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Latin America's Big Three Sugar Producers in Transition: Cuba, Mexico, Brazil

Peter Buzzanell

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Latin America's Big Three Sugar Producers in Transition: Cuba, Mexico, Brazil. By Peter Buzzanell, Commodity Economics Division, Economic Research Service, U.S. Department of Agriculture, Agriculture Information Bulletin No. 656.

Abstract

Major government policy turning points for Latin America's three largest sugar producers--Cuba, Mexico, and Brazil--could significantly affect U.S. and world sugar trade. The breakup of the socialist trading bloc has reduced Cuba's ability to purchase inputs needed for sugar production, while forcing it to look for new markets. Privatization of the sugar industry in Mexico has revitalized its production efficiency and freedom to trade in the private market. These potential gains must be measured against rapidly growing domestic consumption, which has bumped Mexico from a net sugar exporter to a net sugar importer in recent years. Brazil, meanwhile, continues to balance domestic needs (especially sugar-derived ethanol fuel for its autos) against export earnings. Brazil, unlike Cuba and Mexico, has enough refineries to satisfy a large share of world demand for refined sugar.

Keywords: Sugarcane, sugar, production, consumption, exports, fuel ethanol.

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Contents

Summary

Latin America's three largest sugar producers--Cuba, Mexico, and Brazil--face major changes in their governments' policies, which could significantly affect the United States and the world sugar market. The impact of these changes on the sugar industries in all three countries will affect production and trade this season and in the years ahead.

Cuba, long one of the world's leading producers and exporters of sugar, is at a major crossroads in its economic history. As a result of a sharp contraction in economic aid, Cuba faces a significant drop in sugar production in 1992 and a much-reduced exportable surplus. Problems in finding markets could lead to a pulling of resources away from sugar and toward increased domestic food production.

Over the medium term, sugar is likely to remain central to Cuba's economy, not only because it is the island's main trading commodity for hard currency and barter, but also because of the byproducts it generates, from animal feed to alcohol. But substantial investment is needed to modernize the industry and considerable downsizing would probably be required to make the industry economically viable in a nonsocialized environment. Cuba's key trading partner, the Russian Republic, needs sugar but has less oil to barter. Moreover, Cuba lacks the capability to export large volumes of refined sugar needed to expand markets in North Africa and the Middle East.

Mexico's sugar consumption, spurred by population growth and a recovering economy, has outpaced production, shifting Mexico from a net exporter to a significant net sugar importer. A sizable share of this surge in Mexican imports has been refined sugar from the United States. Recent government policies aim to achieve greater self-sufficiency by reprivatizing the milling sector and through initiatives to reduce government intervention and increase the influence of market forces.

Mexico has sufficient land to expand sugarcane acreage significantly. Yields could be improved with existing technology. More remunerative prices, capital investments by private sector mills, and modifications to the land tenure system to allow some amalgamation of "ejido" or communal lands would all spur production advances. However, production could stagnate or decline due to guaranteed producer prices below grower expectations, which would cause a shift to more remunerative substitute crops. For the mills, stagnation or contraction might result from problems with scaling down over-employment at mills.

Sugar consumption in Mexico is expected to expand about 3.5 percent a year to an estimated 5.5 million tons by 1996. This projection assumes population increases of 2.3 percent per year, real per capita income growth of 1 percent per year, and soft-drink consumption growth of 4.0 percent per year. Underlying this growth assumption is the belief that sugar prices to industry users and consumers will continue to be controlled. However, a radical shift to HFCS (high-fructose corn syrup) for the soft-drink industry similar to the U.S. shift in the mid-1980's could push sugar consumption below 4 million tons. This would be likely only if there is a significant change in Mexican Government policy related to corn imports or domestic price supports, and significant investment in HFCS/ethanol facilities, or a Government commitment to lowering barriers to imported HFCS along with investment in the infrastructure to import HFCS. Mexico is likely to continue to fill its

small annual U.S. sugar quota, owing to the premium price received by these sales compared with the world price, currently a difference of 9 to 10 cents per pound. Mexico also is likely to supply substantial quantities of molasses to the United States.

Brazil is a world leader in the volume of cane sugar it produces, consumes, and exports. Nevertheless, Brazil uses about two-thirds of its annual sugarcane output to produce fuel ethanol. Brazil's sugar and ethanol are inextricably linked despite recent periods of serious surpluses and shortages as well as a persistent problem of funding subsidies. However, a return to the sharp ethanol growth rates of the early 1980's is unlikely without another oil price explosion. Likewise, a sharp contraction in the ethanol program is not foreseen, in large part due to the significant share of Brazilian passenger vehicles that can run only on hydrous ethanol or an ethanol blend. Incremental growth in ethanol production will likely approach Brazil's capacity of 15-16 million cubic meters.

To maintain its domestic sugar consumption at 45 kilograms per capita, and maintain exports at 1.5-2.0 million tons, Brazil would need to produce about 9.5 million tons of raw sugar each year. At recent extraction rates, the cane requirement for that much sugar would be about 100 million tons. With its state-regulated milling industry and varied harvest schedules, Brazil has the unique technical flexibility to shift significant tonnage of cane between sugar and ethanol production. With sugar milling capacity estimated at 12 million tons, Brazil appears able to lift sugar production to that level from recent levels of 8.5-9 million tons, by diverting 30-40 million tons of cane away from ethanol production. Even an additional 3-4 million tons of cane sugar would be more than enough to sustain domestic sugar consumption as Brazil's population tops the 166-million mark by the mid-1990's.

Brazil's surplus sugar could be placed on the world market in the event of a price surge resulting from global supply shortages. Brazil's economy would benefit from a sharp jump in sugar export earnings. However, such a large volume of adjustment is unlikely. Brazil needs to ensure the security of ethanol supplies to service its ethanol-dependent motor fleet. This, along with the longstanding commitment to satisfy domestic sugar needs, could curtail Brazil's ability to take advantage of higher sugar export prices. Nevertheless, the recent emergence of "methanol blends" presents an interesting new factor. For example, if world sugar prices were to explode, Brazil could produce less hydrous ethanol and replace it with relatively cheap imported methanol. Cane originally earmarked for ethanol use could then be used to produce sugar for export.

Latin America's Big Three Sugar Producers In Transition: Cuba, Mexico, Brazil

Peter J. Buzzanell*

Introduction

Cuba, Mexico, and Brazil--Latin America's three largest sugar producers--produced a combined 1991/92 sugar crop of 18.6 million tons, 42 percent of total Western Hemisphere sugar. The sugar industries in all three countries face changes in government policies that will affect production this season and in the years ahead. The three countries have 260 million people, and in 1991/92 used 12.4 million tons of sugar, 43 percent of Western Hemisphere consumption and up 20 percent from a decade ago. Cuba and Brazil continue to rank among the world's top five sugar exporters, together accounting for about one-quarter of the world total. Mexico, in contrast, has recently been a significant net importer of sugar, importing from Cuba and Brazil as well as the United States.

Cuba's sugar industry is confronted with a new world trading order with the breakup of the socialist trading bloc. Concessional trade arrangements with Eastern Europe and the former Soviet Union have ceased, reducing Cuba's ability to purchase inputs needed for sugar production. Cuba's sugar production and exports (fig. 1) could contract if inputs remain scarce. Cuba may pursue alternative barter arrangements with the Republics of the former Soviet Union as well as expand its sugar exports to other regions of the world. Cuba is also encouraging Western investment to help sustain and modernize its sugar industry.

Mexico has privatized its sugar industry to cut government deficit spending and to improve efficiency in the industry. Mexico is one of the world's largest sugar producing and consuming countries. Rising sugar consumption has exceeded production in recent years, shifting Mexico from a net exporter to a net importer (fig. 2). A sizeable share of imports has been refined sugar from the United States. Mexico's Government has now privatized its entire sugar milling sector. However, the Mexican sugar market, especially its pricing policies, remains highly regulated. Mexico could expand production by raising yields in the field and improving efficiencies in the factory, but many institutional and technical problems have to be resolved. Whether or not production expands, consumption is likely to continue its rapid growth. Mexico's future as either a net sugar importer or a net exporter has considerable implications for U.S.-Mexican trade in sweeteners.

Brazil uses two-thirds of its sugarcane to produce fuel ethanol. The Government's policy of using sugarcane for domestic fuel and sugar reduces Brazil's potential to remain a major sugar exporter (fig. 3). Brazil, with its huge sugarcane production base and milling capacity, could expand exports more rapidly than any other sugar exporter should conditions warrant. However, because Brazil's autos are largely dependent on ethanol, short-term options to reduce ethanol production in favor of sugar are limited.

This report profiles these three key sugar industries and provides benchmark data and analysis to help judge the direction they may take into the late 1990's. Much of this analysis has appeared in three articles in USDA's Sugar and Sweetener Situation and Outlook reports: Cuba (March 1992), Mexico (March 1991), and Brazil (June 1988). However, each article has been updated with information available through September 1992.

*Peter Buzzanell is Leader, Sweeteners Analysis Section, Commodity Economics Division, ERS, USDA.

Figure 1

Cuba's sugar crop disposition, 1990/91

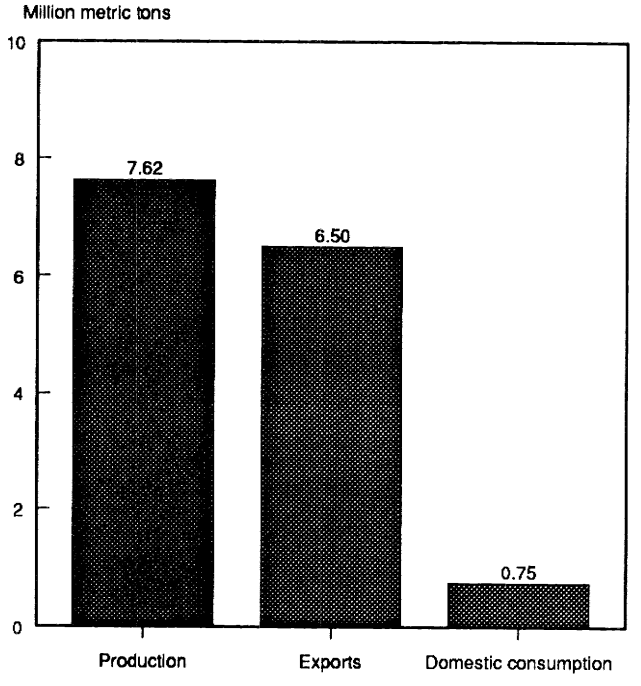


Figure 2

Mexico's sugar crop disposition, 1990/91

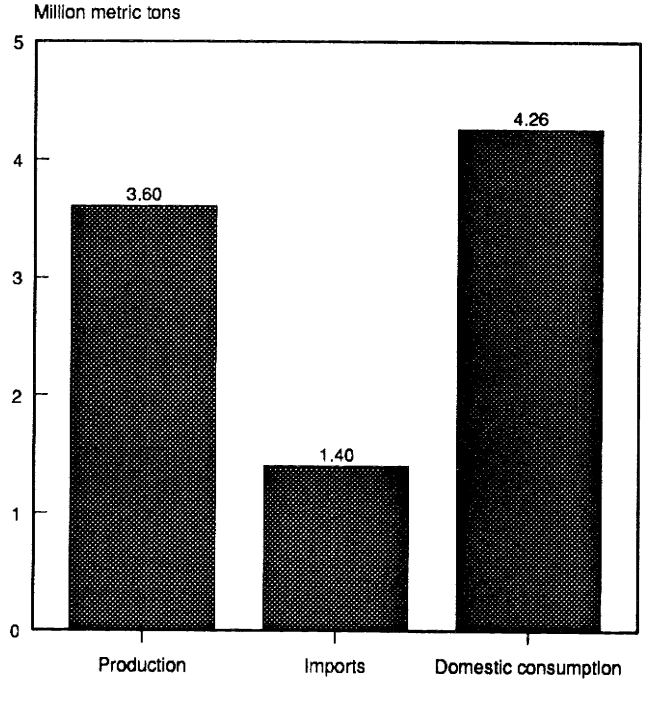
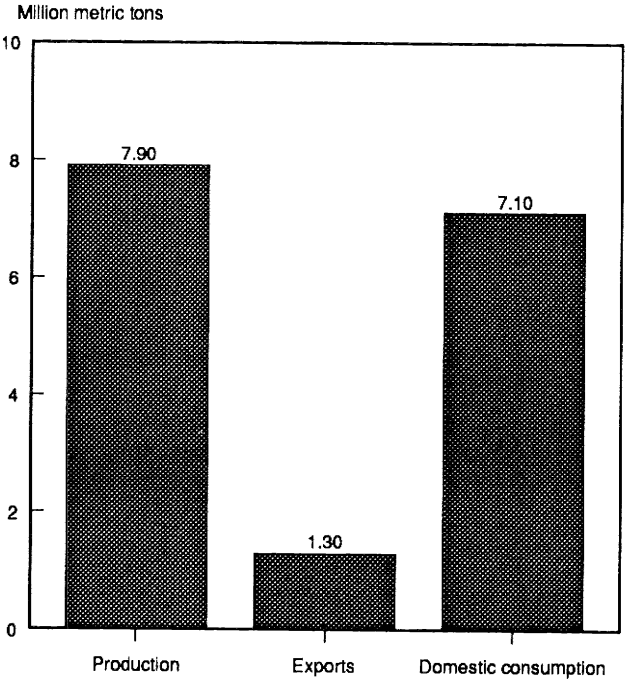


Figure 3

Brazil's sugar crop disposition, 1990/91



Cuba's Sugar Industry Confronts A New World Trading Order

Cuba, long one of the world's leading producers and exporters of sugar, is at a major crossroads in its economic history. As a result of a sharp contraction in economic aid, the Cuban Government faces a significant drop in sugar production in 1992 and a much-reduced exportable surplus. The radical political and economic changes in Eastern Europe and the former Soviet Union have altered traditional trade partnerships and forced Cuba to develop relationships with the new Republics and expand sales in other regional markets. Cuba also now encourages Western investment to help sustain and modernize its sugar industry.

Sugar Is Mainstay of the Domestic Economy

Sugar has long been the linchpin of the Cuban economy. For decades prior to the 1959 revolution, sugar provided around 80 percent of export earnings and was so pervasive that a popular Cuban phrase was "sin azucar no hay pais" (without sugar there is no country).

The intellectual leadership of the 1959 Cuban revolution believed it necessary to transform the agrarian economy into an industrial-agrarian economy. The agricultural sector would play only a complementary role. Revolution leadership believed the sugar industry was a major reason for the underdevelopment of the island. The well-known revolutionary "Che" Guevara stated that the 3 million tons of sugar that Cuba annually sold to the United States at preferential prices enslaved the Cuban people.

Despite this early economic philosophy, the Cuban economy still heavily depends on sugar 33 years later, and the Government gives priority to the sugar industry. Cuba has followed the edicts of the Marxist division-of-labor theory to do what it does best: grow sugar. Eastern Europe and the Soviet Union had the energy and industrial products to exchange for Cuba's sugar, tobacco, and minerals.

As a result, sugar remained Cuba's dominant agricultural crop and leading export commodity throughout the 1960's, 1970's, and 1980's, averaging 75-80 percent of that nation's annual export earnings. Although the economy has diversified with new exports of citrus and medical products, sugar exports have also risen and continue to underpin the national economy (fig. 4).

Cuba has ranked among the leading sugar producers and exporters for generations. In the years just preceding the revolution, Cuba's annual exports of around 5 million tons provided almost one-third of global sugar exports. In the last 3 years, Cuba accounted for 24 percent of world exports and was the leading exporter of raw cane sugar.

