table 3.3

Aluminum Production and Prices, 1974–1996 (in thousands of metric tons and in dollars per metric ton)

Year	Total production	London price
1974	78,362	763.2
1975	73,610	866.6
1976	77,417	888.1
1977	81,931	1,141.4
1978	80,975	1,322.2
1979	85,522	1,599.4
1980	89,215	1,771.2
1981	85,522	1,260.2
1982	77,793	989.6
1983	76,016	1,435.5
1984	92,502	1,248.9
1985	89,747	1,038.6
1986	92,534	1,147.3
1987	96,517	1,561.8
1988	103,105	2,541.2
1989	103,722	1,946.6
1990	113,000	1,636.1
1991	111,000	1,301.3
1992	105,000	1,253.6
1993	109,000	1,137.6
1994	107,000	1,472.5
1995	109,000	1,801.4
1996	—	1,503.7

Source: Production figures are taken from CRB, *Commodity Yearbook*; prices are derived from IMF, *International Financial Statistics*.

an agreement. It was not until 1972 that a successful agreement, the International Cocoa Agreement or ICCA, was negotiated under the auspices of UNCTAD. The producing nations established a system of buffer stocks and export quotas to reduce what had been a persistent oversupply of cocoa on the world market. The first ICCA was never enforced, however, as cocoa prices increased significantly on their own in the year subsequent to the agreement.

The price of cocoa continued to rise into the late 1970s, reaching a peak of $4,038 per ton in 1977 (Table 3.5). The second ICCA was concluded in 1976, just prior to the height in prices. With this agreement, a higher price floor was established, but due to the ever-rising value of cocoa, the target never became binding. Prices then began a significant decline that led to the negotiation of the third ICCA in 1981. This agreement set a target range of $1.00 to $1.50 per pound and restricted total

Table 3.4

Range of Levies Imposed on Bauxite Production (in dollars per metric ton)

Year	Levy	Year	Levy
1974	5–15	1985	13–20
1975	5–15	1986	13–17
1976	5–15	1987	13–17
1977	5–15	1988	13–17
1978	5–15	1989	15–20
1979	5–15	1990	15–20
1980	6–16	1991	15–18
1981	8–20	1992	15–18
1982	8–20	1993	15–24
1983	13–20	1994	15–18
1984	13–20		

Source: CRB, *Commodity Yearbook.*

cartel exports to 250,000 tons, but the nonparticipation of the largest producer of cocoa, the Ivory Coast, resulted in a further deterioration of prices. The cartel's attempt to firm up prices by purchasing nearly 100,000 tons of cocoa in the open market worked only temporarily, and prices continued to fall into 1982. The fourth and final ICCA was concluded in 1986, with new price ranges set this time in special drawings rates. The cartel's additional large purchases of cocoa failed to elevate prices to the target levels. The cocoa market saw its lowest price in 1993, when the commodity sold for only $978 per metric ton, nearly 40 percent below its 1974 level.

The cocoa cartel failed to either stabilize or raise prices. The degree of overproduction was simply too great and the cartel was incapable of buying a sufficient quantity of cocoa to counteract the downward pressure on prices. The entry of new producers such as Malaysia in the 1980s not only further weakened prices but also exerted additional outside pressure on ICCA negotiations. Using a simulation model to estimate the effects of the 1981 and 1986 agreements on the cocoa market, Herrmann et al. (1993, 210) found a reduction in demand for cocoa totaling 89,000 tons as well as an increased supply of 30,000 tons for the period from 1981 to 1989. Their analysis also determined that prices had been increased by only 2 to 4 percent in the wake of the last two ICCAs. Given these results, one must conclude that the International Cocoa Agreements were failures.

Oddly enough, given its unimpressive record, the cocoa market con-

Table 3.5

World Cocoa Production and Prices, 1974–1997 (in thousands of metric tons and in dollars per metric ton)

Year	Total Production	New York Price
1974	1,448	1,613.7
1975	1,547	1,245.0
1976	1,510	1,694.4
1977	1,339	4,037.7
1978	1,512	3,377.7
1979	1,502	3,096.1
1980	1,651	2,355.3
1981	1,694	1,925.0
1982	1,737	1,502.4
1983	1,545	1,828.2
1984	1,545	2,317.0
1985	1,967	2,089.3
1986	1,946	2,024.9
1987	2,014	1,847.1
1988	2,214	1,599.0
1989	2,471	1,250.7
1990	2,419	1,079.5
1991	2,526	1,045.9
1992	2,301	989.8
1993	2,416	978.3
1994	2,519	1,230.0
1995	2,398	1,330.1
1996	2,876	1,409.5
1997	2,660	—

Sources: Production figures are taken from CRB, *Commodity Yearbook*; prices are derived from IMF, *International Financial Statistics*.

forms to many of the conditions necessary for cartelization. The four-country concentration ratio stood at 72.1 percent in 1997, a level certainly high enough for successful cooperation. Although artificial flavorings can imitate the taste of cocoa, for most purposes the real item is utilized. Cocoa beans are nonperishable, enabling a working cartel to adjust stocks to prevailing demand. Spar (1994, 261) noted that some differentiation exists among cocoa beans, yet the ICCA negotiations did not appear to be disrupted by this. The primary challenge to profitability for the cartel was permanent overproduction, which was only worsened by the group's deliberate inflation of prices. Despite a 35 percent drop in the world price of cocoa from 1981 to 1989 (Table 3.5), production rose by 46 percent. In addition, the entry of Malaysia into the market in 1986 demonstrated that the barriers to entry in the cocoa market could be

overcome. Thus the market continued to be plagued by a growing oversupply, which explains the de facto collapse of the ICCA after 1990.

The Organization of Petroleum Exporting Countries

The Organization of Petroleum Exporting Countries (OPEC) was formed in September 1960 in response to a developing weakness in the price of oil. In addition, OPEC members wanted to increase their share of the profits enjoyed by the multinational firms (primarily from the United States and Great Britain) that extracted and marketed their petroleum resources. The softening of prices resulting from a variety of economic and political factors led to a substantial surplus in the oil markets by the late 1950s. First, voluntary import restrictions imposed by the United States in 1957 were made mandatory in 1959, significantly reducing demand. Second, new producers of petroleum, particularly the USSR, were beginning to influence supply to the detriment of existing exporters. Finally, in the latter part of the decade, the international oil market was adversely affected by a surplus of tanker traffic, which led to additional competition and falling prices (see Ghanem 1986, 71–74, for additional details). By 1960, the price received by OPEC members had declined by 15 to 20 percent (depending on the grade of petroleum). At the time, it was projected that petroleum prices would continue to fall into the foreseeable future. Consequently, OPEC sought a return to the prices that had prevailed earlier in the decade.

OPEC membership has generally been confined to countries in the Middle East and North Africa. The original signatories—Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela—were joined by Qatar in 1961, Libya and Indonesia in 1962, and Algeria in 1969. Abu Dhabi became a member in 1967, but was later absorbed into the United Arab Emirates. The ranks of OPEC further expanded in the ensuing years with the entry of Nigeria in 1971, Ecuador in 1973, and Gabon in 1975. Despite its growing membership, OPEC was only gradually able to achieve its goal of manipulating prices by controlling world production of petroleum.

In spite of the regularity of its meetings during the early 1960s, OPEC failed to significantly increase the prevailing price of crude oil. The perennial problem of worldwide overproduction was complicated by the refusal of international oil companies to boost petroleum prices. The situation did not change until September 1, 1969, when the government of Libya was overthrown in a coup by Colonel Muammar Qaddafi, who

immediately took a hard line with the multinational oil firms. By September 1970, Occidental Oil had agreed to increase the price of Libyan crude by $0.30 per barrel, and within a few months, all petroleum firms operating in Libya had agreed to the new terms. Recognizing the impossibility of maintaining the new pricing structure with Libya in the absence of similar price increases for oil originating elsewhere, the multinationals increased petroleum prices by $0.20 to $0.25 for Middle Eastern crude. This represented OPEC's first real success in securing higher prices.

The notoriety of OPEC arose from its ability to manipulate the price of petroleum during the period from 1973 to 1980. The cartel's apparent effectiveness in controlling oil markets was somewhat illusory, however, being more the result of international conflict than of its inherent power. In September 1973, Egypt and Syria went to war against Israel in an attempt to regain land lost in previous conflicts. The international oil markets immediately tightened, and in October, OPEC members from the Gulf region increased their crude oil prices. These same producers decided to punish Israel's key ally, the United States, by placing an embargo on all shipments to the States (sales to the Netherlands were also forbidden). In addition, OPEC instituted its first significant tightening of petroleum supplies when it decreed a 5 percent reduction in world oil shipments.

As shown in Table 3.6 and Figure 3.1, the impact of this measure on world oil prices was immediate. While the price of crude had crept up slowly during the early 1970s—to an average price of $3.14 by 1973—the cost per barrel rose nearly 260 percent to $11.22 by 1974. After fourteen relatively frustrating years of attempting to firm prices, the members of OPEC finally saw a significant rise in the value of their oil exports. Due to the inelasticity of demand for petroleum (at least in the short run), OPEC was able to hold to these prices without producing a drop in the imports of the industrialized nations. These increases slowed after 1974, with the price of crude rising to $12.95 per barrel by 1978. The key problem for OPEC during this period was that the substantially higher price of oil stimulated production from non-OPEC producers. Hence it was not declining demand but rather the arrival of new sources of petroleum on the world market that kept OPEC in check from 1974 to 1978.

