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# Sugar

## Background for 1990 Farm Legislation

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### **Abstract**

The sugar support program and rapid adoption of high fructose corn syrup (HFCS) played important roles in transforming the U.S. sugar industry in the 1980's. While sugar output and productivity increased, consumption of sugar fell dramatically as HFCS displaced sugar in many uses, particularly beverages. After a decade of steady decline, sugar consumption in 1987 began rising at a slow rate. U.S. imports of sugar for consumption fell from an average of over 4 million short tons in 1979-81, to about 1 million tons in 1988. U.S. sugar import quotas have been binding since May 1982, to keep prices at levels required by the sugar program. Regional sugar balances have altered in the 1980's, and beet sugar now provides about 45 percent of U.S. sugar use, up from about 30 percent. The world sugar market changed much in the past decade, moderating the price cycle and extending the period of persistently low prices.

**Keywords:** sugar, costs and returns, imports, quotas, HFCS, low-calorie sweeteners, program effects, world sugar

### **Foreword**

Congress will soon consider new farm legislation to replace the expiring Food Security Act of 1985. In preparation for these deliberations, the Department of Agriculture and many groups throughout the Nation are studying preceding legislation to see what lessons can be learned that are applicable to the 1990's. This report updates **Sugar: Background for 1985 Farm Legislation**, (AIB-478) by Frederic L. Hoff, Robert D. Barry, Luigi Angelo, and John Nuttall. It is one of a series of updated and new Economic Research Service background papers for farm legislation discussions. These reports summarize in a nontechnical form the experience with various farm programs and the key characteristics of the commodities and the farm industries which produce them. For more information, see the Additional Readings listed at the end of the text.

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## Summary

The U.S. and world sugar markets changed significantly in the 1980's as a result of rising use of substitute sweeteners, new technologies, and government policy. The sugar support program mandated by 1981 farm legislation and particularly the Food Security Act of 1985 played an important role in the evolution of the U.S. industry by providing market prices which protected domestic producers from the persistently low prices of sugar in the world market.

U.S. sugar producers increased both productivity and output in the 1980's. While the number of sugarcane mills declined, daily grinding capacity expanded and cane sugar production rose to a record 3.3 million short tons in 1987/88, and an estimated 3.4 million tons in 1988/89. Beet factories are fewer, but daily average slicing capacity per factory rose over 16 percent in the 1980's. Factories are also more efficient, with higher extraction rates (sugar recovered as a percentage of sucrose in the beets). Beet sugar production was a near-record at 4 million tons in 1987/88, and total beet and cane sugar production reached a record 7.3 million tons. At current levels of support, U.S. sugar production is likely to increase further.

Deliveries of refined sugar for domestic consumption peaked in 1977 at 10.4 million tons and then declined for a decade as high fructose corn syrup (HFCS) displaced sugar in liquid industrial uses, primarily beverages. As HFCS approached the limits of its technical ability to substitute for sugar, aggregate sugar consumption begun rising again with population and income.

The combination of higher domestic sugar output and lower consumption has pushed imports for consumption down from an average of over 4 million tons in 1979-81 to about 1 million tons in 1988. A production shortfall and some rise in consumption have raised the 1989/90 sugar import quota to an annualized 1.4 million tons. Restrictive sugar import quotas have been in force since May 1982 to keep prices at the U.S. sugar program's required levels.

The radical alteration of U.S. sugar supply and use in the past decade has transformed regional sugar balances. The Northeast (New England-Mid-Atlantic) has shifted from its position of supplying nearly all its refined sugar needs, to being in deficit by about 600,000 tons (raw value basis) in 1988. Beet sugar from the Midwest and North Central States have serviced the balance. Beet sugar now provides about 45 percent of U.S. sugar consumption, up from about 30 percent in 1981. As beet sugar output expands, its role in pricing both beet and refined cane sugar will be magnified.

U.S. Government intervention in the sugar market has a 200-year history. Comprehensive regulation of production, imports, and prices under the U.S. Sugar Act lasted 40 years, until 1974.

However, since then, support programs have been reestablished (although not as comprehensively) whenever the world price has been deemed so low as to threaten the viability of the domestic sugar industry. Since 1974, Government support was absent only in 1975-76 and 1980-81 when world prices surged to cyclical highs. In most years, the world price is artificially low, reflecting the residual nature of sugar sold in that market. Intervention in sugar is an almost universal practice among governments around the world.

The structure of world sugar trade was transformed in the 1980's: (1) developing countries account for a much larger and growing percentage of global consumption and, with lower incomes than developed countries, are likely to drop out of the market as prices rise; (2) both starch-based and low-calorie sweeteners are now more widely accepted as sugar substitutes and low-calorie sweeteners in particular appear poised to take advantage of sugar shortfalls and extreme prices; (3) refined beet sugar accounts for a larger percentage of trade and its production can respond more quickly than cane sugar to a price rise; and (4) Brazil's potential to switch sugarcane between sugar and alcohol fuel, while uncertain in 1989/90, can technically provide a safety valve for world sugar prices. These factors have tended to stretch out the sugar cycle by moderating price run-ups and extending the period of low prices.

Past, unsuccessful efforts at rationalizing the world market for sugar took the form of international sugar agreements to control supplies and prices. A different direction is being undertaken in the current round of multilateral trade negotiations which aim to eliminate trade-distorting government interventions.

Sugar is a highly controversial and politically charged commodity, nationally and internationally. Sugarbeet and sugarcane growers, processors, and refiners, as well as consumers and industrial sweetener users, foreign sugar suppliers, corn sweetener manufacturers, and others are significantly affected by the U.S. sugar program. The changing structure of the sugar and sweetener industry has added new issues for decisionmakers to consider in developing sugar policy and deciding the level and form of a U.S. sugar support program.

# **Sugar**

## **Background for 1990 Farm Legislation**

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### **Introduction**

Sugar enters such a wide variety of food and beverage products that its price, denominated in one/one-hundredths of a cent, is constantly and very closely observed all over the globe. U.S. sales of sugar totaled about \$4.4 billion in 1987, while the value of corn and low-calorie sweeteners with which sugar competes in varying degrees, amounted to over \$2.5 billion.

The U.S. sugar program is the key determinant of the domestic sugar price the level of which directly affects producers and processors of sugarcane in 4 States and sugarbeets in 14 States. Various segments of the sugar market are continually at odds on the appropriate level and form of support. Moreover, over 110 countries produce sugar, in tropical as well as temperate climates. Many developing countries depend on sugar as a significant source of revenues and employment. Sugar has consequently long been involved in North-South, developed-developing country trade issues. The sugar program has strong foreign policy aspects and does not simply apply to an item of commerce.

U.S. Government involvement in the sugar market began 200 years ago. Comprehensive regulation of production, imports, and prices lasted 40 years, to 1974. Since then, sugar support programs have been re-established (although not as comprehensively) whenever the world price has been deemed so low as to threaten the viability of the U.S. sugar industry. Since 1974, Government support was absent only in 1975/76 and 1980/81 when world prices climbed to cyclical highs. In most years, the world market price is artificially low, reflecting the residual nature of sugar sold in that market. Sugar issues are not clear-cut, partly because most national governments intervene in the sugar market.

The 1990/91 crop of sugarcane and sugarbeets will be the last one produced under the price support program of the Food Security Act of 1985. As discussion continues on the next omnibus farm bill, accurate information on the U.S. sugar industry in the context of the world sweetener market and agricultural trade in general will be important to all sides in formulating decisions relating to U.S. policies and programs.

## Structure of the U.S. Sugar Industry

About 85 percent of the sugar deliveries for consumption in the United States was produced domestically during 1986-88 (about 45 percent from sugarbeets and 40 percent from sugarcane). The balance was imported. Farm value of the sugar crops produced in 1987/88 was \$1.9 billion or 3 percent of the total value of all principal crops. In 1987, the value of U.S. sugar deliveries equaled about \$4.4 billion.

The sugar industry consists of: (1) production and harvest of sugarcane and sugarbeets, (2) extraction of raw sugar from sugarcane, (3) refining of raw cane sugar and the processing of sugarbeets into commercial refined grades of sugar, and (4) distribution of refined sugar among consumers. This report focuses on the first three stages.

### Production Characteristics

#### Sugarcane Production

Sugarcane, a tall perennial grass, is grown in tropical and semitropical climates. After the planting of cane stalk cuttings, the plant matures in 12-24 months. Two to four crops (ratoon crops) are harvested from the original plantings, unless the plant is impaired or destroyed by frost, disease, or other causes. However, Hawaii has recently been experimenting with replanting after each harvest.

Most U.S. sugarcane production and harvesting operations are mechanized. In Florida, however, about two-thirds of the sugarcane is cut by hand.

Production Areas. Florida, Hawaii, Louisiana, and Texas grow sugarcane. In 1987/88, the four States harvested 778,300 acres of sugarcane (except seed) that produced 28 million short tons of sugarcane for sugar, or 36 net short tons per harvested acre. Florida accounted for 52 percent, Louisiana 34 percent, and Hawaii 10 percent of the sugarcane acreage, producing 46, 21, and 29 percent of the sugarcane. The remainder was produced in Texas. Puerto Rico, also covered by the domestic sugar price support program, harvested 1.2 million short tons of sugarcane from 50,006 acres and produced 96,417 tons of raw sugar. Preliminary estimates for the 1988/89 sugarcane crop indicate that 793,600 acres will be harvested for sugar in the United States and will produce 28.5 million tons of sugarcane or 35.9 net tons per acre (tables 1-4).

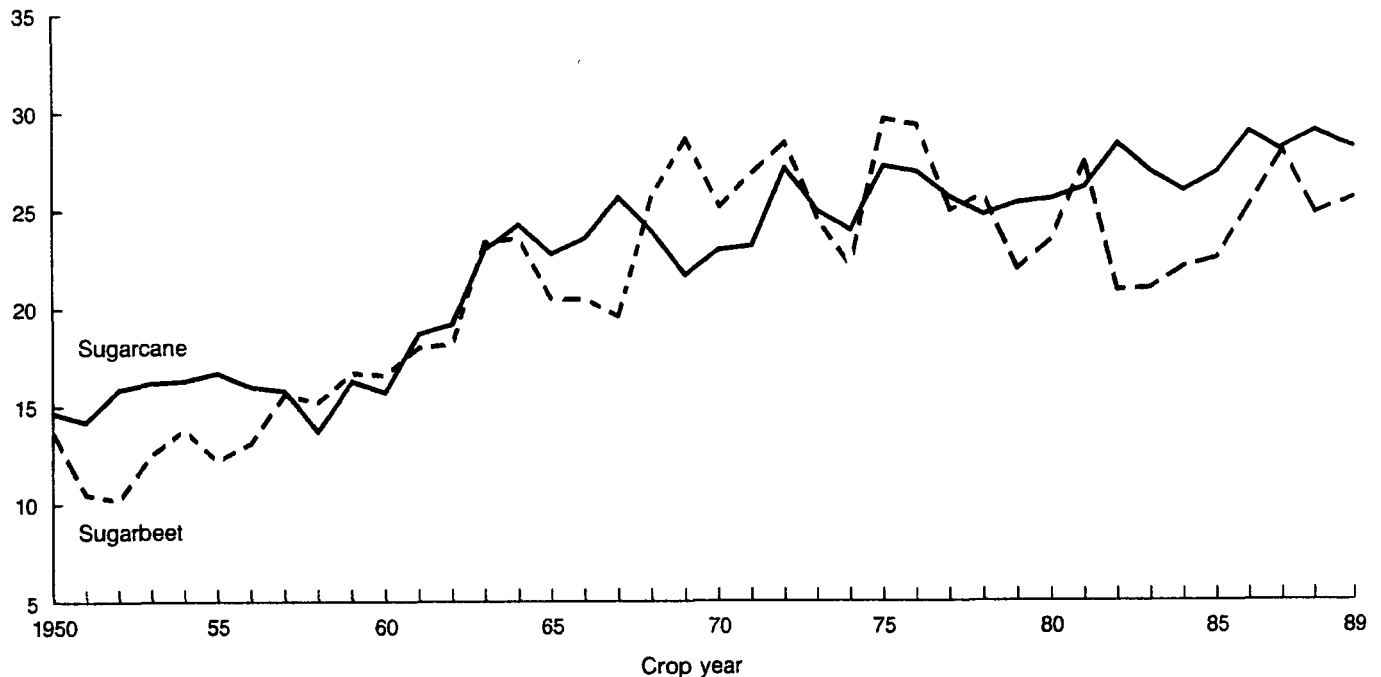
Florida's sugarcane production has expanded significantly since 1960 when the United States ceased importing Cuban sugar. In the 1980's, Florida became the largest cane producer in the United States, accounting for 50 percent of the acreage and 43 percent of sugarcane production. Most of the sugarcane is produced on organic soils along the southern and southeastern shore of Lake Okeechobee in southern Florida. The majority of the sugarcane acreage is land brought into production after 1960. In addition



Figure 1

**U.S. sugarcane and sugarbeet production, 1950 - 89**

Million short tons



Source: U.S. Dept. Agr., Agricultural Stabilization and Conservation Service.

to having highly fertile soil, the area has a long growing season and generally warm winters.

Soil subsidence is a problem facing the Florida industry. Organic soils oxidize when exposed to the atmosphere and the rate of oxidization has been estimated at 1 foot every 10 years. Some say that much of the present sugarcane land may eventually have to revert to pasture or other crops that can adapt to the soil after it can no longer support sugarcane production.

In Louisiana, the northernmost cane-growing State, most sugarcane production has been confined to the Delta where the soils are fertile and the climate is warm. However, freezing weather makes the growing season shorter than in other States and yields are lower because the cane is generally harvested before maturing fully.

Texas sugarcane is produced in the lower Rio Grande Valley in the southern tip of the State. This area has a subtropical climate of long hot summers and short mild winters, but occasionally killing freezes. Production of sugarcane resumed with the 1973/74 crop after years of inactivity.

Sugarcane is produced on Hawaii's islands of Hawaii, Kauai, Maui, and Oahu under a wide variety of conditions. On the island of Hawaii, the leading production area, harvest occurs virtually year-round. The average age of the sugarcane crop at harvest is 2 years. In recent years, Hawaii has been outstripped by Florida as the largest U.S. producer of sugarcane, but Hawaii's average

Table 1--U.S. sugar: Harvested acreage, yield per acre, and production, 1970-88

Crop year	Cane sugar <u>1/</u>			Beet sugar <u>2/</u>			Total (cane and beet) <u>1/</u>		
	Harvested area	Yield	Production	Harvested area	Yield	Production	Harvested area	Yield	Production
	1,000 acres	Short tons, raw value	1,000 s.t., raw value	1,000 acres	Short tons, raw value	1,000 s.t., raw value	1,000 acres	Short tons, raw value	1,000 s.t., raw value
1970/71	549.5	4.39	2,416	1,367.0	2.43	3,322	1,916.5	2.99	5,738
1971/72	607.1	3.71	2,436	1,325.0	2.65	3,512	1,932.1	3.08	5,948
1972/73	663.7	4.13	2,740	1,335.0	2.72	3,632	1,998.7	3.19	6,372
1973/74	702.3	3.63	2,549	1,215.0	2.65	3,216	1,917.3	3.01	5,765
1974/75	689.9	3.63	2,512	1,213.0	2.40	2,916	1,902.9	2.85	5,428
1975/76	734.7	3.99	2,934	1,517.0	2.65	4,019	2,251.7	3.09	6,953
1976/77	704.0	3.87	2,724	1,479.0	2.63	3,895	2,183.0	3.03	6,619
1977/78	719.3	3.73	2,684	1,216.0	2.56	3,108	1,935.3	2.99	5,792
1978/79	699.8	3.74	2,612	1,269.0	2.59	3,289	1,968.8	3.00	5,901
1979/80	689.7	3.91	2,700	1,120.0	2.57	2,879	1,809.7	3.08	5,579
1980/81	683.6	3.99	2,728	1,190.0	2.65	3,149	1,873.6	3.14	5,877
1981/82	715.6	3.96	2,833	1,228.1	2.76	3,388	1,943.7	3.20	6,221
1982/83	700.4	4.37	3,063	1,026.8	2.67	2,737	1,727.2	3.36	5,800
1983/84	733.4	4.00	2,930	1,055.8	2.56	2,699	1,789.2	3.15	5,629
1984/85	700.7	4.29	3,007	1,096.3	2.65	2,905	1,797.0	3.29	5,912
1985/86	722.8	4.20	3,033	1,102.5	2.72	3,000	1,825.3	3.31	6,033
1986/87	750.7	4.37	3,281	1,191.2	2.87	3,416	1,941.9	3.45	6,697
1987/88	778.3	4.28	3,333	1,252.4	3.19	3,998	2,030.7	3.61	7,331
1988/89 <u>3/</u>	793.6	4.28	3,398	1,300.7	2.70	3,512	2,094.3	3.30	6,910

1/ Excludes Puerto Rico.

2/ ASCS data prior to 1975.

3/ Preliminary.

Source: U.S. Dept. Agr., National Agricultural Statistics Service.

Table 2--U.S. mainland sugarcane: Harvested acreage, yield per acre, and production, 1970-88

Crop year	Florida			Louisiana		
	Harvested area	Yield	Production	Harvested area	Yield	Production
	1,000 acres	Short tons, raw value	1,000 s.t., raw value	1,000 acres	Short tons, raw value	1,000 s.t., raw value
1970/71	170.0	3.83	652	265.7	2.26	602
1971/72	189.9	3.34	635	301.4	1.90	571
1972/73	243.8	3.94	961	311.4	2.12	660
1973/74	257.6	3.19	824	318.9	1.75	558
1974/75	258.4	3.07	803	308.0	1.93	594
1975/76	286.6	3.70	1,061	308.0	2.08	640
1976/77	286.0	3.25	930	291.0	2.23	650
1977/78	285.0	3.14	894	304.0	2.20	668
1978/79	300.0	3.24	972	268.0	2.05	550
1979/80	318.2	3.29	1,047	240.0	2.08	500
1980/81	320.7	3.50	1,121	232.0	2.12	491
1981/82	334.4	2.88	963	247.0	2.88	712
1982/83	341.4	3.83	1,307	234.0	2.88	675
1983/84	361.1	3.39	1,223	245.0	2.46	603
1984/85	371.9	3.80	1,412	205.0	2.20	452
1985/86	383.4	3.69	1,413	226.0	2.35	532
1986/87	390.0	3.78	1,476	248.0	2.71	671
1987/88	402.0	3.77	1,517	263.0	2.78	731
1988/89 1/	404.0	3.88	1,566	279.0	2.86	797

	Texas			Mainland		
	Harvested area	Yield	Production	Harvested area	Yield	Production
	1,000 acres	Short tons, raw value	1,000 s.t., raw value	1,000 acres	Short tons, raw value	1,000 s.t., raw value
1970/71	0	0	0	435.7	2.88	1,254
1971/72	0	0	0	491.3	2.45	1,206
1972/73	0	0	0	555.2	2.92	1,621
1973/74	18.0	2.11	38	594.5	2.39	1,420
1974/75	28.0	2.64	74	594.4	2.47	1,471
1975/76	35.0	3.60	126	629.6	2.90	1,827
1976/77	27.0	3.48	94	604.0	2.77	1,674
1977/78	34.0	2.59	88	623.0	2.65	1,650
1978/79	32.0	1.88	61	600.0	2.64	1,583
1979/80	30.9	3.01	93	589.1	2.78	1,640
1980/81	33.5	2.78	93	586.2	2.91	1,705
1981/82	36.6	3.01	110	618.0	2.89	1,785
1982/83	35.7	2.75	98	611.1	3.40	2,080
1983/84	34.5	1.74	60	640.6	2.94	1,886
1984/85	34.3	2.36	81	611.2	3.18	1,945
1985/86	30.4	2.50	76	639.8	3.16	2,021
1986/87	29.1	3.13	91	667.1	3.35	2,238
1987/88	33.8	3.14	106	698.8	3.37	2,354
1988/89 1/	31.7	3.38	107	714.7	3.46	2,470

1/ Preliminary.

Source: U.S. Dept. Agr., National Agricultural Statistics Service.

Table 3--U.S. offshore sugarcane: Harvested acreage, yield per acre, and production 1970-88

Crop year	Hawaii			Puerto Rico		
	Harvested area	Yield	Production	Harvested area	Yield	Production
	1,000 acres	Short tons, raw value	1,000 s.t., raw value	1,000 acres	Short tons, raw value	1,000 s.t., raw value
1970/71	113.8	10.19	1,162	187.5	2.45	460
1971/72	115.8	7.41	1,230	157.3	2.06	324
1972/73	108.5	10.36	1,119	155.4	1.92	299
1973/74	108.2	10.45	1,129	137.6	1.85	255
1974/75	95.8	10.84	1,041	130.5	2.23	291
1975/76	105.1	10.54	1,107	127.7	2.34	299
1976/77	99.1	10.50	1,050	123.8	2.52	312
1977/78	96.8	10.66	1,034	114.8	2.33	267
1978/79	99.4	10.39	1,029	93.3	2.19	204
1979/80	100.6	10.54	1,060	86.8	2.24	194
1980/81	97.4	10.50	1,023	78.7	2.25	177
1981/82	97.6	10.74	1,048	74.6	2.05	153
1982/83	89.3	11.01	983	53.7	2.12	114
1983/84	92.8	11.25	1,044	54.9	1.82	100
1984/85	89.5	11.87	1,062	56.2	1.73	97
1985/86	83.0	12.19	1,012	55.7	1.96	109
1986/87	83.6	12.48	1,043	52.5	1.83	96
1987/88	79.5	12.31	979	50.0	1.92	96
1988/89 2/	78.9	11.76	928	56.6	1.80	102
	Total offshore			Total cane 1/		
	Harvested area	Yield	Production	Harvested area	Yield	Production
	1,000 acres	Short tons, raw value	1,000 s.t., raw value	1,000 acres	Short tons, raw value	1,000 s.t., raw value
1970/71	301.5	5.38	1,622	738.0	3.89	2,876
1971/72	323.3	4.81	1,554	760.0	3.63	2,760
1972/73	263.4	5.38	1,418	815.0	3.73	3,037
1973/74	245.6	5.64	1,384	835.0	3.35	2,794
1974/75	226.5	5.88	1,332	812.0	3.44	2,793
1975/76	232.7	6.04	1,406	867.0	3.73	3,233
1976/77	223.8	6.09	1,362	828.0	3.67	3,036
1977/78	211.8	6.14	1,301	836.0	3.53	2,952
1978/79	192.3	6.41	1,233	800.0	3.52	2,816
1979/80	187.4	6.69	1,254	773.0	3.74	2,893
1980/81	176.1	6.81	1,200	767.5	3.79	2,905
1981/82	172.2	6.97	1,201	790.5	3.78	2,986
1982/83	143.0	7.67	1,097	754.1	4.21	3,177
1983/84	147.7	7.75	1,144	788.3	3.84	3,030
1984/85	145.7	7.95	1,159	756.9	4.10	3,104
1985/86	138.7	8.08	1,121	778.5	4.04	3,142
1986/87	136.1	8.37	1,139	803.2	4.20	3,377
1987/88	129.5	8.27	1,075	828.3	4.15	3,429
1988/89 2/	135.5	7.60	1,030	850.2	4.12	3,500

1/ Includes Puerto Rico.

2/ Preliminary.

Source: U.S. Dept. Agr., National Agricultural Statistics Service.

Table 4--U.S. sugarcane: Number of mills, milling capacity, sugarcane ground, raw sugar production, and recovery, 1970-88

Crop year	Florida	Hawaii	Louisiana	Texas 1/	Total	Daily milling capacity	Net tons of cane ground for sugar	Sugar production, raw value	
								Total	Per ton of cane
	-----					-----		-----	
			Number of mills				1,000 short tons		Pounds
1970/71	9	23	43	---	75	273	23,058	2,416	210
1971/72	1	23	43	---	74	178	23,145	2,436	210
1972/73	8	21	43	---	72	282	27,239	2,740	201
1973/74	8	19	39	1	67	280	24,924	2,549	204
1974/75	8	18	37	1	64	277	24,031	2,512	209
1975/76	8	17	36	1	62	274	27,306	2,934	215
1976/77	8	16	35	1	60	282	26,919	2,724	202
1977/78	7	16	33	1	57	271	25,730	2,684	209
1978/79	7	15	28	1	51	256	24,821	2,612	210
1979/80	7	14	25	1	47	248	25,410	2,700	213
1980/81	7	14	24	1	46	260	25,582	2,728	213
1981/82	7	14	23	1	45	257	26,165	2,833	217
1982/83	7	14	21	1	43	254	28,449	3,063	215
1983/84	7	14	21	1	43	268	27,201	2,930	215
1984/85	7	14	21	1	43	268	26,008	3,007	231
1985/86	7	13	21	1	42	264	26,877	3,033	226
1986/87	7	13	21	1	42	270	28,936	3,281	227
1987/88	7	12	21	1	41	289	28,026	3,333	238
1988/89 2/	7	12	21	1	41	289	28,479	3,398	239

--- = Not applicable.