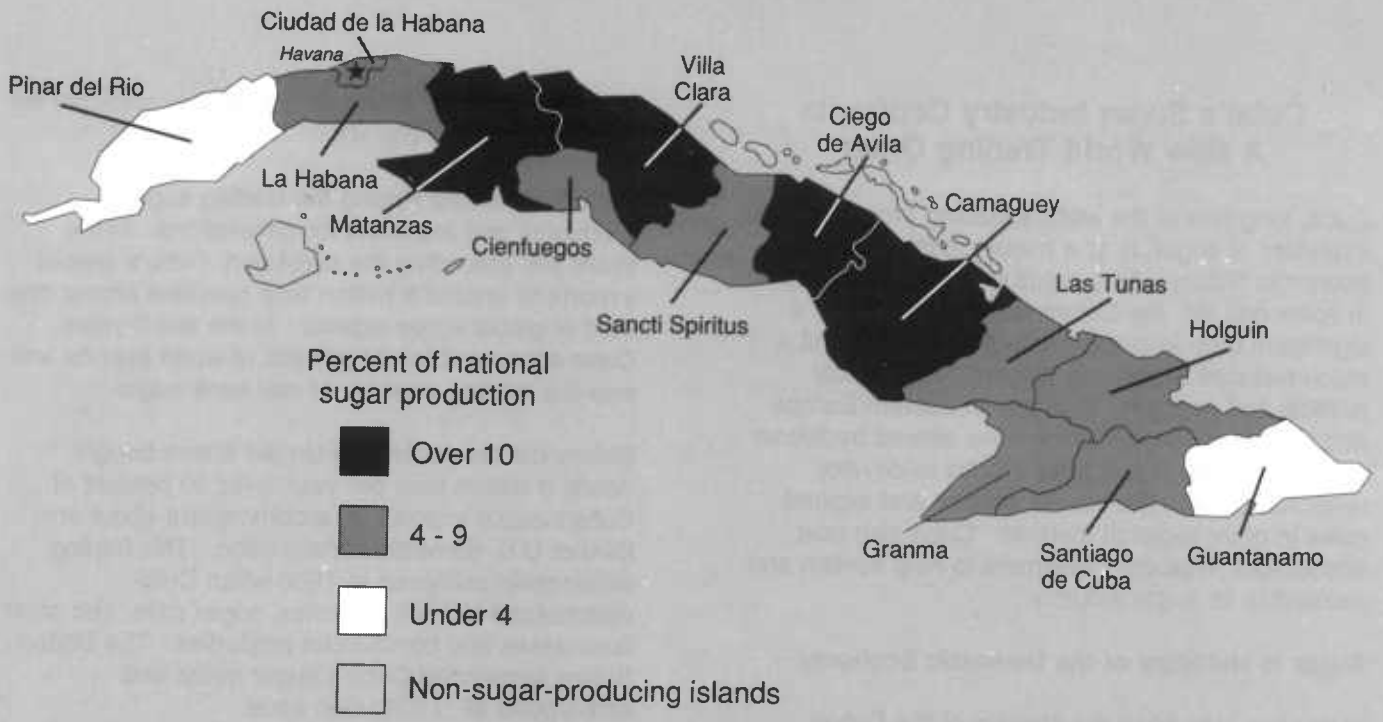
Before the revolution, the United States bought nearly 3 million tons per year, over 50 percent of Cuba's sugar exports, to accommodate about one-third of U.S. domestic consumption. This trading relationship collapsed in 1960 when Cuba nationalized U.S. oil refineries, sugar mills, and other businesses and commercial properties. The United States suspended Cuba's sugar quota and embargoed all U.S.-Cuban trade.

Most of Cuba's sugar exports found a new outlet in the 1960's in the Soviet Union, China, and the socialist countries of Eastern Europe. By 1965, two-thirds of Cuban sugar exports were shipped to socialist markets. These trade ties were solidified through a series of agreements between Cuba and the Soviet Union and in 1972 when Cuba joined the socialist bloc's Council for Mutual Economic Assistance (CMEA).

Over nearly three decades, the Soviets generally paid the Cubans a premium for sugar compared with the prevailing world price. In 1988, for example, the Soviets paid the equivalent of 41.8 cents per pound in transferrable rubles for Cuban sugar during a year when the world price averaged 10.2 cents a pound. Despite the premium, the payments were generally not made in convertible currency and therefore most of the export earnings had to be spent in the Soviet Union and other CMEA countries for products of generally inferior quality.

Since many consumer and capital goods have not been available within the socialist system, Cuba sought to earn convertible currencies from nonsocialist markets such as Canada and Japan. Sales of Cuba's sugar for convertible currencies ranged between one-fifth and one-third of annual exports from 1960 through 1985. The Soviets accommodated Cuba's hard currency needs during most of this period by allowing a portion of its petroleum and petroleum products earmarked for

Cuba's leading sugar producing Provinces



Provinces	Percent of production	Sugar mills	Sugar production 1988/89
	Percent	Number	1,000 metric tons raw value
Villa Clara	13.1	12	1,036
Camaguey	12.6	15	998
Matanzas	10.4	21	825
Ciego de Avila	10.1	9	804
Las Tunas	9.2	6	731
Holguin	8.8	10	696
La Habana[1]	7.7	17	614
Granma	6.8	10	538
Cienfuegos	6.3	27	500
Sancti Spiritus	6.2	9	494
Santiago de Cuba	4.4	8	345
Pinar Del Rio	2.9	5	230
Guantanamo	1.5	6	119
Total	100	155	7,930

[1] Includes City of Havana

Cuba to be resold for hard currency. For example, in the late 1980's, about 3 million tons of oil out of 13 million tons called for in the bilateral barter arrangement were resold by the Cubans each year. In some years, the resale of Soviet oil and oil products brought in as much hard currency as did Cuba's world market sales of sugar.

Effect of the Collapse of Socialism on the Cuban Economy

"To speak of the collapse of the Soviet Union is to speak of the possibility of the sun not rising," said President Fidel Castro to the 4th Congress of the Cuban Communist Party in October 1991. After spending 30 years integrating Cuba's economy with that of its Socialist allies, the Castro regime now faces a vastly changed world order.

Oil-import dependence is a particular problem for Cuba. Before 1991, the Soviets annually supplied Cubans with 13-13.5 million tons of oil (1 ton equals 7 barrels) in exchange for about 4 million metric tons of sugar. This "subsidized" exchange from the Soviets was reduced by one-quarter in a 1991 protocol to 10 million tons of oil for 4 million tons of sugar (fig. 5).

The Cuban Government announced in December 1991 measures to drastically reduce the use of oil-derived fuels, reflecting the severity of the energy crisis. Under the new guidelines, many work centers closed or reduced hours; street lighting, television transmissions, and public transportation were cut back; and most taxis were eliminated. Priority for the use of oil was to be given to food production and the pharmaceutical, sugar, and fledgling tourist industries.

Cuban Sugar Production

Cuba has been either the largest or among the world's largest sugar producers throughout this century. But unlike many other large producers, such as the former Soviet Union, India, the United States, and the European Community, most of Cuba's production has traditionally been exported, with only a small fraction used domestically (table 1).

In the 5 years before the 1959 revolution, Cuba's sugar production averaged 5.1 million tons and accounted for more than 15 percent of world production. With its commitment to service the sugar needs of the world's socialist community, as well as to maintain a substantial presence in the world market, the Government has since devoted even more of Cuba's natural and industrial resources to sugar production.

Sugar was produced in all 13 Cuban Provinces in 1988/89, the last year that official statistics are available. While production is well distributed throughout the island, the five Provinces of Central Cuba (Matanzas, Villa Clara, Sancti Spiritus, Ciego de Avila, and Camaguey) accounted for 52 percent of production. Total sugarcane harvested area was 1.35 million hectares and total planted area was 1.79 million hectares, up 25 and 27 percent from the area harvested and planted 5 years before the revolution. To help minimize Cuba's vulnerability to drought, the Government has built a number of small reservoirs and expanded irrigation capabilities, especially in the drier parts of eastern Cuba. A fifth of the total planted area was irrigated by 1988/89.

The Government aggressively expanded sugar production during the 1970's. The decade started with the 1969/70 "long harvest" (217 days), during which the Government focused the nation's physical and human resources on producing a 10-million-ton sugar crop. According to official Cuban data, 81.5 million tons of cane were harvested, and a record 8.54 million tons of sugar were produced, nearly double the previous year's figures, but still some 1.5 million tons below the target.

The immediate result of this effort, which depleted cane for upcoming crops, was a sharp fall in production over the next three seasons when sugarcane production and sugar output averaged only 48.2 million and 5.2 million tons. Moreover, in the aftermath of the "long harvest," Cuban planners decided to mechanize sugarcane harvesting to overcome the lingering logistical problems and inefficiencies in the use of large numbers of unskilled workers.

The switch from manual labor to machines, particularly for harvest, has been the most significant development in Cuba's sugarcane agriculture over the last two decades. In recent years, 100 percent of land preparation and about 90 percent of the cultivation and fertilization have been done mechanically. A record 73 percent of the cultivated area was harvested by over 4,200 combines in 1990/91, compared with 45 percent in 1980, and 25

percent in 1975 (fig. 6). *Macheteros* (cane cutters) now cut cane only in areas too rocky or steep for combines, their numbers dropping from 350,000 in the 1970/71 harvest to 56,000 for the 1990/91 crop.

Mechanized harvesting, however, has led to increased dependence on imported parts and fuel. With mechanization, essential parts for combines were bought from the former Soviet Union and other Eastern European countries with rubles rather than from Western countries that would have required payment with hard currencies. Higher fuel costs resulting from mechanization were paid for in rubles and facilitated by the sugar-oil barter trade that grew out of the heightened Cuban-Soviet trade relationship after 1960. Soviet-designed KTP combines leave an excessive quantity of cane in the field, reflecting technical defects in conveyor belts and blowers. Cuba's Minister of Sugar stated in the late 1980's that Cuba loses several thousand tons of sugarcane each year due to inefficiencies in the mechanized harvest system.

Moreover, a chronic shortage of spare parts and inadequate repairs and maintenance have reduced the efficiency of harvesters. Mills frequently are not supplied with enough cane and many machine hours are lost. This typically extends harvesting and milling into the rainy season. These problems were evident in 1990/91 when Castro blamed a chronic shortage of fuel, spare parts, and lubricants as well as heavy late-season rains for a decline in production.

Evolution of the Processing Subsector

Cuba has maintained one of the world's largest sugarcane-grinding capacities. Before the revolution, Cuba had 161 raw sugar mills with a daily grinding capacity of 561,735 metric tons. In addition, there were 16 refineries. There are now 155 cane mills (with a daily capacity of 658,800 tons), 14 refineries, and 7 bulk-loading terminals, all state-owned and managed by the Ministry of the Sugar Industry.

Since the revolution, 13 small sugar mills have been dismantled and 8 new ones built. The number of sugar mills with daily capacity of 2,500 tons and under was cut from 70 to 40 and those with capacity of over 10,000 tons were increased from 2 to 9 (fig. 7). National daily sugar capacity was increased by about 15 percent, or 100,000 tons. Despite heavy capital investments made to renovate and modernize the industry, Cuba's milling sector continues to have a significant number of small, inefficient operations. Two-thirds of the mills still have daily grinding capacities of 5,000 tons or less and 85 percent were built before 1913.

Statistics on raw sugar production and industrial yield (recovery rate) illustrate the industry's performance during the last four decades. The averages per decade show a slight decline in total sugar production from the 1950's to the 1960's, and an increase thereafter. The average recovery rate has dropped since the 1950's.

While these data reflect expanding volume of annual and daily cane milled and sugar produced, they also reveal a decline in recovery rates consistent with the lengthening of the milling season. These trends are indicators of a general decline in the quality (sucrose content) of cane entering the mill, especially at the beginning and end of the milling season. This decline reflects in part the loss of the high-sucrose sugarcane variety B-4362 (a result of a rust outbreak) and the inefficiencies of the chopper-type harvester combine.

Cuba's sugar industry entered the 1991/92 season hamstrung by severe shortages of fuel and spare parts to harvest and mill an underfertilized crop. Thousands of oxen replaced tractors for cultivating fields and transporting harvested cane in many growing areas. Press reports suggest that just prior to the harvest season, half of the mechanical harvesters had not received off-season maintenance due to a lack of spare parts.

Moreover, the harvesting season, which normally starts in mid-November, did not get underway until early January, possibly to conserve fuel and to let the crop ripen further. The Cuban crop is not likely to be more than 6.5 million metric tons (mmt) and could be lower, compared with 8.0 and 7.6 mmt the last 2 years (fig. 8). This assessment was reinforced by politburo member Carlos Lage, an advisor to Castro, who stated in late January 1992 that the Cuban sugar crop would continue to suffer due to a shortage of spare parts, lack of adequate fertilization, breakdown in the sugar transportation system, lack of fuels for field operations and mill boilers, and a 2-month delay in starting the harvest season.

Cuba announced in September 1992 that its sugar production had reached 7.0 million tons for the 1991/92 season. Cuba says the recent harvest was

conducted with only 30 percent of the fuel, herbicide, and fertilizer previously available. While Cuba has apparently tempered the decline in sugar production for 1991/92, largely by extending the harvest into August (well past its normal May completion), all signals point to futher contraction in 1992/93.

Heavy seasonal rains in June 1992 reportedly disrupted harvesting and milling operations for the delayed 1991/92 crop. The decision by Cuban authorities to extend the harvest could also damage the production potential for the 1992/93 crop. Subsidized production inputs from the former Soviet Bloc are no longer available, spring planting for the new sugar crop was well below target levels--reflecting the effort to get out the 1992 crop--and land in western Cuba is being shifted from sugar to food crops to reduce the food import bill. USDA has maintained its initial forecast for the 1992/93 Cuban sugar crop at 6.0 million tons. Cuba's falling sugar production will continue unless substantial foreign investment is made to modernize the industry.

Cuba's Sugar Exports by Region

Cuba consistently has been one of the world's top five sugar exporters, along with the European Community, Australia, Brazil, and Thailand (table 2). Cuba exported an annual average of 7 million tons from 1980/81 to 1990/91. The export estimate for 1991/92 has been trimmed to 5 million tons, nearly 30 percent below the recent average. Reduced export sales volume will hurt the Cuban economy, its balance of payments, foreign currency reserves, and its capacity to purchase needed imports, making it more difficult for the Cuban sugar industry to maintain high output and export levels.

The Former Soviet Union

The Soviet Union was the dominant market for Cuba's sugar exports since the Cuban revolution. In the 5 years before 1960, exports to the Soviet Union averaged only 298,000 tons each year; in the 5 years after 1960, they averaged 2.2 million tons. For the 25-year period through 1990, annual exports to the Soviets averaged 3.4 million tons, ranging from a low of 1.0 million in 1963 to a high of 4.2 million in 1982. Cuba shipped 3.8 million tons to the Soviet Union in 1991, accounting for 58 percent of exports (fig. 9). This trade, under a series of 5-year pacts, provided Cuba with a significant annual subsidy.

With the Soviet Union's collapse, Cuba faces the need to develop trading relationships with the newly independent Republics of the former Soviet Union. Moreover, the apparent guiding principle of these emerging trade relationships is that they will take place without concessional terms. The early transition to a new trading order has not gone easily for either side. Castro has complained publicly of the chaos and disorganization of the Republics of the former Soviet Union. The conversion of regional boundaries into national borders has greatly complicated previously straightforward trading arrangements. The apparent inability of Russian and Ukrainian authorities to agree on how to pay for each other's goods is the most obvious difficulty. Under the old command economy, a large share of raw sugar imports from Cuba were processed in Ukrainian beet factories and then shipped to Russian cities. Now these cross-border transactions require something other than the ruble.

Still, the process has moved forward. Cuba has signed trade agreements with several Republics, some under the rubric of "development and cooperation." Cuba has agreed to send 1 million tons of sugar to the Russian Republic this year, according to press reports. The first phase was to have been completed in the first 4 months of 1992, and involved 500,000 tons of Cuban sugar bartered for 900,000 tons of oil.

For each ton of Cuban sugar, Russia is apparently giving up 1.8 tons of oil, which at 7.35 barrels per ton is equivalent to 13.2 barrels of oil. If the ton of sugar is valued at the world price, roughly 9 cents a pound, it is worth $200. This implies that Russia is receiving about $15 per barrel of oil.

There also have been press reports of a 5-year agreement between Cuba and Kazakhstan, in which Cuba would supply 200,000 tons of sugar in exchange for 400,000 tons of oil each year. If sugar is worth 9 cents a pound, Cuba is implicitly paying $13.60 per barrel of Kazak oil. Cuba reportedly has undertaken negotiations with Lithuania, Kyrgystan, Tajikistan, and the City of St. Petersburg. However, the consensus of sugar trade analysts is that only about 2.0-2.5 million tons of Cuban sugar will move into the Republics of the former Soviet Union during 1992.