The next significant expression of OPEC's power, once again, arose more from international conflict than from the inherent ability of the cartel to control the oil market. The sensitivity of petroleum prices to

Table 3.6

Petroleum Production and Prices, 1970–1996 (in thousands of barrels per day and in dollars per barrel)

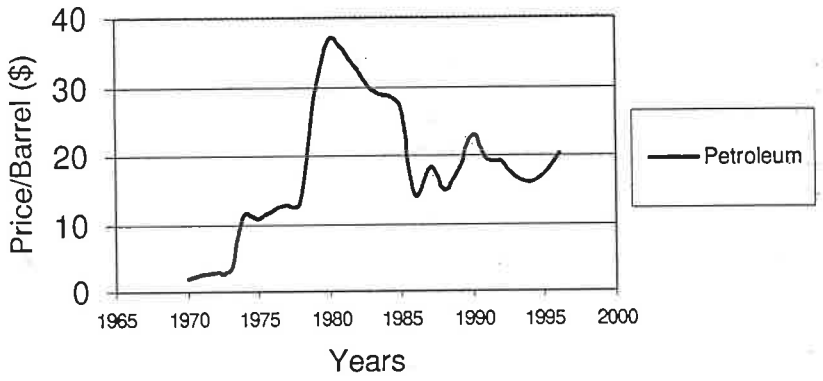
Year	Daily Production	Average Price
1970	45,731	2.11
1971	48,397	2.57
1972	50,967	2.80
1973	55,808	3.14
1974	56,274	11.22
1975	53,425	10.60
1976	58,066	11.83
1977	59,803	12.84
1978	60,057	12.95
1979	62,535	29.22
1980	59,538	36.68
1981	55,900	35.27
1982	53,458	32.45
1983	52,981	29.66
1984	54,488	28.56
1985	53,981	27.31
1986	56,227	14.23
1987	56,666	18.15
1988	58,737	14.72
1989	59,863	17.84
1990	60,566	22.97
1991	60,207	19.33
1992	60,216	19.03
1993	61,358	16.82
1994	61,358	15.90
1995	62,230	17.16
1996	63,821	20.42

Sources: Production figures are taken from CRB, *Commodity Yearbook*; prices are derived from IMF, *International Financial Statistics*.

small supply reductions was demonstrated after the revolution in Iran in late 1978, when that country's 60 percent reduction in output resulted in the elevation of world oil prices from $12.95 in 1978 to $29.22 per barrel in 1979. OPEC was able to maintain most of this increase for the next six years, with prices only gradually moving down to $27.31 by 1985. Conservation efforts on the part of the industrialized nations and the increased number of non-OPEC producing nations precipitated a 50 percent drop in prices, to just $14.23 per barrel in 1986. It was at this point that many observers began to regard OPEC as a faltering, if not broken, cartel.

Although OPEC exercised some power over petroleum markets be-

Figure 3.1 **Petroleum Prices, 1970–1997**



tween 1973 and 1986, and despite the fact that it fulfills some of the necessary conditions for cartelization, such as product homogeneity, the international oil market fails to meet two criteria. First, the barriers to entry that would prevent competition from additional producers are very weak. Second, as noted above, the rapid price increases realized under OPEC's tenure provided a strong incentive for nonmembers to discover new petroleum resources and expand existing ones. Thus oil production in Mexico, which was just over 500,000 barrels per day in 1973, grew to nearly 2.5 million barrels per day by 1986 (CRB, *Commodity Yearbook*). Similarly, China, which was not a major exporter of petroleum in 1973, nearly doubled its production to 2.6 million barrels per day by 1986 (CRB, *Commodity Yearbook*). As new producers entered the market and traditional suppliers expanded their production, OPEC's share of the world oil market began a long decline, falling from over 50 percent of world production in 1973 to just slightly over 45 percent by 1980, and then to less than 30 percent by 1985 (Table 3.7). Not surprisingly, a price collapse occurred in 1986 when Saudi Arabia, in a desperate attempt to induce its cartel partners to negotiate seriously, flooded the market with oil. By this point, OPEC's clout in world oil markets had become negligible.

The second factor that disempowered the cartel during the 1980s was the substitution of alternative energy sources for oil. Although there are no alternatives for some petroleum uses (primarily, of course, the traditional internal combustion engine), as the price of crude increased, de-

Table 3.7

OPEC's Share of Total World Production, 1970–1986 (as a percentage)

Year	%
1970	48.6
1971	52.1
1972	52.7
1973	55.4
1974	54.2
1975	50.9
1976	52.8
1977	52.3
1978	49.7
1979	49.4
1980	45.2
1981	40.4
1982	35.5
1983	32.1
1984	30.4
1985	28.5
1986	32.6

Source: CRB, *Commodity Yearbook.*

mand for substitutes such as coal and natural gas rose. Thus, after the major price increases of 1979 and 1980, world petroleum shipments fell from over 62 million barrels per day in 1979 to under 53 million barrels in 1983, a decline of nearly 15 percent. The volume of shipments did not rebound to their 1979 levels until 1990.

The undoing of OPEC's power was also partly attributable to the tendency of member nations to cheat once the cartel had achieved some degree of monopoly power (see chapter 1 for an analysis of these quota violations). As demand for petroleum declined in the early 1980s, it became increasingly difficult for OPEC members to maintain the cartel's benchmark price. Finally, in January 1982, the prices of some grades of petroleum were cut. This measure, however, did not end the glut of oil in the market. Faced with declining revenues, individual producers began offering various discounts, frequently coupled with extended payment terms. By December 1992, price cuts had become the norm, and the international price of oil began to slide precipitously. Even when demand for petroleum recovered later in the 1990s, OPEC remained an effete cartel, with little power to manipulate world production or prices until very recently.

The International Sugar Controls

The first attempts to regulate sugar production and pricing arose out of the deterioration of the sugar market in the mid-1920s. The price per pound, which had been as high as $0.11 in 1920, had fallen to just under $0.03 in 1925. This drop had resulted in a massive reduction in the revenues of sugar producers, with Cuban suppliers particularly hard-hit. On October 4, 1927, Congress passed legislation that allowed the president to impose production quotas on Cuban producers. The resulting restriction in output led to some temporary firming of sugar prices in the late 1920s. Cuban production fell by over 1.3 million tons, from 5.8 million tons in 1925 to 4.6 million tons in 1928 (Stocking and Watkins 1991, 29). Despite this action by the United States, the world price of sugar began to decline sharply in 1929 and the quota system was abandoned.

The Cuban experience is instructive because it represents a unilateral attempt to manipulate international prices and production. It should have been obvious to both the United States and the sugar-producing firms that the quota system was doomed to fail in the absence of some form of international cooperation. This is because while Cuba was the dominant exporter of sugar in 1927, it was responsible for less than 20 percent of total world production. Thus, while the production quotas had a significant affect on Cuba's output, the impact of these measures on total world production was negligible.

The international initiative to reduce the persistent oversupplies of sugar dates to 1931, when industry representatives from Belgium, Cuba, Czechoslovakia, Germany, Hungary, Java, and Poland signed the Chadbourne Plan, which held its signatories to export limits for the ensuing five years. Notably absent from these negotiations were representatives of American and British sugar producers, a situation that suggested that the Chadbourne Plan would likely experience many of the same problems that had plagued the unilateral Cuban restrictions. Indeed, the plan did nothing to firm prices during its five-year tenure. The price of sugar declined to a low of $0.59 per pound in 1932 and recovered only slightly after that (Stocking and Watkins 1991, 39). Although Cuba and Java adhered to the agreement and faithfully cut production and exports, their efforts were offset by the increased production of countries outside the Chadbourne Plan.

It was futile to try to revive the plan when it expired in 1935. An alternative attempt at cartelization was undertaken in 1937, with producers and consumers now joining to regulate both supply and demand. Unlike the Chadbourne Plan, the cartel of 1937 was an intergovernmental arrangement involving twenty-one countries that controlled 90 percent of world production and consumption (Stocking and Watkins 1991, 43–44). The 1937 agreement established export quotas for the major producers and reserve quotas for nations that intermittently released excess production onto the world market. As noted by Stocking and Watkins, rather than directly addressing the problem of worldwide oversupply, the agreement focused on preventing additional import restrictions by nations like the United States. By restricting exports, the cartel managed to increase sugar prices by approximately 30 percent. This increase, nonetheless, represented an absolute increase of only .30 cents (from 1.03 to 1.34 cents per pound), hardly significant enough to improve economic circumstances in the producing countries.