1/ Began operations in 1973.

2/ Preliminary.

Source: U.S. Dept. Agr., Economic Research Service.

yield of 96.4 net short tons of sugarcane per harvested acre in 1988/89 was over two times higher than the average yield in the other domestic sugarcane areas. Hawaii's was the highest yield in the world. The high sugarcane yields in Hawaii are due to its unique year-round growing season, ideal climate, and biennial harvest pattern.

Characteristics of Producing Units. Sugarcane growing is generally a monoculture type of farming in which only one crop is produced. About 50 percent of the sugarcane is produced from operations vertically integrated from the growing of sugarcane through processing into raw sugar. About 30 percent is produced by growers who have formed cooperatives and the remainder is produced by independent growers.

Sugarcane was grown on 1,038 U.S. farms in 1988/89, down 355 from 1983/84 (table 5). The largest absolute decline in sugarcane farms has been in Louisiana. Farm numbers are from cost of production surveys conducted in 1983/84 and 1988/89.

The average sugarcane farm size increased from 523 harvested acres in 1983/84 to 765 acres in 1988/89. The average farm size in 1988/89 ranged from 305 acres in Texas to 3,339 in Florida where several large sugarcane processors produce their own sugarcane. Florida and Hawaii have the highest concentration in

Table 5--United States: Number of sugarcane farms and average acreage harvested by area, 1983/84 and 1988/89 crop years

Area	1983/84		1988/89	
	Farms	Average area harvested per farm	Farms	Average area harvested per farm
	<u>Number</u>	<u>Acres</u>	<u>Number</u>	<u>Acres</u>
Florida	127	2,799	121	3,339
Hawaii	243	383	87	907
Louisiana	925	265	726	384
Texas	98	360	104	305
U.S. total	1,393	523	1,038	765

Source: U.S. Dept. Agr., Economic Research Service.

ownership of sugar production. For the 1987/88 crop, the three largest producers in Florida, which are also processors, accounted for about 50 percent of the sugarcane production. In Hawaii, more than 96 percent of the sugarcane acreage and production is accounted for by five companies. Alternative uses for land in sugarcane are relatively limited. In Florida, vegetables, beef cattle, rice, citrus, and sod are possible but generally poor competitors to sugarcane. Possible, but much less financially attractive crops in Hawaii are coffee, macadamia nuts, some fruits and vegetables, and flowers. Some areas can be developed for nonagricultural uses. Crops competing with sugarcane in Louisiana are soybeans in the north and cotton, rice, and kenaf. In Texas, the alternative crops are cotton, vegetables, corn, kenaf, citrus, and possibly soybeans.

### Sugarbeet Production

The sugarbeet is a cool-weather plant grown most successfully in northern latitudes. However, the plant adapts to many climatic conditions. In the United States, sugarbeets grow in the hot climate of the Imperial Valley of California as well as in the colder climates of Minnesota, Montana, and North Dakota.

Sugarbeets are grown in the United States on many soil types, but soils ranging from clay loam to the fine sandy loams are best. Beets respond to highly fertile soils better than many other crops. Sugarbeets require a well-drained, deep, and permeable seedbed of good moisture-holding capacity. The sugarbeet is a deep-rooted plant that often extends its roots to a depth of 6-8 feet. Most sugarbeet growers plant sugarbeets in a 3- to 5-year crop rotation with other crops.

Production Areas. Sugarbeets are grown in 14 States (table 6). The leading States, Minnesota, California, North Dakota, and Idaho, accounted for 68 percent of the acreage and 70 percent of the 1987/88 sugarbeet production of 28.1 million tons. Growers planted 1.27 million acres of sugarbeets for the 1987/88 crop and harvested 1.25 million acres, at an average yield of 22.4 tons of beets per harvested acre. The 1988/89 sugarbeet planted acreage

Table 6--U.S. sugarbeets: Area, yield per acre, and production, 1975/76, 1980/81, 1985/86, and 1988/89 crop years

Region and State	Area harvested				Yield				Production			
	1975	1980	1985	1988	1975	1980	1985	1988	1975	1980	1985	1988
	-----1,000 acres-----				-----Short tons-----				-----1,000 short tons-----			
<b>Far West:</b>												
Arizona	17.0	9.1	NA	NA	21.5	22.9	NA	NA	366	208	NA	NA
California	326.3	229.0	203.0	212.0	27.3	25.7	23.0	25.0	8,892	5,885	4,669	5,300
Idaho	158.3	137.9	152.0	166.0	18.6	23.9	23.0	24.5	2,942	3,296	3,496	4,084
Oregon	17.9	7.2	11.8	14.1	23.8	27.4	27.0	26.7	426	197	319	376
Washington	82.4	NA	NA	NA	26.0	NA	NA	NA	2,142	NA	NA	NA
Total	601.9	383.2	366.8	392.1	24.5	25.0	23.1	24.9	14,768	9,586	8,484	9,760
<b>Central:</b>												
Colorado	154.9	91.0	2.5	38.6	17.2	19.0	18.5	22.8	2,661	1,729	46	880
Kansas	43.0	14.5	NA	NA	15.5	13.8	NA	NA	667	200	NA	NA
Minnesota	196.0	243.0	276.0	334.0	14.2	14.9	18.4	14.2	2,783	3,621	5,088	4,743
Montana	48.5	43.3	42.7	48.9	17.1	20.3	19.0	21.1	829	879	811	1,032
Nebraska	96.0	85.0	53.2	62.2	18.5	20.9	23.1	21.2	1,776	1,777	1,229	1,319
New Mexico	.9	1.6	NA	.7	16.7	23.1	NA	12.9	15	37	NA	9
North Dakota	130.9	142.7	144.2	175.5	13.9	14.1	16.8	14.7	1,820	2,017	2,423	2,580
Texas	33.7	24.4	37.0	33.0	13.1	15.8	22.5	21.9	440	386	833	723
Utah	22.5	.7	NA	NA	15.7	21.4	NA	NA	353	15	NA	NA
Wyoming	57.7	45.3	49.4	56.0	18.4	22.6	20.9	20.3	1,060	1,024	1,032	1,137
Total	784.1	691.5	605.0	748.9	15.8	16.9	18.9	16.6	12,404	11,685	11,462	12,423
<b>Eastern:</b>												
Michigan	91.4	97.0	118.0	145.0	19.2	19.5	19.7	16.5	1,755	1,892	2,325	2,393
Ohio	39.2	17.8	12.7	14.7	19.8	19.1	20.3	15.9	777	339	258	234
Total	130.6	114.8	130.7	159.7	19.4	19.4	19.8	16.5	2,532	2,231	2,583	2,627
U.S. total	1,516.6	1,189.5	1,102.5	1,300.7	19.6	19.8	20.4	19.1	29,704	23,502	22,529	24,810

NA = Not available.

Source: U.S. Dept. Agr., Economic Research Service.

of 1.33 million acres was the highest recorded since the 1976/77 crop, but suffered from bad weather and disease.

Characteristics of Producing Units. Sugarbeets were grown on 9,893 farms in 1988/89, an increase of 118 from 1983/84 (table 7). Since 1983/84, sugarbeet production ceased in Kansas, due to the closing of a processing facility there. Sugarbeets compete with various other crops for resources in the farming operations of most sugarbeet producers. However, because of greater productivity in sugarbeet growing, more efficient processing, and the sugar support program, sugarbeet production has become relatively more profitable than other crops. Sugarbeet harvested area rose from 1.03 million acres in 1982/83 to 1.25 million in 1987/88. Harvested area in 1988/89 which was hit by drought was 1.3 million acres. The average area for sugarbeets harvested per farm increased from 108 acres in 1983/84 to 131 acres in 1988/89, ranging from 52 acres in Ohio to 214 acres in Oregon.

Typical sugarbeet producers in Ohio and Michigan are small relative to other regions as sugarbeet acreage per farm is about half the national average. In Ohio, the major competing crops are alfalfa, corn, oats, soybeans, and wheat. Dry beans, corn,

Table 7--United States: Number of sugarbeet farms and average acreage harvested, by area, 1983/84 and 1988/89 crop years

Area	1983/84		1988/89	
	Farms	Average area harvested per farm	Farms	Average area harvested per farm <sup>1/</sup>
	<u>Number</u>	<u>Acres</u>	<u>Number</u>	<u>Acres</u>
Far West:				
California	1,118	151	1,117	190
Idaho	1,402	102	1,308	127
Oregon	160	71	66	214
Washington	---	---	1	NA
Subtotal/average	2,680	121	2,492	157
Central:				
Colorado	565	66	463	83
Kansas	31	223	NA	NA
Minnesota	1,440	178	1,597	209
Montana	419	98	452	108
Nebraska	827	79	626	99
New Mexico	---	---	4	175
North Dakota	943	152	1,083	162
Texas	312	102	320	103
Wyoming	335	96	472	119
Subtotal/average	4,872	147	5,017	149
Eastern:				
Michigan	1,906	54	2,103	69
Ohio	317	39	281	52
Subtotal/average	2,223	52	2,384	67
<b>Total/average</b>	<b>9,775</b>	<b>108</b>	<b>9,893</b>	<b>131</b>

--- = Not applicable or zero.

NA = Not available.

<sup>1/</sup> Preliminary.

Source: U.S. Dept. Agr., Economic Research Service.



soybeans, and wheat compete for sugarbeet acreage in Michigan. Sugarbeet acreage is nonirrigated in both States.

Sugarbeet production in the Red River Valley is concentrated near the North Dakota-Minnesota border with some production in southern Minnesota. The far northern latitude limits the number of feasible alternative crops to such major competitors as feed grains, wheat, sunflowers, and potatoes. Almost all beets are nonirrigated.

Northern Plains States producing sugarbeets include eastern Wyoming, Nebraska, and northeastern Colorado. Elevations are high and rainfall low, so all beets must be irrigated. Major competing crops are corn, wheat, soybeans, and alfalfa. The Southern Plains sugarbeet area consists of the Texas High Plains and eastern New Mexico. Major competing crops are feed grains, wheat, alfalfa, and cotton in Texas. Sugarbeets are irrigated in this region.

Sugarbeet production in eastern Idaho occurs in the high-elevation, low-rainfall area between the Rocky Mountain and Cascade-Sierra ranges. All sugarbeet acreage in the region is irrigated. Competitive crops include hay, grain, and potatoes.

Sugarbeet production in Montana and north-central Wyoming competes with feed grains and alfalfa, reflecting the importance of cattle feeding in the region. All acreage in the region is irrigated. A diverse set of crops competes with sugarbeets in the Northwest, which includes western Idaho, eastern Oregon, and the Columbia Basin and Yakima Valley areas of Washington (although not now in sugarbeet production). Wheat, feed grains, and potatoes are the main crops in western Idaho and eastern Oregon while alfalfa, soybeans, potatoes, corn, wheat, and mint compete in Washington and northern Oregon. All beets in these areas are irrigated.

California has four distinct production regions: the north central (Sacramento Valley), the south central (San Joaquin Valley), the Coastal region, and the Imperial Valley. The climate of California is highly beneficial to crop production, and more than 30 different crops are grown on farms producing beets. The major competing crops are feed grains, wheat, cotton, alfalfa, and vegetables. About 70 percent of the sugarbeets are planted in the spring and harvested in the fall or overwintered for harvest in the spring. Another 15 percent is produced in the Imperial Valley where planting is in the fall and harvesting in the spring. In other areas, such as the lower San Joaquin Valley, planting is in the fall and harvesting in the late summer and early fall.

## **Processing Characteristics**

### **Sugarcane Processing**

Sugarcane must be processed into raw sugar before it can be refined. Processing must be done within hours after the cane is

cut because the sucrose starts breaking down, resulting in lower yields. This breakdown is accelerated when the sugarcane is burned to remove the leaves prior to harvest.

Sugarcane mills are located near the cane fields to minimize transportation costs and the loss of sucrose once the cane is cut. Many sugarcane processors grow their own sugarcane (producer/processor) and supplement their production with sugarcane purchased from independent growers. Others are either cooperatives that process members' cane or producer/processors that process only their own production.

In order to convert sugarcane into raw sugar, the juice from the sugarcane stalk is extracted, clarified, boiled, and crystallized. The raw sugar, usually 96- to 99-percent pure, is then shipped to a refinery for further processing into refined sugar.

Byproducts of sugarcane milling include blackstrap molasses and bagasse. Molasses is used mainly for cattle feed, while bagasse, the fibrous residue from milling, is used principally as fuel in the raw sugar mill. Some bagasse is also used as raw material in the manufacture of building materials and certain chemicals.

Production. U.S. production of raw cane sugar totaled 3.3 million tons, raw value, for the 1987/88 crop year, the highest ever (table 1 and fig. 1). The preliminary estimate for 1988/89 is 3.4 million tons. Sugar recovery in 1987/88 was a record 238 pounds, raw value, per net ton of sugarcane (table 4). Sugar recovery averaged 11.9 percent, ranging from 10.1 percent in Texas to 12.25 percent in Louisiana.

Characteristics of Processing Mills. Forty-one raw sugar mills owned by 39 companies processed the 1987/88 U.S. sugarcane crop. The mills ground about 28 million net tons of sugarcane. The number of mills has declined from 45 in 1980/81, but the daily grinding capacity for U.S. sugarcane processors has increased from 260,000 tons to 288,800 tons (app. table 1). Five sugarcane mills operated in Puerto Rico.

In Florida, the three largest processing companies accounted for about 75 percent of the 1.5 million tons of raw sugar produced in 1987/88. Five companies that wholly own 11 of the 12 processing facilities in Hawaii accounted for 92 percent of Hawaii's raw sugar production. The Louisiana sugarcane processing industry consists of 10 cooperative and 11 independent mills. The five largest processors (one cooperative and four independent) accounted for 33 percent of the 1987/88 crop raw sugar production in Louisiana.

Milling Capacity. The domestic sugarcane industry, operating under normal conditions and assuming average recovery rates, presently has milling capacity to produce about 3.5 million tons of raw sugar a year. If the operating season were extended where practical, output could be increased to 3.7 million tons. These estimates take into account restrictions imposed by land and climatic conditions.

Cane Sugar Refining. Cane sugar refineries buy raw sugar from both domestic and foreign sources and process it into a usable product. Refiners receive, refine, and distribute sugar throughout the year and are not restricted to any seasonal production patterns.

Most U.S. refining facilities are located at ports of entry near densely populated areas. This gives refiners easy access to offshore raw sugar (including Hawaii), from which about one-fourth of the sugar consumed is produced.

Cane sugar refining is a complex process that involves transforming raw sugar into refined sugar. Prior to refining, raw sugar crystals are surrounded by a film of molasses along with a number of impurities, all of which must be removed during the refining process. Refining consists of washing the raw sugar, melting it into syrup, filtering the syrup, and drying and packaging the sugar.

During 1988, 11 cane sugar refineries operated in the continental United States and one operated in Hawaii (app. table 2). These 12 refineries were owned and operated by eight companies. The four largest companies accounted for 78 percent of the total refining capacity. All but two of the refineries are located on or near the east and gulf coasts. In 1988, cane refiners melted 4.32 million tons of raw sugar (plus about 400,000 tons of sugar for export), or 53 percent of the sugar consumed in the U.S. sugar market.

Cane sugar refineries are the principal importers of raw sugar. In 1988, domestic refiners obtained about 32 percent of their raw sugar supplies from foreign sources. Under optimal conditions for efficient plant operations of 260 days per year, the industry could refine 5.5 million tons of raw sugar. This is substantially down from 1981 when 21 cane refining plants operated in the United States, with an annual capacity of over 8.5 million tons.

### Sugarbeet Processing

Sugarbeet processors transform sugarbeets into refined sucrose and byproducts such as molasses and beet pulp. All sugarbeet processors rely on independent growers or members of grower cooperatives for their supply of sugarbeets. Because yields are higher and diseases reduced if sugarbeets are rotated with other crops, it is economically impractical for a processor to raise its own beets. Sugarbeet processors locate their factories near large farming communities where beets can be successfully grown. The beets are grown under contract, which requires growers to deliver beets to the processor from a specified acreage. The beets are processed into refined sugar and the growers are paid a percentage share of the returns the processor receives.

After harvest, beets are prepared for processing. This usually includes receiving beets at the factory site, removing dirt and trash, storing for a short time, removing trash and cleaning for the final time, and conveying to the factory slicers.

The beet-sugar manufacturing process consists of six stages: (1) diffusion, (2) juice purification, (3) evaporation, (4) crystallization, (5) pulp drying, and (6) recovery of sugar from the molasses. After crystallization, the mass of crystals known as "massecuite" is fed into centrifuges which spin off the liquid surrounding the crystals. The crystals are then moved by conveyor to the drier or granulator to be dried and subsequently prepared for marketing as refined beet sugar.

Production. U.S. sugarbeet processors produced 4 million tons of beet sugar, raw value, from 27.6 million tons of beets sliced in 1987/88 (table 8). The output was just marginally below the record in 1975/76. The 1987/88 average recovery per ton of beets sliced was 271 pounds of refined sugar and the extraction rate was 83.54 percent. Average sucrose content was 16.89 percent.

Characteristics of Processing Factories. Thirty-six factories processed the 1987/88 sugarbeet crop. These factories were owned and operated by 12 companies, three of which were grower cooperatives (app. table 3). The four largest companies operated 24 facilities and accounted for 70 percent of the 4 million tons of beet sugar produced in 1987/88. The number of factories has declined from 43 in 1980/81, but the average daily slicing capacity per factory has risen 16.4 percent from 4,033 tons to 4,694. The sugar extraction rate (sugar recovered as percentage of sucrose in the beets) has also increased, from an average 81.4 percent in 1979/80-1981/82 to 83.4 percent in 1985/86-1987/88.

Slicing Capacity. U.S. beet sugar production is limited by the industry's capacity to slice sugarbeets. Daily slicing capacity totaled 168,700 tons for the 1988/89 sugarbeet crop (app. table 3). Based on this slicing capacity and assuming optimal conditions for efficient plant operations and average recovery rates, annual sugar output would approximate 4 million tons, raw value, or 3.7 million tons refined. Capacity of current facilities can be stretched about 10 percent, at higher operating costs.

## **Production and Processing Costs and Returns**

### Sugarcane

The cost of producing the 1987/88 sugarcane crop averaged 12.07 cents a pound of 96-degree raw sugar (degree of polarization indicates sucrose purity) (app. table 6). Production costs ranged from 10.71 cents in Louisiana to 13.21 cents in Florida. Total production costs averaged \$28.33 a net ton of sugarcane and ranged from \$22.99 in Texas to \$30.31 in Florida. The average cost was \$1,020 on a per acre basis. A net ton is gross weight less dirt, leaves, trash, debris, and other extraneous materials.

The total cost of processing the 1987/88 crop averaged 7.88 cents a pound of 96-degree raw sugar and \$18.50 a net ton of sugarcane (app. table 6). Processing costs were lowest in Florida at 6.29 cents a pound and highest in Hawaii at 10.59 cents.

Table 8--U.S. sugarbeets: Number of factories, slicing capacity, beets received, beets sliced, production, and sugar extracted, 1950/51, 1955/56, 1960/61, 1965/66, and 1970/71-88/89

Crop year	Factories <sup>1/</sup>	Daily slicing capacity		Beets received	Beets sliced		Production				Extraction rate <sup>3/</sup>
		Total	Average per factory <sup>2/</sup>		Total	Average per factory <sup>2/</sup>	Refined sugar		Sugar, raw value		
							Total	Per ton of beets sliced	Total	Per ton of beets sliced	
	Number	1,000 short tons		-----1,000 short tons-----		Pounds	1,000 s.tons	Pounds	Percent		
1950/51	72	138	1,944	13,582	13,306	187	1,883	283	2,015	303	89.33
1955/56	64	134	2,127	12,237	12,061	191	1,617	268	1,730	287	87.70
1960/61	62	143	2,344	16,617	16,657	273	2,313	278	2,475	297	88.25
1965/66	61	172	2,867	20,470	20,583	343	2,632	256	2,816	274	85.05
1970/71	58	193	3,386	25,320	25,392	445	3,105	245	3,322	262	82.44
1971/72	55	187	3,463	26,865	26,677	494	3,282	246	3,512	263	82.11
1972/73	54	185	3,491	28,463	28,176	532	3,395	241	3,632	258	81.64
1973/74	53	183	3,519	24,569	24,514	471	3,005	245	3,216	262	81.50
1974/75	55	202	3,741	22,123	22,197	411	2,725	246	2,916	263	78.95
1975/76	56	208	3,782	29,704	29,616	538	3,756	254	4,019	272	81.88
1976/77	56	215	3,909	29,386	28,889	525	3,640	252	3,895	270	82.68
1977/78	51	203	3,980	25,007	24,120	473	2,905	241	3,108	258	80.17
1978/79	49	200	4,082	25,788	24,929	509	3,074	247	3,289	264	80.04
1979/80	43	173	4,023	21,996	21,572	502	2,691	249	2,879	267	80.74
1980/81	43	173	4,023	23,502	23,328	543	2,943	252	3,149	270	82.41
1981/82	43	173	4,023	27,538	26,528	617	3,166	239	3,388	255	81.02
1982/83	38	155	4,079	20,894	20,539	541	2,558	249	2,737	267	81.91
1983/84	41	166	4,049	20,992	20,548	501	2,522	245	2,699	263	82.21
1984/85	41	166	4,049	22,134	21,606	527	2,715	251	2,905	269	82.21
1985/86	34	139	4,088	22,693	21,960	646	2,804	255	3,000	273	83.18
1986/87	36	166	4,611	25,097	24,657	685	3,193	259	3,416	277	83.33
1987/88	36	169	4,694	28,049	27,601	767	3,736	271	3,998	290	83.54
1988/89 <sup>4/</sup>	36	169	4,694	24,716	24,213	673	3,282	271	3,512	290	82.65

<sup>1/</sup> Data for 1950-76 include one factory that produced sugar from molasses, but not directly from sugarbeets.

<sup>2/</sup> Calculations for 1950-76 exclude molasses plant.

<sup>3/</sup> Sugar recovered as percentage of sugar in beets.

<sup>4/</sup> Preliminary data.

Source: U.S. Dept. Agr., Economic Research Service; prior to 1975, Agricultural Stabilization and Conservation Service.

Combining the production and processing costs provides the cost of producing raw sugar, 96-degree basis, in the United States. For the 1987/88 crop, the combined cost (net of byproduct credits of 1.07 cents) was 18.88 cents a pound.

Preliminary average production costs for the 1988/89 crop averaged \$1,046 a harvested acre and ranged from \$602 in Louisiana to \$2,822 in Hawaii.

Prices paid for sugarcane are based on the returns that processors receive from the sale of raw sugar and molasses. The grower generally receives about 60 percent and the processor 40 percent of the total income received from the sale of raw sugar. In addition, the grower receives a share of the value of the molasses in the sugarcane.

Prices paid for sugarcane generally relate directly to the domestic price of raw sugar. Independent growers are paid for their share of the sugar in the cane, based upon the season's average price a processor receives for raw sugar. To this value is added the grower's share of molasses. Grower returns for the 1987/88 crop averaged \$29.30 a net ton of sugarcane and ranged from \$27.20 in Hawaii to \$30.90 in Florida (app. table 4).

The market value per acre and the gross value of production for sugarcane are shown in appendix table 8 for the 1970/71-1987/88 crop years. In 1987/88, sugarcane growers received an estimated \$1,055 per acre for their sugarcane or \$35 an acre more than the total cost of production.