Russia will likely remain an important market for Cuban sugar as it has the largest sugar import need

of all importers--around 2.5 million tons--and sufficient oil with which to barter. However, reports that Russia's oil production is in decline suggest the terms of the exchange will be even more closely negotiated in order to maximize benefits for the newly independent Republic.

Eastern Europe

The former socialist countries of Eastern Europe had been the third largest market for Cuban sugar after the Soviet Union and China. Cuban exports to the region averaged 735,700 tons in 1984-1988, accounting for 15 percent of total Cuban exports. Cuban exports hit a record 1.2 million tons in 1989, reflecting increased needs due to poor crops across Central Europe. However, since the rapid breakup of the communist regimes, exports have fallen precipitously and for 1991 totaled 68,000 tons, about 1 percent of total Cuban exports. This dramatic contraction reveals that, in large part, the barter trade that developed over the last 30 years was largely political, with the Eastern European nations importing Cuban raw sugar in excess of domestic needs.

The rationale for the previous trading arrangements rapidly dissipated as the political-economic landscape changed. The German Democratic Republic annually bought an average of 277,000 tons from Cuba during the 1980's. However, as a part of the new unified Germany and the European Community market, the former East Germany is a lost outlet for Cuban sugar. Hungary has not imported sugar from Cuba for several years and, with improved yields and the influx of foreign investment, is expected to be self-sufficient and generate a small exportable surplus each year. Poland did not import Cuban sugar in 1990 and 1991 and continues as a surplus producer.

The future of markets in Romania, Czechoslovakia, Bulgaria, and Albania are also in question. Romania's imports were above 200,000 tons from 1987 through 1990, but dropped to 15,000 tons in 1991. If Romania can improve its generally inefficient industry, its need for Cuban imports will dwindle. Also, some trade analysts have suggested future Romanian import needs could be provided by neighboring Ukraine.

Czechoslovakia has a relatively efficient industry, especially compared with Romania, and has used imports from Cuba as part of a re-export program of premium refined sugar. Czechoslovakia's imports, which had annually run over 125,000 tons during 1986-89, dipped to 89,000 tons in 1990 and zero in 1991.

Bulgaria's yields are the lowest in Eastern Europe and its sugar industry needs considerable financing to upgrade. Imports from Cuba, spurred by the remaining barter trade, are likely to continue. Likewise, Albania is expected to continue a small volume of trade with Cuba.

Asia and Oceania

About 15-19 percent of Cuban sugar exports have recently flowed to Asia and Oceania, second only to the former Soviet Union in volume of trade in 1991 at 1.2 million tons. Cuba has communist markets in Vietnam, North Korea, and China. But China, while importing 800,000 tons in 1991 and agreeing to about 900,000 tons for 1992, has a long-term program for greater sugar self-sufficiency. Substantial growth in Chinese imports from Cuba therefore appears doubtful. The combined imports of Vietnam and North Korea are expected to remain under 100,000 tons.

Cuba's nonsocialist Asian trade is dominated by Japan, its third largest sugar market in 1991 after the former Soviet Union and China. Exports to Japan of over 300,000 tons in 1991 were nearly double those of the year before. However, the jump reflects the reduced availability of Australian sugar due to drought and high premiums for Thai sugar in the summer of 1991.

Cuba faces the prospect of increasing competition for market share in Asia and Oceania from Australia and Thailand. High freight rates across the Pacific are also an obstacle. For example, freight costs from Cuba to Japan have been about $46 per ton compared with $20 from Thailand. Cuba also faces stiff competition from Australia and Fiji in the import markets of New Zealand and Indonesia, and from Thailand in the import markets of Malaysia and Hong Kong. Cuba may be about to develop a new market niche in the region by shipping to South Korea. Cuban raw sugar would be used by South Korea for refining for domestic use and/or re-export (about 300,000 tons per year).

Middle East and Africa

About 10 percent of Cuba's exports in recent years have gone to markets in the Middle East and Africa. Despite yearly variations in Cuba's sugar trade to major markets such as Algeria, Egypt, and Syria, the trend for the region is generally upward. Moreover, Cuban commercial officials have been discussing increasing trade opportunities with oil-exporting countries such as Iran, Iraq, and Libya.

The growth potential for exports to the Middle East and Africa above the current 600,000-850,000 tons per year is uncertain. Cuba faces competition in North Africa and the Middle East from refined sugar exports originating in the European Community, Brazil, and Turkey. The lifting of trade sanctions against South Africa is also likely to result in another formidable competitor, especially in regional markets where South Africa has a freight advantage. Moreover, many of the countries of North Africa and the Middle East do not have raw sugar processing facilities and, therefore, are restricted to importing refined sugar which Cuba has limited capacity to provide.

Western Hemisphere

Cuba's sugar exports to other countries in the Western Hemisphere have pivoted on the import needs of one steady customer, Canada, and changing year-to-year needs of other countries, most notably Brazil (for re-export), Mexico, Peru, and Venezuela. Canada, accounting for over 300,000 tons in 1991, more than half of total Cuban exports to the Western Hemisphere, is expected to remain the dominant market. Sizeable growth in Canada's import demand from Cuba is unlikely unless the Canadian Government fosters a reduction in its domestic beet sugar production or implements a program to bring in raw cane sugar for refining and re-export.

Shipments were made to Brazil in 1989, 1990, and 1991 for refining and re-export. Mexico and Venezuela's high imports in 1990 were off in 1991 because of improved domestic production and high stock levels. Other trade opportunities in Latin America are very limited, reflecting the fact that most countries are substantial net exporters.

For Cuba's sugar export prospects, the two pivotal countries in Latin America remain Venezuela and Mexico, both sugar importers and oil exporters. However, Venezuela has a program to increase its domestic production plus a new trade relationship with Colombia. Mexico appears to be the wild card. Mexico has maintained good trade relations with Cuba since 1960. In recent years Mexico has run a large trade surplus with Cuba, exporting $105 million in goods in 1990 while importing only $2 million. Some Mexican commercial interests reportedly are considering investments in Cuba. Cuba needs the oil, spare parts, and machinery that Mexico could provide. In turn, Mexico has the potential to increase purchases of Cuban sugar on a regular basis, especially if its domestic production fails to keep pace with the expected expansion in sugar consumption.

In sum, Cuba's exports to the Western Hemisphere are not likely to exceed 800,000 tons per year. And, in normal production years, exports could dip to 400,000 tons.

Western Europe

Cuba's presence in West European sugar markets has been a relatively small share of its total trade, averaging 1-3 percent in recent years. Leading markets have been Finland and Sweden. Cuban exports to Portugal averaged approximately 95,000 tons per year in the 10 years before Portugal joined the European Community in 1986. Afterward, Portugal continued to import Cuban sugar, but the quantities were generally lower.

The largest West European market for Cuban sugar in 1991 was the European Community at 93,224 tons. The growth in Cuban exports to the Community in 1991, more than double the year before, may reflect the fact that in December 1990, Cuba was made a deliverable origin against the London No. 6 Raw Sugar Contract. Delivery terms against the London market were widened in 1991 to cover more ports, and it is possible that this might encourage heavier deliveries of Cuban sugar, starting with the 1992/93 crop.

Prospects

All signs point toward a contraction in Cuban sugar production. Problems in finding markets could lead to a restructuring of the use of resources away from sugar and toward domestic food production. The end of subsidized inputs for sugar production appears to reinforce this change. USDA's initial forecast for Cuba's 1992/93 crop is 6.0 million tons, 1 million tons below the extended 1991/92 crop and reflecting an expected continuation of shortages of fertilizer and spare parts and fuel for field and mill operations.

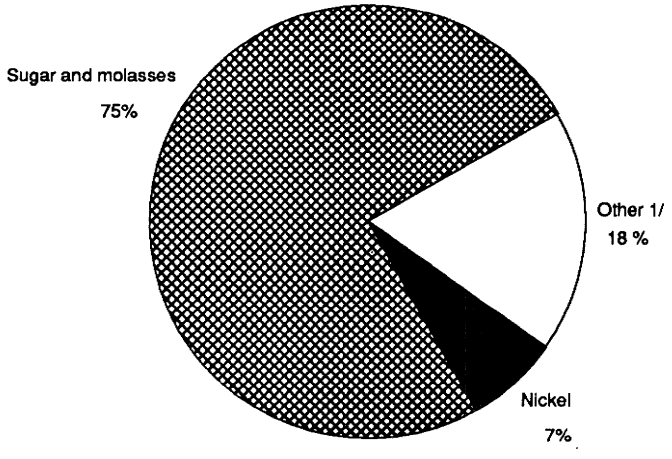
Over the medium term, sugar is likely to remain central to Cuba's economy, not only because it is the island's main trading commodity for hard currency and barter, but also because of the byproducts it generates, from animal feed to alcohol. But substantial investment is needed to modernize the industry and considerable downsizing would probably be required to make the industry economically viable in a nonsocialized environment. The prospect of substantial foreign investment in sugar production and refining capacity through joint ventures with Western companies may indicate the direction of the industry.

Cuba's 1992/93 sugar exports will probably be significantly lower than in previous years. With a crop of 6.0 million tons and domestic consumption at 0.9 million tons, new-crop export availabilities would total around 5.0 million, down 1.0 and 1.5 million tons from the previous two seasons.

To adapt to the radically altered trading environment, Cuba is aggressively attempting to build trade bridges with the former Soviet Republics and to expand into other regions. For example, Cuba has been discounting prices to move sugar into Far East markets, especially Japan.

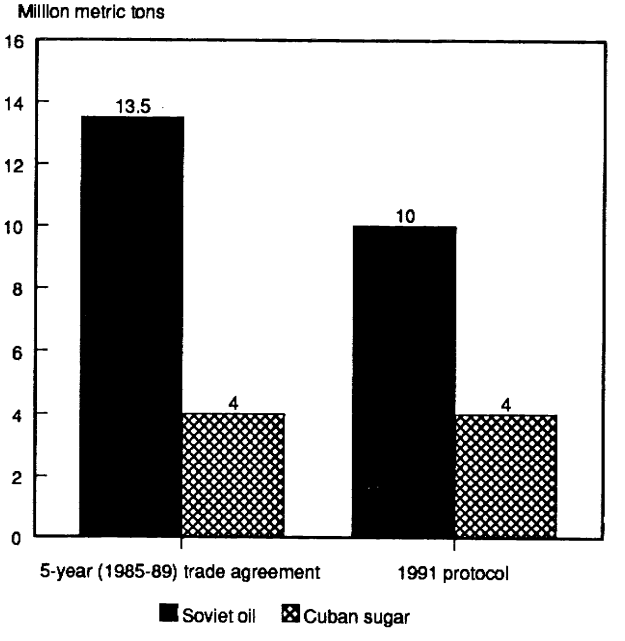
Beyond 1992, Cuba faces a key trading partner, the Russian Republic, that needs sugar but has less oil to barter. Moreover, Cuba lacks the capability to export large volumes of refined sugar needed to expand markets in North Africa and the Middle East. Cuba might also lose markets in several of the former Soviet Republics that do not have refining capacity and have depended on tolled sugar (imported raws that are refined and re-exported) from surplus-sugar Republics such as Ukraine. If these Republics opt to go to other sources, such as the European Community, less raw sugar from Cuba would be needed. Cuban sugar apparently will face a much more competitive international trading environment.

Figure 4
Cuba's composition of export earnings, 1986-88 average



1/ Others include citrus and medical products.
Source: Anuario Estadistico de Cuba.

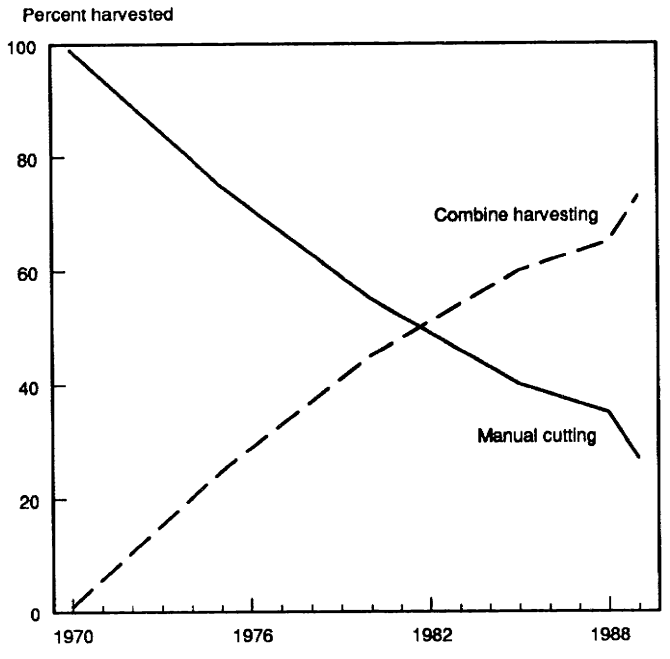
Figure 5
Cuba-Soviet trade agreements



Source: Press and trade information.

Figure 6

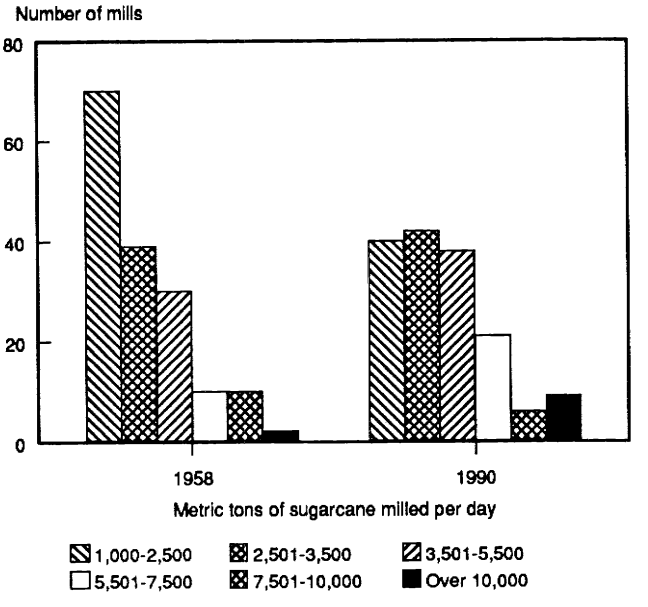
Cuba's mechanization of sugarcane



Source: Anuario Estadistico de Cuba and press reports.

Figure 7

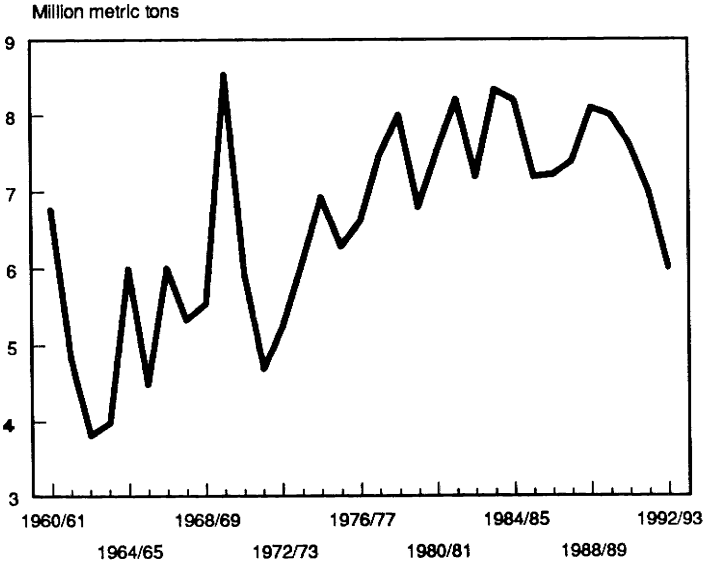
Cuba's installed capacity by mill size



Source: Rivero Intl. Databank (derived from Anuario Azucareo de Cuba, 1958 and F.O. Licht Sugar Yearbook, 1990).