The failure of the 1937 agreement did not dissuade the sugar-producing nations from further attempts at cartelization. With Cuba in the lead, the first International Sugar Agreement (ISA) was signed in 1953. Like the attempts made in the 1920s to address the oversupply of sugar through the restrictions imposed on a single producer, the 1953 accord relied primarily on Cuba to manage exports. As noted by Spar (1994, 223), with its production level centralized under governmental control, the Cuban sugar industry was well suited to act as the world's manager of supply, for it could raise or lower output to fit market conditions. In addition, while sugar production was widely distributed internationally, the export market was dominated by Cuba through the 1970s. The ISA succeeded in maintaining the target price of sugar through 1955, but a poor European harvest of sugar beets in 1956 resulted in an increase in prices beyond target levels. The second ISA, which was in force from 1959 to 1963, managed to keep prices within range until the final year of the agreement, at which time the U.S. embargo on Cuban exports forced the excess production of the latter onto the world market. Although additional ISAs were signed in 1968 and 1977, they proved to be largely irrelevant in the face of falling production in Cuba and the former Soviet Union, which eventually led to a fivefold increase in the price per pound (Table 3.8). Unfortunately for sugar producers, this resulted in a sizable increase in world output, and prices collapsed in 1985.

As noted by Gilbert (1987), the ISAs were far less successful in managing prices than other collusive agreements of the same period. For one thing, the various ISAs lacked any supply-management system and

Table 3.8

Sugar Production and Prices, 1974–1997 (in thousands of metric tons and in dollars per metric ton)

Year	Total Production	New York Price
1974	80,488	558.4
1975	78,620	642.0
1976	81,888	253.4
1977	86,913	181.3
1978	92,065	169.4
1979	90,170	193.4
1980	84,560	479.4
1981	88,466	372.2
1982	100,555	207.2
1983	101,348	208.1
1984	95,553	201.7
1985	97,546	146.5
1986	98,798	154.7
1987	103,951	149.6
1988	103,786	185.2
1989	105,562	267.1
1990	108,772	350.7
1991	113,484	261.1
1992	116,512	244.6
1993	112,088	255.4
1994	109,787	289.1
1995	115,842	302.5
1996	122,509	290.4
1997	124,989	—

Source: Production figures are taken from CRB, *Commodity Yearbook;* prices are derived from IMF, *International Financial Statistics.*

relied instead on export controls of participating nations. Market conditions produced rapid price increases that created an incentive for new producers to enter the market. By the time the fourth ISA expired in 1983, production had become far more diversified and difficult to control. Thus the sugar cartel's failure was due, at least in part, to an inability to control prices on the upside. Despite the lack of barriers to entry and the diffusion of production among too many producers, the sugar market meets other requirements for successful cartelization. If one is careful to include all sources of sugar (notably cane and beet), then a suitable substitute for sugar does not really exist. The product is nonperishable, at least in the short term, and is considered (at least in the Western diet) to be a necessity. In conclusion, the ISAs might have been more successful if world production had not been so diffuse.

The Natural Rubber Agreements

The market for natural rubber is probably the most complex of the international commodity markets, for its producers must compete with a near perfect substitute: synthetic rubber. This substitutability places a significant constraint on the degree to which the producers of natural rubber can increase or stabilize prices. On the positive side for the members of any potential cartel, natural rubber production is highly concentrated, with only five nations responsible for nearly 90 percent of world output. Consequently, although it is unlikely that a cartel could significantly raise the price of rubber, certain mechanisms for stabilizing prices can be implemented.

As with most commodity markets, cartelization in the rubber industry has an early history during which rubber-producing firms sought a means by which to reduce oversupply. In 1920, the British firms that made up the largest segment of membership in the Rubber Growers' Association cut production by 25 percent. Although purely voluntary, these production restrictions were widely supported by both British and Dutch firms. Unfortunately for the association, however, American rubber producers, which were heavily overstocked, did not endorse the quotas. Rubber prices subsequently fell, bottoming out at less than $0.17 per pound in 1921. The recovery of prices later that year, however, made renegotiating the output quotas impossible. In devising the Stevenson Plan in 1922, British producers acted unilaterally to reduce world production by setting export quotas. Although the dramatic rise in rubber prices in the ensuing years seems to demonstrate the effectiveness of the Stevenson Plan, the recovery in the natural rubber market probably owes more to the accelerating pace of economic expansion in the industrialized nations.

The onset of the Great Depression, coupled with the development in the 1920s of the first synthetic rubbers, resulted in considerable weakness in natural rubber markets. By 1933, the price had fallen to less than $0.04 per pound, down over 95 percent from its high of $0.73 in 1925. In desperation, the governments of the major rubber-producing nations once again sought to establish a workable cartel. In 1934, the International Rubber Agreement (IRA) was concluded, with its signatories—France, India, the Netherlands, Siam, and the United Kingdom—agreeing to quotas enforced through the use of penalties for excess exports.

The IRA succeeded in controlling both supply and prices. A major

problem for the cartel was the existence of excessive stocks of raw rubber; in 1934, stockpiled rubber represented nearly nine months of normal demand (Stocking and Watkins 1991, 80). By restricting output to 70 percent of that permitted under the quotas set by this agreement, both the excess supply and stockpiles began to fade, reducing the holdings of rubber to less than a six-month supply by 1936 (Stocking and Watkins 1991, 82). Prices recovered rapidly, so that by 1937, rubber was selling for over $0.19 per pound. Although this represented a major accomplishment for the cartel, rubber prices remained substantially below their 1920 levels. The IRA, which was extended twice, in 1938 and again in 1943, came to an end during World War II, in April 1944.

Interestingly, the major producers of synthetic rubber developed their own collusive schemes to control supply. These measures primarily involved self-imposed restrictions on production in exchange for access to improved technology for the production of synthetics. Although this history is fascinating, it falls outside the concerns of this analysis (for this history, see Stocking and Watkins 1991, 87–117).

The most recent phase of cartelization of the rubber market dates to the signing in October 1980 of the Natural Rubber Agreement (NRA), whose major goal was the elimination of price fluctuations through the creation of a buffer stock of up to 550,000 tons of the commodity. The accord also established critical prices that were to act as a guide for the manager of the buffer stock.[1] The price of rubber fell substantially during the first two years of the accord, prompting additions to the buffer stock in 1982. Similarly, the price dipped close to the "must-buy" range in 1985, leading to further purchases. A very rapid price recovery then occurred, leading to the dispersal of the buffer stocks accumulated in the earlier period. By 1988, the buffer stocks were down to less than 5 percent (approximately 25,000 tons) of their maximum permissible level. Despite a renewal of the agreement in 1987, rubber demand and prices began to fall as world automobile and tire markets softened in advance of the U.S. recession of 1991. Prices bottomed out in 1993, when rubber sold for only $990 per ton, a value below the 1982 level.

The correspondence between the business cycle, automobile and tire production, and the price of natural rubber can be seen in Table 3.9. As illustrated in Figure 3.2, rubber prices followed a path similar to that of other renewable commodities. The recessions of 1974–1975, 1982, and 1991–1992 dampened demand for automobiles in the United States,

which led to weakness in natural rubber demand. Similarly, the slowdown in GDP growth in 1986 also resulted in a decline in prices. Thus, although the rubber cartel was able to somewhat dampen price fluctuations, the level of economic activity in the industrial world still predominated. Was the cartel able to reduce the variability of prices after 1980? The standard deviation of prices fell from 314.1 during the period from 1974 to 1980 to 126.9 in the years from 1981 to 1989. Although this reduction in variability was accompanied by a slight decrease in the average price paid for rubber, the cartel's members benefited enormously from the reduced uncertainty of demand. (Additional evaluations of the performance of the IRAs can be found in Herrmann et al. 1993, 165–197; and Burger and Smit 1990.)

Although they achieved only limited success, the Natural Rubber Agreements benefited both consumers and producers by measurably reducing price variability. Several characteristics of the rubber market made it conducive to cartelization. The four-country concentration ratio of the natural rubber market stood at 83.3 percent in 1980, at the time the cartel was formed, and dropped only slightly, to 81.3 percent, in 1994. Both of these ratios are well above the level considered necessary for the successful operation of a cartel. The barriers to entry in natural rubber production are considerable (although not insurmountable). Thus while Brazil was one of the top ten producers in the early 1980s, by the 1990s it had been superseded by a new entrant, Vietnam. While the entry of additional producers is possible, it is likely to have minimal impact on the success of the cartel. Instead of achieving its price targets through production quotas, which are always difficult to enforce in a large cartel, the Natural Rubber Agreement functioned through the use of a buffer stock. Although the rubber market could have been overwhelmed by the entry of numerous new producers, the cartel was able to stabilize prices without the explicit cooperation of all the existing rubber exporters. In addition, rubber can be characterized as a fairly homogeneous product, which eliminated any need for complex pricing schemes.

The most difficult problem for the cartel was the substitutability of synthetic rubber. The production of synthetics had grown from 7.6 million metric tons in 1974 (31.3 percent of world production of all rubber commodities) to over 8.8 million metric tons by 1994 (39.4 percent of world output). Therefore, although the four-country concentration ratio in the natural rubber industry is high, if recalculated as a percentage of total rubber production, it is, in fact, rather low (28.8 percent in 1994).