### Sugarbeets

The total cost of producing 1987/88 crop sugarbeets averaged \$27.82 a net ton (10.44 cents a pound refined sugar) and \$623 a planted acre (app. table 7). Production costs per net ton of sugarbeets were lowest in Michigan-Ohio at \$21.19 and highest in Texas-New Mexico at \$34.05.

The cost of processing 1987/88 crop sugarbeets, before byproduct credits, averaged 10.6 cents a pound of refined beet sugar and \$28.24 a net ton of sugarbeets. Primarily due to the higher sugar recovery rates, processing costs were lower in the West (eastern part of North Dakota and all other areas west of the Mississippi River).

Combining production and processing costs provides the cost of producing refined beet sugar in the United States. For the 1987/88 crop, the total cost (net of byproduct credits totaling 2.87 cents per pound) was 18.18 cents a pound.

Sugarbeets are grown by farmers under contract to sugarbeet processors. The contracts generally call for growers to deliver beets to processors from a given acreage and for processors to pay the growers a percentage of the returns processors receive from the sale of the refined sugar. With the exception of growers in Michigan and Ohio and cooperative growers in the Red

River Valley of Minnesota and North Dakota, growers do not generally share in processor returns from sales of dried beet pulp and molasses, the two principal byproducts of sugarbeet processing.

For the 1987/88 crop, sugarbeet farmers received an average of \$38.20 a net ton of sugarbeets, ranging from \$35.70 in the Far West to \$40.60 in the East (app. table 5). Estimated per acre receipts were \$857. The market value of the sugarbeets sold exceeded the estimated average production cost by about \$234 an acre.

Preliminary 1988/89 crop data show total production costs averaged \$735 a planted acre and ranged from \$557 in Minnesota and eastern North Dakota to \$1,097 in western Idaho and Oregon.

Based on an analysis by Landell Mills Commodities Studies of costs of production of world sugar and high fructose corn syrup (HFCS) for the 8-year period 1979/80-1986/87, the United States ranked 33rd of 61 regions in raw cane sugar, 7th of 31 regions in beet sugar, and was the lowest cost producer of HFCS in 12 major producing countries.

### **Structural Changes in the U.S. Sugar Market**

The structure of the U.S. market for sugar changed significantly in the 1980's in both supply and demand. Production of sugar and caloric sweeteners increased under the protection of the sugar program. A new technology to produce high fructose corn syrup (HFCS) simultaneously caused a reduction in and changed the composition of sugar demand.

#### **Production Trends**

U.S. sugar production reached a record 7.331 million tons, raw value, in crop year 1987/88, up 24 percent from the 1979/80-1981/82 average (table 1). Cultivated area and yield increased for both beet and cane crops. After a near-record beet sugar output of 4 million tons, raw value, in 1987/88, drought and disease struck the 1988/89 crop, and output did not fully recover in 1989/90. Cane sugar output reached a record 3.4 million tons in 1988/89 but may be down slightly in 1989/90. Florida and Louisiana output levels have advanced 50 percent and 40 percent from their 1979/80-1981/82 averages, while Hawaii has dropped about 10 percent. Florida now supplies about 45 percent of domestic cane sugar output and Hawaii about 25 percent, compared with equal shares of 38 percent a decade ago. Louisiana's output is up, and its share has risen to 25 percent of the total, from 21 percent.

The rise in U.S. sugar output in the 1980's reflects both higher productivity achieved by the industry and assurance of relatively high prices through the support program in the 1981 and 1985 farm acts (table 9). Sugar price support was provided through a purchase agreement price of 16.75 cents a pound, raw sugar, for

Table 9--U.S. and world raw sugar prices, 1960-89

Calendar year	United States <sup>1/</sup>		World <sup>2/</sup>		GNP deflator 1982 = 100
	Nominal	Real <sup>3/</sup>	Nominal	Real <sup>3/</sup>	
	-----Cents per pound-----				Index
1960	6.30	20.39	3.14	10.16	30.9
1961	6.30	20.19	2.91	9.33	31.2
1962	6.45	20.22	2.98	9.34	31.9
1963	8.18	25.25	8.50	26.23	32.4
1964	6.90	20.97	5.87	17.84	32.9
1965	6.75	19.97	2.12	6.27	33.8
1966	6.99	19.97	1.86	5.31	35.0
1967	7.28	20.28	1.99	5.54	35.9
1968	7.52	19.95	1.98	5.25	37.7
1969	7.75	19.47	3.37	8.47	39.8
1970	8.07	18.18	3.75	8.93	42.0
1971	8.52	18.32	4.52	10.18	44.4
1972	9.09	18.36	7.43	15.98	46.5
1973	10.29	19.06	9.61	19.41	49.5
1974	29.50	49.75	29.99	55.54	54.0
1975	22.47	35.61	20.49	34.55	59.3
1976	13.31	19.78	11.98	18.99	63.1
1977	11.00	15.24	8.11	12.05	67.3
1978	13.93	17.72	7.81	10.82	72.2
1979	15.56	18.16	9.66	12.29	78.6
1980	30.11	35.13	29.02	33.86	85.7
1981	19.73	20.99	16.93	18.01	94.0
1982	19.92	19.92	8.42	8.42	100.0
1983	22.04	21.21	8.49	8.17	103.9
1984	21.74	20.19	5.18	4.81	107.7
1985	20.34	18.34	4.04	3.64	110.9
1986	20.95	18.39	6.05	5.31	113.9
1987	21.82	18.59	6.71	5.72	117.4
1988	22.12	18.24	10.18	8.39	121.3
1989 <sup>4/</sup>	22.67	17.92	14.03	11.09	126.5

<sup>1/</sup> C.i.f., duty/fee-paid. Contract No. 14. since January 1986.

<sup>2/</sup> F.o.b. Caribbean, Contract No. 11.

<sup>3/</sup> Deflated with gross national product deflator (1982=100).

<sup>4/</sup> January-September.

Source: Coffee, Sugar & Cocoa Exchange, Inc.

part of the 1981/82 crop, and then through loan rates increasing from 17 cents a pound for the 1982/83 crop to 18 cents for the 1989/90 crop.

Market prices for raw cane sugar ranged from 18.84 cents a pound in fiscal 1981/82 to 22.49 cents in 1988/89 (c.i.f., duty/fee-paid, Contract No. 14). At the same time, costs of production were declining so that net cash returns for sugar crops improved in relation to alternative crops (including Government deficiency and diversion payments for corn, cotton, rice, and wheat). Despite somewhat lower prices in real (inflation-adjusted) terms for domestic raw sugar in the last half of the 1980's, most of the production gains in the past decade occurred after 1984. If the 1985 U.S. sugar program were continued, production would likely rise further, although some incremental expansion of sugarbeet processing capacity might be needed.



## Price Trends

Price support programs for the U.S. sugar industry have historically been mandated to protect domestic sugar producers from unstable world sugar prices which tend to be low for long periods of time. U.S. sugar prices were administratively determined by the Government through comprehensive regulation of domestic sugar production and imports for 40 years until 1974. Prices were allowed to reflect world levels in 1975-76 and 1980-81 when prices were high enough not to threaten the domestic industry (tables 9 and 16). But for most years, given low world prices, sugar support programs were implemented. U.S. sugar prices averaged 21.28 cents a pound between 1982 and 1988 compared with the world price average of 7.01 cents. Annual average prices in the U.S. market ranged between 19.92 cents and 22.12 cents a pound compared with a world price range of 4.04 to 10.18 cents a pound. The U.S.-world price differential narrowed to about 9 cents in September 1989 as the world market strengthened. Without a U.S. sugar program, the U.S. price would move in tandem with the world price but about 1.5 cents higher because of shipping and handling charges between the Caribbean (world market) and U.S. ports.

## Consumption Trends<sup>1</sup>

Deliveries of refined sugar for U.S. consumption peaked in 1977 at 10.4 million tons (11.1 million tons, raw value). Thereafter, consumption steadily declined for a decade as HFCS displaced sugar (table 10). As losses to HFCS slowed, population and income growth were able to lift aggregate consumption up again, to 7.5 million tons in 1987 from the low of 7.2 million in 1986. Consumption in 1989 is estimated at 7.6 million tons, and is expected to continue to rise slowly. Per capita consumption reached a record 102.3 pounds in 1972, then declined to 60.8 pounds in 1986. After an increase in 1987, per capita consumption has again started to decline slowly (app. table 11 and fig. 2).

Between 1977 and 1989, HFCS consumption grew from 1 million tons, dry basis, to an estimated 6 million. Mostly because of sugar's loss to HFCS, the distribution of sugar among its various uses in the United States changed greatly (app. table 13). Sugar use in beverages fell nearly 90 percent, from 2 million tons in 1975 to about 237,000 tons in 1988. Use in canned, bottled, and frozen foods fell more than 43 percent to 354,000 tons. Beverages now constitute only 3 percent of U.S. sugar consumption, down from 22 percent in 1975. Industrial uses of sugar have declined by 1.4 million tons, and now account for 56.5 percent compared with 61.8 percent in 1975. Retail sales of sugar have declined from 1.2

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<sup>1</sup> "Consumption" data are U.S. sugar deliveries and do not deduct waste and losses in transportation and packaging. Some deliveries, such as for pharmaceuticals, tobacco products, and feedstock for yeast, are not designated for human consumption and are excluded from these data.

Table 10--U.S. domestic deliveries of cane sugar, beet sugar, and HFCS, 1975-89 1/

Calendar year	Total sugar and HFCS deliveries							Share of total sugar and HFCS deliveries		
	Beet sugar	Cane sugar			Total sugar	HFCS	Total sugar and HFCS	Beet sugar	Cane sugar	HFCS
		Domestic	Imported	Total						
	-----1,000 short tons, refined dry basis-----							-----Percent-----		
1975	3,250	2,659	3,719	6,378	9,628	525	10,153	32	63	5
1976	3,489	2,441	4,251	6,692	10,181	750	10,931	32	61	7
1977	3,281	2,522	4,570	7,092	10,373	1,000	11,373	29	62	9
1978	3,050	2,546	4,581	7,127	10,177	1,250	11,427	27	62	11
1979	2,982	2,375	4,695	7,070	10,052	1,625	11,677	25	61	14
1980	3,064	2,170	4,289	6,459	9,523	2,050	11,573	26	56	18
1981	2,946	2,472	3,713	6,185	9,131	2,550	11,681	25	53	22
1982	2,941	2,731	2,882	5,613	8,554	3,100	11,654	25	48	27
1983	2,712	2,920	2,603	5,523	8,235	3,650	11,885	23	46	31
1984	2,548	2,511	2,818	5,329	7,877	4,425	12,302	21	43	36
1985	2,860	2,403	2,211	4,614	7,474	5,275	12,749	23	36	41
1986	2,911	2,690	1,605	4,295	7,206	5,550	12,756	23	34	43
1987	3,415	3,157	939	4,096	7,511	5,740	13,251	26	31	43
1988	3,581	3,031	919	3,950	7,531	5,914	13,445	27	29	44
1989 3/	3,364	3,154	1,071	4,225	7,589	5,936	13,525	25	31	44

Note: To convert refined sugar to raw value, multiply by 1.07.

1/ Deliveries for domestic food and beverage use. Includes Hawaii.

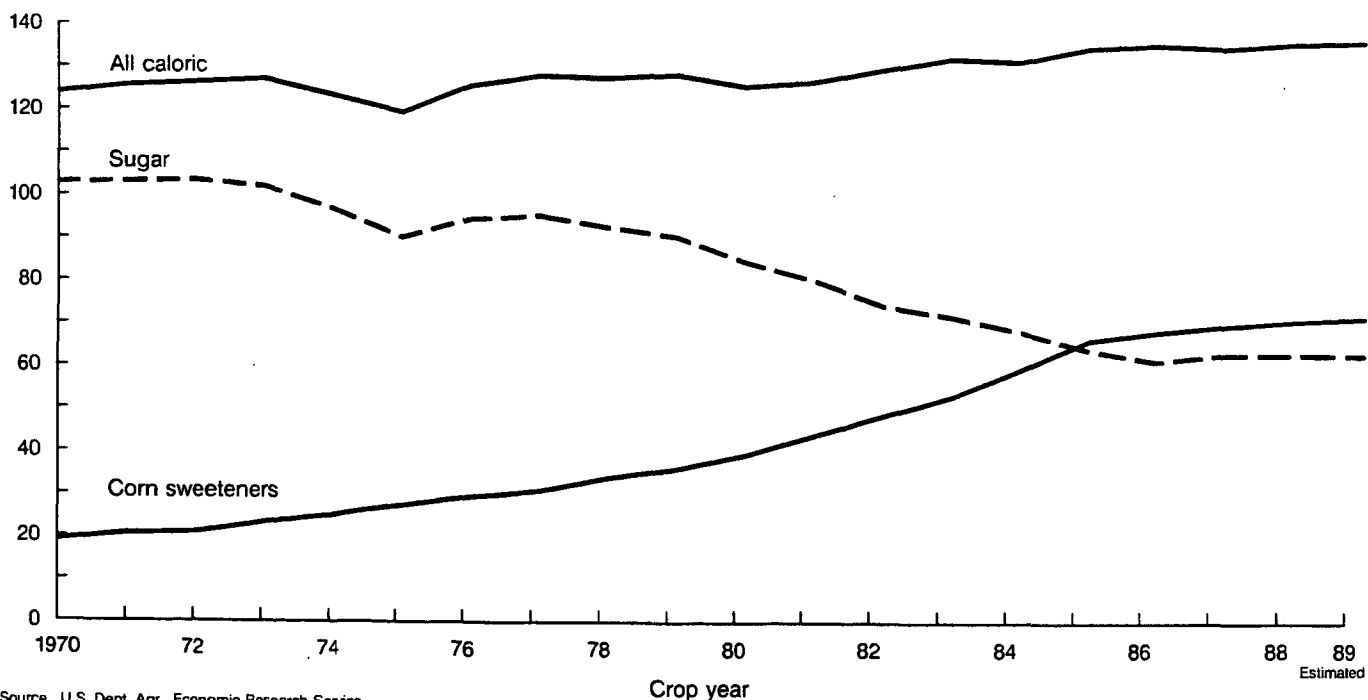
2/ Includes negligible quantities of imported beet sugar.

3/ Forecast.

Source: U.S. Dept. Agr., Economic Research Service.

Figure 2  
U.S. per capita consumption of sugar and sweeteners

Pounds, dry weight



Source: U.S. Dept. Agr., Economic Research Service.

million tons to 941,000 tons, reflecting the decline in home preparation.

### **Export Trends**

The United States has customarily been a large net importer of sugar, but small amounts of sugar have been imported, refined, and re-exported over the years (tables 11 and 12). Through the 1970's, exports were less than 100,000 tons, raw value, except in 1975 and 1979. In the 1980's, larger quantities were exported, 689,000 tons in 1980 and a record 1.191 million tons in 1981, as refiners made use of the drawback provision available to U.S. refiners (in Section 313(a) of the Tariff Act of 1930). Under that provision, a manufacturer who imports merchandise and then exports products made from this merchandise is eligible to receive a refund on the duties and fees paid on the imports, less 1 percent. In addition, if both imported and domestic materials of the same kind and quality are used within a specified period to produce a product, some of which is exported, a drawback equal to 99 percent of the duties and fees paid on the imported material is payable on the exports. The use of drawback is particularly advantageous when current duties and fees are lower than those in effect during a recent time period. Duties and fees on 96-degree raw sugar rose to as high as 6.88 cents a pound before the system of tariffs to protect the program was replaced by quotas in 1982. Since April 1985, the duty has been at the statutory minimum of 0.625 cent a pound and the fee zero (1 cent for refined sugar). Exports averaged 486,000 tons during 1983-88. These exports reflect the "import for re-export" program in 1983 (see below) and continuing shipments of refined sugar to Puerto Rico.

### **Import Trends**

Imports rose to an all-time record of 6.2 million tons, raw value, in 1977. Since May 1982 when U.S. restrictive quotas were imposed, an import quota on sugar for domestic consumption has been established annually on the basis of the balance between overall supply and demand, to achieve U.S. price support objectives and with "due consideration" to materially affected contracting parties to the GATT. Rising domestic sugar production and declining demand in the 1980's have reduced annual imports from slightly less than the average of 4.2 million tons in 1979-81 to a quota of about 1 million tons in 1988 (fig. 3). The imports under quota represented about 12 percent of U.S. sugar consumption compared with the typical 40-50 percent before the 1980's. Even more telling is that sugar imports accounted for only 7 percent of the combined consumption of sugar and HFCS in 1988 (tables 10 and 11).

Total imports include sugar for re-export under a program initiated in 1983 which stipulates that re-exports of refined sugar must be made within 3 months after entry of the raw sugar or within 2 years if the re-export is in the form of sugar in products.

Table 11--U.S. cane and beet sugar supply and use, calendar years 1981-90

Description	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 forecast
	<u>1,000 short tons, raw value</u>									
Beginning stocks <sup>1/</sup>	3,082	3,461	3,068	2,570	3,005	3,126	3,225	3,195	3,134	2,947
Total production	6,224	5,934	5,680	5,890	5,967	6,267	7,309	7,087	6,771	7,185
Beet sugar	3,182	3,160	2,588	3,059	2,869	3,201	3,899	3,658	3,447	3,825
Cane sugar	3,042	2,774	3,092	2,831	3,098	3,066	3,410	3,429	3,324	3,360
Total offshore receipts	5,074	3,044	3,147	3,468	2,833	2,254	1,558	1,407	1,847	2,031
Quota sugar imports <sup>2/</sup>	---	1,546	2,661	3,095	2,016	1,747	998	999	1,275	1,541
Quota-exempt imports for re-export	---	---	282	453	385	522	519	403	530	450
Quota-exempt imports for polyhydric alcohol	---	---	---	8	15	30	30	30	30	30
Difference between receipts and imports <sup>3/</sup>	---	---	137	-112	381	-76	-1	-44	---	---
Total foreign <sup>4/</sup>	5,025	2,964	3,080	3,444	2,797	2,223	1,546	1,388	1,835	2,021
Puerto Rico	49	80	67	24	36	31	12	19	12	10
Total supply	14,380	12,439	11,895	11,928	11,805	11,647	12,092	11,689	11,752	12,163
Total exports	1,191	137	300	429	464	557	567	415	500	440
Quota-exempt for re-export	---	---	259	365	432	492	487	336	450	390
Puerto Rico	45	62	76	62	54	57	55	59	50	50
Other exports	1,146	75	---	2	---	8	---	20	---	---
CCC disposal for export	---	---	---	---	---	177	---	---	---	---
Statistical difference <sup>3/</sup>	---	---	-35	---	-22	---	-152	---	---	---
CCC disposal for domestic use	---	---	---	---	127	---	---	---	---	---
Refining loss adjustment	53	53	72	58	122	28	18	12	55	20
Statistical adjustment <sup>5/</sup>	-95	28	141	-18	-69	51	145	-60	---	---
Total deliveries	9,770	9,153	8,812	8,454	8,035	7,786	8,167	8,188	8,250	8,350
Transfer to sugar cont. products for export under re-export program	---	---	---	18	23	45	100	100	100	100
Transfer to polyhydric alcohol	---	---	---	8	15	30	30	30	30	30
Deliveries for domestic food and beverage use	9,770	9,153	8,812	8,428	7,997	7,711	8,037	8,058	8,120	8,220
Total use	10,919	9,371	9,325	8,923	8,679	8,422	8,897	8,555	8,805	8,810
Ending stocks <sup>1/</sup>	3,461	3,068	2,570	3,005	3,126	3,225	3,195	3,134	2,947	3,353
Privately owned	3,441	3,068	2,570	3,005	2,906	3,048	3,195	3,134	2,947	3,353
CCC	20	---	---	---	220	177	---	---	---	---
	<u>Million</u>									
Population (July 1)	230.14	232.52	234.80	237.00	239.28	241.63	243.93	246.33	248.78	250.94
	<u>Pounds, refined</u>									
Per capita sugar deliveries	79.35	73.58	70.15	66.47	62.47	59.65	61.58	61.14	61.00	61.23
	<u>Percent</u>									
Stocks-to-use ratio	31.7	32.7	27.6	33.7	36.0	38.3	35.9	36.6	33.5	38.1
	<u>Cents a pound</u>									
U.S. price (No. 14)	19.73	19.92	22.04	21.74	20.34	20.95	21.83	22.12	22.76 <sup>6/</sup>	---
World price (No. 11 spot)	16.93	8.42	8.49	5.18	4.04	6.05	6.71	10.18	12.49 <sup>6/</sup>	---

--- = Not applicable or zero.

<sup>1/</sup> Stocks in hands of primary distributors. <sup>2/</sup> The 1989 sugar import quota includes 26,144 short tons of 1988 quota sugar that entered the United States in January 1989, due to force majeure. <sup>3/</sup> Receipts compiled by National Agricultural Statistics Service differ from U.S. Customs data. National Agricultural Statistics Service exports differ from Foreign Agricultural Service. <sup>4/</sup> For 1982, total foreign includes 1,418,000 tons imported prior to the imposition of the quota on May 5, 1982. <sup>5/</sup> Calculated as a residual. Largely consists of invisible stocks change of wholesalers, retailers, and industrial users. <sup>6/</sup> Average for first 10 months.

Source: Data are from U.S. Dept. Agr., National Agricultural Statistics Service, Sugar Market Statistics and Crop Production Summary. Beginning calendar 1983, customs data for quota sugar and company data for quota-exempt sugar are shown as separate categories. Quota-exempt sugar for re-export is also shown separately.

Table 12--U.S. sugar supply and use, fiscal years 1980/81-1989/90 calendar years 1981-90

Description	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90 forecast
	<u>1,000 short tons, raw value</u>									
Beginning stocks <u>1/</u>	1,691	1,576	1,649	1,408	1,611	1,760	1,652	1,497	1,316	1,224
Total production	6,068	6,009	5,905	5,813	5,831	6,028	6,885	7,146	6,712	7,075
Beet sugar	3,234	3,318	2,692	2,837	2,915	2,988	3,653	3,822	3,396	3,725
Cane sugar	2,834	2,691	3,213	2,976	2,916	3,040	3,232	3,324	3,316	3,350
Total offshore receipts	4,967	3,614	3,106	3,496	2,871	2,428	1,779	1,291	1,973	1,986
Quota sugar imports	---	587	2,988	3,009	2,193	1,839	1,221	874	1,376	1,491
Oct.-Dec.	---	---	959	632	718	541	449	226	351	250
Jan.-Sept.	---	587	2,029	2,377	1,475	1,298	772	648	1,025	1,241
Quota-exempt for re-export	---	---	190	428	419	467	547	410	550	450
Quota-exempt for polyhydric alcohol	---	---	---	11	19	30	30	33	35	35
Difference between receipts and imports <u>2/</u>	---	---	-139	24	206	59	-31	-45	---	---
Total foreign	4,881	3,534	3,039	3,472	2,837	2,395	1,767	1,272	1,961	1,976
Puerto Rico	86	80	67	24	34	33	12	19	12	10
Total supply	12,726	11,199	10,660	10,717	10,313	10,216	10,316	9,934	10,001	10,285
Total exports	1,263	300	255	394	458	507	599	438	516	440
Quota-exempt for re-export	---	---	144	400	390	469	511	354	466	390
Puerto Rico	41	62	66	73	55	52	57	62	50	50
Other exports	1,222	238	45	---	13	---	---	22	---	---
CCC disposal for export	---	---	---	---	---	---	177	---	---	---
Statistical adjustment	---	---	---	-79	---	-14	-146	---	---	---
CCC disposal for domestic use	---	---	---	---	---	127	---	---	---	---
Refining loss adjustment	73	60	69	68	48	58	30	8	53	25
Statistical adjustment <u>3/</u>	4	-16	54	66	-50	73	144	-21	-18	---
Total deliveries	9,810	9,206	8,874	8,578	8,097	7,799	8,046	8,193	8,226	8,325
Transfer to sugar cont. products for export under re-export program	---	---	---	13	21	27	100	100	100	100
Transfer to polyhydric alcohol	---	---	---	11	19	30	30	33	35	35
Deliveries for domestic food and beverage use	9,810	9,206	8,874	8,554	8,057	7,742	7,916	8,060	8,091	8,190
Total use	11,150	9,550	9,252	9,106	8,553	8,564	8,819	8,618	8,777	8,790
Ending stocks <u>1/</u>	1,576	1,649	1,408	1,611	1,760	1,652	1,497	1,316	1,224	1,495
Privately owned	1,556	1,649	1,408	1,611	1,673	1,456	1,497	1,316	1,224	1,495
CCC	20	---	---	---	87	196	---	---	---	---
	<u>Million</u>									
Population (April 1)	229.33	231.93	234.24	236.46	238.68	241.03	243.36	245.73	248.16	250.41
	<u>Pounds, refined</u>									
Per capita sugar deliveries	79.96	74.19	70.81	67.62	63.10	60.04	60.80	61.31	60.93	60.95
	<u>Percent</u>									
Ending stocks/total use	14.1	17.3	15.2	17.7	20.6	19.3	17.0	15.3	13.9	17.0

--- = Not applicable or zero.