Figure 8

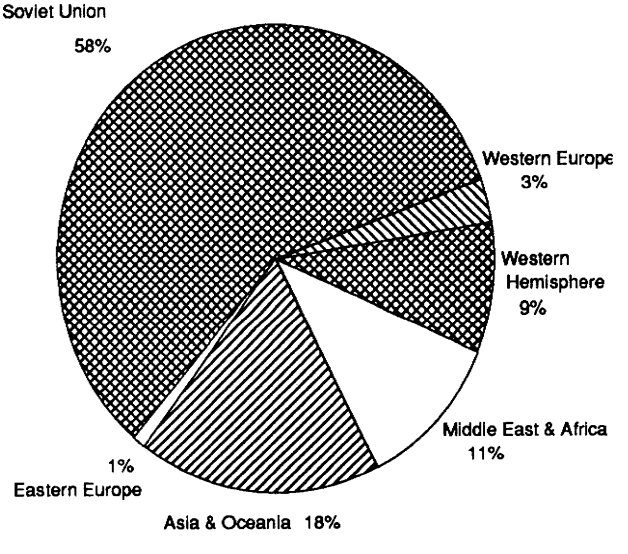
Cuba's sugar production



1/ Preliminary 91/92.
2/ Forecast 92/93.

Figure 9

Cuba's sugar exports by destination, 1991



Source: International Sugar Organization.

Table 1--Cuban sugar production, supply, and distribution

Market year	Beginning stocks	Total sugar production	Total imports	Total supply	Total exports	Total domestic consumption	Ending stocks
			1,000 metric tons, raw value				
1960/61	1,616	6,765	0	8,381	5,978	362	2,041
1961/62	2,041	4,814	0	6,855	5,131	374	1,350
1962/63	1,350	3,821	0	5,171	3,521	416	1,234
1963/64	1,234	3,991	0	5,225	4,103	429	693
1964/65	693	5,986	0	6,679	5,316	446	917
1965/66	917	4,490	0	5,407	4,435	517	455
1966/67	455	6,000	0	6,455	5,580	580	295
1967/68	295	5,315	0	5,610	4,613	680	317
1968/69	317	5,534	0	5,851	4,799	681	371
1969/70	371	8,533	0	8,904	6,906	726	1,272
1970/71	1,272	5,924	0	7,196	5,511	726	959
1971/72	959	4,688	0	5,647	4,440	500	707
1972/73	707	5,250	0	5,957	4,797	451	709
1973/74	709	6,044	0	6,753	5,494	513	746
1974/75	451	6,432	0	6,883	5,757	507	619
1975/76	619	6,279	0	6,898	5,666	541	691
1976/77	691	6,607	0	7,298	6,211	510	577
1977/78	577	7,457	0	8,034	6,910	550	574
1978/79	574	8,048	0	8,622	7,213	531	878
1979/80	878	6,787	0	7,665	6,700	539	426
1980/81	426	7,542	0	7,968	6,520	528	920
1981/82	920	8,207	30	9,157	7,940	625	592
1982/83	592	7,200	56	7,848	6,540	728	580
1983/84	580	8,330	0	8,910	6,935	745	1,230
1984/85	1,230	8,200	0	9,430	7,514	760	1,156
1985/86	1,156	7,200	0	8,356	7,000	806	550
1986/87	550	7,220	0	7,770	6,630	780	360
1987/88	360	7,400	0	7,760	6,600	700	460
1988/89	460	8,100	0	8,560	7,420	800	340
1989/90	340	8,000	0	8,340	7,065	800	475
1990/91	475	7,620	0	8,095	6,500	850	745
1991/92 [1]	745	7,000	0	7,745	6,000	925	820
1992/93 [2]	820	6,000	0	6,820	5,000	930	890

[1] Preliminary.
[2] Forecast.
Source: Foreign Agricultural Service, USDA.

Table 2--Cuban sugar exports to major trading partners

Calendar year	United States	Soviet Union	Eastern Europe	China	Japan	Canada	Other countries	Total
			1,000 metric tons, raw value					
1960[1]	1,949	1,578	227	477	205	75	1,601	6,112
1961	0	3,302	490	1,032	423	16	1,151	6,414
1962	0	2,112	669	938	431	20	961	5,131
1963	0	973	571	500	161	70	1,246	3,521
1964	0	1,937	306	386	346	3	1,198	4,176
1965	0	2,456	669	398	415	69	1,309	5,316
1966	0	1,815	788	620	360	69	783	4,435
1967	0	2,473	768	556	542	66	1,278	5,683
1968	0	1,832	808	431	555	47	940	4,613
1969	0	1,352	863	445	1,018	80	1,041	4,799
1970	0	3,105	961	530	1,221	65	1,024	6,906
1971	0	1,581	1,032	464	912	73	1,449	5,511
1972	0	1,097	740	295	909	31	1,068	4,140
1973	0	1,661	847	302	985	47	955	4,797
1974	0	1,975	846	359	1,152	116	1,043	5,491
1975	0	3,187	582	183	339	156	1,297	5,744
1976	0	3,036	941	254	150	149	1,234	5,764
1977	0	3,790	644	228	183	139	1,254	6,238
1978	0	3,936	615	534	530	279	1,337	7,231
1979	0	3,842	731	486	297	316	1,597	7,269
1980	0	2,726	704	512	267	264	1,718	6,191
1981	0	3,204	912	573	355	376	1,651	7,071
1982	0	4,426	804	915	295	160	1,134	7,734
1983	0	3,315	1,004	772	354	190	1,157	6,792
1984	0	3,650	1,173	705	231	241	1,017	7,017
1985	0	3,709	1,030	680	511	152	1,127	7,209
1986	0	4,020	863	307	534	168	811	6,703
1987	0	3,863	1,024	612	223	87	673	6,482
1988	0	3,308	1,040	1,399	372	112	747	6,978
1989	0	3,469	1,190	889	205	180	1,190	7,123
1990	0	3,576	616	892	162	291	1,635	7,172
1991	0	3,835	68	796	412	332	1,324	6,767

[1] Since July 1960, exports to the United States have been zero, reflecting the U.S. embargo on all imports from Cuba. In the 5 years before the U.S. embargo (1955-59), Cuba's exports to the United States averaged 2.86 million tons annually and accounted for 55 percent of total sugar exports.

Source: International Sugar Organization, London.

Mexico's Sugar Industry Moves to Privatization and Greater Self-Sufficiency

Mexico is eighth in the world in sugar production and fourth in the Western Hemisphere, behind Brazil, Cuba, and the United States (fig. 10). Mexican sugar consumption ranks third in the Western Hemisphere and per capita use, at 45 kilograms, is among the highest of any country. In recent years, an upward trend in sugar consumption, spurred by population growth and a recovering economy, has outpaced production, shifting Mexico from a net exporter to a significant net sugar importer. A sizable share of this surge in Mexican imports has been refined sugar from the United States.

Mexican policies aim to achieve greater self-sufficiency by reprivatizing the milling sector and through initiatives to reduce Government intervention and increase the influence of market forces. The direction the sugar industry takes in the near future will have considerable implications for future U.S.-Mexican bilateral trade in sweeteners.

Government Intervention in Agriculture

The Government's agricultural programs in the early 1980's were intended to protect low-income producers and promote food self-sufficiency. At the same time, national economic policies sought to protect urban wage earners by subsidizing food prices.

Two types of Government policies have helped to shape Mexico's sugar sector: those affecting output, such as guaranteed minimum producer prices, marketing subsidies, trade volume controls, and exchange rate manipulation; and those affecting inputs, such as subsidies for inputs, crop insurance premiums, and irrigation. In addition, food consumption has been influenced by both price controls and subsidized prices for basic staples. Trade has been controlled by licensing requirements, import levies, and export duties. Sugar trade has been regulated by the Government-controlled marketing agency, Azucar, S.A.

Mexico's drastic debt reduction program has prompted the Government to eliminate or significantly reduce many producer and consumer subsidies. Reflecting a new strategy to reduce public sector involvement in the economy, the administrations of both President Miguel de la Madrid (1982-88) and President Carlos Salinas de Gortari (1988 to present) initiated programs to privatize many Government-owned enterprises that have dominated the economy, including the assets of state agricultural companies such as Azucar, S.A. In addition, trade reforms have been implemented to make Mexican markets more open to foreign competition and more responsive to market forces.

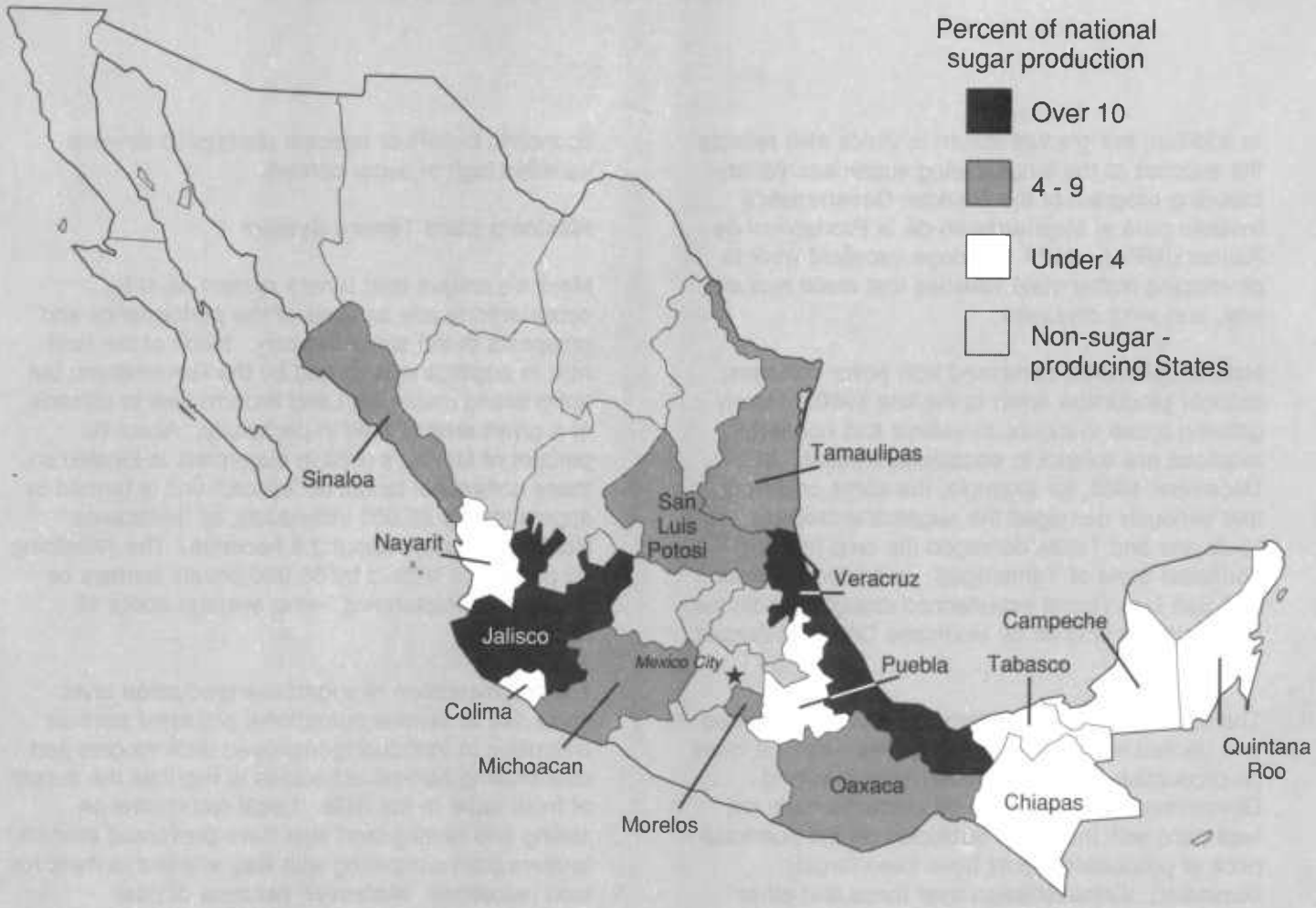
Mexican Sugar Production

Sugarcane is one of Mexico's most widely grown crops, with commercial production in 15 of the 23 States. However, six States account for about 75 percent of the area devoted to sugarcane. Veracruz alone accounts for nearly 40 percent of national production, although its dominance has declined in recent years.

Recent trends in area, yield, and production illustrate the wide range of topography, climate, and soils of sugarcane agriculture in Mexico. Sugarcane area expanded from 415,000 hectares in the early 1970's to a record 597,000 hectares in 1986/87, before falling to 511,000 hectares in 1989/90 (fig. 11). Area harvested for the upcoming 1992/93 crop is expected to total 530,000 hectares. While sugarcane area has been relatively stable over the last two decades in Veracruz, other States--Jalisco, Oaxaca, and San Luis Potosi--have shown considerable growth. In contrast, Sinaloa in northern Mexico has lost some sugarcane acreage in recent years to more remunerative vegetable production (map).

Yields in Mexico have been increasing slowly, from an average 68.2 tons in 1975/76-1979/80 to 68.9 tons in 1985/86-1988/89. The record sugarcane yield was 74.3 tons in 1985/86. Yields for 1991/92 and 1992/93 are forecast at 68.0 and 68.3 tons. Yields in the field vary significantly across Mexico, reflecting several factors, including climate and soil conditions. The slight increase in average Mexican cane yields since the early 1970's is due in part to area expansion in higher yielding States such as Chiapas, Jalisco, Michoacan, and Puebla. For example, in central Mexico, yields in the States of Morelos and Michoacan averaged 104.6 tons and 93.7 tons during the 1980's, reflecting in part their rich alluvial soil. Yields during the 1980's in the Gulf States of Veracruz and Tabasco were lower--66.1 tons and 59.0 tons--owing in part to dependence on erratic rainfall.

Mexico's leading sugar producing States



State	Percent of production	Sugar mills	Sugar production 1988/89
	Percent	Number	1,000 metric tons raw value
Veracruz	37.7	22	1,301
Jalisco	12.0	7	414
San Luis Potosi	9.0	4	310
Oaxaca	6.3	5	217
Sinaloa	5.4	4	189
Michoacan	4.2	5	144
Morelos	4.0	2	138
Tamaulipas	4.0	2	140
Chiapas	3.8	1	131
Nayarit	3.6	2	123
Puebla	3.2	2	109
Tabasco	3.1	4	106
Quintana Roo	2.2	1	77
Colima	.9	2	31
Campeche	.6	1	21
Total	100	64	3,451

In addition, the gradual upturn in yields also reflects the success of the longstanding sugarcane variety breeding program of the Mexican Government's Instituto para el Mejoramiento de la Produccion de Azucar (IMPA). IMPA has done excellent work in developing higher yield varieties that resist mosaic, rust, and smut diseases.

Natural calamities, combined with policy changes, brought production down in the late 1980's. Many growing areas in mountain valleys and northerly locations are subject to occasional freezes. In December 1989, for example, the same cold front that seriously damaged the sugarcane crops in Louisiana and Texas damaged the crop in the northeast State of Tamaulipas. In addition, Jalisco and San Luis Potosi experienced drought conditions, and Veracruz was hit by Hurricane Gilbert in August 1988.

The contraction in production can also be attributed to a decline in Government subsidies. Interest rates on production credit have been increased and Government-set cane price adjustments have not kept pace with inflation. Subsidies on the purchase price of production inputs have been largely eliminated. Dissatisfaction over these and other policy initiatives has prompted some growers to shift land from sugarcane to tomatoes, peppers, and other vegetables in Sinaloa and to citrus in Veracruz.

Despite the constraints imposed by the natural environment and Government policy, Mexico's sugar industry is one of the world's largest and most productive. In the Western Hemisphere, only Cuba and Brazil produce more cane sugar and have more land devoted to sugarcane. In terms of cane and sugar yields per hectare, Mexico performed at 12 and 7 percent above the world averages for the 1985/86-1989/90 period. Moreover, Mexico's yields have been higher than both Cuba's and Brazil's over this period, despite weather-related production problems.

Mainland U.S. cane producers, in comparison, averaged 5 percent lower than the Mexican average in sugarcane yields, but 14 percent higher in sugar per hectare, indicating the relatively low sugar content of Mexican sugarcane, a problem area for the industry. The IMPA has concentrated instead on tonnage improvement and disease resistance in its national breeding program. There has been no clear economic benefit or national strategy to develop varieties high in sugar content.

Mexico's Land Tenure System

Mexico's unique land tenure system must be considered in any analysis of the performance and prospects of the sugar industry. Much of the land now in sugarcane is owned by the Government, but apportioned under the Land Reform Law to citizens of a given area to hold in perpetuity. About 60 percent of Mexico's area in sugarcane is located on these communal lands, or "ejidos," and is farmed by approximately 80,000 individuals, or "ejidatarios." Holdings average about 3.5 hectares. The remaining 40 percent is farmed by 35,000 private farmers or "pequeños propietarios," who average about 12 hectares.