Table 3.9

Natural Rubber Production and Prices, 1974–1995 (in thousands of metric tons and in dollars per metric ton)

Year	Production	New York Price
1974	3,445	875.6
1975	3,315	657.8
1976	3,575	869.0
1977	3,605	915.2
1978	3,715	1,091.2
1979	3,770	1,432.2
1980	3,850	1,606.0
1981	3,705	1,267.2
1982	3,750	996.6
1983	4,025	1,232.0
1984	4,260	1,091.2
1985	4,400	919.6
1986	4,490	943.8
1987	4,840	1,111.0
1988	5,020	1,278.7
1989	5,150	1,108.8
1990	5,120	1,018.6
1991	5,240	1,005.4
1992	5,460	1,018.9
1993	5,340	990.0
1994	5,720	1,313.4
1995	—	1,810.6

Source: CRB, *Commodity Yearbook.*

The signatories of the Natural Rubber Agreements realized the futility of raising prices under these circumstances, and concentrated instead on maintaining prices. The success of the natural rubber cartel is therefore at least partially attributable to its fairly modest goals.

The International Tin Cartel

The foundations of the International Tin Cartel date to 1931, when representatives of the major producing countries—Bolivia, China, Malaysia (represented by the United Kingdom), the Netherlands, and the United Kingdom—sought to stabilize falling prices by adopting a set of supply restrictions, production carryovers, and price objectives. Even before the four-year implementation period had passed, a second agreement was struck by the signatories in 1933. The third agreement added a new entrant, Siam (Thailand), whose demands forced the existing members to accede to extremely high production quotas. Although the expansion

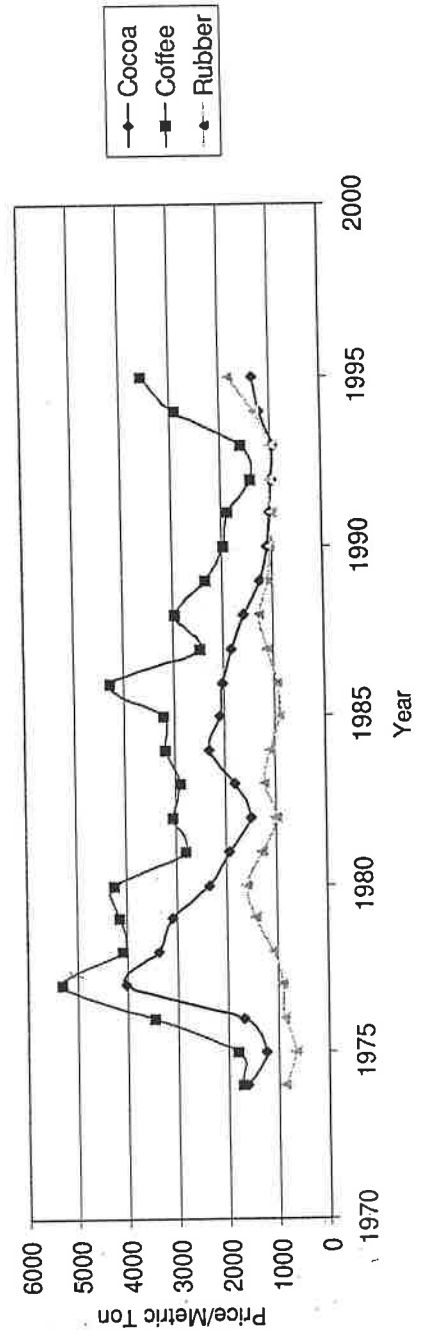


Figure 3.2 **Coffee, Cocoa, and Rubber Prices, 1974–1997**

Table 3.10

Tin Production and Prices, 1974–1996 (in thousands of metric tons and in dollars per metric ton)

Year	Total Production	London Price
1974	232.9	8,167.1
1975	224.2	6,862.2
1976	225.3	7,569.8
1977	231.4	10,781.8
1978	235.0	12,848.2
1979	241.1	15,415.0
1980	245.9	16,742.7
1981	238.0	14,139.4
1982	219.9	12,802.9
1983	196.9	12,960.4
1984	198.4	12,204.7
1985	188.6	11,514.8
1986	179.4	6,148.6
1987	179.7	6,675.9
1988	200.2	7,036.9
1989	216.5	8,516.6
1990	221.0	6,072.7
1991	201.0	5,584.3
1992	182.0	6,091.8
1993	195.0	5,156.8
1994	182.0	5,448.5
1995	187.0	6,184.4
1996	—	6,145.9

Sources: Production figures are taken from CRB, *Commodity Yearbook*; prices are derived from IMF, *International Financial Statistics*.

of membership strengthened the cartel, it was soon forced to institute a system of buffer stocks and pools in the face of rising production in the nonmember state of the Congo (for a description of how these two market controls were used to manipulate tin prices, see Hillman 1988, 250–253). The cartel achieved some success in controlling prices, but constant infighting among its members reduced the effectiveness of these measures. As tin was considered a strategic wartime mineral, support for the cartel's actions diminished after 1940, with the British arguing forcibly that international interests should outweigh industry profits.

The postwar phase of cartelization began in 1956, when the first International Tin Agreement (ITA) was instituted. The United States and other consuming nations joined the agreement in an attempt to bring

about greater price stability. The provisions of the initial ITA were renewed four times, with each agreement establishing higher target prices. The relative success of the cartel can be seen in the movement of prices during the latter half of the 1970s (Table 3.10). After reaching a low of $6,862.2 per metric ton in 1975, prices rebounded to nearly $17,000 per ton in 1980, an increase of over 144 percent. In 1981, the final year of the fifth ITA, the United States withdrew its support from the cartel and prices declined rapidly during the first half of the 1980s. In 1996, prices had still not returned to their 1974 levels.

Despite their eventual collapse, the ITAs were successful in keeping tin prices close to the target ranges for the period from 1956 to 1981 period (see Gilbert 1987, 609). The high concentration ratio in this market (nearly 70 percent) made cooperation on production quotas possible. The geographic distribution of tin ore is narrow, preventing the entry of additional producers in response to price increases. The cartel managed the international market through the effective use of an international buffer stock, coupled with export controls. These factors tended to make the ITAs function far better than other commodity agreements. As noted by Gilbert, however (1987, 610), the market's one wild card was the stockpile of strategic reserves of tin held by the United States, which in 1956 were equivalent to six years of domestic consumption. Although the United States made an effort to carefully manage the release of tin from its stockpile, the cartel's control of prices was always dependent on U.S. restraint. In addition, Anderson and Gilbert (1988) noted that the ITAs frequently targeted prices at an unmaintainable level, acting as if establishing a price floor rather than price stability was the goal. This misstep led to market disequilibrium, with the downward price pressure leading to the demise of the International Tin Agreement.

THE INTERNATIONAL COMMODITY CARTELS: AN EVALUATION

Although it would be erroneous to assert that all commodity arrangements are destined to fail, the analyses carried out above suggest that cartels accomplish far less than their signatories set out to achieve. In addition, collusive agreements appear to be fairly fragile, even in industries whose market characteristics are most conducive to cartelization. OPEC, the most notorious of the modern cartels, functioned most effectively for only thirteen years. In fact, the very features that had made the

Table 3.11

Characteristics of Selected Commodity Markets in 1974

Market	Concentrated	Barriers	Non-substitutability	Storability	Homogeneous
Petroleum	Yes	Weak	Strong	High	Yes
Bauxite	Yes	Strong	Moderate	High	Yes
Sugar	No	Weak	Strong	Short-Term	Yes
Coffee	No	Moderate	Strong	Short-Term	No
Rubber	Yes	Moderate	Moderate	High	Yes
Tin	Yes	Strong	Moderate	High	Yes
Cocoa	No	Moderate	Moderate	Short-Term	Yes

formation of OPEC feasible, in particular the low elasticity of demand, led to its downfall in 1986, for increased market power resulted in rapid diversification of petroleum production among nonmember nations.

Characteristics of Commodity Cartels

Table 3.11 summarizes the characteristics of the various markets discussed in the previous section. In only four of the seven markets considered was the four-country concentration ratio high enough to enable the cartel to successfully manage both output and pricing. By the mid-1990s, this number had dropped to three, when the concentration ratio of the petroleum market fell to only 38 percent. As for the barriers to entry, only the bauxite and tin suppliers enjoyed market exclusivity. For the rest, the price increases brought about by cartelization inevitably resulted in the entry of additional producers. The nonsubstitutability criterion was fulfilled by the coffee, petroleum, and sugar industries. For the other four products, however, increased prices led to the introduction of substitutes by the consuming nations, thereby weakening the power of the cartels. Even with the shorter storage limits for cocoa, coffee, and sugar, all seven markets met the criterion of nonperishability. Finally, in six of the seven industries, the product could be considered homogeneous. The exception to this is coffee, for which the absence of homogeneity became a vexing problem. In summary, except for bauxite, the commodity markets under consideration failed to meet one or more of the criteria necessary for successful collusive agreements. These shortcomings explain the instability of commodity cartels and their inability to control production and prices in the long-term.

Despite the eventual demise of most cartels, it could be argued that members of collusive agreements benefit from the temporarily higher prices brought about by the coordination of supply. Yet this assertion is

Table 3.12

Variability in Prices of Cartelized and Noncartelized Commodities, 1974–1991 (coefficient of variation in prices)

Commodity	Price Variability
Cocoa	.428
Petroleum	.391
Sugar	.483
Tin	.386
Copper	.269
Nickel	.402
Rubber	.181
Zinc	.236

difficult to test. For example, it is impossible, ex post, to establish the path that petroleum prices would have taken in the absence of OPEC. Similarly, one cannot readily determine the price that would have prevailed in the coffee market in the absence of the various ICAs. One could, however, compare the experiences of cartelized markets with other commodity trade, in terms of both price trends and price stability. For the former, the long-term path of commodity prices is determined by a variety of factors, many of which are wholly beyond the control of the cartel (namely, changes in demand due to changes in technology or in the cost of other inputs). Conversely, achieving at least some reduction in price variability is a core objective of every cartel.