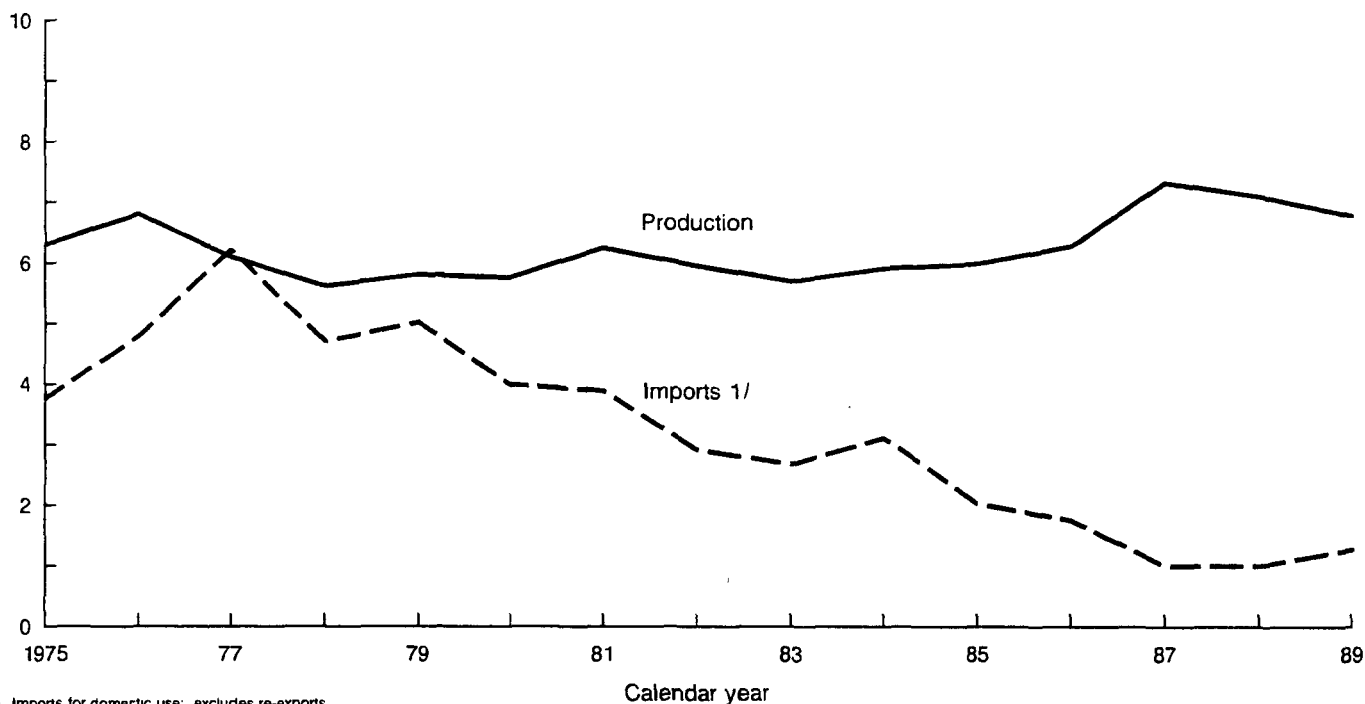
1/ Stocks in hands of primary distributors and CCC. 2/ Receipts and import data compiled by USDA's National Agricultural Statistics Service differ from U.S. Census/U.S. Customs data. 3/ Calculated as a residual.

Source: Data are from U.S. Dept. Agr., National Agricultural Statistics Service, Sugar Market Statistics. Beginning fiscal 1983, imports based on customs data for quota sugar and company data for quota-exempt sugar; exports based on census data. Forecasts are from USDA's Interagency Sugar Estimates Committee.

Figure 3

**U.S. sugar production and imports, 1975 - 89**

Million tons, raw value



1: Imports for domestic use: excludes re-exports.

Source: U.S. Dept. Agr., Economic Research Service.

Import quotas are allocated country by country based on U.S. imports during 1975-81 (the high and low import years for each country were excluded in arriving at a pro rata allocation). The 1989 quota year, extended by 9 months, applies to the period January 1988-September 30, 1989, and is equivalent to a calendar 1989 quota of 1.423 million short tons (app. table 14).

**U.S. Regional Sugar Balances**

U.S. sugar is marketed in five major geographic areas: New England, Mid-Atlantic, North Central, South, and West (including Hawaii). In the 1980's, major shifts developed in the production-use balances in these areas because of sharp drops in sugar consumption and imports. The approximately 3-million-ton loss in domestic sugar use between 1977 and 1988 affected sugar requirements differently in the five markets, largely depending on the degree that HFCS was able to displace sugar for particular uses in each area, but also as a result of regional population and income trends which favored the South and West. More important, the immense cutback in imports (which were virtually all raw cane sugar for refining) reduced supplies in New England, Mid-Atlantic, and South. In 1980-81, the Northeast (New England-Mid-Atlantic) supplied nearly all its refined sugar needs. By 1988, this was dramatically changed, as the area's deficit climbed in excess of 600,000 tons, raw value equivalent (app. table 15). The deficit has been serviced by beet sugar from the West and North Central areas.

The importance of beet sugar has increased, rising from an average 31 percent of U.S. sugar consumption in 1979-81 to about 45 percent in 1988. If it were not for the 1988 drought, beet sugar would have supplied about 50 percent of U.S. sugar use. As beet sugar output recovers and enlarges, its supply to the north-east markets and other areas could put increased pressure on refined cane sugar prices.

## **Alternative Sweeteners**

### **Corn Sweeteners**

Corn sweeteners consist of high fructose corn syrup (HFCS), glucose corn syrup, dextrose, and crystalline fructose. Consumption of corn sweeteners in 1986 reached 8.146 million tons, dry basis, surpassing sugar as the predominant sweetener in the United States (app. table 12).

Expansion of corn sweetener use is largely the result of explosive growth in the use of HFCS (app. tables 12, 16, and 17). Consumption of glucose corn syrup and dextrose was relatively stable in the 1980's.

HFCS was first introduced in 1967 but commercial use did not increase significantly until 1972 when a technological breakthrough permitted the continuous use of an enzyme to convert glucose to fructose at low cost. HFCS-55 (55-percent fructose) is as sweet as sugar and, after its commercial introduction in 1977, rapidly displaced liquid sugar in beverages. HFCS-42 (42-percent fructose), about 90 percent as sweet as sugar, is also used in beverages but mostly in baking, canning, dairy, and processed foods, and in 1988 accounted for 40 percent of total HFCS use.

The rapid rise in use of HFCS was made possible by its technical ability to substitute for sugar in a wide range of products, especially soft drinks, and by HFCS's much lower costs of production relative to sugar. The lower production cost enabled HFCS to be priced strategically below refined sugar prices. HFCS prices followed changes in sugar prices but at discounts of 10-30 percent (table 13 and fig. 4).

Production costs for HFCS, including normal returns on capital, are estimated at about 14 cents a pound, dry basis, based on 4 cents a pound net starch costs (\$2.60 a bushel of corn, which approximates the 1980-88 average). High fructose syrups are produced from starch obtained from corn, rice, wheat, cassava, and other sources. In the United States, high fructose and other starch sweeteners are almost exclusively corn-based. U.S. net starch costs tend to be relatively low because the value of corn wet milling byproducts--oil, gluten feed, and meal--increases when the price of corn rises and, consequently, byproduct values usually pay for about half of corn costs (app. table 18). In the 1980's, HFCS costs declined as enzyme costs fell, the scale of production increased, and plant capacity was more fully utilized

Table 13--HFCS prices and their discount to sugar, Midwest market, 1980-89

Calendar year/month	HFCS-42	HFCS-55	Refined beet sugar 1/	Price discount to sugar	
				HFCS-42	HFCS-55
	-----Cents per pound dry basis-----			-----Percent-----	
1980	23.64	NA	38.29	38.3	NA
1981	21.47	23.59	28.26	24.0	16.5
1982	14.30	18.81	27.62	48.2	31.9
1983	18.64	21.60	26.10	28.6	17.2
1984	19.94	22.70	25.66	22.3	11.5
1985	17.75	20.03	23.18	23.4	13.6
1986	18.07	19.96	23.42	22.8	14.8
1987	16.50	17.46	23.60	30.1	26.0
1988	16.47	18.68	25.49	35.4	26.7
1988:					
Jan.	11.06	14.25	23.25	52.4	38.7
Feb.	11.06	14.25	22.75	51.4	37.4
Mar.	11.90	14.69	22.75	47.7	35.4
Apr.	15.80	17.00	23.45	32.6	27.5
May	16.01	17.51	24.19	33.8	27.6
June	17.10	19.00	22.25	23.4	14.6
July	21.61	24.00	27.10	20.3	11.4
Aug.	21.61	24.00	27.75	22.1	13.5
Sept.	20.70	23.00	27.50	24.7	16.4
Oct.	17.10	19.00	27.25	37.2	30.3
Nov.	17.10	19.00	26.75	36.0	28.9
Dec.	16.56	18.41	27.80	40.4	33.8
1989:					
Jan.	16.20	18.00	28.75	43.7	37.4
Feb.	16.20	18.00	29.00	44.1	37.9
Mar.	17.28	19.50	29.50	41.4	33.9
Apr.	19.58	21.75	29.50	33.6	26.3
May	20.25	22.50	29.50	31.4	23.7
June	21.27	23.62	29.50	27.9	19.6
July	21.61	24.00	29.38	25.0	16.9
Aug.	22.94	25.50	29.25	21.6	12.8
Sept.	22.94	25.50	29.06	21.1	12.3

NA = Not available.

Note: HFCS is sold on a delivered basis, refined beet sugar is sold f.o.b. HFCS and refined beet sugar both Midwest market prices.

Source: Milling and Baking News, and John Crowe and Company.

through the output of other corn wet milling products such as ethanol, industrial starches, and starch-based chemicals.

HFCS consumption climbed sharply during 1979-85, with growth averaging over 600,000 tons or nearly 5 pounds per capita each year. Most of this growth was at the expense of sugar (and some displacement of dextrose and glucose corn syrup), but HFCS also generated new uses and was the primary impetus in raising overall caloric sweetener consumption from an annual 124 pounds per capita in 1975-79 to 130 pounds by 1986.

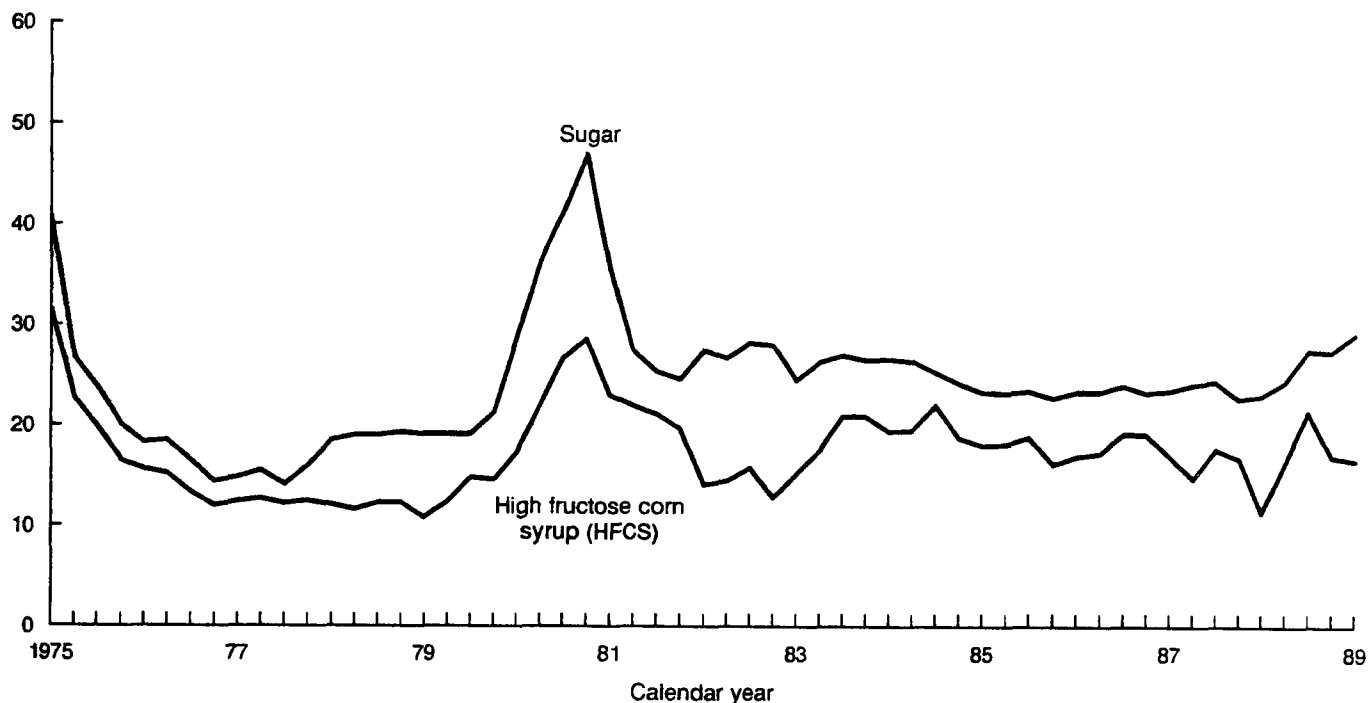
After capturing most of the market for sugar in beverages, HFCS growth slowed considerably to about 213,000 tons or 1.3 pounds per capita a year during 1985-88. In 1988, HFCS consumption (including 184,000 tons imported from Canada) totaled 5.9 million



Figure 4

**Wholesale HFCS and sugar prices, by quarter, 1975 - 89**

Cents a pound, dry weight



Source: U.S. Dept. Agr., Economic Research Service.

tons, dry basis. HFCS currently constitutes 45 percent of the combined HFCS-sugar use in the United States, a proportion here regarded as close to HFCS's ability to substitute for sugar. Primarily because HFCS is a liquid sweetener, its use in major food products continues to be constrained; however, in 1987, a crystalline fructose was introduced for industrial use in some "niche" products. Further development of a high-quality and low-cost crystalline fructose or dry HFCS could substantially expand potential market loss by sugar.

### **Low-Calorie Sweeteners**

Low-calorie sweeteners have a sweetness so highly intense that only a fraction is needed to provide the same degree of sweetness as sugar. U.S. per capita consumption of low-calorie sweeteners (mainly aspartame and saccharin) increased faster than caloric sweetener use in the 1980's. By 1988, low-calorie use was about 20 pounds per capita in sugar-sweetness-equivalent (SSE), accounting for about 13 percent of overall caloric and low-calorie sweetener consumption, compared with 6 percent in 1980 (app. table 11).

The rapid rise of low-calorie sweetener use reflects the accelerated adoption of aspartame (APM) which was introduced for U.S. commercial use in 1981. APM is 180-200 times as sweet as sucrose compared with saccharin at 300 SSE, but has a taste considered superior to saccharin. Another high-intensity, low-calorie sweetener, acesulfame-k (ace-k), entered U.S. commercial

use in 1988. Ace-k is equal to APM in sweetness but unlike APM does not lose its sweetness when heated; its taste quality, however, is said to be below sucrose or APM. Other low-calorie sweeteners are awaiting approval by the Food and Drug Administration (FDA) for use in the U.S. market. Among them are alitame, which is 2,000 times sweeter than sugar, and sucralose, 600 times sweeter than sugar. Cyclamate use was banned by the FDA in 1970 but is being reconsidered for certain restricted uses.

Although per capita consumption of both low-calorie sweeteners and caloric sweeteners increased in the 1980's, the potential exists over the next decade for a reduction in the use of sugar and corn sweeteners as low-calorie alternatives find increasing areas for substitution at competitive prices. Industrial food processors and beverage manufacturers will likely adopt a multisweetener policy: sweeteners, both caloric and low-calorie, will be combined to obtain the optimal mix in terms of price and functional factors such as sweetness, taste, texture, and stability.

Worldwide, low-calorie sweetener consumption was about 5 million tons SSE in 1980. In 1989/90, low-calorie sweetener use has been estimated at somewhat above 7.8 million metric tons SSE, compared with 7.1 million tons of HFCS and 108 million tons of centrifugal sugar. Low-calorie sweeteners account for 6.5 percent of the combined consumption of sugar, high fructose starch syrups, and low-calorie sweeteners. As costs of production and prices decline for low-calorie sweeteners, their use will become increasingly attractive to developing countries where demand for sweeteners is high but incomes low.

### **The World Sugar Market**

The world market for sugar (f.o.b. Caribbean) represents only a small part of world production. Over 70 percent of world sugar output is typically consumed in the producing countries, usually at government-regulated prices. Another part is exported under bilateral long-term agreements or preferential terms such as the U.S. sugar quota and the European Community's Lome Agreement. Only about 20 percent (at times, as low as 15 percent) of world sugar production is freely traded in international markets, largely as a residual after domestic needs and preferential sales are satisfied.

### **The Sugar Price Cycle**

Sugar prices are among the most unstable in international trade, principally because even incremental changes in the world crop or shifts in government policy tend to have disproportionate effects in a small and residual market (table 9). In periods of crop failure, governments may temporarily restrict exports to meet domestic needs, thus intensifying the upward movement in the world price. Similarly, in periods of bumper harvests when output exceeds domestic needs, supplying nations may attempt to

sell or "dump" their surpluses on the world market, exerting downward pressure on the world price.

Superimposed on the world sugar market's day-to-day price variability is a broad pattern of high prices for 1 or 2 years followed by a long period of low prices (fig. 5). In this sugar cycle, intermittent large investments in world sugar production and government intervention play key roles.

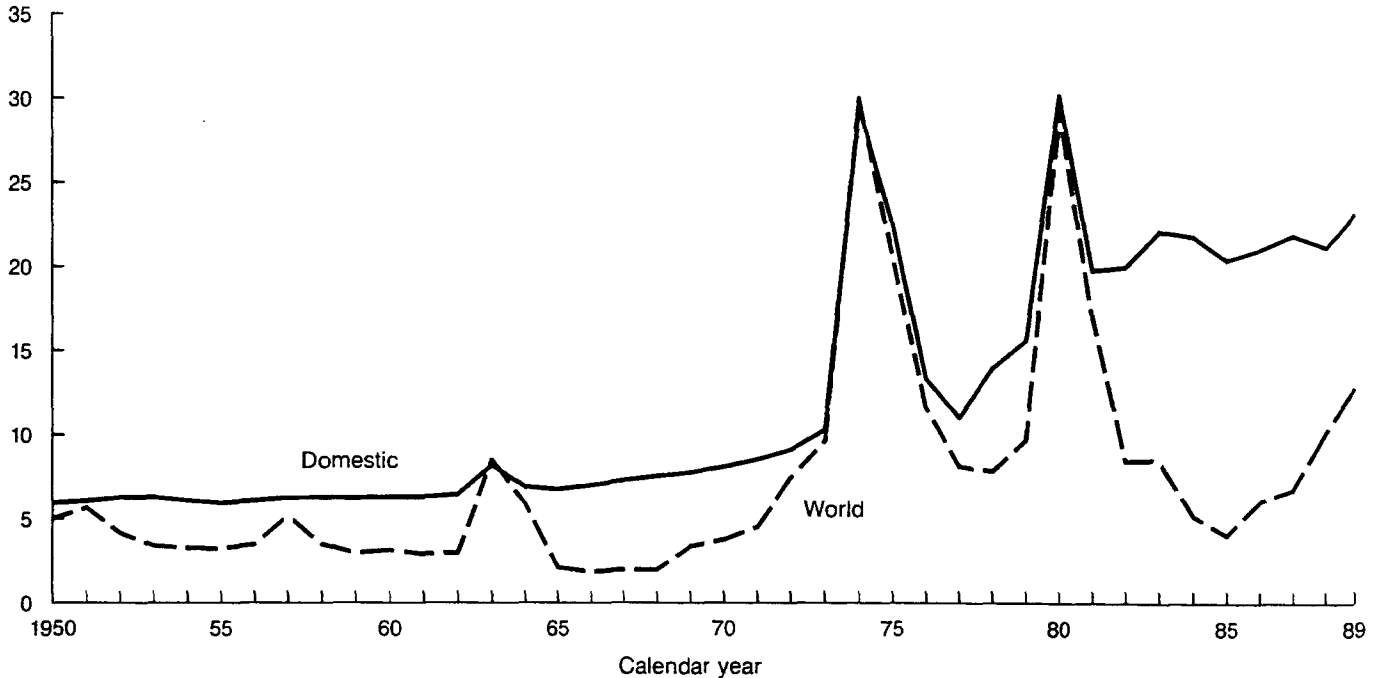
Increases in production capacity during the high-price phase of the sugar cycle take several seasons to be absorbed by relatively steady but slow consumption growth. Processing facilities are expensive to construct and require large size to capture scale economies. Consequently, once in place, there is a strong incentive for plants to be fully utilized to spread out fixed costs. Then global sugar production tends to exceed consumption, stocks are built up, and prices fall. After 5 to 10 years of low prices and slow growth in production, world sugar demand typically catches up with processing capacity. At this point, a disruption to production could trigger an explosive price rise, and a new sugar cycle begins.

The cycle shows that sugar production responds rapidly to high prices but is much less elastic downward when prices fall. Rapid production increases bring down price spikes within 2 years, but high production levels tend to persist even at depressed prices which are below the cost of production for many exporting countries. Producers are able to maintain output because (1)

Figure 5

**Raw sugar prices, 1950 - 89**

Cents a pound



Source: U.S. Dept. Agr., Economic Research Service.

previously high prices provide a reserve of funds; (2) the true price to the producer is the result of a blend between the "free" market and the higher priced domestic and preferential trade markets; and (3) governments intervene through price support and income programs.

Government involvement in the sugar market has a long history going back to the age of mercantilism and the establishment of colonial plantation economies. Almost all national governments intervene in the sugar trade, not only because sugar is a staple commodity that enters a wide array of manufactured products, but also because of its sizable investment requirements and role in generating employment and foreign exchange. However, the global impact of extensive protection has narrowed the scope of the world free market, caused world prices to be more unstable, and impeded the potential for fast adjustment of supply and demand to price signals.

Two notable examples of supported sugar prices relate to Cuba and the European Community (EC). Cuba in recent years has been selling 3-5 million tons of raw sugar each year to the Soviet Union at an estimated 30-40 cents a pound, compared with average annual world prices of 10.2 cents in 1980-88 and less than 7 cents in 1984-87. The EC has used high internal price supports for sugar consumed domestically to finance sugar exports at prices below the cost of production.

#### International Sugar Agreements

Attempts to reduce the sharp fluctuations in world sugar prices have led to several International Sugar Agreements (ISA's) between sugar producing and consuming nations. Four ISA's have been negotiated and signed since 1953. The latest ISA, signed in 1977, expired on December 31, 1984, after a 2-year extension. The 1977 ISA was ineffective, largely because of its inability to limit exports. The EC, with about 20 percent of the world "free" market in sugar, was not a member and much of the sugar trade of Cuba and other centrally planned economies was beyond ISA control. A loop-hole in the ISA rules prevented members' exports from being reduced sufficiently to have a price effect when world sugar supplies were large. Also, the amount of special stocks set aside was too low and not easily verified.

Negotiations in Geneva for a new ISA failed, and since 1985 only an "administrative ISA," without economic provisions and restricted largely to maintaining statistics, has been in effect.