The fragmentation of sugarcane production units gives rise to serious operational problems such as difficulties in introducing improved technologies and coordinating harvest schedules to regulate the supply of fresh cane to the mills. Legal restrictions on selling and renting land also have prevented efficient farmers from competing with less efficient farmers for land resources. Moreover, because of past restrictions against farm amalgamation, some efficient farmers have sought to increase production by using more than optimum nonland inputs, increasing field costs.

The Salinas administration has recognized the constraints imposed by the existing land tenure system and has undertaken policy changes to increase capitalization and efficiency in the agricultural sector. Farms can now be grouped together to achieve economies of scale and facilitate the application of yield-improving inputs. The Government reports that at the Los Mochis mill in Sinaloa new "production units" have been created through formal agreements between cane growers and the mill. This conglomeration is particularly important for a cane sugar industry that requires highly capital-intensive inputs and coordination to achieve economies of scale and improved efficiency.

Producer and Mill Pricing Structure

For more than a decade, the Government each year announced a guaranteed minimum price for cane growers. The basis for this price was a 1979

Presidential Decree, which mandated that producers have real incomes equivalent to the previous year, plus the annual rate of inflation. For the 1988/89 crop, for example, producers were guaranteed 40,676 pesos per ton of cane delivered to mills. For 1989/90, they received a 13.85-percent increase to 46,309 pesos per metric ton, roughly in line with the increase in the wholesale price index. But growers complained it was not enough to offset actual production cost increases. Some growers reduced sugarcane acreage and shifted land into more remunerative crops.

In November 1990, the Government, after consultation with industry groups, announced a 1990/91 price of 58,766 pesos ($20.44) per ton, up 26.9 percent from the previous year. This price was eventually accepted by growers, but it was again below what they had lobbied for and resulted in a nationwide strike that lasted until late December and delayed the start of the harvest by about a month.

The 1990/91 minimum guaranteed producer price was based on an assumed extraction rate of 83 kilograms of sugar (raw value) per ton of cane, assumed mill processing losses not to exceed 2.64 percent, and was equivalent to 708.20 pesos per kilogram of sugar or 11.2 cents per pound. However, this did not take into account the actual sugar content of cane produced by individual growers. As a result, high-quality cane growers tended to subsidize poor growers.

Government and industry leaders understand the need to provide economic incentives for quality improvement and to develop techniques to test for sucrose content in cane. Under a new Government initiative, sugarcane prices to growers are to be determined monthly, based on 54 percent of the monthly wholesale price of standard sugar times KARBE (kilograms of standard quality sugar recovered). KARBE data would include sucrose content, fiber content, juice quality of cane, and efficiency of the mill. KARBE data would be different for each producer and mill. An average cane price for April 1992 would have been 76,187 pesos ($24.44) per ton, according to the KARBE formula and recent exchange rates.

The wholesale price, like the grower cane price, is set monthly and is tied to the exchange rate. For example, the April 1992 wholesale price for raw sugar was 1,285 pesos per kilogram (18.7 cents a pound) and 1,587 pesos (23.1 cents) for refined sugar (f.o.b.). These prices compare with a U.S. price in April 1992 of 21.3 cents a pound c.i.f. for raw sugar, and 27.0 cents f.o.b. for refined sugar.

Milling Industry Shifts to Private Ownership

Mexico has 64 sugarcane-processing mills spread across 15 of its 23 States. The annual national production capacity of these 64 mills is 4.2 million tons. About one-third of the mills are in Veracruz, while eight other States have three or fewer mills. National milling capacity on a daily basis was approximately 330,000 metric tons, average sucrose recovery was 9.57 percent, average cost of production was 14.5 cents a pound, and the total number of mill employees was 40,834, according to Mexican Government data for the 1987/88 season. There are no stand-alone sugar refineries; all refined sugar production takes place in integrated milling and refining facilities.

The milling sector produces four types of sugar: refined, standard or plantation white, brown, and raw. Standard and raw sugar currently comprises about half of total annual mill production, refined sugar accounts for about a third, and "mascabado" or brown sugar accounts for the remainder. Raw sugar production has declined in recent years. As demand for refined sugar has risen above domestic capacity, estimated at 1.5 million tons, Mexico has increased imports, mostly from the United States and Brazil.

Mexico is also a sizeable producer of byproducts derived from sugarcane, including molasses, alcohol, and bagasse. About a third of annual production of 500,000 tons of molasses is exported, mostly to the United States, and the remainder is used for animal feed and nonfuel alcohol production. Alcohol produced from uncrystallized molasses is currently estimated at 80 million liters a year. While the bulk of bagasse produced from processing sugarcane is used as an energy source, about 25 percent is used as pulp for paper.

About half of the mills have a daily grinding capacity of 4,500 tons or less, and only four mills have capacity above 10,000 tons. The national average is 5,000 tons. This relatively small size, compared with 7,280 metric tons average in the mainland United States, reduces opportunities for economies of scale.

Moreover, most mills are more than 50 years old and have not received the new equipment and machinery necessary to stay efficient.

Nearly half of Mexico's cane mills operate with obsolete equipment, causing frequent breakdowns, high sucrose loss, and inefficient energy consumption. About one-quarter of the plants have modern equipment coexisting with antiquated equipment, thereby reducing the overall efficiency and increasing energy consumption. The remaining one-quarter of the mills are modern, using efficient, up-to-date machinery and equipment. These differences in technology levels are reflected in striking cost differences. Data for over 90 percent of the mills reveal 8 mills have production costs above 18 cents per pound, 18 mills have costs of 15-18 cents, 21 mills have costs of 12-15 cents, and 12 mills have costs of 12 cents or less.

Mexico's mills are chronically overmanned by as much as 40 percent, resulting in high labor costs. The powerful workers' union (STIASRM) has resisted automation, resulting in low output of sugar per worker. While labor is a more abundant factor of production than capital in Mexico, excess labor has been counterproductive. Government and industry are devising alternative employment opportunities for mill workers and reevaluating costly worker benefit programs.

The private sector owned three-fourths of all mills in the early 1970's. But a combination of stalled consumer prices for sugar, reflecting a national cheap food policy, and rising production costs in the early 1980's forced many mills into insolvency. Many private mills had borrowed from the Government as private sector loans were unavailable. When mills went bankrupt, the Government took them over rather than allow them to shut down. At its height in 1986/87, this shift to government control resulted in the public sector's owning and managing 52 mills, or 75 percent of the total.

The industry was generally stagnant and declining by the late 1980's. To reverse this trend, the Government decided to reprivatize ownership of the mills and to decontrol domestic sugar marketing. The de la Madrid administration began selling off Government-owned sugar mills in October 1988, using several investment incentives. First, soft financing--10 percent down, a 2-year repayment grace period, and the balance of the repayment in 10 years, either in cash or sugar--was extended. Second, mills were auctioned off in investment packages containing both good and deteriorated mills. Third, in May 1989, the Government moved to allow privately owned mills to market their own sugar without paying a heavy sales tax. Before, regulations had required mills to deliver 80 percent of the sugar to Azucar, S.A., or pay a 50-percent tax. As of mid-1992, all Mexican sugar mills were owned by the private sector.

Mexican Sugar Consumption

Sugar consumption in Mexico was estimated at 3.15 million metric tons, raw value, and 41 kilograms per capita in 1980/81. Consumption for 1992/93 is forecast at 4.53 million tons and 45 kilograms per capita (table 3). Sugar use jumped by two-thirds in the 1970's and 28 percent in the 1980's, due partly to an increase in population of 16 million in the 1970's and 10 million in the 1980's. Other factors include higher incomes, attractive retail pricing, and lack of alternative sweeteners.

Patterns of sugar use by sector and class illustrate recent trends. Consumption of standard sugar rose from nearly 700,000 tons in 1970 to 1.9 million tons in 1989, of which households accounted for about 90 percent. Expansion in industrial sugar use has been even stronger, moving from 763,000 tons (41 percent of total use in 1970) to 2.1 million tons (57 percent in 1989). In 1991, industrial use of sugar by industry and households was 55 and 45 percent.

About three-fourths of refined sugar use is by commercial food and beverage firms. The soft-drink sector has driven the expansion in industrial use of sugar (fig. 12). In 1991, for example, the Mexican soft-drink industry, one of the largest in the world after the United States, accounted for an estimated 1.3 million tons of sugar or about 56 percent of total industrial use. Other major users are the bakery and confectionery industries, each with about 15 percent of total industrial use.

Low Government-controlled prices have stimulated soft-drink consumption. Soft drinks also partially compensate for the widespread lack of potable water and serve as a source of calories. Volume buyers of sugar such as the soft-drink industry normally receive price discounts from sugar mills. These discounts are facilitated by the fact that several purchasers of Government sugar mills have been soft-drink firms.

Alternative sweeteners such as high-fructose corn syrup (HFCS) and low-calorie sweeteners such as aspartame have not been significant factors in the soft-drink market. However, diet soft drinks are increasing in popularity among the urban middle- and upper income groups.

Market Deregulation

Until recently, Azucar, S.A., maintained a monopoly in domestic marketing of sugar. The Government facilitated sugar storage and shipping throughout the country and, through a pan-Mexican pricing policy, sought to prevent black marketing. However, this policy led to inefficiencies and high costs to the Government. Government subsidies were needed to sustain the monopoly, especially to maintain a single national price in areas remote from domestic sugar growing areas and mills.

As part of the privatization process, Azucar, S.A., is no longer the sole distributor of sugar in Mexico. There are efforts to foster several regional private traders to sell and distribute sugar throughout Mexico. A new law provides that officially controlled sugar prices will be 30 pesos per kilogram (about 0.5 cent per pound) higher in States without sugar mills to provide an incentive to market sugar in remote areas.

The Government's cheap food and inflation-control policies have kept Mexican retail sugar prices among the world's lowest. For example, the annual USDA survey of food prices in 15 selected national capitals in recent years has shown Mexico's spot retail price for sugar lower than in all capitals except Ottawa and Brasilia.

Beginning in February 1990, retail prices began to rise monthly according to a new pricing formula. As of April 1992, the retail price for refined sugar was 1,587 pesos per kilogram (27.2 cents a pound). The current difference between the f.o.b. refined sugar price and the new retail price is 18 percent, versus 10 percent before the new pricing formula was implemented. This change is aimed at enhancing mill profit margins.

Sugar Trade

Mexico's trade in sugar has shown significant year-to-year variation between net exports and imports. In the 1960's and 1970's, Mexico imported no sugar, while it exported several hundred thousand tons per year (fig. 13). The major market for exports (all raw sugar) has been the United States.

Stagnant production and growing consumption reduced exports in the late 1970's. In the first half of the 1980's, the contraction in exports continued, with Mexico exporting in only 1 year out of 5. Imports for 1980-84 averaged 556,130 tons per year, largely refined sugar from the United States and Brazil. Mexico did not import sugar in 1985-88, exporting a record 1 million tons in 1988, due to reduced consumption. This surplus was caused by a slowdown in the domestic economy, higher sugar production, and stock drawdowns to earn foreign exchange. However, the resurgence in exports was short-lived and Mexico again imported substantial volumes of sugar in 1989, 1990, and 1991.

For marketing year 1991/92 (November/October), USDA estimates that Mexico will import only 275,000 tons, compared with 1.4 million tons in 1990/91. The sharp drop in imports is due to higher import tariffs and a drawdown of high stock levels built up by the record imports the previous 2 years. USDA forecasts imports to rebound to over 800,000 tons in 1992/93 as stocks will have been drawn down and consumption growth is again expected to outpace production expansion (table 3).

As of November 1989, the Government eliminated the import permit requirement for cane and beet sugar as part of its trade liberalization effort under the General Agreement on Tariffs and Trade. A variable tariff is used in its place, which is adjusted monthly to bring imported sugar up to a Government-set reference price. Mexico raised the tariff sharply in early 1991 to stem the flow of refined sugar imports. For July 1992, the tariff on refined sugar was 58 percent ad valorem. The variable tariff system for imports creates a domestic price ceiling for raw sugar of approximately 22 cents a pound, in line with the cost of production estimated at 23.4 cents, according to the Government. The price ceiling allows efficient sugar mills and growers to invest and expand activities, while forcing out inefficient and unprofitable firms and growers.

Prospects

Both expansion and contraction of Mexican sugar production in the next 5 years are possible. Mexico has sufficient land for significant expansion in

sugarcane acreage. Yields, while very good in some areas by international standards, could be improved with existing technology. More remunerative prices, capital investment by private sector mills, and modifications to the land tenure system to allow some amalgamation of "ejido" lands would all spur production advances. A key to mill owners' future success is the program to pay growers on the basis of sucrose content.

A linear trend line fitted to production data for 1971-91 projects a 1996 production level of 4.0 million tons. Sugar production might increase 400,000 tons per year to 5.2 million tons by 1996 if quality of cane entering the mill increases, recovery rates improve, and milling capacity grows.

While Mexico's sugar production has considerable potential to expand, it could stagnate or decline due to producer prices below grower expectations, which would foster a shift to more remunerative crops. Stagnation or contraction might result from the problem of scaling down overemployment at mills. A nationwide sugar content payment program could, in the aggregate, reduce supplies of cane if inefficient farmers stop growing cane. Mexico's need to develop varieties of sugarcane higher in sucrose will take a number of years, especially since IMPA closed its doors on February 15, 1991. The Government was unable to privatize IMPA's research and extension work and, as of now, there are no immediate successors to continue varietal development on a national scale. These negative influences might depress Mexican sugar production to around 2.8 million tons, the level achieved in 1980/81, a decline of about 200,000 tons per year.

Over the long run, much depends on the relative profitability of sugar compared with alternative crops. If policy liberalization resulted in improved efficiencies for all Mexican agriculture, sugarcane expansion or contraction would occur according to the comparative advantage of resource use among crops.

Sugar consumption in Mexico is expected to expand at about 3.5 percent a year to an estimated 5.5 million tons by 1996. This projection assumes population increases of 2.3 percent per year, real per capita income growth of 1 percent per year, and soft-drink consumption growth of 4.0 percent per year. This projection assumes that sugar prices to industry users and consumers will continue to be controlled, but at a somewhat higher price than in the past. A higher growth rate of 5 percent a year would be the maximum if circumstances were optimal.

In contrast to this high-growth scenario, sugar consumption could stagnate if consumer prices were allowed to rise rapidly, or attractively priced substitutes such as HFCS (high-fructose corn syrup) or high-intensity (low-calorie) sweeteners such as aspartame were to replace sugar in liquid uses. Overall economic performance could also depress sugar consumption. The lowest consumption path foreseen would be a 1-percent growth rate per year, resulting in consumption of 4.66 million tons by 1996.

However, a radical shift to HFCS for the soft-drink industry similar to the U.S. shift in the mid-1980's could push sugar consumption below 4.0 million tons. This would be likely only if there is a significant change in Mexican Government policy related to corn imports or domestic price supports, and significant investment in HFCS/ethanol facilities, or a Government commitment to lowering barriers to imported HFCS along with investment in the infrastructure to import HFCS.

Will consumption continue to outpace production over the next 5 years, as has occurred the last several years? Or will a surge in production lead to self-sufficiency and/or generate an exportable surplus? For the next two seasons (1992/93 and 1993/94), it is likely Mexico will require sizeable sugar imports, a substantial portion of which is likely to be refined sugar from the United States, facilitated by the U.S. sugar re-export program, and destined for industrial users (table 4).