It is instructive to compare the price variability of three noncartelized commodities—copper, nickel, and zinc—with the price deviations of the cartelized resources already discussed (Table 3.12). The highest degree of price stability (as measured by the coefficient of variation) was achieved in the cartelized rubber market, closely followed by the zinc and copper markets. For the two most volatile markets, sugar and cocoa, cartelization did little to eliminate price fluctuations. From these figures, it would appear that cartels are no better at achieving price stability than unmanaged commodity markets.

Cartels and the Commodity Terms of Trade

The fundamental problem for commodity producers, particularly developing nations, is the decline in the relative price of their exports versus the manufactured goods that they must import. If, for example, the price of cocoa fails to keep pace with the increasing price of industrial products, then cocoa exporters must increase their foreign sales simply to

Table 3.13

Price of Manufactured Goods Exported by the G-5 to Developing Nations, 1974–1982

Year	Index
1974	56.5
1975	62.8
1976	63.7
1977	69.9
1978	80.5
1979	91.2
1980	100.0
1981	100.4
1982	98.9
1983	96.6
1984	94.5
1985	95.3
1986	112.4
1987	123.4
1988	132.4
1989	131.5
1990	138.9
1991	141.8

Source: IMF, *International Financial Statistics.*

Figure 3.3 **Relative Price of Coffee, Cocoa, Sugar, and Rubber, 1974–1991**

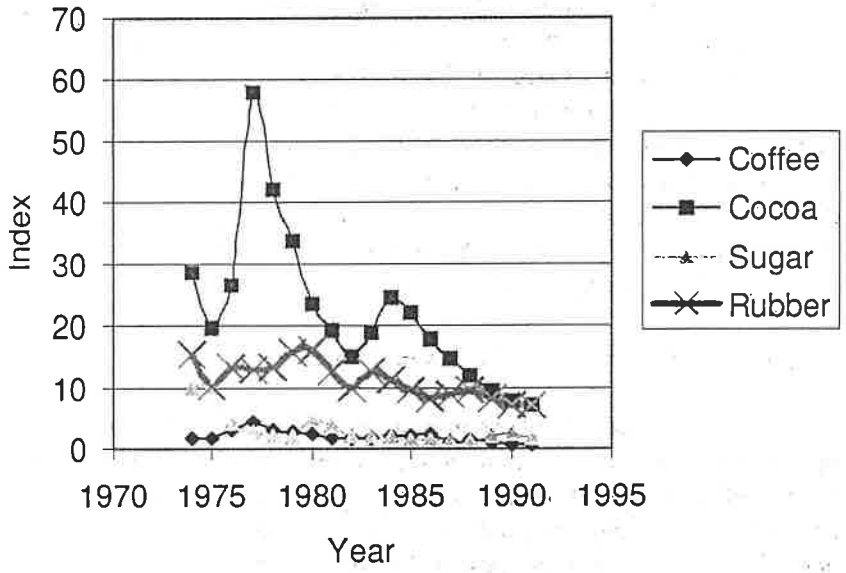
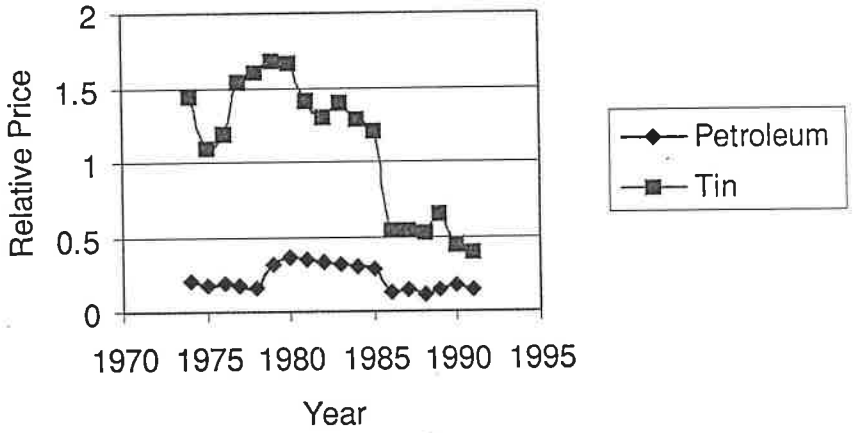


Figure 3.4 **Relative Price of Petroleum and Tin, 1974–1991**



maintain the existing level of import revenues. Exporters, however, cannot raise production without causing a severe and self-defeating decline in the price of the commodity. Consequently, one of the major goals of any cartel is to control oversupply and prevent a decline in the terms of trade facing producers.

How successful have the various cartel arrangements been in maintaining or improving the terms of trade of member nations? Table 3.13 contains the World Bank's price index for manufactured goods exported by G-5 countries to developing nations for the years 1974 through 1991. Over this period, the price of G-5 exports rose by over 5.5 percent per year (this despite some significant weakness in prices between 1981 and 1986). These figures can be used to create a relative price for key commodities exported by the developing nations.

Table 3.14 and Figures 3.3 and 3.4 show the price of various cartelized commodities versus the price of manufactured exports from the industrialized nations. Although there are important differences in the pattern of prices for each commodity, some generalizations can be made. The producers saw their greatest gains during the period from 1975 to 1980. From 1980 onward, however, a general downward trend can be observed in all six commodities. By 1991, cocoa's relative price had fallen approximately 75 percent from its 1974 level, and during the same period, sugar depreciated in value by over 80 percent.

The deterioration in the terms of trade for each of these commodities took place despite the existence of active cartels. The mixed results of cartelization are demonstrated by the ICAs, for the 1980 agreement was

Table 3.14

Relative Price of Commodity Exports, 1974–1991

Year	Coffee	Cocoa	Petroleum	Sugar	Rubber	Tin
1974	1.82	28.6	0.20	9.88	15.5	144.5
1975	1.71	19.8	0.17	10.22	10.5	109.3
1976	3.25	26.6	0.19	3.98	13.6	118.8
1977	4.56	57.8	0.18	2.59	13.1	154.2
1978	3.04	42.0	0.16	2.10	13.6	159.6
1979	2.65	33.9	0.32	2.12	15.7	169.0
1980	2.54	23.6	0.37	4.79	16.1	167.4
1981	1.68	19.2	0.35	3.71	12.6	140.8
1982	1.86	15.2	0.33	2.10	10.1	129.5
1983	1.80	18.9	0.31	2.15	12.8	139.2
1984	2.01	24.5	0.30	2.13	11.5	129.2
1985	2.02	21.9	0.29	1.54	9.6	120.8
1986	2.28	18.0	0.13	1.38	8.4	54.7
1987	1.20	15.0	0.15	1.21	9.0	54.1
1988	1.35	12.1	0.11	1.40	9.7	53.1
1989	1.07	9.5	0.14	2.03	8.4	64.8
1990	0.85	7.8	0.17	2.52	7.3	43.7
1991	0.79	7.4	0.14	1.84	7.1	39.4

Source: Derived from figures in IMF, *International Financial Statistics*.
Note: Figures are for intracommodity, year-by-year comparisons only. Data cannot be used to compare changes in terms of trade for one commodity versus another.

followed by a significant decline in the terms of trade while the accord of 1983 saw a temporary firming of prices (Table 3.14). Similarly, of the ICCAs of 1976, 1981, and 1986, only the first resulted in higher prices. Since 1986, the relative price of cocoa has declined by over 87 percent from its peak value in 1977. Finally, the Natural Rubber Agreement of 1980 was followed by two years of significant price declines. Thus whether prices are measured in absolute or relative terms, cartels have done little to assist exporters.

CARTELS AND COMMODITY FUTURES TRADING

In addition to the variations of supply and demand, markets for raw materials are impacted by trading on futures and options exchanges. That a proportion of these transactions are purely speculative suggests that trading may contribute to volatility. Bosworth and Lawrence (1982, 86–87) had set out to prove that such speculation added to price volatility, particularly during the 1970s, yet they found that the empirical evidence contradicted their original assumptions. Their work demonstrated that the addition of commodities to existing holdings of stocks and bonds

actually increased investor risk. It has become apparent that futures markets, which are part of the major commodity exchanges, are a potential source of stability for producers. There is now substantial research to support the notion that futures markets are reliable forecasters of forward prices. It is therefore unlikely that futures and options trading contributes to market volatility. Moreover, futures contracts represent the assumption of risk by speculators on behalf of producers. Under these circumstances, it is likely that commodity exporters will benefit from the existence of organized, efficient forward markets.