#### **Trends in Prices, Production, Consumption, and Trade**

##### Price Trends

Since 1950, world sugar price "spikes" have occurred five times: during 1950-52, 1957, 1963-64, 1974-76, and 1980-81 (table 9). In between, world prices have been low. World sugar production saw two major shortfalls in 1979/80 and 1980/81 resulting from bad weather in the USSR, India, and Thailand, crop disease in

Cuba, and reduced sugarcane acreage in Brazil. Stocks fell and prices surged to an average of 41.1 cents in October 1980. Record production and stock buildup lowered price to 8.4 cents in 1982, and further to 4 cents in 1985. Since 1984/85, stocks have steadily declined and prices have gradually risen, reaching an average of 14.1 cents in September 1989.

Prices in 1989/90 have a potential to accelerate, possibly to a cyclical spike. However, changes in the structure of the world sugar market could keep the price run-up below historical peaks: (1) developing countries account for a much larger and growing percentage of global sugar consumption and, with lower incomes than developed countries, are likely to drop out of the market sooner as prices rise; (2) both starch-based and low-caloric sweeteners are now more widely accepted as sugar substitutes and low-calorie sweeteners in particular appear poised to take advantage of sugar shortfalls and high prices; (3) refined beet sugar accounts for a larger percentage of trade and its production can respond more quickly than cane sugar to a price rise; and (4) Brazil's potential to switch sugarcane for processing between sugar or alcohol fuel, while uncertain in 1989/90, can technically provide a safety valve for world sugar prices. These factors taken together have tended to stretch out the sugar cycle by moderating price run-ups and extending the period of low prices.

#### Production and Consumption Trend Lines

World price fluctuations are associated with imbalances between production and consumption. Over time, however, production and consumption tend to equal each other. Trend lines for 1974/75-1988/89 show that global production and consumption have risen about 2 million tons a year (figs. 6 and 7).

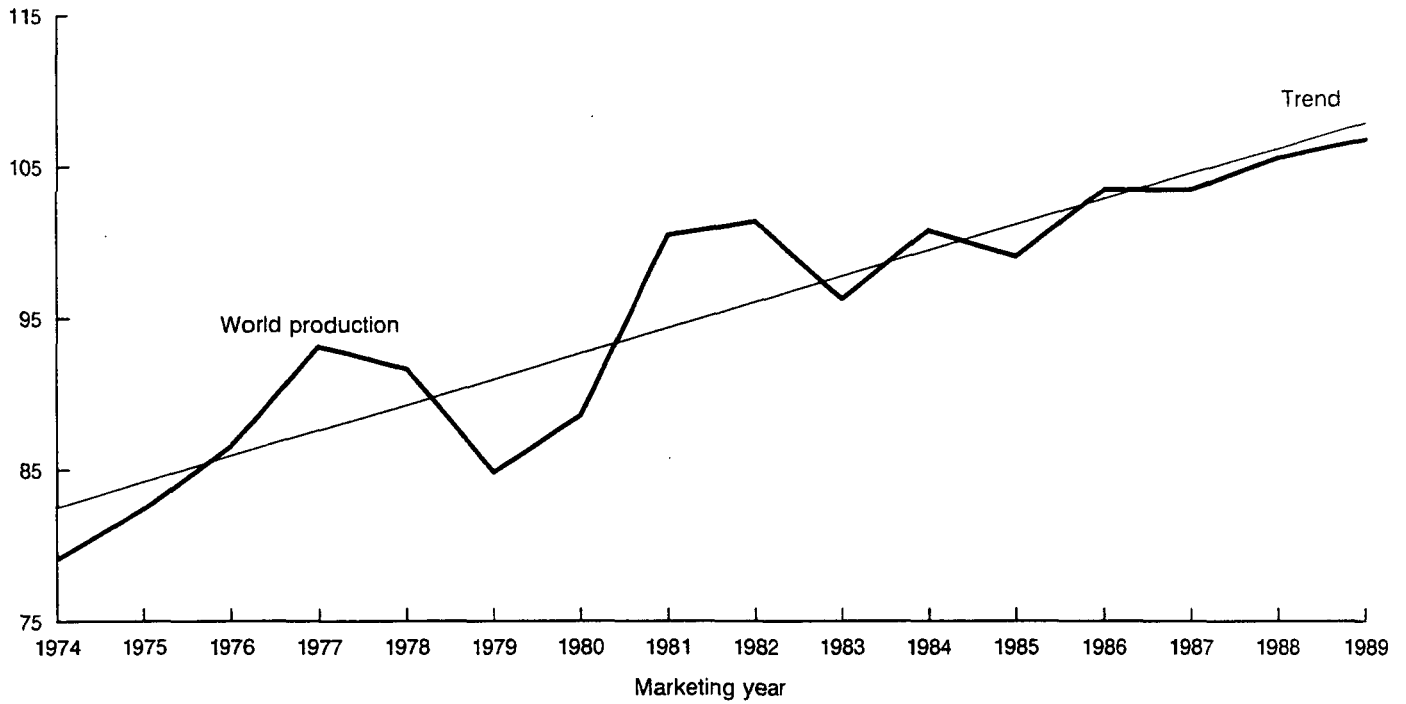
Global consumption is relatively steady year to year, reflecting the stability of the human diet. In contrast, substantial fluctuations can occur in production because of weather factors. In any year, production and consumption can also be influenced by decisions of producers, traders, consumers, and governments. For the period since 1974/75:

- The average annual change (plus or minus) in production was 4.2 million tons and 2.4 million in consumption.
- Production is about three times as variable as consumption, as measured by the standard deviation of year-to-year fluctuations from the statistical trend.
- The largest annual increase in production was 12 million tons (1981/82); the largest decrease, 6.8 million tons (1979/80).
- The largest annual increase in consumption was 5 million tons (1975/76); the largest decrease, 0.6 million tons (1980/81).

Figure 6

**World sugar production trend**

Million metric tons, raw value

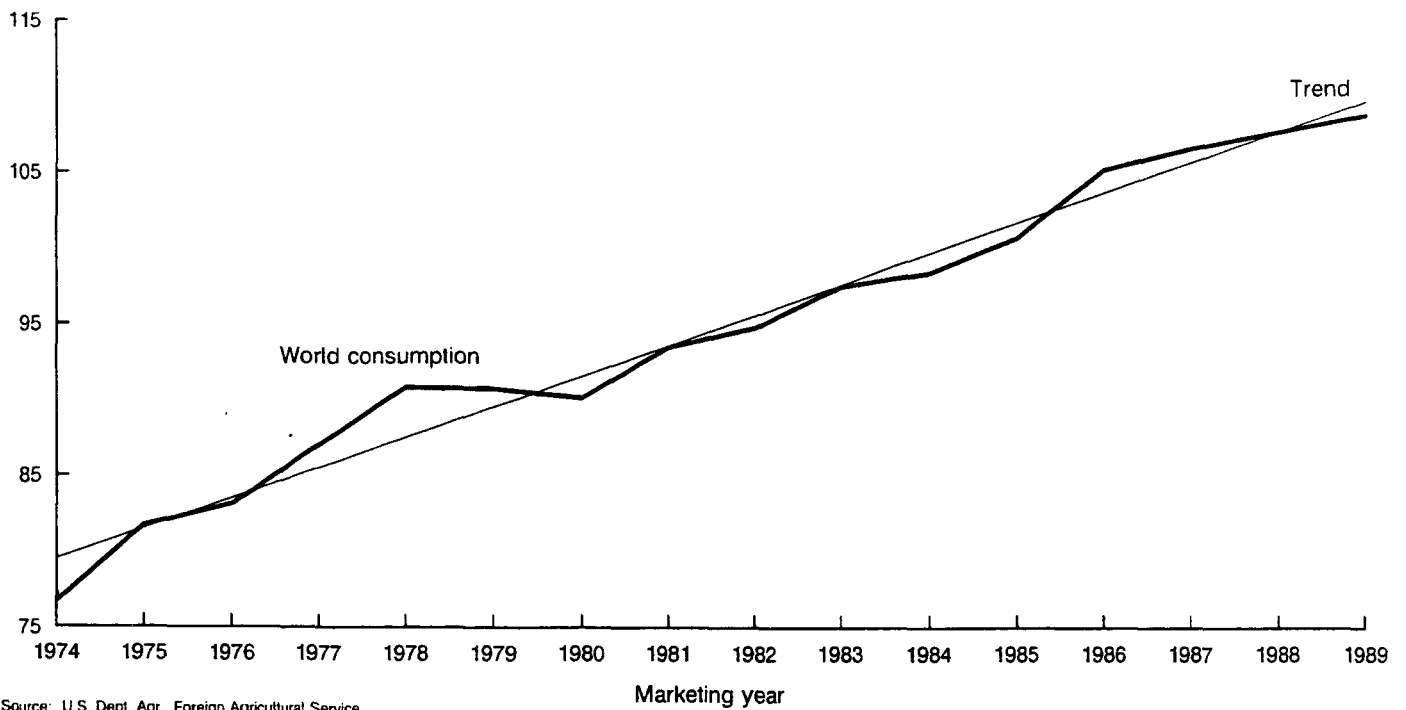


Source: U.S. Dept. Agr. Foreign Agricultural Service.

Figure 7

**World sugar consumption trend**

Million metric tons, raw value



Source: U.S. Dept. Agr., Foreign Agricultural Service

- o Declines in production occurred in 4 of the 14 years (1978/79, 1979/80, 1983/84, 1985/86) whereas declines in consumption occurred only twice (1979/80 and 1980/81).

### Production Trends

World centrifugal sugar production in 1988/89 was a record 105.5 million metric tons, an increase of nearly 20 percent in the period from 1978/79-1980/81 (table 14).<sup>2</sup> Cane sugar production rose 26 percent and beet sugar 9 percent. Cane sugar now accounts for nearly 65 percent of overall world sugar output, compared with about 61 percent in the earlier period (tables 14 and 15).

The increase in world cane sugar production in the last decade was achieved through a 35-percent expansion in harvested area; cane sugar yields per hectare actually fell by about 7 percent. In contrast, the higher beet sugar output came from improved yields and sugarbeet harvested area was down nearly 3 percent in the period (app. table 20). Higher beet sugar productivity reflects the more capital-intensive agriculture in the Northern Hemisphere where most sugarbeets are grown and the greater investment over the years in research into seed varieties and improved refining technology.

World sugar production is highly concentrated among a few producers (fig. 8). Although sugarbeets and sugarcane are among the most widely grown crops with about 110 countries cultivating either one or both sugar crops, the world's top 10 (including the EC as a group) producers in 1988/89 accounted for nearly 70 percent of the total and the EC, India, USSR, Brazil, Cuba, and the United States--the top 6 producers--produced 54 percent. The two leading beet sugar producers, the EC and the Soviet Union, produced a total of nearly 24 million tons of beet sugar, accounting for nearly two-thirds of the world's beet sugar and more than one-fifth of total world sugar production.

The leading foreign cane sugar producers are India, Brazil, Cuba, China, and Australia which together produced 35.8 million tons of cane sugar in 1988/89, representing about one-half of global cane sugar production and one-third of total world sugar output. The United States is the only country in the world which is both a leading cane sugar and beet sugar producer, ranking as the world's eighth largest cane sugar and third largest beet sugar producer.

The past decade has seen a drive toward greater self-sufficiency in sugar production by several important traditional sugar importing countries (fig. 9). Some of the countries implementing import-substitution policies in order to conserve foreign exchange have been the oil-exporting countries of Mexico, Venezuela, and Indonesia as well as the oil-importing countries

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<sup>2</sup> The marketing year varies by country but generally begins in September and ends in August of the following calendar year (app. table 31).

Table 14--World sugar production, supply, and distribution, 1980-89

Marketing year	Beginning stocks	Sugar production	Percentage change in production	Imports	Percentage change in imports	Total supply distribution	Exports	Domestic consumption	Percentage change in consumption	Ending stocks	Stocks-to-use ratio	Imports as percentage of consumption
	1,000 metric tons, raw value		Percent	1,000 m.t., raw value	Percent	---1,000 metric tons, raw value---			Percent	1,000 m.t., raw value	-----Percent-----	
1980/81	19,474	88,716	---	28,353	---	136,543	28,464	90,743	---	17,336	19.1	31.25
1981/82	17,336	100,095	11.37	30,687	7.61	148,118	31,529	92,721	2.13	23,868	25.6	33.10
1982/83	23,868	101,218	1.11	29,550	-3.85	154,636	30,991	94,210	1.58	29,435	31.2	31.37
1983/84	29,435	96,378	-5.02	28,611	-3.28	154,424	29,768	97,229	3.11	27,427	28.2	29.43
1984/85	27,427	100,544	4.14	28,189	-1.50	156,160	30,091	97,435	.21	28,634	29.4	28.93
1985/86	28,634	98,773	-1.79	28,289	.35	155,696	29,713	100,014	2.58	25,969	26.0	28.29
1986/87	25,969	103,371	4.45	27,247	-3.82	156,587	28,124	105,055	4.80	23,408	22.2	25.94
1987/88	23,408	103,447	.07	27,796	1.98	154,651	27,721	106,489	1.35	20,441	19.2	26.10
1988/89	20,441	105,469	1.92	29,903	7.05	155,813	28,280	107,617	1.05	19,947	18.5	27.79
1989/90 1/	19,947	106,747	1.20	28,894	-3.49	155,588	27,429	108,718	1.01	19,441	17.9	26.58

--- Not applicable.

Note: The world production, supply, distribution, and stock table covers all countries in the world. They are based on reports from USDA's agricultural counselors and attaches in 60 countries, and USDA analysis. The marketing year used by USDA varies by country because of differences in the timing of crop production, both beet and cane throughout the world. The most common is a September/August marketing year. The stock figures are for stocks at the beginning of the local marketing year. To assist readers in analyzing the world sugar situation, appendix table 31 presents marketing years for various countries.

1/ Forecast.

Source: U.S. Dept. Agr., Foreign Agricultural Service.



Table 15--World production of beet and cane sugar, selected years

Marketing year	Sugar production			U.S. share		
	Beet	Cane	Total	Beet	Cane	Total
	Million metric tons, raw value			-----Percent-----		
1974/75	29.24	49.88	79.12	9.1	4.6	6.2
1979/80	33.98	50.77	84.75	7.8	.7	5.9
1984/85	37.11	63.30	100.41	7.1	4.3	5.3
1988/89	37.15	68.43	105.58	8.6	4.5	5.9
1989/90 <sup>1/</sup>	37.90	67.81	105.71	8.8	4.5	6.1

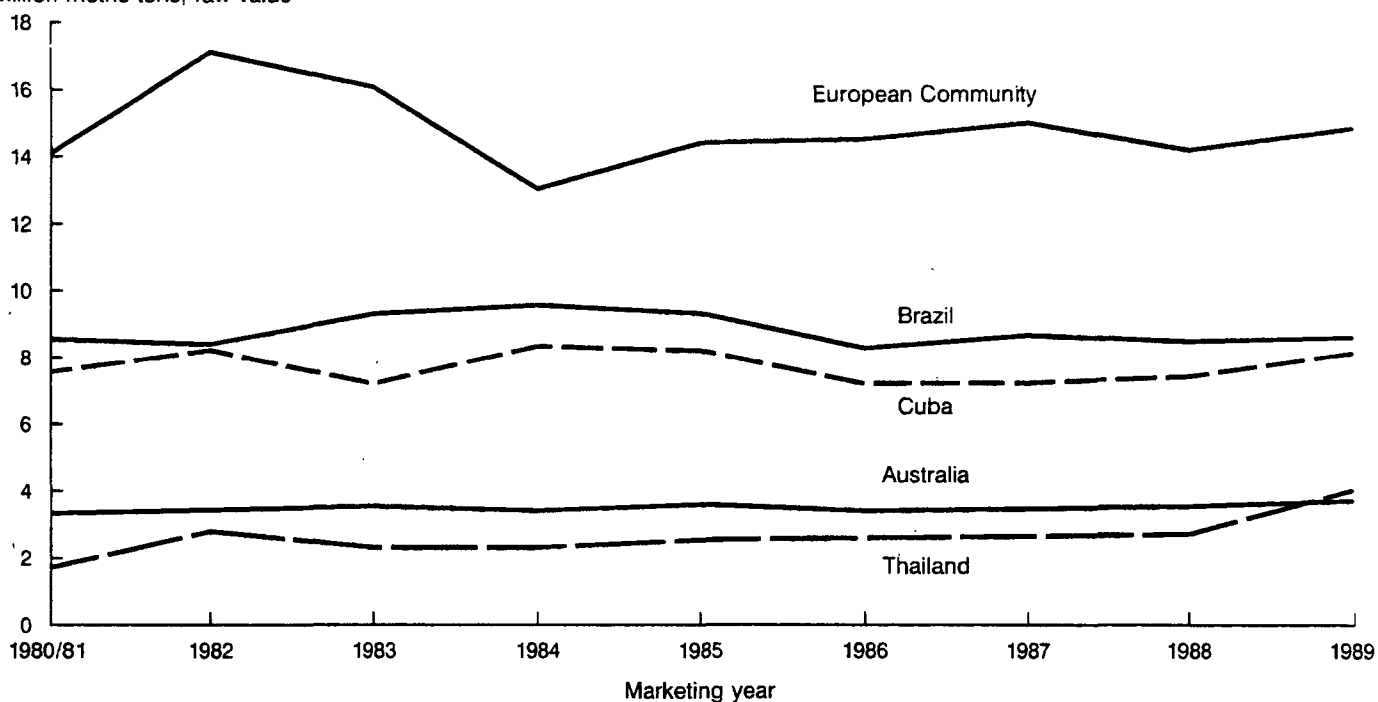
<sup>1/</sup> Forecast.

Source: U.S. Dept. Agr., Foreign Agricultural Service.

Figure 8

**Sugar production of major exporters**

Million metric tons, raw value



Source: U.S. Dept. Agr., Foreign Agricultural Service

of the Sudan and Chile. Production of sugar in these five countries is forecast at 7.1 million tons in 1989/90, a 54-percent increase from 1980/81.

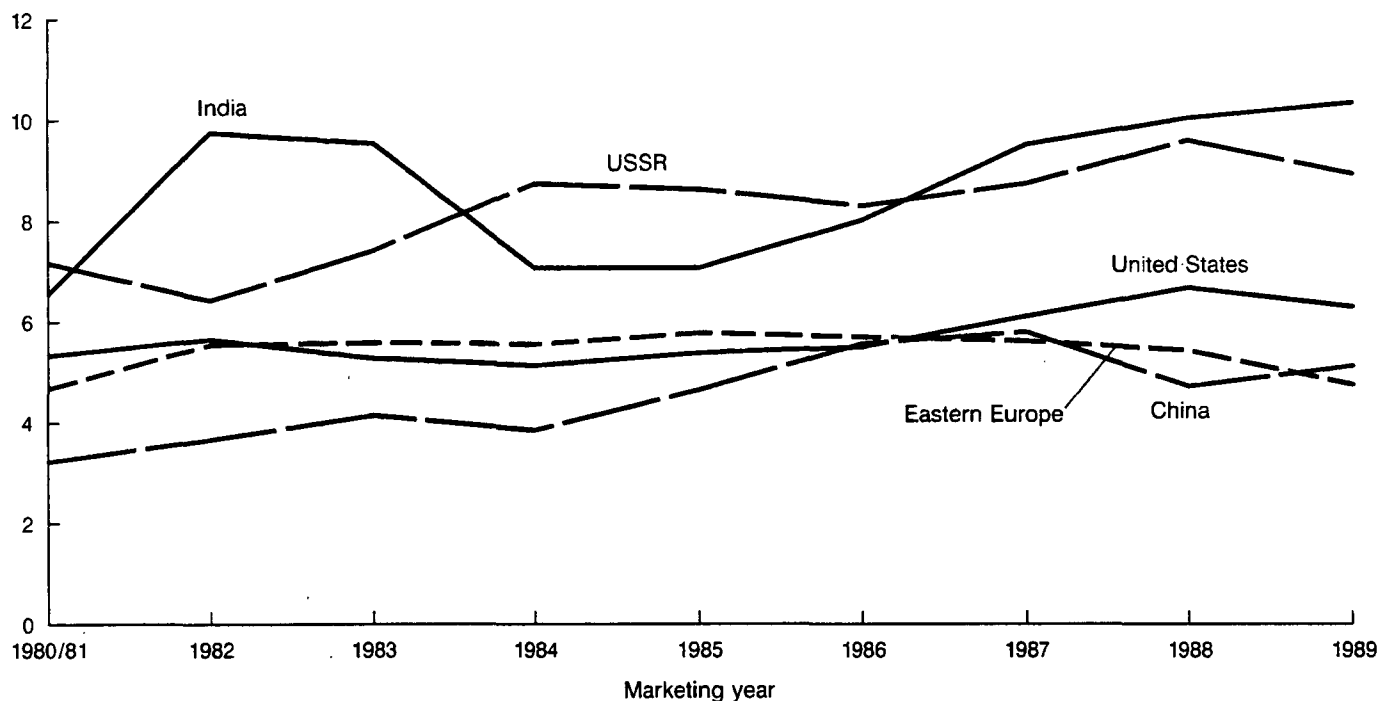
Consumption Trends

World sugar consumption grew at a fairly steady pace of about 2 percent a year over the past decade, to an estimated 108 million in 1988/89. Much growth took place in developing countries in Latin America, Africa, and especially Asia, reflecting the improved availability of domestically produced sugar in many countries and demand associated with rapidly expanding populations. Consumption in Asia rose about 2 pounds per capita in the 1979-87 period, but sugar consumption per capita across a

Figure 9

**Sugar production of major importers**

Million metric tons, raw value



Source: U.S. Dept. Agr., Foreign Agricultural Service

wide range of developing countries, including Asia, remains well below saturation levels. Even leading consuming countries such as China, India, and Indonesia have per capita sugar consumption under 15 kilograms. In many of the countries of sub-Saharan Africa, consumption remains well under 10 kilograms, compared with the 35- to 40-plus kilogram levels in Western Europe (app. table 21).

In the developed economies of Western Europe, North America, and Japan, sugar consumption, already at near-saturation on a per capita basis in the late 1970's, either stagnated or declined during the 1980's because of low population growth and the sharp expansion in availability of competitively priced substitutes, primarily HFCS.

In the EC, sugar consumption remained relatively stable at 12 million tons over the last decade with per capita levels between 38 and 40 kilograms. Alternative sweeteners such as HFCS have limited effect, owing to production controls.

In Eastern Europe and the Soviet Union, in contrast to the market economies of Western Europe, sugar consumption has trended upward over the last decade, pushing per capita use to the highest in the world. In the Soviet Union, the world's largest sugar-consuming country, use went from 46 to 48 kilograms per capita. Combined with a population increase of 25 million over the last decade and lack of alternative sweeteners, the high per capita use is expected to raise consumption to 14.1 million tons in 1989/90.

Government pricing policies are also an important factor influencing consumption trends. Many governments insulate domestic markets from world prices and follow either a cheap or expensive retail sugar policy depending on policy goals (app. table 23). Thailand, for example, in an attempt to keep farm prices of cane at an attractive level, has kept the domestic wholesale and retail prices of sugar relatively unchanged since 1980, despite low world prices. The policy has dampened domestic demand growth, but spurred increases in production and exports. In contrast, Brazil in early 1986 froze prices of sugar but not wages, so that real prices of sugar by mid-year had declined 40 percent; as a result, consumption of sugar surged 17 percent during 1986/87.

### Trends in World Sugar Trade

World sugar trade has been relatively stable in volume over the last decade, averaging 27 million tons of raw and refined sugar traded each year (app. table 24). Refined sugar annual imports, after doubling in volume from the mid-1970's to the late 1970's, have been relatively stable at around 10 million tons, accounting for about one-third of global trade. Raw sugar imports have displayed greater volatility during the decade, ranging from a high of 18.8 million tons in 1982 to a low of 16.2 million in 1986. These changes reflect the fact that most sugar consumption growth is coming from domestically produced sugar and so global imports in percentage terms have actually declined from 31.6 percent of total consumption in 1979/80 to 27 percent in 1988/89.