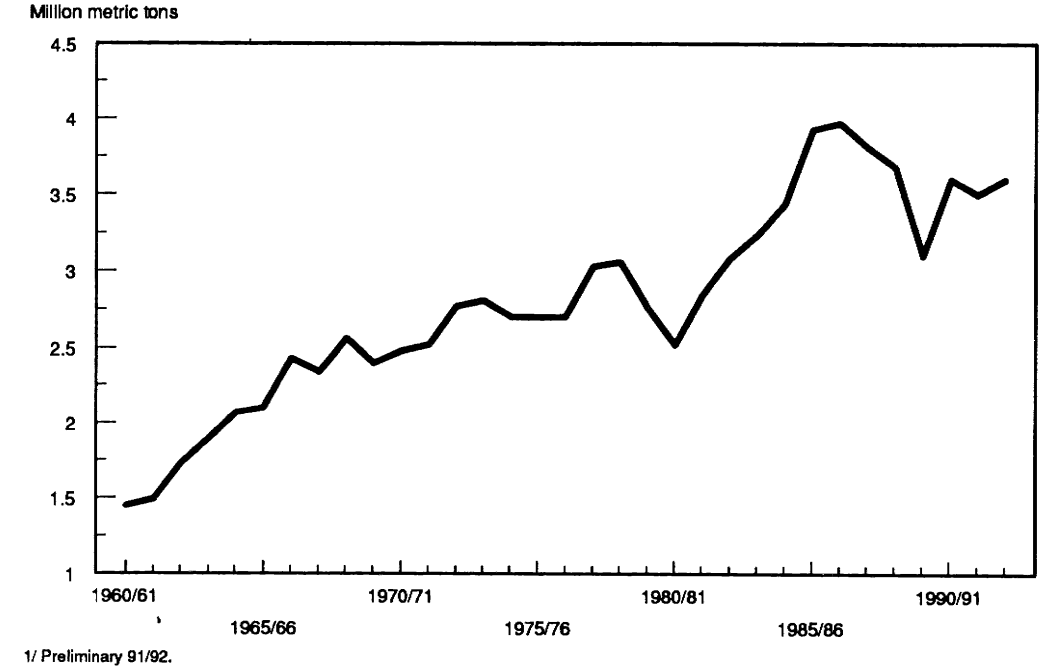
Also, Mexico could become a regular importer of HFCS from the United States, especially for the beverage industry in northern Mexico far from sugar-producing areas. A partial shift to HFCS imports would likely be spurred by a significant world sugar price spike, coupled with the lowering of the HFCS tariff rate currently set at 15 percent ad valorem. Also, if the economics are right, imports of U.S. corn to corn-deficient Mexico could be used as a starch source for the production of HFCS. Some corn wet-millers in Mexico, who now produce only starch, meal, and feed, are weighing the feasibility of installing HFCS capacity.

On the export side, Mexico is likely to continue to fill its small annual U.S. sugar quota (table 5), owing to

the premium price received by these sales compared with the world price, currently a difference of 9-10 cents a pound. Mexico also is likely to supply substantial quantities of molasses to the United States. The United States imported 235,000 tons of molasses from Mexico in 1991, 20 percent of total molasses imports.

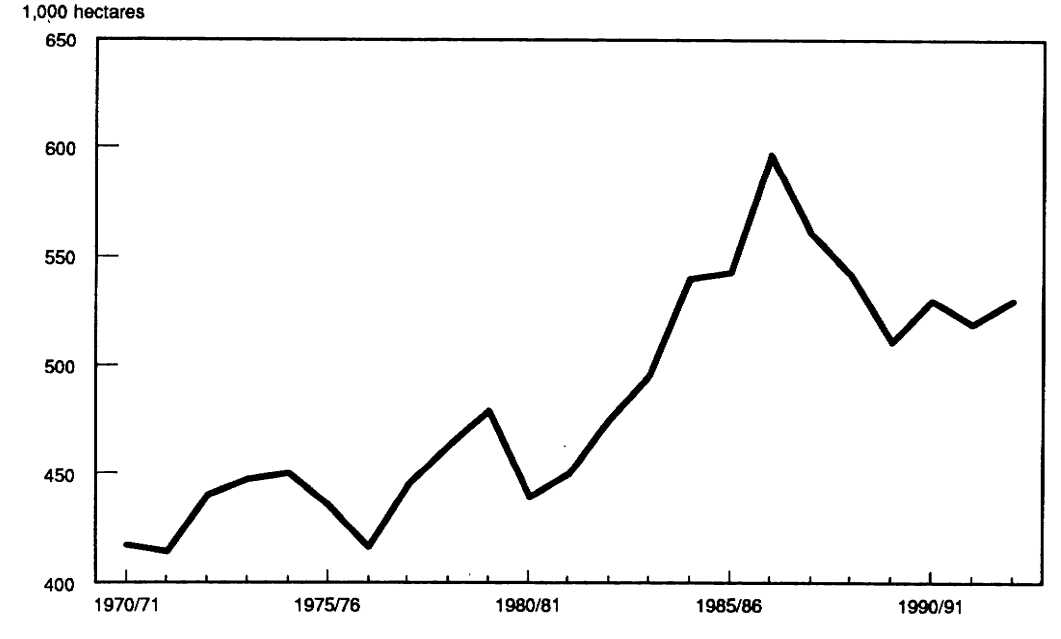
Under the high production and low consumption scenarios, Mexico would have an exportable surplus of 500,000 tons by 1996. Conversely, the combination of low production and high consumption scenarios would result in import needs of 2.7 million tons (fig. 14).

Figure 10
Mexico's sugar production 1/



1/ Preliminary 91/92.

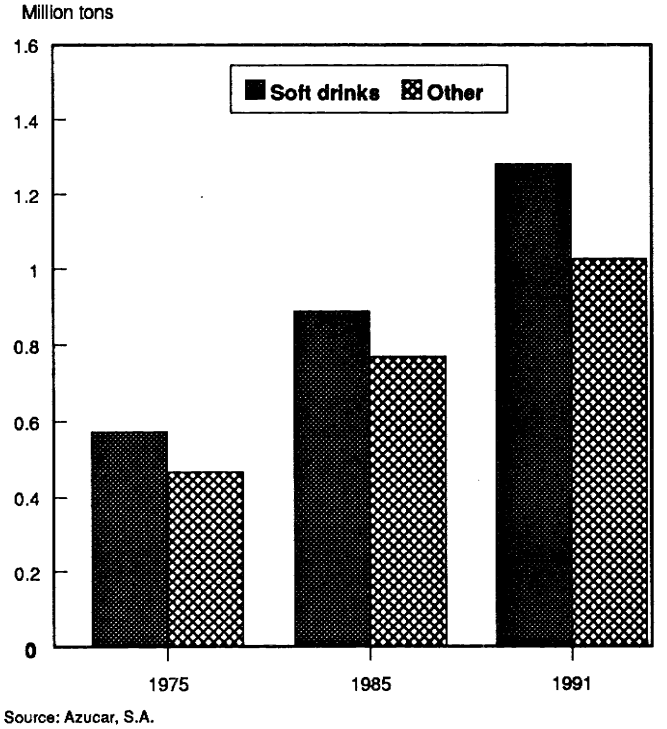
Figure 11
Mexico's sugarcane harvested area 1/



1/ Preliminary 91/92.

Figure 12

Mexico's industrial uses of sugar



Source: Azucar, S.A.

Figure 13

Mexico's sugar trade

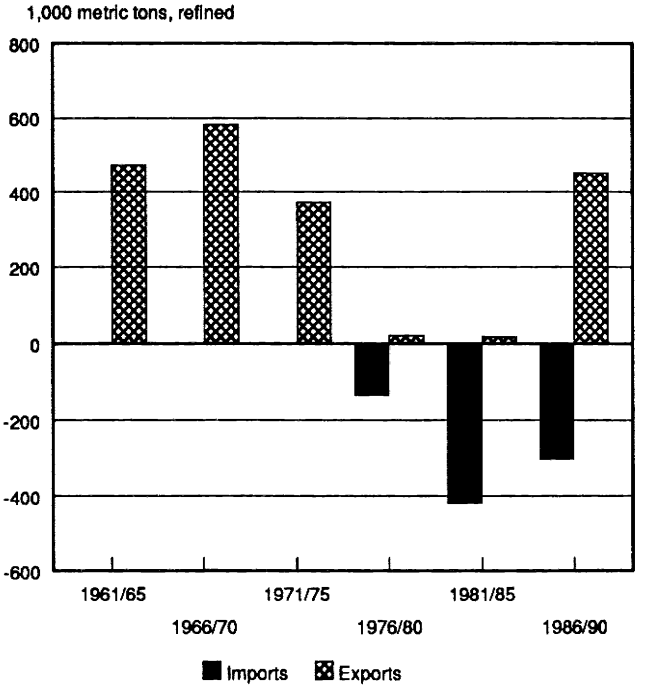


Figure 14

Mexico's sugar production and consumption, historic and forecast

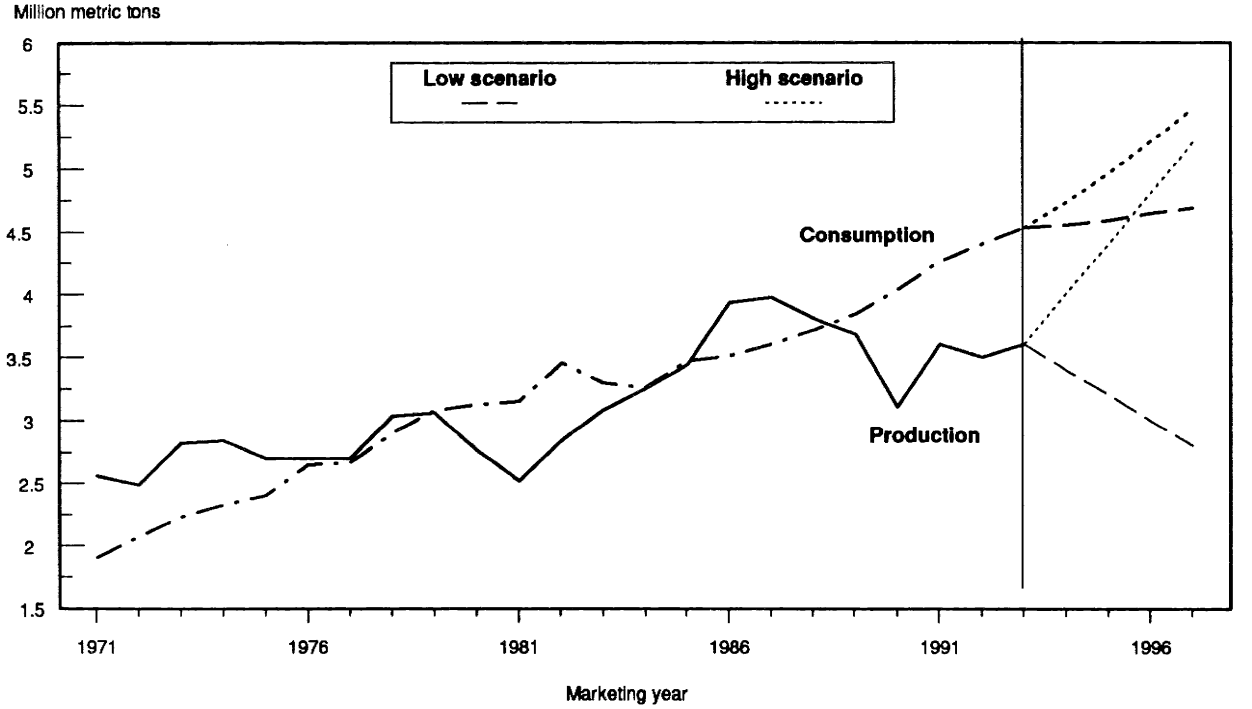


Table 3--Mexican sugar production, supply, and distribution

Market year	Beginning stocks	Total sugar production	Total imports	Total supply	Total exports	Total domestic consumption	Ending stocks
			1,000 metric tons, raw value				
1960/61	322	1,454	0	1,776	417	1,137	222
1961/62	222	1,494	0	1,716	357	1,201	158
1962/63	158	1,735	0	1,893	393	1,325	175
1963/64	175	1,902	0	2,077	484	1,371	222
1964/65	222	2,068	0	2,290	528	1,451	311
1965/66	311	2,104	0	2,415	475	1,517	423
1966/67	423	2,430	0	2,853	550	1,595	708
1967/68	708	2,336	0	3,044	610	1,724	710
1968/69	710	2,563	0	3,273	604	1,769	900
1969/70	900	2,402	0	3,302	548	1,954	800
1970/71	800	2,475	0	3,275	556	2,021	698
1971/72	698	2,520	0	3,218	532	2,073	613
1972/73	613	2,769	0	3,382	561	2,200	621
1973/74	621	2,805	0	3,426	623	2,285	518
1974/75	619	2,696	0	3,315	232	2,400	683
1975/76	683	2,698	0	3,381	432	2,650	299
1976/77	299	2,696	0	2,995	0	2,660	335
1977/78	335	3,029	0	3,364	0	2,900	464
1978/79	464	3,058	0	3,522	103	3,080	339
1979/80	339	2,763	778	3,880	0	3,125	755
1980/81	755	2,518	607	3,880	0	3,150	730
1981/82	730	2,842	470	4,042	0	3,455	587
1982/83	587	3,078	862	4,527	40	3,300	1,187
1983/84	1,187	3,242	270	4,699	0	3,260	1,439
1984/85	1,439	3,436	0	4,875	11	3,470	1,394
1985/86	1,394	3,928	0	5,322	192	3,510	1,620
1986/87	1,620	3,970	0	5,590	505	3,600	1,485
1987/88	1,485	3,806	0	5,291	967	3,747	577
1988/89	577	3,678	600	4,855	410	3,840	605
1989/90	605	3,100	1,100	4,805	17	4,038	750
1990/91	750	3,600	1,400	5,750	285	4,260	1,205
1991/92[1]	1,205	3,500	275	4,980	50	4,400	530
1992/93[2]	530	3,600	890	5,020	10	4,530	500

[1] Preliminary.
[2] Forecast.
Source: Foreign Agricultural Service, USDA.

Table 4--Mexican sugar imports from major trading partners

Calendar year	United States	Cuba	Brazil	European Community	Other countries	Total
			1,000 metric tons			
1980	218	383	75	18	67	761
1981	409	232	0	0	32	673
1982	12	137	165	141	83	538
1983	51	76	70	300	336	833
1984	81	53	31	40	68	273
1985	0	0	0	0	0	0
1986	0	0	0	0	0	0
1987	0	0	0	0	0	0
1988	0	0	0	0	0	0
1989	158	68	26	135	210	597
1990	239	302	416	152	443	1,552
1991	19	16	95	97	671	898

Source: International Sugar Organization, London.

Table 5--Mexican sugar exports to major trading partners

Calendar year	United States	Other countries	Total
		1,000 metric tons	
1960	382	80	462
1961	585	1	586
1962	350	15	365
1963	344	49	393
1964	426	65	491
1965	424	131	555
1966	449	64	513
1967	472	100	572
1968	575	101	676
1969	625	0	625
1970	612	0	612
1971	551	0	551
1972	598	0	598
1973	586	0	586
1974	496	0	496
1975	139	78	217
1976	1	12	13
1977	0	0	0
1978	74	0	74
1979	30	0	30
1980	0	0	0
1981	0	0	0
1982	17	0	17
1983	15	0	15
1984	0	0	0
1985	32	34	66
1986	119	100	219
1987	212	306	518
1988	168	846	1,014
1989	115	219	334
1990	5	0	5
1991	8	245	253

Source: International Sugar Organization, London.

Brazil's Sugar Industry Balancing Sweetener and Fuel Ethanol Requirements

Brazil is either first or among the world leaders in production of sugarcane, sugar, and ethanol (fuel alcohol), and in sugar consumption and exports. In addition, it is among the most efficient of all the major sugar producers and its sugar export products are the most diverse.

Brazil uses about two-thirds of its annual sugarcane output to produce fuel ethanol (fig. 15). Brazil's outlook as a major sugar exporter is mixed. Brazil could expand exports more rapidly than any other exporter, but its potential to do so may be constrained by the country's need to satisfy its large and growing domestic sugar and ethanol requirements. Moreover, if Brazil's auto transportation continues to depend largely upon ethanol, short-term options to reduce ethanol production in favor of sugar are limited.

Sugarcane Production Expansion

Brazil and India are by far the world's leading producers of sugarcane. Brazil produces 225-250 million metric tons from over 4 million hectares. India produces 245 million tons from 3.7 million hectares. Cuba, the third-largest producer, turns out about 68 million tons of cane from 1.5 million hectares. Brazil has tripled sugarcane production since the mid-1970's, largely by expanding sugarcane area while investing in milling capacity and ethanol distilleries. Even though only about a third of Brazil's cane is now ground for sugar, it is consistently among the world's top three sugar producers. Its most recent 3-year production average of 8.3 million tons, raw value, trails only the former Soviet Union and India (fig. 16).