It was McKinnon (1967) who first argued that futures markets provide primary producers with a means of securing a known future price. Later, Gilbert (1985) argued that collusive agreements and futures contracts perform the same function and are therefore redundant. Measuring the risk benefits from cartelization both with and without futures markets in place, Gilbert concluded that in the presence of efficient futures markets, the producers of cocoa, coffee, sugar, and tin—like those for the noncartelized commodities of copper, cotton, rice, and tea—suffer financially when cartels are formed. A similar indictment of cartels was presented by Gemill (1985), who examined the risk benefits of both buffer stocks and forward trading for cocoa, coffee, and sugar for the period from 1961 to 1978.[2] Gemill's model firmly supported the use of futures contracts over buffer stocks as a means of reducing risk in the international sugar market. The findings for the cocoa and coffee markets were, on the other hand, ambiguous. Although the use of futures markets tended to be more cost-effective than buffer stocks for the cocoa producers, neither mechanism achieved the level of risk reduction necessary to make it attractive to exporters. As for coffee, forward trading provided superior risk reduction in three of the six exporters examined. In contrast to the positions held by Gilbert and Gemill, MacBean and Nguyen (1987) argued that futures markets are imperfect and that speculation influences future prices. Moreover, the latter authors noted that futures contracts have a very limited timeframe, for, in general, they cannot be used for planning beyond a six-month horizon.

Futures Trading on the New York Coffee, Sugar, and Cocoa Exchange

Price data for the New York Coffee, Sugar, and Cocoa Exchange (CSCE) in the 1970s provides substantial evidence that futures markets influence overall trade conditions for commodities. As detailed by Bosworth and Lawrence (1982, 84), pending futures contracts can represent sev-

Table 3.15

Commodity Futures Contracts for Coffee and Cocoa, 1974–1996 (in thousands of contracts and as a percentage of total world output)

	Coffee "C"		Cocoa	
Year	(Contracts)	(%)	(Contracts)	(%)
1974	151.9	68.9	469.7	324.4
1975	71.1	24.6	426.9	276.0
1976	174.5	67.3	453.6	300.4
1977	214.2	99.7	418.5	312.5
1978	164.0	65.5	303.0	200.4
1979	449.8	161.5	315.8	210.3
1980	906.9	313.7	456.5	276.5
1981	515.3	169.2	562.7	332.2
1982	556.4	160.7	608.0	350.0
1983	427.4	147.9	1,162.5	752.4
1984	499.1	159.2	1,127.8	730.0
1985	650.8	204.0	800.6	407.0
1986	1,073.1	317.4	777.8	399.7
1987	964.6	344.2	895.5	444.6
1988	1,149.7	315.6	1,268.1	572.8
1989	1,329.0	399.7	1,341.9	543.1
1990	1,774.1	518.2	1,635.9	676.3
1991	1,772.6	501.2	1,233.5	488.3
1992	2,152.4	588.1	1,397.2	607.2
1993	2,489.2	759.1	2,128.4	881.0
1994	2,658.1	807.2	2,417.0	959.5
1995	2,003.0	577.9	2,090.1	871.6
1996	2,039.6	642.8	2,121.6	737.7

Source: CRB, *Commodity Yearbook.*

Note: Traditionally, coffee contracts have been sold on the CSCE (each contract representing 37,500 pounds or 17 metric tons of beans). Cocoa is traded on the same exchange, with each contract representing 22,000 pounds or 10 metric tons. More recently, coffee and cocoa have also been traded on the London Mercantile Exchange.

eral years of consumption for a commodity, a finding that suggests that speculation is more important than actual demand. For example, they demonstrated that as a percentage of total demand for cocoa, the turnover in contracts rose from 242 percent in 1972 to 373 percent by 1980. Similarly, whereas coffee contracts represented only 3 percent of end-use in 1972, by 1980 they translated into 433 percent of demand. The same was true for sugar futures, which rose from 46 to 220 percent of total demand during the same period. Not surprisingly, this increased level of activity on commodity exchanges persisted into the 1980s. Tables 3.15 and 3.16 show the volume of contracts traded on the cocoa, coffee,

Table 3.16

Commodity Futures Contracts for Petroleum and Sugar, 1974–1996 (in thousands of contracts and as a percentage of total world output)

	Petroleum		Sugar	
Year	(Contracts)	(%)	(Contracts)	(%)
1974	—	—	736.9	46.5
1976	—	—	984.7	61.1
1977	—	—	1,056.0	61.7
1978	—	—	1,016.8	56.1
1975	—	—	790.6	51.1
1979	—	—	1,792.7	101.0
1980	—	—	3,576.7	214.9
1981	—	—	2,470.3	141.9
1982	—	—	2,037.0	102.9
1983	323.2	1.6	3,202.0	160.5
1984	1,840.3	9.2	2,449.5	130.2
1985	3,980.9	19.8	3,012.9	156.9
1986	8,313.5	40.0	3,583.8	184.3
1987	14,581.6	69.1	3,853.5	188.3
1988	18,858.9	86.6	5,819.1	284.8
1989	20,534.9	92.6	6,243.4	300.5
1990	23,686.9	105.5	5,424.8	253.4
1991	21,005.9	94.2	4,268.5	191.1
1992	21,109.6	94.7	3,667.5	159.9
1993	24,868.6	109.3	4,285.9	194.2
1994	26,812.3	117.9	4,719.2	218.4
1995	23,614.0	102.3	4,711.1	206.6
1996	23,487.8	99.3	4,751.9	197.0

Source: CRB, *Commodity Yearbook.*

Note: Crude oil futures are traded on the New York Mercantile Exchange, with each contract representing 1,000 barrels of oil. Sugar is traded on the CSCE, with each contract representing 112,000 pounds (approximately 50.9 metric tons) of #11 sugar, by far the largest category (the volume of trade for #14 sugar was just under 4 percent of that for #11 sugar in 1996).

petroleum, and sugar markets in New York from 1974 through 1996, both in units and as a percentage of total production.

The number of coffee contracts traded on the CSCE in 1974 was equivalent to just under 70 percent of total world production. The annual turnover in contracts continued to represent less than annual output until 1979, when 162 percent of total coffee production was traded. A decade later, futures trading was equal to nearly 400 percent of supply, a figure that continued to rise until 1994, when the contracts traded totaled 807 percent of production. These numbers suggest that speculation in coffee now accounts for more of the commodity than the market itself. One of the primary ele-

ments determining the volume of futures contracts is the presence of a functioning ICA. As will be discussed later in this chapter, the volume of futures trading is inversely related to the existence and efficiency of a cartel within the given market.

While futures contracts in coffee did not exceed total production until the late 1970s, cocoa contracts were already 324 percent of total output by 1974. This high level of futures trading was likely due to the greater variability in cocoa prices, which encourages the use of futures markets for both securing a predictable price and engaging in speculation. The ratio of turnover to total cocoa production was relatively stable until 1983, when it suddenly doubled to 752 percent of output. As will be argued below, much of this increased participation in the cocoa futures markets is attributable to the failure of the ICCA of 1981 and the ensuing market volatility. Although the volume of contracts declined somewhat in 1985 and 1986, it subsequently rebounded until by 1994 futures contracts represented nearly 950 percent of world production.

Trading in sugar futures has remained much more placid, with total contracts representing just 197 percent of production in 1996. As discussed above, the international sugar market is considerably more dispersed than other commodity markets, with many more producing and importing nations. This dispersion has tended to reduce price variability and limit the need for futures contracts. Even with the increased volatility in prices in the 1970s, the volume of trading remained below world production until 1979. It was only during the period from 1988 to 1990 that speculation took place, with contracts representing from 250 to 300 percent of world supply.

Options Trading on the New York Coffee, Sugar, and Cocoa Exchange

When examining the trading of coffee, cocoa, and sugar on the CSCE, one must also consider options contracts, which are a near-perfect substitute for futures contracts. Although futures contracts were a common means of reducing risk during the 1970s, options did not begin to play a significant role in most commodity markets until the mid-1980s. Table 3.17 illustrates the volume of options contracts for coffee and cocoa from 1986 through 1996. In 1986, coffee options represented less than 2 percent of world production, whereas the volume of futures contracts stood at over 300 percent of output. Likewise, in the cocoa market, options trading reflected less than 1 percent of annual supply, whereas the volume of futures contracts was approximately 800 percent of production.

Table 3.17

Commodity Options Contracts for Coffee and Cocoa, 1986–1996 (in thousands of contracts and as a percentage of total world output)

	Coffee "C"		Cocoa	
Year	(Contracts)	(%)	(Contracts)	(%)
1974	5.3	1.6	1.0	0.5
1987	25.6	9.2	13.9	6.9
1988	65.2	18.4	95.5	43.1
1989	114.2	34.0	153.6	62.2
1990	282.6	82.5	344.9	142.6
1991	411.6	116.8	163.6	64.9
1992	860.9	236.3	209.9	91.2
1993	1022.0	312.2	326.8	135.3
1994	1208.9	367.6	341.1	135.4
1995	867.3	250.5	319.5	133.2
1996	856.7	270.3	335.2	116.6

Source: CRB, *Commodity Yearbook.*

Note: Coffee and cocoa options are traded on the CSCE. As with futures contracts, each coffee option represents 37,500 pounds of coffee, while cocoa options represent 10 metric tons each.