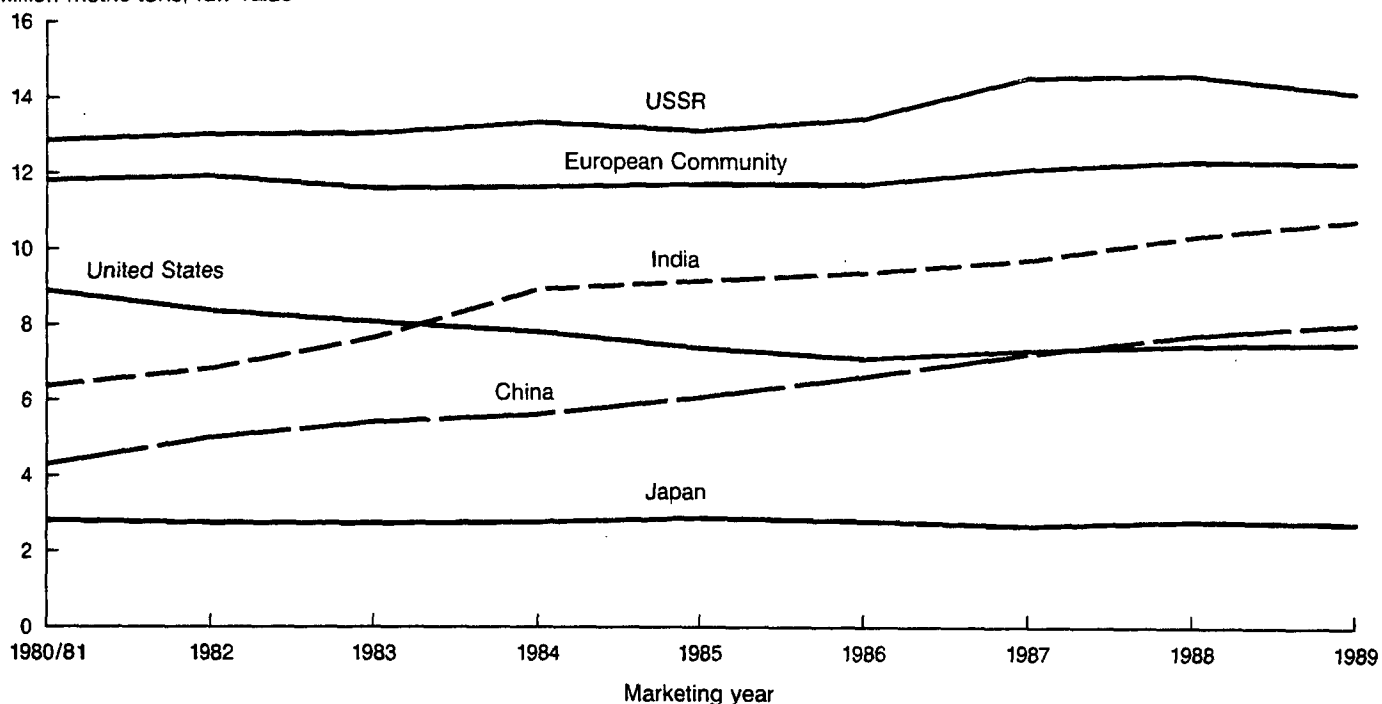
The lack of growth in imports reflects the lower level of raw sugar import requirements in the United States and Japan, increasing self-sufficiency in a number of countries, and the partial replacement of sucrose by other sweeteners. Despite contraction in import needs, both the United States and Japan still rank among the world's top five importers, along with the USSR, China, and the EC which combined account for about one-half of annual global imports, but down 5 percent from a decade ago (app. table 25 and fig. 10). Developing countries like China, Indonesia, Nigeria, and Mexico now are more important to world trade than they were a decade ago. And, developing countries, especially in North Africa and the Middle East, take about two-thirds of the 10 million tons of refined sugar imported each year.

While the composition of import markets has been changing in terms of the level of imports by key countries, sugar exports have been characterized by an increased concentration of trade among the world's four leading exporters: Australia, Brazil, Cuba, and the EC (app. table 26). When Thailand, an emerging export power through the decade, is added to the group, the five countries (including the EC) accounted for 70 percent of world exports in 1988/89, compared with 60 percent a decade earlier. Australia and Cuba are the dominant exporters of raw sugar with Australia, along with Thailand, having a comparative advantage in shipping sugar to growing markets in the Far East and Oceania. The bulk of Cuban exports go to the USSR and other centrally

Figure 10

### Sugar consumption of major importers

Million metric tons, raw value



Source: U.S. Dept. Agr. Foreign Agricultural Service.

planned economies in Eastern Europe and China under special trading arrangements.

Virtually all the sugar exported from the EC is in refined form. EC exports, with major markets concentrated in North Africa, the Middle East, and Eastern Europe, annually averaged 5.5 million tons, raw value (including intra-EC trade), accounting for more than one-half of global refined sugar exports during the 1980's. The EC also imports about 1.4 million tons annually under terms of the Sugar Protocol for ACP (African, Caribbean, and Pacific) countries in the Lome Agreement. Brazil is both a raw and refined sugar exporter in recent years and has ranked second to the EC as the world's largest exporter of refined sugar. The bulk of the balance of global refined sugar exports comes from toll refiners; countries like the United States, South Korea, and Singapore utilize excess refining capacity by bringing in raw sugar, refining it, and re-exporting the processed sugar in refined form.

### History of U.S. Sugar Programs

The Government has a long history of involvement in the sugar trade. Tariffs were imposed throughout the Colonial period and into the early 19th century, mainly to finance Government operations. However, near the end of the 19th century, the rationale for sugar tariffs shifted from revenue-generation to protection of a domestic industry. Sugarcane has been cultivated in the United States since the Louisiana Purchase in 1803; sugar-

beet production and processing was started in the late 19th century.

### **Chronology of Sugar Policy**

The first U.S. tariff on raw sugar was imposed in 1789 at 1 cent a pound for brown sugar, 3 cents on loaf sugar, and 1.5 cents for all other sugar. Since then, the United States has maintained some import duty on sugar, except for raw sugar imports during 1890 to 1894. In that brief period, U.S. refiners and processors were paid a bounty of 2 cents a pound of sugar produced to permit them to compete with an influx of surplus production from Europe.

In 1894, the Federal bounty was removed and a new tariff was levied on sugar, at 40-percent ad valorem. The tariff's primary purpose was not to generate revenue but to protect the domestic industry. The tariff remained in force until 1934.

### **The Sugar Acts, 1934-74**

World sugar production expanded rapidly in the early 20th century and brought about an extended period of low world sugar prices in the 1920's and 1930's. U.S. sugar producers were in economic distress when President Roosevelt initiated the New Deal, because the established tariffs were no longer sufficiently protective. Legislation designed to improve the balance between sugar supplies and consumption was approved by the President on May 9, 1934, and provided an entirely new method for regulating the domestic sugar industry and controlling the imports of sugar.

For the next 40 years, sugar policy sought to preserve within the United States the ability to produce a substantial portion of the Nation's sugar requirements. Protection was provided because it was considered unlikely that much sugar would be grown in the United States if domestic producers had to compete on the open market with sugar produced with cheap labor or under subsidy in other countries.

The Sugar Act of 1934, otherwise known as the Jones-Costigan Act, required the Secretary of Agriculture to determine the consumption requirements for sugar in the United States each year and to divide these requirements among domestic areas and foreign countries by assigning each a quota. The act also made provision for: (1) benefit payments to growers, (2) a processing tax on sugar, (3) minimum wage rates for fieldworkers, (4) child labor provisions, and (5) acreage restrictions.

The processing tax was set at 50 cents per 100 pounds of sugar, raw value, equal to 53.5 cents for refined sugar, and was assessed against all sugar, domestic and foreign. Benefit payments were made only to sugarbeet and sugarcane growers in domestic areas and in the Philippines, prior to its change to commonwealth status, from proceeds of the processing tax. A major purpose of the payments to sugar producers, as was true of similar payments to producers of other crops, was to provide growers with an incentive to limit their acreage in line with

quotas, as determined by USDA. However, the Federal Government did not have the authority to impose acreage restrictions.

In the Sugar Act of 1937, an excise tax was substituted for the processing tax which had been declared unconstitutional by the Supreme Court. However, the excise tax, collected by the Internal Revenue Service and payable into the general fund of the Treasury, was also assessed against all sugar processed or refined in the United States. In addition, an import tax was assessed against all direct-consumption sugar imported into the United States and more detailed guidelines were provided for determining sugar consumption requirements. The quota provisions were suspended in April 1942.

The Sugar Act of 1948 took effect January 1, 1948. The basic features of the act were the same as the 1934 and 1937 Acts, although regulations were more detailed and extensive and had greater economic effects. The 1948 Act was amended in 1951, 1956, 1962, 1965, and 1971. The 1971 amendment covered the period January 1, 1972, through December 1, 1974. In 1974, new sugar legislation was introduced in Congress, but the bill failed to pass the House.

#### 1975-81

The focus of sugar policy debates began to change in the mid-1970's as consumers and Congress began to question whether the sugar program was serving the public interest. Also, the introduction of HFCS provided new competition in the sweetener industry.

As world sugar supplies tightened in 1974 and world prices climbed above 23 cents a pound in May (the price would average 57.2 cents a pound in November), opponents argued that the sugar program was no longer needed and any program would further raise prices to consumers. Amendments to the program dealing with labor provisions were also opposed by some members of Congress. The sugar act was permitted to expire on December 31, 1974.

The 1975 and 1976 sugar crops were not covered by a support program. However, a growing sugar surplus and prices below 9 cents a pound in September prompted Congress to include sugar support provisions in the 1977 farm legislation.

The Food and Agriculture Act of 1977 provided support for the 1977 and 1978 sugarcane and sugarbeet crops, through loans or purchases, at between 52.5 and 65 percent of the parity price, but no less than 13.5 cents a pound, raw value. Loan rates for the 1977 and 1978 crops were established at 13.50 and 14.73 cents a pound, raw value (table 16). Processors were required to pay growers at least the support prices specified by the program for average-quality sugarbeets and sugarcane as long as the growers met USDA minimum wages for fieldworkers. To provide incentive for processors to sell their sugar in the marketplace rather than forfeit it to the Commodity Credit Corporation (CCC), import duties and fees were used to maintain the domestic sugar price at the market price objective.

Table 16--U.S. sugar loan rates and support prices, 1977-89

Fiscal year	Loan rate		Raw sugar market price objective	Actual raw sugar market price	Support based on loan rates	
	Raw sugar	Refined beet sugar			Sugarcane <sup>1/</sup>	Sugarbeets
	-----Cents per pound-----			--Dollars per net ton--		
1977/78	13.50	<sup>2/</sup> 15.57	13.50	12.99	18.37	22.84
1978/79	14.73	16.99	15.00	14.99	20.36	24.73
1979/80	13.00	15.15	15.00	25.05	17.92	22.46
1980/81 <sup>3/</sup>	---	---	15.00	24.92	---	---
1981/82 <sup>4/</sup>	16.75	19.70	<sup>5/</sup>	18.84	---	---
1982/83	17.00	20.15	20.73	21.78	23.00	30.60
1983/84	17.50	20.86	21.17	21.84	23.48	31.45
1984/85	17.75	20.76	21.57	20.89	23.89	31.63
1985/86	18.00	21.06	21.50	20.46	24.02	31.81
1986/87	<sup>6/</sup> 18.00	<sup>6/</sup> 21.09	21.78	21.68	<sup>7/</sup> 24.07	<sup>7/</sup> 29.44
1987/88	18.00	21.16	21.76	22.10	24.68	30.57
1988/89	<sup>6/</sup> 18.00	<sup>6/</sup> 21.37	21.80	22.49	<sup>7/</sup> 24.71	<sup>7/</sup> 31.18
1989/90	<sup>6/</sup> 18.00	<sup>6/</sup> 21.54	21.95	NA	<sup>7/</sup> 25.02	<sup>7/</sup> 31.36

NA = Not available.

--- = Not applicable.

<sup>1/</sup> Florida only. <sup>2/</sup> Initially set at 14.24 cents a pound. <sup>3/</sup> No program was established, but market price continued to be supported. <sup>4/</sup> Represents data for price-support purchase program for sugar produced December 22, 1981-March 31, 1982. The sugar was statutorily defined as part of the 1982 crop. <sup>5/</sup> 15 cents October 1-December 23, 1981; 19.08 cents December 24, 1981-May 5, 1982; and 19.88 cents May 6-September 30, 1982. <sup>6/</sup> Loan proceeds were reduced 4.3-percent as result of Balanced Budget and Emergency Deficit Control Act (Gramm-Rudman-Hollings) for 1986/87 and 1.4 percent for 1988/89 and 1989/90. <sup>7/</sup> Based on actual loan proceeds.

Source: U.S. Dept. Agr., Economic Research Service.

Before the loan program took effect, an interim price-support payment program for the 1977 crop was instituted under authority of the Agricultural Act of 1949. Processors received the difference between a price objective of 13.50 cents and the average market price, raw value. The payment program ceased when the loan program began in November 1977. Under the payment program, processors received \$237.5 million for 3.9 million tons of sugar that met the eligibility requirements. The payments were shared with growers according to the terms of their contracts.

The 1979 through 1981 crops were not designated in the Food and Agriculture Act of 1977 to receive price support. Therefore, price support authority reverted to Title III, Section 301, of the Agricultural Act of 1949 ("permanent legislation") which gives the President, through the Secretary of Agriculture, discretionary authority to make available price support at up to 90 percent of parity through loans, purchases, or other operations. A sugar loan program was adopted for the 1979 crop with a basic loan rate of 13 cents a pound, raw value, but no support program was provided for the 1980 and most of the 1981 sugar crops, because world and U.S. market prices were high enough to sustain the industry.

#### Agriculture and Food Act of 1981

Section 201(h) of the Agriculture Act of 1949 was amended to provide a price support program for domestically grown sugarcane

and sugarbeets for the 1982 through 1985 crop years. The act established a purchase-agreement program at 16.75 cents a pound for raw cane sugar processed between December 22, 1981 (the date of enactment), and March 31, 1982. Effective October 1, 1982, a nonrecourse loan program was established. Sugar processed after March 31, 1982, but before July 1, 1983, was supported through a loan rate for raw cane sugar of 17 cents a pound. The loan rate was increased to 17.5 cents in 1983, 17.75 cents in 1984, and 18 cents in 1985 (table 16).

The loan rate for beet sugar was established at a level consistent with the historical relationship between refined beet sugar net selling prices and raw cane sugar prices, the basis used by sugarcane and sugarbeet processors in determining grower returns.

To minimize the risk of the CCC acquiring sugar because of low sugar prices, a market stabilization price was established for raw cane sugar above the purchase or loan rate. The market stabilization price was considered to be the minimum market price required to discourage sale or forfeiture of any sugar to CCC. The difference between the purchase or loan rate and the market stabilization price covered all transportation costs, the interest required to redeem a loan, and an incentive factor to encourage processors to sell sugar in the marketplace rather than to sell or forfeit it to the CCC.

#### Food Security Act of 1985

The Food Security Act of 1985 amends Section 201 of the Agricultural Act of 1949 and mandates a price-support program for domestically produced sugarcane and sugarbeets for the 1986-90 crop years. The act requires the Secretary of Agriculture to support the price of domestically grown sugarcane through nonrecourse loans at such levels as he determines appropriate, but not less than 18 cents a pound for raw cane sugar (table 16). The support for sugarbeets is to be fair and reasonable in relation to that for sugarcane.

The 1985 Act strengthens effective support for sugar in several ways:

- (1) The Secretary may increase the support level for each of the 1986-90 crops based on appropriate factors. These include changes (during the 2 immediately preceding crop years) in the cost of sugar products, in the cost of domestic sugar production, and in other factors that may adversely affect domestic sugar production. If the Secretary does not increase the support price for any crop year, he must submit a report justifying his determination to the Committee on Agriculture of the House of Representatives and the Committee on Agriculture, Nutrition, and Forestry of the Senate. All loans are to be made available during the fiscal year and are to mature during the fiscal year.
- (2) The act requires that the President use all authorities available to enable the Secretary of Agriculture to operate



the sugar program at no cost to the Federal Government by preventing the accumulation of sugar acquired by the CCC.

- (3) Finally, any cane or beet producer who, as a result of a processing firm's insolvency, did not receive maximum entitled benefits under the price-support program is to be paid the maximum through the CCC.

### **Legislative Authorities to Support U.S. Sugar Industry**

The President is authorized to proclaim duties and quotas under Headnote 2 of the Tariff Schedules of the United States (additional U.S. Note 3, Chapter 17 of the Harmonized TSUS). Headnote 2 fixes the rate of duty to countries granted most-favored-nation status by the United States. The minimum rate of duty is 0.625 cent a pound, raw value (sugar testing 96 degrees by the polariscope). According to the headnote, the rate of duty will snap back to the statutory rate of 1.875 cents a pound whenever sugar quota legislation is not in effect in the United States, unless the President acts to impose specific rates of duty and quotas. Any duty rates and quotas proclaimed under Headnote 2 authority must consider the interests of domestic producers and materially affected contracting parties to the General Agreement on Tariffs and Trade (GATT).

The President is also empowered, on the basis of an investigation and report by the International Trade Commission (ITC), to regulate commodity imports whenever he finds that such imports tend to render ineffective or materially interfere with commodity price support or stabilization programs of the USDA. This authority under Section 22 of the Agricultural Adjustment Act of 1933 permits the imposition of fees not in excess of 50-percent ad valorem or quotas not in excess of 50 percent of the quantity imported during a representative period determined by the President. Section 22 provides authority to impose fees or quotas but not both simultaneously. However, if quotas are invoked under other authorities (such as Headnote 2), Section 22 may be used to impose fees while such quotas are in effect.

### **Mechanics of the 1985 U.S. Sugar Program**

The sugar program of the Food Security Act of 1985 provides price support through nonrecourse loans for domestically grown sugarcane and sugarbeets. Unlike other commodity programs, loans are made to processors and not directly to producers. This is because sugarcane and sugarbeets, being bulky and very perishable, must be processed into sugar before they can be traded and stored. Beets are processed directly into refined sugar, while cane is milled into raw sugar and then marketed to cane refiners for further processing. When processors sell the sugar, growers share in the returns.

Raw cane sugar and refined beet sugar are used as collateral for loans obtained from the CCC. To qualify for loans, processors must agree to pay producers the USDA-established minimum price-

support levels based on the loan rates for sugarcane and sugarbeets. Growers generally receive about 60 percent of the loan or sale proceeds of the sugar and processors 40 percent, but the exact arrangements vary by contract.

The 1985 sugar program specifies the minimum national loan rate for sugarcane at 18 cents a pound for raw cane sugar, with sugarbeets to be supported at a level that is "fair and reasonable" in relation to the loan rate for sugarcane. USDA calculates the beet loan rate by using a production-weighted, 10-year ratio of prices received for sugarbeets relative to sugarcane (converted into cents per pound of beet sugar and raw cane sugar). The ratio, multiplied by the cane loan rate, plus fixed marketing expenses for beet sugar, is the national average loan rate for refined beet sugar. This rate usually runs about 3 cents above the loan level for sugarcane.

Loan rates differ by location. The farther a processor is from its markets, the lower the rates. If freight costs for a region are above the national weighted-average, the difference is reflected in a lower loan level. The opposite is also true. For example, Hawaii's loan rate for 1988 crop raw cane sugar is 17.42 cents a pound, while Louisiana's is 18.27 cents. This is done so that the loans do not distort the routine marketing of sugar. In other words, no area will have more of an incentive to default on its loans than any other.

The processing company can either repay its loan with interest or default on it. If the firm defaults, the sugar held as collateral is forfeited to the CCC. The processor (borrower) will be inclined not to default if the market price for sugar is high enough to permit repayment of the loan, interest, freight, and related marketing expenses. (Freight is not part of the formula for beet sugar because the buyer pays the freight.)

Prior to the 1985 Act, part of Florida's 1984 crop was forfeited at a net cost to the Government of \$47 million. But because the current program has to be run "at no cost," the market stabilization price plays a critical role as a reference price which, if attained in the market, would be sufficient to avoid forfeitures.

The market stabilization price (MSP) is comprised of the national average loan rate for raw cane sugar, loan interest for 6 months, transportation and handling costs, and a market incentive of 0.2 cent a pound. Transportation costs are based on average shipping charges from Hawaii to U.S. ports north of Cape Hatteras, NC, so that the MSP will be high enough to cover the processing area with the highest costs. As a result, all the other sugarcane areas are automatically covered from risk of forfeiture. Sugarbeet areas are also protected from forfeiture because the cost of refining raw sugar, including weight loss in the physical refining process, is more than 4 cents a pound; therefore, the price of refined cane sugar would exceed the price at which beet sugar is forfeited. The MSP is announced each September for the next fiscal year. For fiscal 1989, the MSP was 21.8 cents a

pound and actual market prices in New York averaged 22.49 cents (includes insurance and freight charges).

To get U.S. prices up to the MSP, USDA estimates the domestic demand for sugar and then limits supply. No limit is placed on domestic production, but imports are restrained by a quota. Without the quota, low-priced sugar in the world market would flood the U.S. market and undercut the MSP.

Before May 1982, tariffs were used to raise the U.S. sugar price to the desired level. However, the duty could not exceed 50 percent of the price of the U.S. sugar imports. When world prices plunged in the 1980's, tariffs could no longer assure achievement of the MSP and restrictive quotas were imposed. Today, only a nominal duty exists, at the legal minimum of 0.625 cent a pound. Fees are zero for raw sugar and 1 cent a pound for refined. With the restrictive quota in place, the duty and fee do not affect the price of U.S. sugar but serve to capture some of the price premium of sugar marketed in the United States. Most nations eligible to ship sugar to this country receive duty-free status under the Generalized System of Preferences, the Caribbean Basin Initiative, or both (see Glossary for details). All countries are subjected to the fee on refined sugar, little of which is imported.

The size of the import quota each year is determined on the basis of estimated demand for sugar in the U.S. market and domestic supplies. Conditions can change, however, and the quota can be revised. For example, in 1988, the drought reduced sugar production far below the forecast level and, in order to keep prices from skyrocketing, the quota was raised from 758,000 tons to 1.057 million tons.

Allocation of the quota to individual countries is generally based on their share of the U.S. market during 1975-81 when imports were relatively unrestricted. Quotas were extended to 39 countries for 1989. Nicaragua and South Africa, originally quota recipients, have been excluded and their shares reallocated.

The United States actually imports more sugar each year than prescribed by the quota. The extra imports enter under special programs at world prices. (The world price plus charges for delivery to New York averaged about 12 cents a pound in 1988 versus quota sugar priced at 22 cents.) A small amount of quota-exempt sugar comes in for industrial uses as polyhydric alcohol. Sugar also enters the domestic market indirectly through imports of sugar-containing products.

### **Program Effects**

Groups affected by U.S. sugar policy include sugar producers and processors, consumers and users of sugar and products containing sugar, taxpayers, foreign suppliers of raw and refined sugar, manufacturers of sugar-containing products, cane sugar refiners, sugar brokers and traders, employees of sugar processing and

refining firms, and corn sweetener manufacturers. Although several reports have been published that estimate the costs and benefits of U.S. sugar policy, the studies have not received wide acceptance by all segments of the sugar trade. Universal acceptance of cost and benefit estimates is unlikely because of the different interests and objectives of the various segments of the sugar industry.

Moreover, the effects change over time as the industry structure evolves (for example, declining sugar use has reduced foreign suppliers' benefits from the program). Industry structure itself may change because of the program.

While measuring the full effects of the 1985 sugar program is complex, a key element is the price premium provided in the U.S. market.

The premium is the difference between the world price (f.o.b. Caribbean) converted to a New York basis and the actual price of raw sugar in the United States as a result of the import quota. Because the world price represents transactions of a small and residual market and fluctuates considerably, two alternative measures of the world price are used to calculate the U.S. premium: the average for fiscal years (FY's) 1987-89, and a longrun average cost for world sugar estimated at about 15 cents a pound (16.5 cents a pound, New York basis). A cost of production survey for 60 countries (subdivided into regions) by Landell Mills Commodities Studies indicates average cost of production for raw cane sugar during 1979/80-1986/87 ranged between 12.6 and 15.4 cents a pound (about 14-17 cents, New York basis).

### **Producers and Processors**

Protecting domestic producers is a primary objective of most farm programs. For sugar, however, the agricultural and industrial phases of production and processing are inseparable because sugarbeets and sugarcane, being bulky and perishable, must be processed before they can be traded or stored. Thus, growers share in the receipts of sugarcane and sugarbeet processors.