Brazil has two geographically distinct producing regions with important agronomic differences and policy orientations. The central-south region is dominated by the State of Sao Paulo, which alone accounts for 50 percent of Brazilian sugarcane production. The region in recent years has supplied three-quarters of the country's cane and two-thirds of Brazil's sugar output. Of the estimated 4.3 million hectares of sugarcane planted across Brazil, 2.8 million are in the central-south region.

In addition, the central-south region produces approximately 85 percent of Brazil's domestic ethanol to service its large industrial centers and urbanized population. The central-south harvest season is normally May through September, although cane cutting in some years has begun in mid-April to ease tight ethanol supply situations. The cane area is located on level or gently rolling, highly productive land that is readily adaptable to mechanization. Sugar produced in the central-south region goes predominantly to the domestic market. The central-south sugarcane industry is efficient and cost-effective.

The north-northeastern States account for 20-25 percent of Brazilian sugarcane production, approximately 35 percent of the country's sugar output, and about 15 percent of its ethanol. Two States, Pernambuco and Alagoas, dominate production, accounting for about 80 percent of regional sugar output and about 70 percent of regional ethanol production. The harvest season there is normally September through April, and north-northeastern sugar production goes largely to export markets via the ports of Recife and Maceio. The region accounts for about 70 percent of Brazil's total annual sugar exports.

Brazil's north-northeastern sugarcane industry is considered less efficient than the central-south industry, and has traditionally depended heavily on Government assistance. A large proportion of its cane is on steeply rolling hills, largely precluding the use of mechanized equipment. The soils are not as productive as in the central-south States and drought is more frequent. Average sugarcane yield per hectare in the region was 48 tons in 1988/89 (the last year regional and State data are available), compared with 70 tons in the central-south region.

Domestic Sugar Use Growing

The world's sixth-largest population and a long tradition of high per capita sugar consumption have made Brazil one of the world's leading sugar-consuming countries. With annual consumption of 7.20 million tons forecast for 1991/92, about 6 percent of global use, Brazil ranks behind only the former Soviet Union, India, China, and the United States in total annual sugar use. In recent years, per capita consumption has averaged about 43

Brazil's leading sugar producing States, by region

Region and State	Percent of production	Sugar mills	Sugar production[1]
North, Northeast:	Percent	Number	1,000 tons
Pernambuco	15.6	32	1,258.7
Alagoas	13.5	27	1,090.1
Paraiba	1.3	7	107.8
Rio Grande do Norte	1.3	2	103.9
Bahia	1.2	3	96.1
Sergipe	1.1	4	86.3
Maranhao	0.4	1	30.3
Ceara	0.5	2	41.0
Para	0.1	1	2.8
Others[2]	----	1	--------
Region Totals	34.9	80	2,817.0
Central West, South:			
Sao Paulo	49.6	73	4,001.3
Rio de Janeiro	5.7	15	458.1
Minas Gerais	5.6	14	448.3
Parana	2.7	5	217.1
Espirito Santo	0.5	1	38.6
Santa Catarina	0.4	1	30.4
Mato Grosso	0.3	1	25.6
Goias	0.2	2	17.5
Mato Grosso do Sul	0.1	1	14.8
Rio Grande do Sul	0.1	0	1.5
Tocantins	----	----	--------
Region Totals	65.1	113	5,253.2
Total	100	193	8,070.2

[1] Tel quel basis to convert raw value, multiply by 1.062

[2] Includes Acre, Amazonas, Roraima, Amapa, Piaui

kilograms, compared with a world average of about 21 kilograms.

Brazilian Governments have consistently given priority to ensuring that domestic production is sufficient to cover consumption needs. However, Brazil's sugar consumption has fluctuated significantly from year to year, reflecting economic conditions and changes in macroeconomic policies. For example, under the Cruzado Plan in 1986, wages were raised sharply while prices were controlled. Consumption of sugar shot up 400,000 tons in 1986/87 (fig. 17). As the Cruzado Plan collapsed and the economy deteriorated in early 1987, consumer purchasing power shrank and sugar consumption fell by 300,000 tons in 1987/88. The contraction was, however, not as great as for many other items, reflecting the high level of sugar use in the Brazilian diet. Also, as a traditionally controlled-price item, sugar demand has been somewhat insulated from Brazil's high inflation. Since the dip in use in 1987/88, consumption has continued to expand despite a still-troubled Brazilian economy.

Government policymakers have continued the tradition of ensuring that domestic production covers consumption needs. However, price controls on sugar at the retail level have been lifted. Sugar for export, while also vital to the national economy, continues to be of secondary importance. With Brazil's continued population expansion, now nearly 160 million compared with 125 million a decade ago, and increasing industrial demand for sugar-containing products, even greater sugar supplies will be needed. While Brazil is a large corn producer, like Mexico it does not have a corn sweetener industry. The prospect of development of an HFCS industry as a substitute for sugar appears unlikely. For 1992/93, sugar consumption is forecast at 7.3 million tons, 80 percent of expected production, compared with 76 percent in 1985/86 and 71 percent in 1980/81.

Sugar Exports Still Large and Versatile

While sugar exports are a secondary priority, Brazil has consistently ranked among the world's top five sugar exporters, along with Cuba, the European Community, Australia, and Thailand. From the mid-1970's to the mid-1980's, Brazil averaged 2.2 million tons of sugar exports each year, with record sales of 3.4 million tons in 1984/85 (fig. 18) accounting for 11 percent of global exports. However, Brazil's exports fell to a low of 1.3 million tons in 1990/91, reflecting increased internal demand and sluggish production. Exports are expected to total 1.4 million tons in 1991/92 and 1.7 million tons in 1992/93 because of improved crops and the dropping of domestic price controls on sugar, which should dampen consumption growth and allow for heightened exports (table 6).

Traditionally a leading raw sugar exporter, Brazil has also diversified sales to include plantation white or semi-refined sugar (known as crystal sugar in Brazil) and refined sugar. This contrasts sharply with Cuba, which lacks the refining capacity to ship large volumes of refined sugar. Brazil's total exports for calendar year 1991 were 1.61 million tons, of which 887,000 tons were classified as refined sugar, according to the International Sugar Organization. Brazil's refined sugar exports, second only to the European Community in volume, go largely to North Africa (fig. 19) and oil-exporting countries such as Iran, Iraq, and Nigeria, which lack sufficient refining capacity to import raw sugar. Mexico was also a significant importer of Brazil's refined sugar in 1991. In addition, Cuba sent Brazil raw sugar for refining and re-export.

The United States has been a leading market for Brazil's raw sugar exports (table 7). Annual shipments change with U.S. import needs and Brazil's export availabilities. Brazil's exports averaged 452,000 tons per year in the 1960's and 561,000 tons in the 1970's. Only in 1976 did exports drop to zero when Brazil experienced a poor crop at a time of rising internal demand. In the 3 years before the imposition of the U.S. sugar import quota (1979-81), Brazil's exports to the United States averaged 935,000 tons per year.

In 1982, Brazil was assigned the second highest import allocation at 14.5 percent under the U.S. sugar import quota system. Allotments were allocated on the basis of shipments during a base period, 1975-81, with high and low years taken out. Brazil has filled or nearly filled its annual quota in each year except 1989/90, when Brazil's domestic ethanol needs and a controversy over outstanding sugar export contracts led to a shortfall in U.S. quota receipts of 23,000 short tons. Brazil filled its quota of 325,130 short tons in 1990/91, reflecting its improved sugar supply. For 1991/92 (October-September), Brazil had shipped its entire quota allocation of 211,195 tons as of August 3.

Brazil's total refined exports surpassed its raw exports in volume in 1985, and the refined share of Brazil's total has remained at over 50 percent, compared with less than 15 percent in the mid-1970's. Thus, Brazil has positioned itself well in the refined segment of global sugar trade, which shows considerable growth potential. The evolution of a diverse export capability provides Brazil with considerable flexibility to serve a wide range of markets as well as the varied needs of individual importers. Government policy has helped. For example, a tax on raw sugar exports in the northeast region has encouraged increased exports of refined sugar from the northeast in 1991/92. Moreover, unlike Cuba, Brazil has a well-established customer base in the Americas, Europe, Africa, and the Middle East.

Sugar export earnings continue to be important to the economy, though their share of total earnings has shrunk as Brazil's exports of minerals, manufactured products, and other agricultural commodities have grown and world sugar prices have fallen from earlier peaks. Sugar exports of nearly $400 million in 1991 provided less than 2 percent of Brazil's total export earnings of $31.6 billion. Nonetheless, sugar exports, which have averaged between $350-$450 million over the past 5 years, are important to the Brazilian economy, especially the northeast region.

Ethanol Growth Slowed

Brazil is by far the world's leader in ethanol production. Output in recent years has averaged around 12 million cubic meters (mcm) from about 150 million tons of sugarcane (table 8). U.S. ethanol production, the world's second largest, totaled nearly 4 mcm (1 billion gallons) in 1991.

Influenced by the run-up in world oil prices in 1974, Brazil launched the world's first major biomass-based fuel ethanol program in 1975. This decision was reinforced by the further rise in oil prices that began in 1979 and peaked in 1981. Drawing on vast resources of land and rural labor and its highly favorable conditions for sugarcane growth, Brazil has more than doubled its sugarcane area and more than tripled its sugarcane production since 1975. By constructing distilleries "annexed" to existing sugar mills and stand-alone "autonomous" distilleries devoted strictly to converting cane to fuel-ethanol, Brazil increased its ethanol production from half a million cubic meters in 1975/76 to an estimated 12.7 million cubic meters for 1991/92 (fig. 15).

Brazil has a distillation capacity for ethanol estimated at between 15.2 and 16.4 mcm. Of Brazil's 374 distilleries for producing fuel ethanol, 158 are annexed to sugar mills and 216 are autonomous ethanol production units. Based on the national capacity estimate of 16.4 mcm, 8.4 mcm is situated at annexed distilleries and 8.0 mcm at autonomous ones.

As with sugar production, ethanol output is concentrated in the central-south region, which contributed nearly 10.0 million of Brazil's 12.3 mcm of ethanol in 1989/90. The State of Sao Paulo alone accounted for 7.7 million cubic meters. The northeast region accounted for 17 percent or 2.0 mcm, of which Alagoas and Pernambuco contributed 1.5 million.

Brazil has had problems keeping ethanol availability at a level to match internal demand. In the early 1980's, for example, surplus production was exported, mainly to the United States, which filed anti-dumping charges against Brazil. In the late 1980's and early 1990, sugarcane supply was not sufficient to meet sugar and ethanol needs, so ethanol and methanol were imported to meet domestic demand and rebuild stocks. A partial substitute for hydrous ethanol now used in Brazil is a blend of 33 percent methanol, 60 percent hydrous ethanol, and 7 percent gasoline.

In recent years, Brazil's ethanol program, with both subsidized production and consumption, has come under considerable criticism for its cost, particularly given the sharp downturn in world oil prices since 1982. The cost of producing ethanol has been estimated as high as $40-$60 a barrel of oil equivalent, compared with around $20 a barrel for domestically produced oil. Moreover, domestic oil production has increased significantly over the last decade, growing from 187,000 barrels per day (bpd) in 1980 to about 650,000 bpd currently, according to Petrobras, the State oil company. Together, higher domestic oil production, lower oil import prices, and the ethanol program have helped cut Brazil's oil import bill from a record $11 billion in 1981 to $6.3 billion in 1991.

Despite these changes, the ethanol program's future seems assured in the short term. The program has

been a key component of the nation's effort to industrialize, and turning away from ethanol would mean significant capital losses. Since its inception 17 years ago, an estimated $18 billion has been invested in ethanol production. Moreover, the program is now being touted for its clean air aspects, especially for the urban areas of Sao Paulo and Rio de Janeiro. Ethanol reportedly produces 50 percent less carbon monoxide than gasoline.

The Brazilian Government also has been subsidizing the production and marketing of ethanol-powered cars, which in 1988 comprised more than 88 percent of the new cars manufactured in Brazil. This proportion was reduced to 75 percent in 1989 and to 15 percent the last 2 years because consumers shied away from ethanol-powered cars after an ethanol fuel shortage in 1989/90. Of a Brazilian passenger vehicle fleet of about 9.3 million, 4.3 million vehicles run on hydrated ethanol or a blend of hydrous ethanol, methanol, and gasoline. The remaining passenger vehicles are fueled by a mixture of gasoline and anhydrous ethanol.

In addition to reducing the production of ethanol-powered cars and introducing blended fuels, Brazil has pulled back from the ethanol program in other ways. The official production target for 1992 of 16 mcm was dropped. The mandated ethanol content of gasohol was reduced from 22 percent to 12-14 percent. Also, ethanol's price at the pump was lifted from 65 percent of the price of gasohol to 80 percent. These policy changes aim to restrain ethanol demand growth and reduce the cost of ethanol subsidies.

However, by mid-1992, the program apparently has renewed life. Ethanol production for 1992/93 is projected to increase to 13.2 mcm (10.7 million hydrous ethanol and 2.5 million anhydrous) after several years in the 11-12 mcm range as advocates emphasize ethanol's pollution control, reduced cost through technical advances, and traditional role as a substitute for oil imports. Brazil's Association of Ethanol Producers are advocating a return to the nationwide gasohol mix of 22 percent (it has remained at 22 percent in the State of Sao Paulo) and an increase in production of hydrous ethanol-powered cars to 30-40 percent of total passenger vehicle production.

Prospects

Brazil's sugar and ethanol are inextricably linked despite periods of serious surpluses and shortages as well as a persistent problem of funding subsidies. However, a return to the sharp ethanol growth rates of the early 1980's is unlikely without another oil price explosion.

Likewise, a sharp contraction in the ethanol program is not foreseen, in large part due to the significant share of Brazilian passenger vehicles that can run only on hydrous ethanol or an ethanol blend. Ethanol production will likely increase incrementally until it approaches Brazil's capacity of 15-16 mcm. In years when sugarcane crops are short, the prospect of substantial ethanol and methanol imports to meet current demand and maintain strategic stocks is possible. But another wave of surplus ethanol exports is not imminent.

To maintain its domestic sugar consumption at 45 kilograms per capita, and to maintain exports at 1.5-2.0 million tons, Brazil would need to produce about 9.5 million tons of raw sugar per year. At recent extraction rates, the cane requirement for that much sugar would be about 100 million tons (85 million tons were needed to produce 8.6 million tons, raw value sugar, in 1988/89).