By the mid-1990s, options had become a much more widely used means of securing price stability. The ratio of contracts to production for both coffee and cocoa peaked in 1994, with volume representing, respectively, 367 percent and 135 percent of production. Not surprisingly, the number of futures contracts for these commodities also attained its highest level. Table 3.18 and Figure 3.5 contain figures for futures and options contracts for both coffee and cocoa for selected years. In 1994, the aggregate volume of trading represented ten times the yearly production of these products. The numbers support the assertion that futures and options markets provide the means for securing known prices and therefore can serve as substitutes for cartelization. Indeed, when the ICA forged in 1975 was finally put into effect in 1980, the volume of futures and options contracts, which had been running at nearly 300 percent of world production, dropped to just 161 percent of output by 1982. Following the renewal of the ICA in 1983, the volume of coffee contracts dipped slightly but then gradually rebounded to over 300 percent by 1989, the year in which the accord expired; these numbers reveal the relative ineffectiveness of this accord. Nonetheless, after its expiration, the volume of trading skyrocketed to over 600 percent of production by 1990.

A somewhat similar pattern can be observed for the cocoa agreements, which were signed in 1976, 1981, and 1986.[3] As illustrated in

Table 3.18

Aggregate Volume of Futures and Options Contracts for Coffee and Cocoa for Selected Years (in thousands of contracts and as a percentage of total world output)

	Coffee "C"		Cocoa	
Year	(Contracts)	(%)	(Contracts)	(%)
1980	**906.9**	**313.7**	**456.5**	**276.5**
1982	**556.4**	**160.7**	**608.0**	**350.0**
1984	**499.1**	**159.2**	**1127.8**	**730.0**
1986	1078.4	319.0	778.8	573.3
1988	1214.9	334.0	1363.6	615.9
1990	2056.7	600.7	1980.8	818.9
1992	3013.3	824.4	1607.1	698.4
1994	3867.0	1174.8	2758.1	1094.9
1996	2896.3	913.1	2456.8	854.3

Note: Bold figures represent years in which only futures contracts are relevant. Numbers are derived from Tables 3.15 and 3.17.

Figure 3.5 **Volume of Coffee, Cocoa, and Sugar Contracts**

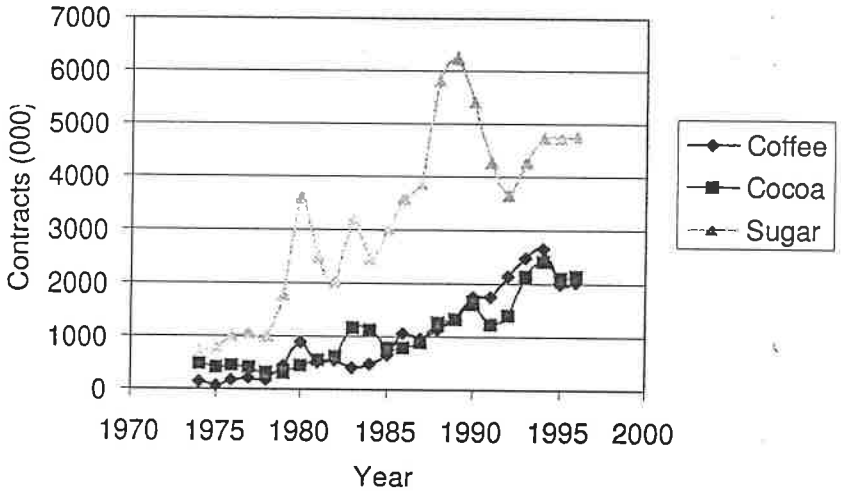


Table 3.18, these ICCAs tended to temporarily reduce the volume of futures and options contracts, with an approximate 33 percent reduction experienced between 1976 and 1978, and a 21 percent decline between 1984 and 1986. The 1981 agreement did little to affect supply, prices, or futures markets, as the nonparticipation of Ghana in this ICCA led to the immediate failure of the accord.

A similar pattern of options trading occurred in the petroleum and

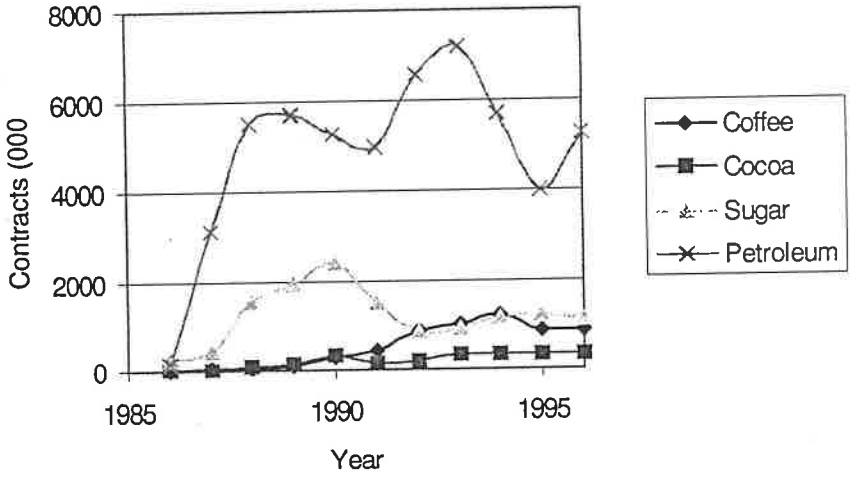
Table 3.19

Commodity Options Contracts for Petroleum and Sugar, 1983–1996 (in thousands of contracts and as a percentage of total world output)

	Petroleum		Sugar	
Year	(Contracts)	(%)	(Contracts)	(%)
1984	—	—	12.0	0.6
1985	—	—	91.4	4.8
1986	135.3	0.6	24.5	13.1
1987	3,117.0	14.9	432.9	21.2
1988	5,480.3	25.1	1,536.3	75.3
1989	5,686.0	25.7	1,932.8	93.2
1990	5,254.6	23.5	2393.0	112.0
1991	4,968.7	22.4	1,513.0	67.9
1992	6,562.2	29.4	848.8	37.1
1993	7,156.5	32.1	916.2	41.6
1994	5,675.1	25.0	1,166.7	54.1
1995	3,975.6	17.2	1,203.8	52.9
1996	5,271.5	22.3	1,094.8	45.5

Note: Crude oil options are traded on the New York Mercantile Exchange. Each contract represents 1,000 barrels of oil. Sugar options are traded on the CSCE. Each contract represents 112,000 pounds (approximately 50.9 metric tons) of sugar.

Figure 3.6 **Options Contracts for Coffee, Cocoa, Sugar, and Petroleum**



sugar markets (Table 3.19 and Figure 3.6). When OPEC effectively collapsed in 1986—with petroleum prices falling to their lowest levels in 13 years—it became apparent that an alternative mechanism for achieving price stability was needed. While petroleum options trading was minimal in 1986, representing only 0.6 percent of total production, it

Table 3.20

Aggregate Volume of Futures and Options Contracts for Petroleum and Sugar for Selected Years (in thousands of contracts and as a percentage of total world output)

	Petroleum		Sugar	
Year	(Contracts)	(%)	(Contracts)	(%)
1984	**1,840.3**	**9.2**	2,461.5	130.8
1986	8,448.8	40.6	3,838.3	197.4
1988	24,339.2	111.7	7,355.4	360.1
1990	28,941.5	129.0	7,817.8	365.4
1992	27,671.8	124.1	4,516.3	197.0
1994	32,487.4	142.9	5,885.9	272.5
1996	28,759.3	121.6	5,846.7	242.5

Note: Bold figures represent years in which only futures contracts are relevant. Numbers are derived from Tables 3.16 and 3.19.

rose rapidly thereafter, reaching 25 percent of total world supply by 1988. Similarly, sugar options represented only 0.4 percent of production in 1983, but rose precipitously to 112 percent by 1990.

The combined volume of futures and options contracts for oil and sugar is illustrated in Table 3.20. The direct link between a functioning cartel and contract volume is most apparent in the figures for petroleum. Indeed, when OPEC faltered in 1986, contract volume rose significantly, with the number of contracts in 1988 standing at 1223 percent over those for 1984. With OPEC unable to control prices, free markets took over the task of pricing petroleum. It is difficult to reach any conclusions regarding the sugar market, for with the exception of the 1977 accord, the ISAs predate the active futures and options markets.

Futures and Options Trading on the London Mercantile Exchange

The figures presented so far represent trading on markets in the United States. The London Mercantile Exchange has also offered contracts for cocoa (since 1929), coffee (beginning in 1958), and sugar (since 1983). Thus aggregate worldwide volume is actually greater than that reflected in Table 3.18. The importance of the London exchange in relation to the futures and options markets in New York is illustrated in Table 3.21. Although the volume of contracts for sugar remained small in London,

Table 3.21

Contract Volume on the London Mercantile Exchange as a Percentage of Trading on the New York CSCE, 1989–1996

Year	Sugar	Cocoa	Coffee
1989	5.4	115.8	—
1990	6.4	104.5	—
1991	7.3	124.6	—
1992	8.3	100.0	40.7
1993	7.7	89.6	36.5
1994	10.2	66.2	47.8
1995	12.2	79.1	53.1
1996	12.2	79.6	58.0

Source: CRB, *Commodity Yearbook.*

trading in cocoa futures exceeded the volume in New York for much of this period. Coffee contracts originating on the London exchange also represented a significant addition to total trading. Combining the information compiled in Table 3.21 with the figures already presented on U.S. contracts indicates that the total volume of trading in the London and New York exchanges was approximately 15 times production in 1996. Although it might seem that this magnitude of speculative purchases would destabilize international markets, the evidence indicates that futures markets are accurate forecasters of forward prices.