Producers and processors usually benefit from sugar policy through income and wealth effects. The higher U.S. price made possible by the sugar program directly raises the income of producers and processors through higher receipts from the sale of raw cane and beet sugar. Less obvious is the program's effect on the value of capital invested in land being used for sugar crops, specialized harvesting and processing equipment, and processing facilities.

In terms of average production of 6.96 million tons, raw value, in FY's 1987-89, the premium yielded domestic sugar growers and processors an estimated \$1.6 billion a year or \$139 million per 1-cent-a-pound of premium. Cane and beet growers received an estimated \$952 million and processors received the balance, based on the sharing provisions of their contracts. For individual producers, the benefit averaged \$235,000 per sugarcane farm,

including Puerto Rico, and \$50,500 per sugarbeet farm. Using the premium based on the longrun world price would reduce the premium benefits by about 50 percent (table 17).

### Taxpayers

The sugar support program under the 1985 Act has operated without any sugar being forfeited to the CCC. Under the loan program for FY's 1987-89, an average 1.6 million tons or 46 percent of the beet crop was placed under loan at a value of \$602.5 million, and 765,500 tons or 22 percent of the cane crop was placed under loan at a value of \$267.9 million. However, market prices were sufficient to encourage processors to sell their sugar in the marketplace and redeem their sugar held as loan collateral by the CCC. All loans were repaid to the Government with interest. Some revenue was generated by the Government through the import duties on sugar.

### Consumers

Critics of Government sugar policy contend that each 1 cent-a-pound increase in the domestic price of raw sugar caused by sugar price-support programs costs consumers of sugar and products containing sweeteners millions of dollars a year. These costs are usually based on the assumption that there is a direct and equal change in the retail cost for all sweeteners consumed. While there appears to be a close relationship between the price of raw sugar and the wholesale and retail prices of refined sugar, the linkage with prices of various categories of sweetener-containing products is less direct. The prices of inputs like energy, transportation, and wage rates appear to be more important in the short run than changes in the wholesale price of sugar. Factors that may dampen the transmission of sugar price increases into the ultimate retail price of particular sweetener-containing products include (1) product

Table 17--Estimated average annual benefits of import quota price premium on U.S. sugar producers and processors, fiscal years 1986/87-1988/89

Item	Unit	Premium basis	
		FYs 1987-89 average world price (NY) 10.7 cents	Long-run world price (NY) 16.5 cents
U.S. sugar price premium	Cents/pound	11.4	5.6
Sugar growers and processors	Million dollars/year	1,587	780
Sugar growers	do.	952	468
Sugarbeet growers	do.	500	246
Sugarcane growers	do.	452	222
Sugarbeet farms 1987/88	Number	9,893	9,893
Average sugar premium benefits per farm	1,000 dollars/year	50.5	24.9
Sugarcane farms 1987/88	Number	1,921	1,921
Average sugar premium benefits per farm	1,000 dollars/year	235.3	115.6

Source: U.S. Dept. Agr., Economic Research Service.

shelf life, (2) sweetener pricing or markup practices, (3) procedures for procuring sweeteners, (4) sweetener content of food and beverage products, (5) input mix, (6) industry structure and competitiveness, (7) seasonality of demand, and (8) changes in other input costs.

During FY's 1987-89, domestic sugar consumption annually averaged 8.162 million tons, raw value. About 28 percent of this sugar, 2.285 million tons, was consumed in nonindustrial uses in the home, restaurants, hotels, schools, and other institutions. As each 1-cent increase in the raw sugar price changes the retail price about 1.1 cents a pound, the 11.4 cents-a-pound premium estimated for FY's 1987-89 cost consumers of nonindustrial sugar about \$573 million or \$50 million for each cent of premium per pound.

For the annual average amount of sugar used in food and beverage products during FY's 1987-89, a 100-percent pass-through of the 11.4 cents a pound premium in the long term at both the wholesale and retail level would cost consumers about \$1.3 billion or \$118 million for each 1-cent-a-pound of premium. However, it is unlikely that the full premium is passed through. And, as some analysts suggest, the actual pass-through for most products may be quite small.

In addition, HFCS prices are also directly influenced by cane and beet prices, but to a lesser degree. It is estimated that the increased price of HFCS-42, HFCS-55, corn syrup, and dextrose due to the sugar program cost consumers an average \$1.3 billion a year in FY's 1987-89, or \$118 million for each 1 cent of premium in the domestic sugar price.

### **Foreign Suppliers**

Countries that supply raw and refined sugar to the United States benefit from the premium domestic price associated with a price support program. However, to the extent a country pays an import duty and/or fee on sugar imports, the premium is reduced. On the other hand, some countries during a tight market are able to pass part of the cost of the import duty and/or fee on to the buyer.

In FY's 1987-89, only five or six countries were subject to the import duty of 0.625 cent a pound, the other countries being exempted through the Generalized System of Preferences (GSP) or the Caribbean Basin Initiative (CBI). All countries are subject to the import fee, but since April 1985 the fee has been zero for raw sugar and 1-cent-a-pound for refined sugar (little of which is imported by the United States). In FY's 1987-89, based on average quota imports of 1.444 million tons, foreign suppliers received quota premium benefits estimated at \$255 million, compared with about \$530 million in FY's 1982-84 when the imports averaged 3.177 million tons each year. Foreign suppliers' average revenues on U.S. sugar imports fell from an estimated \$1.1 billion in FY's 1982-84 to about \$0.5 billion in FY's 1987-89.

## **Cane Sugar Refiners**

Most of the cane sugar consumed in the United States is refined from raw sugar produced either in the United States or abroad. In addition, the refining companies refine sugar for re-export. Between FY's 1982-84 and FY's 1987-89, refining volume declined over 20 percent as quota imports of raw sugar fell more than 50 percent. Ten refineries have ceased operations since 1981 and refining capacity has declined 35 percent. Only 12 refineries remain, with an annual capacity of about 5.5 million tons of raw sugar. The increase in domestic cane sugar production as a result of the sugar program has provided only a small offset to the decline in raw sugar imports for refining.

Still, the interest of cane sugar refiners in U.S. sugar policy is complicated because some companies own sugarcane acreage and beet and cane processing facilities.

## **Manufacturers of Sugar-Containing Products**

After passage of the 1981 farm act, and particularly after restrictive quotas were imposed in May 1982 and world prices were declining rapidly, the U.S.-world sugar price differential climbed from a 1977-82 average of 5 cents a pound to 14.7 cents during 1983-88 (app. table 29). This dramatically raised the incentive to ship sugar-containing products to the United States because with cheaper sugar, the foreign product could be manufactured for less cost. For every 10-cent U.S. sugar market premium, for example, a product containing 20-percent sugar would have a cost advantage of 2 cents per pound of product.

An analysis of 58 imported food items (app. table 30) with an average sugar content of 40 percent showed that, in the 1980's, imports of confectionery and chewing gum, and bakery and cereal products doubled; miscellaneous food preparations, and flavored sugars, syrups, and molasses almost tripled; and another 36 categories of processed and preserved fruit and other products rose tenfold.

The sugar equivalent of the expansion in imported products was about 175,000 tons a year. Domestic demand for industrial sugar fell by that amount, as U.S. manufactures of the products declined. The losses to U.S. manufacturers would have been greater without the import restrictions placed on selected categories of sugar-containing products and blends and mixtures after 1982.

## **Corn Sweetener Manufacturers and Corn Growers**

Corn sweetener manufacturers benefit from the U.S. sugar program through the higher prices they are able to extract for their products. The program's guarantee of stable prices at long-term minimum levels has also stimulated faster investment in corn wet milling and particularly HFCS facilities, and a more rapid acquisition of share in the U.S. sweetener market. Further, the considerable revenues generated in HFCS have made possible

substantial research, development, and promotion of corn wet milling products.

Expansion of corn sweetener production has increased the demand of corn wet millers for No. 2 yellow corn. The equivalent corn grind for HFCS production increased from 131 million bushels in 1980 to 352 million bushels in 1988 (app. table 19). For all corn sweeteners, the equivalent corn grind increased from 276 million bushels in 1980 to 510 million bushels in 1988. About 7 percent of a normal crop and 10.4 percent of the 1988 crop was used by the wet milling industry to produce corn sweeteners.

### **Traders**

Although cane sugar refiners occasionally contract directly for imports of U.S. raw sugar, most of the imports are obtained through sugar operators and traders, or through brokers. The services of sugar importers include: financing the transaction; chartering the transportation; arranging for loading, import, and export documentation, and delivery to the buyer's dock(s); and, in the case of operators/traders, assuming the risk of price changes while these services are being performed. Sugar importers also engage in significant trading in sugar futures markets and may conduct transactions in the world sugar trade outside the U.S. market. Any change in domestic sugar imports due to the price support program will have an effect on the import activities of sugar operators, traders, and brokers. The need for the services of sugar importers arises because domestic and foreign sugar producers cannot always find refiners willing to buy at the times and locations they have sugar to sell.

### **Issues for the 1990's**

The current U.S. sugar support program began with the 1986/87 crop and extends to the 1990/91 crop. The sugar program, part of the 1985 Food Security Act, continues the long history of U.S. Government involvement in the sugar industry. Legislative support has occurred in the context of a world sugar market which has historically displayed unusual price volatility and long periods of low prices. With only a small part of the world's sugar sold freely in the market and the vast majority sold at prices controlled by central authorities or by preferential or long-term agreements, initiatives toward rationalization of the sugar market have usually been multilateral rather than unilateral.

Various international sugar agreements have been implemented to coordinate supplies and keep world sugar prices at some target levels, but these attempts (most recently the 1977-84 International Sugar Agreement) have not succeeded. A radically different approach to international agricultural trade has been initiated by the GATT in the Uruguay Round of multilateral trade negotiations, with potentially profound implications for the sugar and sweetener industries of the United States and other countries. The negotiations, scheduled to be completed by



December 1990, are aimed at substantial progressive reduction (and ultimate elimination) of all trade-distorting government production supports, import barriers, and export subsidies of agricultural commodities. As a result, the degree of government support for sugar industries, and questions of comparative costs and international competitiveness, are facing sharper scrutiny.

In the United States, more immediate pressures on the shaping of the next U.S. sugar program are being exerted by (1) the need to respond to the GATT Council decision in June 1989 that U.S. sugar import quotas have been implemented against GATT rules, and (2) intense controversy involving diverse interest groups affected by the U.S. sugar program, including growers, processors, consumers, industrial sweetener users, refiners, foreign suppliers, and the corn wet milling industry. Major policy issues include:

- Is the current level of U.S. sugar program support sustainable in terms of assuring stable prices at no budget cost to the U.S. Government?
- Are the effects of the current sugar program on sugar and sweetener users, cane refiners, and foreign suppliers acceptable? If not, what would be acceptable in order to ensure a domestic supply of sugar?
- Should refiners be safeguarded from the effects of a continuation of the price support program and, if so, how?
- What is the effect of a sugar price-support program on the competitive position of other industries which use sugar as an input in the manufacturing of food and beverage products?
- What would be the effect of changes in the sugar price-support program on U.S. sugarcane and sugarbeet growers and processors? On consumers and industrial sugar users? On foreign suppliers? On cane refiners? On the corn wet milling industry?
- Should limitations be placed on the amount of farm program benefits received by individual sugar growers and processors?
- To what extent should U.S. sugar support levels equitably reflect the declining supports provided to other domestic crops as a result of U.S. budget limitations?
- Should U.S. Government budget expenditures (direct payments) play a larger role in supporting U.S. sugar producers as an economically more efficient means of gaining the same result and as a means of reducing consumer costs?
- Should production or marketing controls be considered as policy instruments to achieve program ends?
- To what extent can tariffs (duties and fees) be feasible as replacement for restrictive U.S. sugar import quotas?

- o Should U.S. import quotas be auctioned off?
- o How should the United States program be changed to conform to the GATT Council finding that import quota operations have been in violation of GATT?

Important industry factors to consider in developing sugar policy are:

- o U.S. sugar production reached a record 7.331 million tons in crop year 1987/88, up 21 percent from 1979/80-1981/82. At current levels of support relative to other crops, beet sugar output is likely to exceed its 1987/88 record of 4 million tons, and cane sugar could break its 1988/89 record of 3.4 million.
- o U.S. consumption of refined sugar recovered from a low of 7.2 million tons in 1986 to an estimated 7.6 million tons in 1989 (in raw value, from 7.7 million tons to 8.1 million tons) and can be expected to continue to increase slowly, despite some potential per capita loss to alternative sweeteners over the next few years.
- o Beet sugar has increased its share of U.S. sugar consumption from about 30 percent in 1979-81 to nearly 45 percent in 1988. This implies a greater ability for beet sugar to dominate refined sugar prices than in earlier years.
- o World sugar consumption exceeded production for the fourth consecutive year in 1988/89 and the subsequent drawdown on world stocks is forecast to continue into 1989/90. Prices are expected to continue strong at above 14 cents a pound, and possibly "spike" at above 20 cents. However, prices typically fall rapidly after a spike to very low levels and stay cyclically low for years. Without a U.S. sugar program in a global sugar market where most countries continue to intervene, domestic sugar production would unilaterally be subject to a long period of artificially low prices. And, once sugar crop processing facilities close, they are unlikely to be reopened when world prices recover because the prices do not stay high for long and because substantial investment and timelags would be involved.
- o On the other hand, if U.S. price supports are set too high and raw cane imports decline, more U.S. refineries could close. Once closed, cane refineries are unlikely to be reopened even if import requirements increase as a result of domestic output shortfalls or a change in policy such as could follow from successful negotiations in the Uruguay Round of the GATT.

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### Glossary

**Bagasse** -- Fibrous residue remaining after sugarcane has been crushed to extract the sugar-containing juices.

**Base import quota** -- The number which is multiplied by the country percentage allocations found in Paragraph (c) of Headnote 3, Subpart A, Part 10, Schedule 1 of the Tariff Schedules of the United States (19 U.S.C. 1202) to provide the base quota allocation for each country with a percentage quota allocation.

**Base quota allocation** -- That part of a country's import quota allocation which is derived by multiplying its percentage allocation by the base import quota.

**Blends** -- Generic term usually referring to certain liquid and dry mixtures of sugar and other ingredients which were either embargoed by Presidential Proclamation No. 5071 of June 28, 1983, treated as commingled merchandise pursuant to a U.S. Customs Service ruling of November 7, 1984, or subjected to emergency import quotas established by Presidential Proclamation No. 5294, as amended by Presidential Proclamation No. 5340 of May 17, 1985.

**Caribbean Basin Initiative (CBI)** -- Popular name for the 1983 Caribbean Basin Economic Recovery Act, which eliminates duties on imports of products from designated Caribbean countries until September 30, 1995. The CBI also provides for import relief to U.S. industries injured or threatened by increased imports from CBI countries.

**Commodity Credit Corporation (CCC)** -- USDA agency responsible for directing and financing major USDA "action programs," including price support, production stabilization, commodity distribution, and related programs. CCC also directs and finances certain agricultural export activities. CCC activities are implemented by the Agricultural Stabilization and Conservation Service.

**Corn syrup** -- A purified concentrated solution of nutritive saccharides obtained from corn starch by partial hydrolysis, clarification, decolorization, and evaporation to syrup density. Many people consider the expression "glucose" synonymous with corn syrup.

**Cost of production** -- The sum, measured in dollars or cents, of all purchased inputs, allowances for management, investment, and rent necessary to produce farm products. Cost of production statistics may be expressed as an average per acre, per bushel, or per pound.

**Crop year** -- In the sugarbeet areas, the crop year is defined as the year of intended harvest. The only exception is for spring-

planted beets in California that are intended to be overwintered and harvested the following year. In the mainland cane areas, the crop year corresponds with the calendar year in which harvest normally starts. In Hawaii, the crop year corresponds with the year of harvest.

**Dextrose** -- A monosaccharide produced commercially by the complete hydrolysis or conversion of starch. Since dextrose historically has been produced largely from corn starch, it is commonly called "refined corn syrup." To the chemist, the name "glucose" is synonymous with "dextrose," but to the layman glucose usually means corn syrup or a glucose-type syrup produced from sorghum, wheat, or potato starch. Dextrose is of two principal types, hydrate and anhydrous. The larger share of the dextrose is of the hydrate type which contains approximately 8-percent moisture; the anhydrous type contains less than 0.5-percent moisture.

**Direct-consumption sugar** -- The term "direct consumption" means any sugars which are principally of crystalline structure and any liquid sugar which are not to be further refined or otherwise improved in quality.

**Drawback** -- A practice authorized by the U.S. Customs Service whereby an exporter of a product may claim for refund up to 99 percent of any duties and fees paid to import the components of the product. Under regulations dealing with drawback, an export of a product is eligible for drawback if the product was made within 3 years of the date of importation of the components of the product, if the product was then exported within 2 years of the time the product was made, and if documents are to U.S. Customs within 3 years of the date the product was exported.

**European Community (EC)** -- An organization established by the Treaty of Rome in 1957 and also known as the European Economic Community and the Common Market. The EC attempts to unify and integrate member economies by establishing a customs union and common economic policies. Member nations include the original six countries of Belgium, West Germany, France, Italy, Luxembourg, and the Netherlands, as well as Denmark, Greece, Ireland, Portugal, Spain, and the United Kingdom.

**Extraction rate** -- The percentage relationship of the sucrose recovered in sugar to the sucrose content in sugarbeets or sugarcane processed.

**Free market** -- A system in which the market forces of supply and demand determine prices and allocate available supplies. A free market approach in agriculture would eliminate price and income support programs and barriers to international trade.

**Free trade** -- Exchange of goods between countries with no trade barriers or restrictions such as tariffs or import quotas.

**Food Security Act of 1985 (PL 99-198)** -- The omnibus food and agriculture legislation signed into law on December 23, 1985,

that provides a 5-year framework for the Secretary of Agriculture to administer various agriculture and food programs. The act amends permanent legislation--the Agricultural Adjustment Act of 1938 and the Agricultural Act of 1949--for the 1986 through 1990 crops.

**Fructose** -- A highly soluble, simple sugar generally considered sweeter than sucrose, and present in considerable quantities in combination with dextrose and sucrose in invert sugars.

**Futures** -- Contracts which are legally binding commitments to deliver or take delivery of a given quantity and quality of a commodity at a specified price, during a specific month, and at a specified location.

**Futures contract** -- A standardized fixed-price forward contract entered into on an exchange (organized center for trading in commodities). The contract is subject to all terms and conditions included in the rules of that exchange.

**General Agreement on Tariffs and Trade (GATT)** -- An agreement, originally negotiated in Geneva, Switzerland, in 1947 among 23 countries, including the United States, to increase international trade by reducing tariffs and other trade barriers. This multi-lateral agreement provides a code of conduct for international commerce. GATT also provides a framework for periodic multi-lateral negotiations on trade liberalization and expansion. The eighth and most recent round of negotiations began in Punta del Este, Uruguay, in 1986. Currently, 105 nations are participating in the talks, including most of the industrialized market economies, most of the developing countries, and several centrally planned economies in Eastern Europe.

**Generalized System of Preferences (GSP)** -- A policy that permits duty-free entry of certain imports from designated developing countries, for the purpose of increasing economic growth, helping maintain favorable foreign relations with free world developing countries, and providing low-cost aid.

**Glucose** -- Chemically, another name for dextrose. Commercially, another name for corn syrup. Glucose or glucose corn syrup is obtained by the action of acids and/or enzymes on cornstarch. Commercial corn syrups are nearly colorless and very viscous. They consist principally of dextrose and small amounts of maltose, combined with gummy organic materials known as dextrans, in water solution.

**Glucose isomerase** -- An enzyme capable of converting dextrose to fructose.

**Gross returns** -- The measure of returns used for all sugarcane areas where the principal product of the mills is raw sugar. Gross returns from sales contained herein include the values of raw sugar and molasses at mainland ports of entry or market locations, based on the average market price for sugar and

molasses during the applicable settlement periods, and, in addition, include CCC payments.

**High fructose corn syrup** -- HFCS is produced by the enzymatic conversion of a portion of the glucose in corn syrup to fructose. The product is roughly comparable to invert syrup made from sucrose in terms of sweetness and physical properties.

**Typical composition of commercially available HFCS products:**

	HFCS-42	HFCS-55	HFCS-80-90
	<u>Percent</u>		
Fructose	42	55	80-90
Dextrose	52	40	7-19
Higher saccharides	6	5	1-3

**Industrial users** -- Sugar users who receive sugar directly from primary distributors, except hotels, restaurants, wholesalers, and retailers.

**Invert or invert sugar** -- The mixture of equal parts of dextrose and fructose produced by the action of acid or enzymes on solutions of sucrose.

**Invisible stocks** -- Stocks of sugar held by wholesalers, retailers, and users of sugar as distinct from stocks of primary distributors.

**Market stabilization price (MSP)** -- The market stabilization price has served numerous purposes. It is a reference price in the sense that if domestic prices for raw cane sugar are less than the MSP, there is a risk of forfeiture of sugar to the CCC. From December 22, 1981, to May 5, 1982, import fees and duties were applied to imported sugar to raise the price of imported sugar to the level of the MSP. The import fee system was subsequently adjusted (May 5, 1982) so that import fees and duties were applied to imported sugar in an amount equivalent to the difference between the MSP and the domestic market price. Finally, when the import fee system was suspended on an emergency basis by Presidential Proclamation No. 5313 of March 29, 1985, the calculation of the MSP was also suspended. For that reason, the calculation of the MSP was put in regulations on September 5, 1985. The MSP now serves not only as a reference price for the risk of forfeiture of sugar to the CCC, but also for calculating certain bonds and penalties under regulations governing quota-exempt programs.

**Molasses** -- The edible byproduct of the manufacture of sugar when some, but usually not all, of the crystallizable sugar in the sugarcane juice is removed by the crystallization process.

**Net returns** -- The measure of returns to be shared by growers and processors in the domestic beet area. The output of the beet



processors in the domestic beet area. The output of the beet sugar factories consists of refined sugar which moves directly into marketing channels. The net returns from sales of refined sugar are total returns minus delivery and marketing expenses as defined in the sugarbeet purchase contract.

**(New York) Coffee, Sugar & Cocoa Exchange, Inc.** -- World and domestic raw cane sugar contracts are traded daily on the exchange. The world price is the No. 11 contract price for raw cane sugar (f.o.b. Caribbean) and the domestic price is the No. 14 contract price for raw cane sugar (c.i.f., duty/fee-paid, New York).

**Ninety-six degree basis (96<sup>0</sup>)** -- A computed weight of sugar determined by dividing the weight of its sucrose content by 96 percent.

**No cost** -- A provision of the Food Security Act of 1985 requiring the President to use all available authorities to enable the Secretary of Agriculture to operate the sugar program at no cost to the Government. By "no cost," it is meant that the sugar price support program is operated so that there are no forfeitures of sugar to the CCC. In Conference Report language to the act, the conferees explain that "no cost" means the import quota on raw and refined sugar be adjusted to such level that there are no forfeitures and thus no cost to the Government.

**Noncentrifugal sugars** -- Crude sugars made from the sugarcane juice by evaporation and draining off the molasses. Among local names are "gur," "muscovado," "panocha," and "papelon."

**No net cost** -- Often used interchangeably with the term no cost. However, the Food Security Act of 1985 refers specifically to no cost rather than no net cost.

**Nonrecourse loan (program)** -- The loan program for sugarcane and sugarbeets is a nonrecourse loan program. This means that if the sugar processor chooses not to redeem (pay back) the loan, the sugar used as collateral for loans from the Commodity Credit Corporation, can be forfeited as full compensation for the loan, without penalty.

**No. 11 contract price** -- As traded on the (New York) Coffee, Sugar & Cocoa Exchange, this is an f.o.b., Caribbean price for raw cane sugar, and usually referred to as the world price. It is traded in both spot and futures. The No. 11 is used under quota-exempt programs in conjunction with the market stabilization price to calculate bonding requirements and penalties.

**No. 12 contract price** -- As traded on the (New York) Coffee, Sugar & Cocoa Exchange, this was the c.i.f. duty/fee-paid New York price for imported raw cane sugar. It stopped being traded on the spot market on May 31, 1985, and it stopped being traded on the futures market on October 8, 1986. It had been used in conjunction with the market stabilization price to calculate

**No. 14 contract price** -- As traded on the (New York) Coffee, Sugar & Cocoa Exchange, this is the c.i.f. duty/fee-paid New York price for imported raw cane sugar. It is traded only on the futures market, and commenced on July 8, 1985. It trades at a premium (higher grade sugar) of about 0.25 cent a pound to the old No. 12 Contract, and is now usually referred to as the domestic price (for raw cane sugar).