With its state-regulated milling industry and varied harvest schedules, Brazil has the unique flexibility to shift significant tonnage of cane between sugar and ethanol production. Brazil's quantity of cane is so large that even marginal shifts could have important effects on the world sugar market. Ethanol currently absorbs sugarcane sufficient to produce over 20 million tons of sugar, or more than two-thirds of world exports. With sugar milling capacity estimated at 12 million tons, Brazil would appear to be able to lift sugar production to that level, from recent levels of 8.5-9 million tons, by diverting 30-40 million tons of cane from ethanol. Moreover, sugar milling capacity could be expanded by adaptations (installation of crystallization equipment) to autonomous distilleries to produce sugar. Even an additional 3-4 million tons of cane sugar would be more than enough to sustain domestic sugar consumption as Brazil's population tops the 166-million mark by the mid-1990's. Exportable surplus sugar tonnage could be

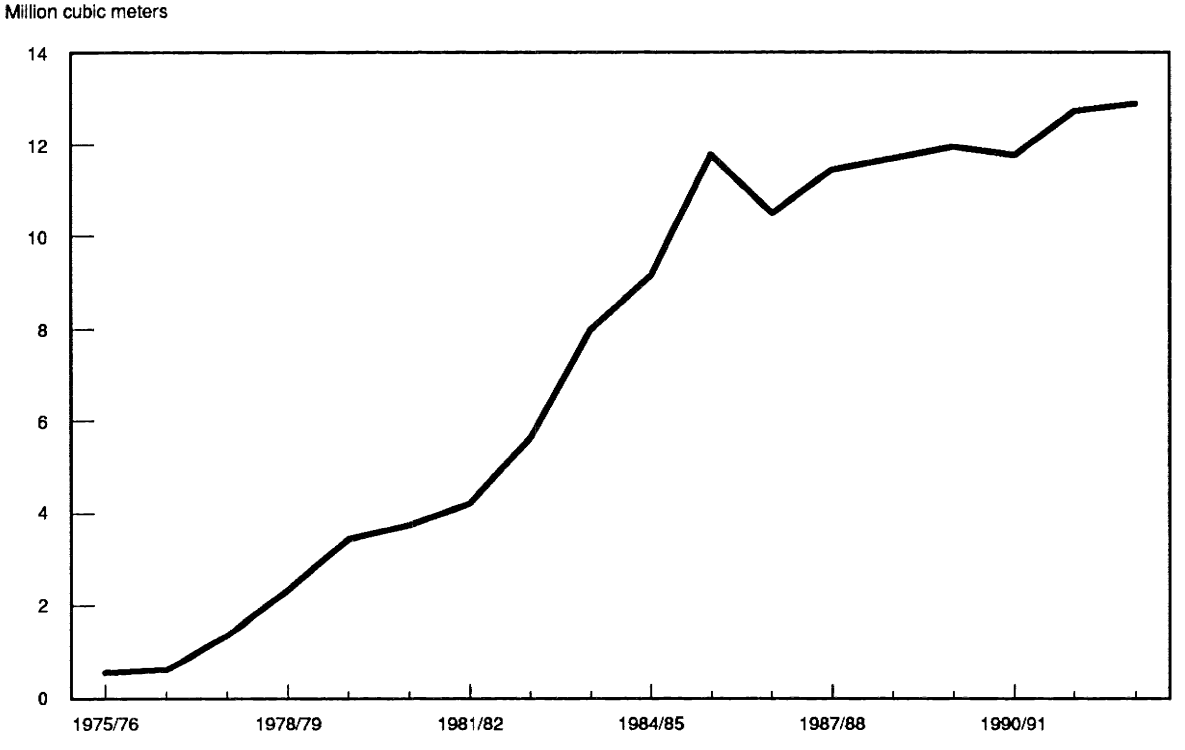
placed on the world market in the event of a price surge resulting from global supply shortages. Under this scenario, Brazil's economy would benefit from a sharp jump in sugar export earnings.

While this scenario would have Brazil providing greater stability to the world sugar market in the event of global shortages, such a large volume of adjustment is unlikely. Brazil needs to ensure the security of ethanol supplies to service its ethanol-dependent motor fleet. This, along with the longstanding commitment to satisfy domestic sugar needs, could curtail Brazil's ability to take advantage of higher sugar export prices.

Nevertheless, the recent emergence of "methanol blends" presents an interesting new factor. If world sugar prices were to explode, Brazil could produce less hydrous ethanol and replace it with relatively cheap imported methanol (1 ton of imported methanol costs about $90 compared with $400 for imported ethanol). Cane originally earmarked for ethanol use could then be used to produce sugar for export.

Figure 15

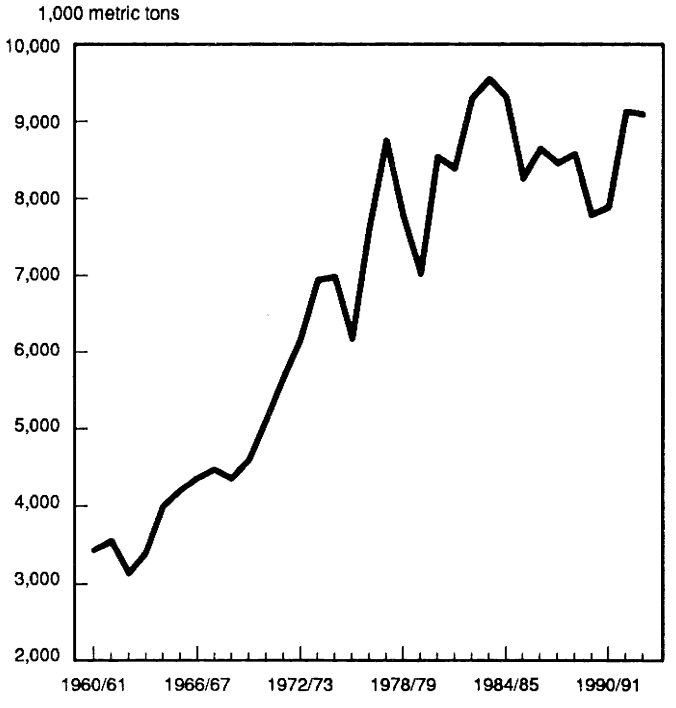
Brazil's ethanol production 1/



1/ Preliminary 91/92.

Figure 16

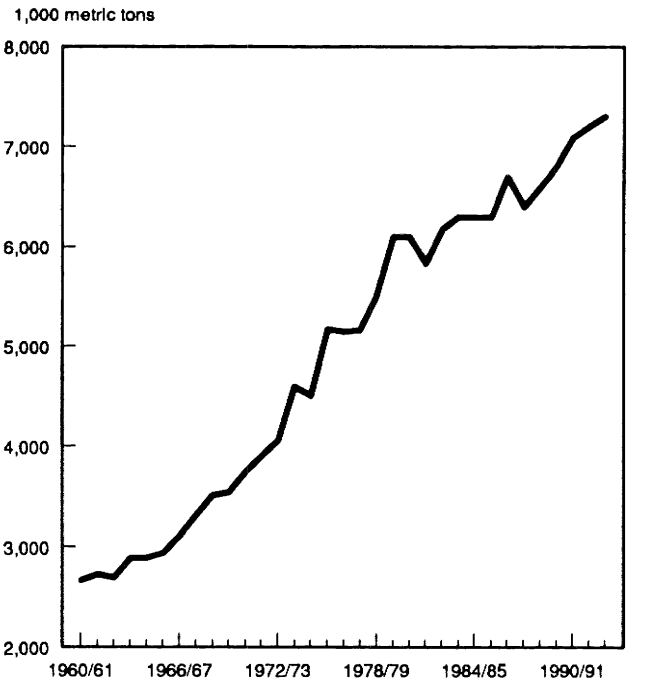
Brazil's sugar production 1/



1/ Preliminary 91/92.

Figure 17

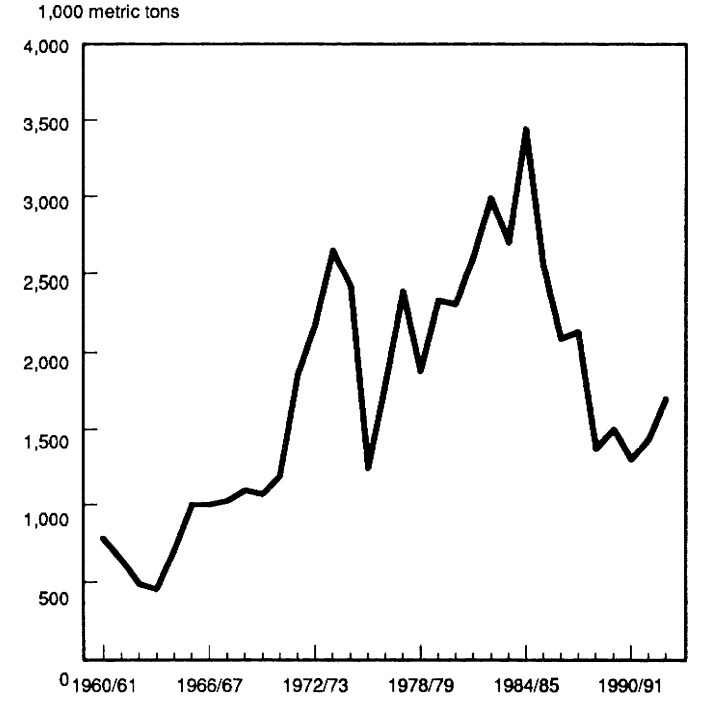
Brazil's sugar consumption 1/



1/ Preliminary 91/92.

Figure 18

Brazil's sugar exports 1/



1/ Preliminary 91/92.

Figure 19

Brazil's sugar exports by destination, 1991

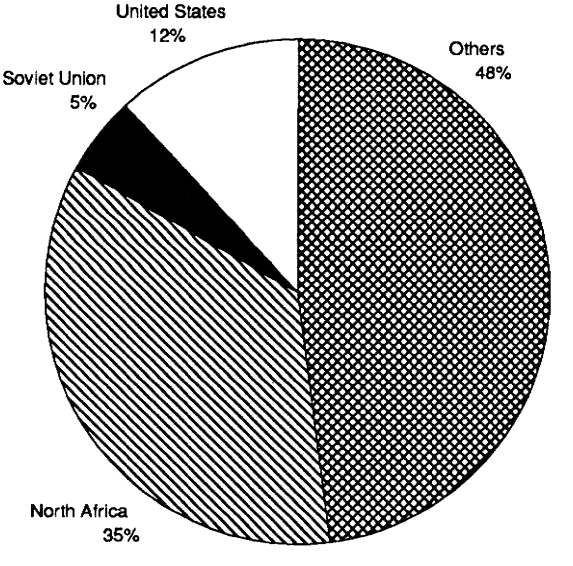


Table 6--Brazil's sugar production, supply, and distribution

Market year	Beginning stocks	Total sugar production	Total imports	Total supply	Total exports	Total domestic consumption	Ending stocks
			1,000 metric tons, raw value				
1960/61	706	3,438	0	4,144	783	2,667	694
1961/62	694	3,568	0	4,262	645	2,731	886
1962/63	886	3,137	0	4,023	487	2,705	831
1963/64	831	3,400	0	4,231	453	2,891	887
1964/65	887	4,000	0	4,887	710	2,897	1,280
1965/66	1,280	4,200	0	5,480	1,005	2,946	1,529
1966/67	1,529	4,360	0	5,889	1,001	3,116	1,772
1967/68	1,772	4,464	0	6,236	1,026	3,317	1,893
1968/69	1,893	4,357	0	6,250	1,099	3,516	1,635
1969/70	1,635	4,593	0	6,228	1,075	3,540	1,613
1970/71	1,613	5,117	0	6,730	1,191	3,743	1,796
1971/72	1,796	5,648	0	7,444	1,854	3,900	1,690
1972/73	1,690	6,163	0	7,853	2,177	4,064	1,612
1973/74	859	6,942	0	7,801	2,650	4,596	555
1974/75	555	6,985	0	7,540	2,418	4,507	615
1975/76	615	6,180	0	6,795	1,244	5,177	374
1976/77	374	7,598	0	7,972	1,798	5,148	1,026
1977/78	1,026	8,756	0	9,782	2,391	5,165	2,226
1978/79	2,226	7,767	0	9,993	1,877	5,508	2,608
1979/80	2,608	7,027	0	9,635	,333	6,098	1,204
1980/81	1,204	8,547	0	9,751	2,305	6,107	1,339
1981/82	1,339	8,393	0	9,732	2,615	5,832	1,285
1982/83	1,285	9,302	0	10,587	2,984	6,178	1,425
1983/84	1,425	9,561	0	10,986	2,700	6,300	1,986
1984/85	1,986	9,324	0	11,310	3,439	6,300	1,571
1985/86	1,571	8,270	0	9,841	2,560	6,300	981
1986/87	981	8,650	0	9,631	2,086	6,700	845
1987/88	845	8,457	0	9,302	2,131	6,400	771
1988/89	771	8,582	0	9,353	1,371	6,600	1,382
1989/90	1,382	7,793	289	9,464	1,500	6,800	1,164
1990/91	1,164	7,900	81	9,145	1,300	7,088	757
1991/92[1]	757	9,133	80	9,970	1,431	7,200	1,339
1992/93[2]	1,339	9,100	80	10,519	1,700	7,300	1,519

[1] Preliminary.
[2] Forecast.
Source: Foreign Agricultural Service, USDA.

Table 7--Brazil's sugar exports to major trading partners

Calendar year	United States	Soviet Union	Japan	Algeria	Iran	Iraq	Other countries	Total
				1,000 metric tons, raw value				
1960	103	0	288	0	0	0	464	855
1961	293	0	259	0	0	0	193	745
1962	362	0	21	0	0	0	96	479
1963	418	0	0	0	0	0	69	487
1964	162	0	0	0	0	0	104	266
1965	323	0	23	0	0	42	430	818
1966	492	0	0	0	0	20	495	1,007
1967	591	0	13	0	0	11	386	1,001
1968	615	0	0	0	0	23	441	1,079
1969	651	0	38	11	0	12	349	1,061
1970	607	0	159	0	0	0	364	1,130
1971	598	0	12	40	0	47	533	1,230
1972	621	325	112	78	12	50	1,440	2,638
1973	446	438	129	79	190	222	1,471	2,975
1974	669	0	235	279	62	247	811	2,303
1975	155	95	347	173	39	277	644	1,730
1976	0	0	210	226	10	153	653	1,252
1977	680	24	79	201	64	352	1,087	2,487
1978	580	83	21	15	170	127	929	1,925
1979	1,053	99	0	0	133	122	535	1,942
1980	806	502	0	130	104	181	939	2,662
1981	946	366	0	212	43	117	986	2,670
1982	286	355	18	201	31	169	1,728	2,788
1983	315	1,254	14	215	46	30	927	2,801
1984	272	612	0	411	152	162	1,431	3,040
1985	360	335	0	258	103	229	1,324	2,609
1986	140	568	0	228	197	305	1,116	2,554
1987	121	521	0	103	136	349	1,194	2,424
1988	126	192	0	15	146	93	1,038	1,610
1989	16	220	0	26	91	0	612	965
1990	498	147	0	0	127	0	805	1,577
1991	199	73	0	29	23	0	1,290	1,614

Source: International Sugar Organization, London.

Table 8--Brazil's sugar mills, ethanol distilleries, ethanol production capacity, and ethanol production, by region and State, 1991

Region and State	Sugar mills			Ethanol distilleries		Ethanol production			
	Sugar mills w/out annex distilleries	Sugar mills w/annex distilleries	Total sugar mills	Autonomous distilleries	Total annex and autonomous distilleries	Capacity	Production 1989/90	Idle capacity	Share of capacity idle
	Number					Million cubic meters			Percent
North, Northeast:									
Alagoas	5	22	27	9	31	1,111.8	929.6	182.2	16.4
Bahia	2	1	3	1	2	50.6	27.0	23.6	46.6
Ceara	0	2	2	1	3	61.4	21.0	40.4	65.8
Maranhao	0	1	1	3	4	118.0	30.0	88.0	74.6
Para	0	1	1	1	2	35.7	11.9	23.8	66.6
Paraiba	2	5	7	9	14	396.2	261.3	134.9	34.0
Pernambuco	7	25	32	7	32	795.0	591.0	204.0	25.7
Sergipe	2	2	4	1	3	63.9	29.5	34.4	53.8
Rio Grande do Norte	0	2	2	3	5	148.0	116.9	31.1	21.0
Others[1]	0	0	1	4	5	72.5	44.3	38.2	52.7
Subtotal	18	61	80	39	101	2,853.1	2,062.5	800.6	28.1
Central West and South:									
Espirito Santo	0	1	1	5	6	179.2	98.4	80.8	45.1
Goias[2]	0	2	2	15	17	590.1	294.1	296.0	50.2
Mato Grosso	0	1	1	9	10	355.9	253.3	102.6	28.8
Mato Grosso do Sul	0	1	1	8	9	309.7	156.4	153.5	49.6
Minas Gerais	3	11	14	18	29	868.3	443.3	425.0	48.9
Parana	0	5	5	22	27	1,001.4	693.0	308.4	30.8
Rio de Janeiro	1	14	15	1	15	407.0	240.7	166.3	40.9
Rio Grande do Sul	0	0	0	1	1	12.4	4.2	8.2	66.1
Santa Catarina	0	1	1	0	1	10.3	7.6	2.7	26.2
Sao Paulo	6	67	73	66	133	8,568.8	7,765.5	803.3	9.4
Subtotal	10	103	113	145	248	12,303.1	9,956.5	2,346.8	19.1
Total	28	164	193	184	349	15,156.2	12,019.0	3,147.4	20.8

[1] Others include States of Acre, Amazonas, Piaui, Rondonia, and territory of Roraima.
[2] State of Goias includes data for Federal District and new State of Tocantins.
Source: Ministerio da Economia, Fazenda e Planejamento, Instituto do Azucar e do Alcool, Brazil.

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Economic Research Service
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