A Nontraditional Futures Exchange—The International Rubber Market

In contrast to the well-established futures markets (for cocoa, coffee, petroleum, and sugar), the trading of natural rubber in Japan is relatively recent (other commodities traded on newer exchanges include robusto coffees [Budapest], peanuts [Beijing], and corn [Tokyo]). The long-term cartelization of the rubber market made futures contracts unnecessary, and so it was not until 1986, when the collusive agreement was weak, that significant trading began. Table 3.22 illustrates the volume of rubber contracts on Japan's KOBE Rubber Exchange (KRE) and the Tokyo Commodity Exchange (TOCOM). Volume on the KRE rose from 1.146 million contracts in 1989 to 2.233 million contracts in 1996, an increase of approximately 95 percent. Volume on the TOCOM increased 294 percent during this period, from approximately 2.305 to 9.085 million contracts. The dominant role played by the Japanese exchanges can be attributed to the size of the automo-

Table 3.22

Natural Rubber Futures Contracts on the KRE and TOCOM Exchanges, 1989–1996

Year	Sugar	Cocoa	Coffee
1989	1,145.5	2,305.6	3,451.1
1990	1,383.4	2,308.4	3,691.8
1991	1,374.3	2,167.3	3,541.6
1992	791.9	1,726.5	2,518.4
1993	1,275.1	2,973.2	4,248.3
1994	2,933.9	9,021.9	11,955.8
1995	3,810.9	14,287.8	18,098.8
1996	2,232.8	9,085.7	11,318.5

Source: CRB, Commodity Yearbook.

bile industry, for natural rubber is far superior to synthetics in the production of tires.

As detailed earlier in the chapter, the Natural Rubber Agreements of the 1980s produced only mixed results. With the 1980 agreement, target prices were maintained through significant purchases and sales of buffer stocks. Conversely, the 1987 accord was doomed to failure, for the demand for rubber—already declining after 1988—spiraled downward as the worldwide recession of the early 1990s gutted automobile sales. A recovery did not occur until 1994. As shown in Table 3.22, the volume of futures contracts rose significantly as a result of the cartel's inability to maintain prices. It is likely that futures markets will continue to regulate prices in the rubber market.

Futures and Options Trading and Variability in Prices

It is difficult to directly measure the impact of futures and options trading on price variability. As argued above, cartels and futures markets offer alternative means of securing known prices. Thus when collusive agreements are in effect, contract volume is low and prices remain stable. Conversely, in markets where cartels are nonexistent or ineffective, suppliers and consumers protect themselves from price volatility by purchasing futures and options contracts. The widespread assumption that futures trading causes price instability is misleading. Rather, the numbers suggest that greater price variability is the natural accompaniment to increased contract volume, and hence there is no causality.

The tangential relationship between contract volume and monthly price variations for four key commodities is demonstrated in Table 3.23. Increased trading on the coffee exchange, for example, was accompanied by greater price variability in only two years, 1994 and 1996. In fact, as the contract volume doubled between 1986 and 1990, the coefficient of variation for prices fell by 60 percent. Moreover, decreased trading in 1996 was accompanied by greater market volatility. An erratic pattern is evident in the rubber market, for whereas the inception of futures trading in 1990 was initially accompanied by a reduction in price variability, one detects a direct correlation between the volume of contracts and market instability after 1994. Any suggestion of causality between futures trading and price variations is completely disproved in the sugar market, where a near tripling of trading volume occurred between 1984 and 1990, yet the coefficient of variation remained essentially the same. By 1996, with trading activity still more than twice what it had been in 1984, the variation in prices had dropped by 75 percent. A similar disconnection between futures contract volume and price movements is apparent in the petroleum market. Under the influence of OPEC's production and pricing targets, the coefficient of variation of oil prices was only 0.012 in 1984, yet it increased twenty-fivefold by 1986, prior to the expansion of futures trading. There is no clear pattern in the variability of prices from 1988 through 1996. The numbers suggest that any connection between price instability and speculation on futures markets is weak at best. Thus the slight variation in prices and market volume observed in the coffee and rubber markets does not necessarily indicate that futures markets are destabilizing, as the causality may run from price volatility to increased market volume and not vice versa.

When Will Cartels Work Better Than Futures and Options Markets?

As noted in chapter 2, there are fundamental differences between markets for agricultural commodities such as cocoa, coffee, and sugar and those for natural resources such as bauxite, petroleum, and tin. The ultimate production levels for agricultural commodities are an unknown at the beginning of a crop cycle, since the climatic conditions that prevail may significantly affect output. In addition, although cocoa, coffee, and sugar can be stored for lengthy periods of time, excess stocks must eventually be either released into the market or destroyed. The carrying costs

Table 3.23

Contract Volume and Price Variability for Coffee, Petroleum, Rubber, and Sugar for Selected Years (in thousands)

		1984	1986	1988	1990	1992	1994	1996
Coffee	Volume	499	1,078	1215	2,057	3,013	3,867	2,896
	Variation	—	0.15	0.05	0.06	0.10	0.37	0.42
Petro.	Volume (millions)	1.8	8.4	24.3	28.9	27.7	32.5	28.8
	Variation	0.0	0.32	0.91	0.31	0.09	0.13	0.10
Rubber	Volume	—	—	—	3,692	2,518	11,956	11,319
	Variation	0.1	0.05	0.09	0.02	0.03	0.19	0.23
Sugar	Volume	2462	3,839	7,355	7,818	4,516	5,886	5,847
	Variation	0.19	0.18	0.16	0.18	0.09	0.10	0.05

Note: Price variability is measured as the coefficient of variation of average monthly prices.

Table 3A-1

Concentration Ratios for Key Commodities (as percentages)

Commodity	Year	Concentration Ratio
Bauxite	1995	70.3
Cocoa	1997	72.1
Coffee	1997	51.9
Manganese	1995	64.4
Petroleum	1996	38.0
Rubber	1994	81.3
Sugar	1997	36.0
Tin	1995	69.3
Tungsten	1995	88.8

Source: CRB, *Commodity Yearbook.*

Table 3A-2

Concentration Ratios for Key Commodities, 1974 (as percentages)

Commodity	Concentration Ratio
Bauxite	54.6
Cocoa	70.4
Coffee	46.2
Manganese	—
Petroleum	57.8
Sugar	33.9
Tin	65.3
Tungsten	57.9

Source: CRB, *Commodity Yearbook.*

of maintaining buffer stocks in these commodities can be significant. Conversely, suppliers of minerals can easily speed up or slow down production in response to changes in demand. Consequently, cooperation on production could eliminate the need for (and costs of) buffer stocks.

The intrinsic differences between agricultural commodities and natural resources indicate that cartels may, in fact, offer a superior approach to managing prices for producers of materials such as bauxite, petroleum, and tin. In the absence of uncertainties about final production, target prices can be easily maintained without reliance on buffer stocks. The matching of supply and demand requires a degree of cooperation among producers that has rarely been attained.[4] The collapse

of the International Tin Agreement in 1985 is but one example of the tendency of cartel members to increase output at the risk of flooding the market with a commodity that is already in excess supply. Thus although collusive agreements may be preferred to futures markets for producers of material resources, their success requires significant sacrifices on the part of cartel members.

CONCLUSION

The cartelization of markets was a poor solution to the problem of declining and unstable commodity prices. As discussed above, most of the collusive agreements reached since 1960 have failed to meet at least one of the requisite criteria for a successful cartel: limited membership, nonsubstitutability, barriers to entry, nonperishability, and homogeneity of the product. Consequently, while cartels have temporarily affected world prices and production, the intrinsic characteristics of each commodity market eventually doomed the arrangements.

The attractiveness of cartelization to both commodity exporters and international agencies such as UNCTAD appears to be waning. With the exception of the bauxite cartel, no collusive arrangements have succeeded in permanently stabilizing prices in the commodity markets of developing nations. As will be argued in chapter 5, it is time for commodity producers to seek an alternative means of achieving a degree of control over the price they receive for their exports.

NOTES

1. Unlike other cartel arrangements, the International Rubber Agreement allowed for a great deal of discretion on the part of the buffer stock manager. Four price barriers were set: "may-sell," "must-sell," "may-buy," and "must-buy." As Burger and Smit noted (1990, 718), considerable buying occurred in the first seven years of the agreement in spite of the fact that the price never entered the "must-buy" or "must-sell" ranges.

2. Gemill's rejection of buffer stocks as a means of reducing risk is even more compelling when one considers the bias against forward markets that he built into his model (1985, 415).

3. One must keep in mind that the ICCAs were never effective in managing world cocoa prices. Consequently, it would not be surprising that futures contracts were popular even when an ICCA was in place.

4. The manipulation of output is especially difficult in agricultural markets. The situation is very different for oil producers, who can curtail output by merely turning a spigot. Thus when the members of OPEC managed to agree to significant production quotas in April 1999, the new quotas were acted on expeditiously and prices jumped.

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