**Parity** -- The price per pound of sugar produced that would be equivalent to the purchasing power of a pound of sugar in the 1910-14 base year. The concept of parity was originally defined in the Agricultural Adjustment Act of 1933. The 1910-14 purchasing power is not adjusted for subsequent productivity growth. In 1986-88, the parity price for sugar approximated 1.9 times the 10-year average of the sugar price.

**Polarization** -- A measure of sucrose concentration based on its ability to rotate the plane of polarized light. Degree of polarization is determined by means of a saccharimeter (commonly referred to as a polariscope) and is indicative of the percentage of sucrose in high-purity products such as raw cane sugar and white refined sugar.

**Primary distributors** -- Primary distributors consist of continental cane sugar refiners, domestic beet processors, importers of direct-consumption sugar, and mainland cane processors.

**Quota-exempt sugar** -- That sugar imported into the United States which is exempt from quota charge. This sugar is entered under bond for the purpose of re-exportation or for use as livestock feed, or production of polyhydric alcohol.

**Ratoon** -- Second and subsequent crops grown from the root systems of previous plantings of sugarcane. Usually one or more ratoon crops are harvested before the fields are plowed and replanted.

**Raw sugar** -- The term "raw sugar" means any sugars whether or not principally of crystalline structure, which are to be further refined or improved in quality to produce any sugars principally of crystalline structure or liquid sugar.

**Receipts** -- Sugar receipts as reported by primary distributors, including quota sugar, quota-exempt sugar for livestock feed, polyhydric alcohol, and export and over-quota sugar held in bond to be charged to a subsequent year's quota.

**Re-export sugar** -- Refers to the process, under regulations governing "Sugar to be Re-Exported in Sugar Containing Products" (7 C.F.R. 1520.200-1520.214) and "Sugar to be Re-Exported in Refined Form" (7 C.F.R. 6.100-6.113) whereby program participants import sugar exempt from quota and subsequently process the sugar for export either as refined sugar or in a sugar-containing product.

**Refined sugar** -- A sugar with most of the undesirable nonsucrose constituents (impurities) removed, and used primarily for human consumption.

**Section 22** -- A section of the Agricultural Adjustment Act of 1933 (PL 73-10) that authorizes the President to restrict imports by imposing quotas or fees if the imports interfere with Federal price support programs or substantially reduce U.S. production of products processed from farm commodities. Fees may not exceed 50-percent ad valorem nor may quotas exceed 50 percent of the quantity imported during a representative period determined by the President.

**Section 22 import quota** -- Under the authority of Section 22 of the Agricultural Adjustment Act of 1933, the Secretary of Agriculture may recommend to the President the imposition of quotas on imports of an article or articles which the Secretary has reason to believe will or is likely to disrupt domestic program operations. The quotas can be imposed on an emergency basis at the discretion of the President but in no event can be less than 50 percent of the volume of trade during a representative period. Since enactment of the Agriculture and Food Act of 1981, section 22 import quotas have been imposed under Presidential Proclamation No. 5071 of June 28, 1983, and under Presidential Proclamation No. 5294 as amended by Presidential Proclamation No. 5340 of May 17, 1985.

**Section 201** -- Part of the U.S. Trade Act of 1974 that allows the President to provide relief to industries hurt by competing imports. Growers or trade associations must petition the International Trade Commission to investigate complaints of trade practices.

**Section 301** -- A provision of the U.S. Trade Act of 1974 that allows the President to take appropriate action to persuade a foreign government to remove any act, policy, or practice that violates an international agreement. The provision also applies to practices of a foreign government which are unjustified, unreasonable, or discriminatory, and which burden or restrict U.S. commerce.

**Specialty sugar(s)** -- Regulations governing "Certificates for the Importation of Specialty Sugars" (15 C.F.R. 2013.1-2013.7) indicate that specialty sugars are sugars provided for in items 155.20 and 155.30 of the Tariff Schedules of the United States and which: (1) are not currently commercially produced in the United States or reasonably available from domestic sources; (2) are the product of a country listed in Headnote 3(c)(ii) of Subpart A, Part 10 Schedule 1 of the Tariff Schedules of the United States and, (3) require no further refining, processing, or other preparation prior to consumption, other than incorporation as an ingredient in human food. If the certifying authority determines that a sugar meets the above criteria, then a certificate can be issued to authorize its importation as a specialty sugar. The total U.S. import quota for specialty sugars has been 2,000 short tons a year. The main types of

specialty sugars imported into the United States under the specialty sugar quota include brown slab sugar (an oriental sugar used for cooking) and pearl sugar used in baking.

**Sucrose** -- A sweet, crystallizable, colorless substance which constitutes the "sugar" of commerce. Refined cane and beet sugar is essentially 100-percent sucrose. Technically, sugar is a disaccharide of glucose and fructose having formula  $C_{12}H_{22}O_{11}$ , derived from either sugarcane or sugarbeets.

**Sugar-containing products** -- Products containing at least 10-percent embodied sugar. With limited exceptions, imported products which contain less than 10-percent sugar are not considered competitive with comparable domestic products.

**Syrup** -- Concentrated clarified cane juice before crystallization.

**Tariff** -- Taxes (duties or fees) imposed on commodity imports by a government. A tariff may be either a fixed charge per unit of product imported (specific tariff) or a fixed percentage of value (ad valorem tariff).

**Tel quel** -- Literally, "as such." In describing sugar, it means a polarization usually varying among mills and producing areas.

Appendix table 1--U.S. sugarcane processors: Company, factory location, and capacity, by area, 1988

Area and company	Factory capacity	Grinding location
		<u>Short tons per day</u>
<b>Florida:</b>		
Atlantic Sugar Association	Belle Glade	12,000
Okeelanta Sugar Corporation	South Bay	20,000
Osceola Farms Company	Canal Point	10,000
Sugarcane Growers Coop. of Florida	Belle Glade	21,000
United States Sugar Corporation	Clewiston	20,000
	Bryant	16,000
Talisman Sugar Corp.	South Bay	10,000
Total		109,000
<b>Texas:</b>		
Rio Grande Valley Sugar Coop.	Santa Rosa	10,000
<b>Louisiana:</b>		
Alma Plantation, Ltd.	Lakeland	3,800
Breaux Bridge Sugar Coop., Inc.	Breaux Bridge	3,000
Caire & Graugnard	Edgard	2,000
Cajun Sugar Coop., Inc.	New Iberia	6,000
Caldwell Sugars, Coop., Inc.	Thibodaux	6,000
Cora-Texas Mfg., Co., Inc.	White Castle	7,000
Dugas & LeBlanc, Ltd.	Paincourtville	5,000
Evan Hall Sugar Coop., Inc.	McCall	5,000
Glenwood Coop., Inc.	Napoleonville	4,200
Harry L. Laws & Co., Inc.	Brusly	4,200
Iberia Sugar Coop., Inc.	New Iberia	5,500
Jeanerette Sugar Co., Inc.	Jeanerette	5,000
LaFourche Sugar Corp.	Thibodaux	8,500
M.A. Patout & Sons, Ltd.	Jeanerette	9,000
Teche Sugar Company	Franklin	4,500
St. Martin Sugar Coop., Inc.	St. Martinsville	3,500
St. James Sugar Coop., Inc.	St. James	6,000
St. Mary Sugar Coop., Inc.	Jeanerette	5,000
Savoie Industries, Inc.	Belle Rose	5,500
South Coast Sugars, Inc.	Raceland	7,500
Sterling Sugars, Inc.	Franklin	7,500
Total		113,700
<b>Hawaii:</b>		
Alexander & Baldwin, Inc.--		
Hawaiian Commercial & Sugar Co.	Puunene, Maui	8,300
	Paia, Maui	4,700
McBryde Sugar, Co., Ltd.	Kola, Kauai	3,200
Amfac, Inc.--		
Kekaha Sugar Co., Ltd.	Kekaha, Kauai	3,000
The Lihue Plantation Co., Ltd.	Lihue, Kauai	4,700
Oahu Sugar Co., Ltd.	Waipahu, Oahu	6,000
Pioneer Mill Co., Ltd.	Lahaina, Maui	2,800
C. Brewer and Co., Ltd.--		
Hilo Coast Processing Co.	Pepeekeo, Hawaii	4,700
Ka'u Sugar Co., Inc.	Pahala, Hawaii	2,900
Olokele Sugar Co., Ltd.	Kaunakani, Kauai	2,800
Castle and Cooke, Inc.--		
Waialua Sugar Co.	Waialua, Oahu	5,000
Hamakua Sugar So.	Haina, Hawaii	8,000
Total		56,100
Total United States		288,800

Source: U.S. Dept. Agr., Economic Research Service.

Appendix table 2--U.S. cane sugar refiners: Company, plant location, and capacity, 1988

Company	Plant location	Melting capacity
		<u>Short tons, raw sugar per day</u>
Amstar Corporation	Baltimore	2,600
	Brooklyn, NY	2,100
	Chalmette, LA	3,250
California and Hawaiian Sugar Co.	Crockett, CA	3,000
	Aiea, HI	200
Colonial Sugars, Inc.	Gramercy, LA	1,750
Imperial Holly Sugar Co.	Sugar Land, TX	1,650
Okeelanta Sugar Corp.	South Bay, FL	500
Refined Sugars, Inc.	Yonkers, NY	1,800
Savannah Foods and Industries, Inc.	Port Wentworth, GA	3,000
	Clewiston, FL	750
Supreme Sugar Co., Inc.	Supreme, LA	700
Total United States		21,300

Note: The 21,300 tons per day translates to an annual 5.5 million short tons, refined cane sugar, at an operating rate of 260 days a year.

Source: U.S. Dept. Agr., Economic Research Service.

Appendix table 3--U.S. sugarbeet processors: Company, factory location, and capacity, by region, 1988

Region and company	Factory location	Slicing capacity
		<u>Short tons per day</u>
<b>Region I:</b>		
Michigan Sugar Co.	Caro, MI	3,200
	Carrollton, MI	2,850
	Croswell, MI	3,000
	Sebewaing, MI	4,250
Monitor Sugar Co.	Bay City, MI	8,000
Great Lakes Sugar Co.	Fremont, OH	3,600
<b>Region II:</b>		
American Crystal Sugar Co.	Crookston, MN	4,500
	Drayton, ND	5,400
	East Grand Forks, MN	6,700
	Hillsboro, ND	4,500
	Moorhead, MN	4,400
Minn-Dak Farmers Cooperative	Wahpeton, ND	5,500
Southern Minnesota Beet Sugar Coop.	Renville, MN	7,200
<b>Region III:</b>		
Western Sugar Co.	Bayard, NE	2,250
	Ft. Morgan, CO	3,800
	Greeley, CO	2,200
	Mitchell, NE	2,250
	Scottsbluff, NE	3,200
Holly Sugar Corp.	Torrington, WY	4,000
<b>Region IV:</b>		
Holly Sugar Corp.	Hereford, TX	7,500
<b>Region V:</b>		
Western Sugar Co.	Billings, MT	4,000
	Lovell, WY	2,500
Holly Sugar Corp.	Sidney, MT	5,000
	Worland, WY	3,400
<b>Region VI:</b>		
The Amalgamated Sugar Co.	Rupert, ID	7,000
	Twin Falls, ID	5,000
<b>Region VII:</b>		
The Amalgamated Sugar Co.	Nampa, ID	10,000
	Nyssa, OR	7,000
<b>Region VIII:</b>		
Delta Sugar Corp.	Clarksburg, CA	3,000
Holly Sugar Corp.	Brawley, CA	7,500
	Hamilton City, CA	3,700
	Tracy, CA	4,800
Spreckels Sugar Co., Inc.	Manteca, CA	4,200
	Mendota, CA	4,200
	Woodland, CA	3,600
Holly Sugar Corp. (Union Sugar Division)	Betteravia, CA	5,500
Total United States		168,700

Source: U.S. Dept. Agr., Economic Research Service.

Appendix table 4--U.S. sugarcane: Grower returns for sugarcane produced for sugar,  
1970/71-1987/88 <sup>1/</sup>

Crop year	Florida	Hawaii	Louisiana	Texas <sup>2/</sup>	U.S. average
<u>Dollars per net ton</u>					
1970/71	12.97	NA	10.58	---	11.67
1971/72	12.91	NA	11.70	---	12.25
1972/73	14.22	NA	11.39	---	12.64
1973/74	27.35	NA	16.15	14.05	21.97
1974/75	47.50	49.65	53.30	40.20	49.64
1975/76	19.80	25.00	19.30	19.80	21.50
1976/77	15.10	18.00	12.30	11.60	15.20
1977/78	19.60	16.00	17.70	15.30	17.70
1978/79	20.50	19.70	18.90	11.00	19.50
1979/80	30.30	22.60	24.20	25.20	26.00
1980/81	39.40	41.80	33.20	27.10	38.50
1981/82	28.60	23.50	22.90	15.90	24.90
1982/83	28.20	26.20	25.10	19.50	26.50
1983/84	28.60	29.90	25.30	15.20	27.80
1984/85	28.90	30.30	23.90	21.70	28.20
1985/86	28.20	28.10	22.20	20.70	26.70
1986/87	29.00	27.90	23.10	27.50	27.30
1987/88	30.90	27.20	28.70	30.10	29.30

NA = Not available. --- = Not applicable.

<sup>1/</sup> Includes sugar act payments.

<sup>2/</sup> Commenced production with the 1973 crop.

Source: U.S. Dept. of Agr., Economic Research Service.

Appendix table 5--U.S. sugarbeets: Grower returns by region,  
1970/71-1987/88 <sup>1/</sup>

Crop year	Far West <sup>2/</sup>	Central <sup>3/</sup>	East <sup>4/</sup>	United States
<u>Dollars per net ton</u>				
1970/71	17.82	16.85	14.30	16.87
1971/72	17.70	17.63	15.41	17.45
1972/73	18.01	19.31	14.61	18.00
1973/74	29.51	34.25	32.69	31.68
1974/75	49.15	48.68	49.18	48.86
1975/76	28.21	27.54	24.68	27.60
1976/77	22.38	20.33	21.87	21.00
1977/78	25.38	23.43	20.12	24.20
1978/79	26.50	24.51	23.79	25.20
1979/80	33.11	33.83	38.01	33.90
1980/81	49.34	46.50	41.54	47.20
1981/82	32.15	27.05	26.79	29.20
1982/83	34.94	35.70	35.80	34.40
1983/84	40.36	34.10	35.55	37.00
1984/85	35.90	<sup>5/</sup> 30.60	<sup>6/</sup> 35.50	34.70
1985/86	34.60	31.00	34.20	33.80
1986/87	35.90	33.30	37.00	35.90
1987/88	35.70	37.70	40.60	38.20

<sup>1/</sup> Includes sugar act payments.

<sup>2/</sup> Includes Arizona, California, Idaho, Oregon, and Washington.

<sup>3/</sup> Includes Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, New Mexico, North Dakota, Texas, Utah, and Wyoming.

<sup>4/</sup> Includes Maine, Michigan, New Jersey, New York, and Ohio.

<sup>5/</sup> Includes bankruptcy compensation payments of \$3.50 per net ton.

<sup>6/</sup> Includes bankruptcy compensation payments of \$0.20 per net ton.

Source: U.S. Dept. Agr., Economic Research Service.



Appendix table 6--U.S. sugarcane: Cost of production and processing by cost item and area, 1987/88 crop

Item	Florida		Hawaii		Louisiana		Texas		United States	
	Per short ton	Per pound	Per short ton	Per pound	Per short ton	Per pound	Per short ton	Per pound	Per short ton	Per pound
	Dollars	Cents	Dollars	Cents	Dollars	Cents	Dollars	Cents	Dollars	Cents
<b>Production:</b>										
Variable	19.09	8.322	19.66	8.045	13.21	5.502	15.38	7.735	17.86	7.607
Fixed	4.46	1.946	4.30	1.760	7.01	2.921	3.24	1.632	4.91	2.093
Operating capital	.58	.252	.59	.243	.23	.096	.50	.253	.50	.215
Nonland capital	.73	.319	.82	.335	.88	.368	.15	.075	.77	.327
Land	5.45	2.374	2.41	.985	5.45	2.271	3.72	1.870	4.52	1.922
Hauling allowance	NA	NA	NA	NA	-1.09	-0.453	NA	NA	-0.23	-0.099
Total production costs	30.31	13.213	27.78	11.368	25.69	10.705	22.99	11.565	28.33	12.065
<b>Processing:</b>										
Variable	10.79	4.704	20.26	8.290	12.92	5.384	11.88	5.975	13.99	5.960
Fixed	2.35	1.025	3.76	1.539	3.14	1.307	4.67	2.347	3.01	1.281
General and administrative	1.28	.557	1.85	.757	1.53	.639	1.26	.635	1.50	.637
Total processing costs	14.42	6.286	25.87	10.586	17.59	7.330	17.81	8.957	18.50	7.878
<b>Total production and processing costs</b>	<b>44.73</b>	<b>19.499</b>	<b>53.65</b>	<b>21.954</b>	<b>43.28</b>	<b>18.035</b>	<b>40.80</b>	<b>20.522</b>	<b>46.83</b>	<b>19.943</b>
<b>Credits:</b>										
Molasses	1.94	.844	1.29	.528	1.64	.683	2.31	1.162	1.70	.725
Bagasse	.05	.023	.01	.004	NA	NA	NA	NA	.02	.011
Other	.14	.062	2.33	.953	.20	.082	NA	NA	.78	.330
Total	2.13	.929	3.63	1.485	1.84	.765	2.31	1.162	2.50	1.066
<b>Net production and processing costs</b>	<b>42.60</b>	<b>18.570</b>	<b>50.02</b>	<b>20.469</b>	<b>41.44</b>	<b>17.270</b>	<b>38.49</b>	<b>19.360</b>	<b>44.33</b>	<b>18.877</b>
	<u>Dollars per acre</u>									
Total production costs	978.95		2,800.39		583.20		715.40		1,019.73	
	<u>Net tons of sugarcane per harvested acre</u>									
Yield	33.6		98.6		27.6		31.0		39.6	
	<u>Pounds of raw cane sugar per ton of cane</u>									
Recovery	216.6		223.2		209.3		177.4		215.5	

NA = Not available.

Source: U.S. Dept. Agr., Economic Research Service.

Appendix table 7--U.S. sugarbeets: Cost of production and processing, by cost item, 1987/88 crop

Item	Per ton, sugarbeets	Per pound, refined sugar
	<u>Dollars</u>	<u>Cents</u>
<b>Production:</b>		
Variable	15.13	5.679
Fixed	6.31	2.369
Operating capital	0.31	0.117
Nonland capital	0.65	0.244
Land	5.42	2.034
Total production costs	27.82	10.443
<b>Processing:</b>		
Variable	20.26	7.606
Fixed	3.09	1.160
General and administrative	1.66	0.621
Pulp drying and marketing	3.23	1.214
Total processing costs	28.24	10.601
<b>Total production and processing costs</b>	<b>56.06</b>	<b>21.044</b>
<b>Credits:</b>		
Dried pulp	5.48	2.057
Molasses	1.69	0.634
Other	0.47	0.177
Total	7.64	2.868
<b>Net production and processing costs</b>	<b>48.42</b>	<b>18.176</b>
	<u>Dollars per acre</u>	
<b>Total production costs</b>	<b>623.16</b>	
	<u>Net tons of sugarbeets per planted acre</u>	
<b>Yield</b>	<b>22.40</b>	
	<u>Pounds of refined sugar per net ton of beets</u>	
<b>Recovery</b>	<b>266.40</b>	

Source: U.S. Dept. Agr., Economic Research Service.

Appendix table 8--U.S. value comparisons for sugar, 1970/71-88/89 1/

Crop year	Loan value per acre 2/				Market value per acre 2/				Gross value of production			
	Nominal		Constant, 1982 dollars		Nominal		Constant, 1982 dollars		Nominal		Constant, 1982 dollars	
	Sugar-cane 3/	Sugar-beets 4/	Sugar-cane	Sugar-beets	Sugar-cane 5/	Sugar-beets	Sugar-cane 5/	Sugar-beets	Sugar-cane 5/	Sugar-beets	Sugar-cane 5/	Sugar-beets
	-----Dollars-----						-----Million dollars-----					
1970/71	---	---	---	---	442.26	264.01	1,053.05	628.60	243.0	377.8	578.6	899.5
1971/72	---	---	---	---	417.58	297.48	940.50	670.00	253.5	413.2	571.0	930.6
1972/73	---	---	---	---	485.44	323.17	1,043.96	694.99	322.2	460.2	692.9	989.7
1973/74	---	---	---	---	657.46	607.69	1,328.20	1,227.66	461.7	777.9	932.7	1,571.5
1974/75	---	---	---	---	1,691.28	827.49	3,132.00	1,532.39	1,166.8	1,035.6	2,160.7	1,917.8
1975/76	---	---	---	---	799.80	514.55	1,348.74	867.71	587.6	820.7	990.9	1,384.0
1976/77	---	---	---	---	580.64	404.35	920.19	640.81	408.8	616.8	647.9	977.5
1977/78	604.26	484.30	897.86	719.61	633.66	474.93	941.55	705.69	455.4	604.4	676.7	898.1
1978/79	659.32	534.63	913.19	740.48	692.25	497.78	958.80	689.45	484.0	649.8	670.4	900.0
1979/80	609.96	473.09	776.03	601.90	956.80	642.11	1,217.30	816.93	660.7	745.3	840.6	948.2
1980/81	---	---	---	---	1,439.90	900.67	1,680.16	1,050.96	1,035.7	1,109.0	1,208.5	1,294.0
1981/82	---	---	---	---	910.71	645.86	968.84	687.09	637.8	803.6	678.5	854.9
1982/83 7/	857.27	592.51	857.27	592.51	1,049.40	701.98	1,049.40	701.98	753.9	740.3	753.9	740.3
1982/83	870.37	606.72	870.37	606.72	1,049.40	701.98	1,049.40	701.98	753.9	740.3	753.9	740.3
1983/84	838.95	599.65	807.46	577.14	1,036.94	718.17	998.02	691.21	756.2	777.7	727.8	748.5
1984/85	914.09	624.39	848.74	579.75	1,051.86	6/ 666.67	976.66	619.01	733.4	750.2	681.0	696.6
1985/86	906.34	652.71	817.26	588.56	990.57	673.94	893.21	607.70	717.6	761.2	647.1	686.4
1986/87	903.64	648.65	793.36	569.49	1,053.78	730.93	925.18	641.73	790.0	902.2	693.6	792.1
1987/88	925.02	773.01	787.92	658.44	1,055.07	857.22	898.70	730.17	821.2	1,080.6	699.5	920.4
1988/89	912.07	644.27	751.91	531.14	NA	NA	NA	NA	NA	NA	NA	NA

NA = Not available.

--- = Not applicable.

1/ Data exclude Puerto Rico.

2/ Values are harvested acre for sugarcane; planted acre for sugarbeets.

3/ Based upon growers receiving 60 percent of the returns and processors 40 percent.

4/ Based upon growers receiving 65 percent of the returns and processors 35 percent.

5/ Excludes Hawaii in 1970-73.

6/ Excludes CCC's \$17.5 million bankruptcy compensation payments to growers.

7/ Purchase program.

Source: U.S. Dept. Agr., Economic Research Service.

Appendix table 9--U.S. sugarcane and sugarbeets: Prices received by farmers, parity, and percentage of parity, 1960/61-1987/88

Crop year	Sugarcane			Sugarbeets		
	Price received 1/	Parity price 2/	Percentage of parity	Price received 1/	Parity price 2/	Percentage of parity
	-----Dollars per ton-----		Percent	---Dollars per ton--		Percent
1960/61	8.54	9.78	87.3	13.91	16.40	84.8
1961/62	8.90	10.30	86.4	13.46	16.90	79.6
1962/63	9.51	11.10	85.7	15.05	17.90	84.1
1963/64	11.35	11.40	99.6	14.42	18.00	80.1
1964/65	7.84	11.90	65.9	14.00	18.80	74.5
1965/66	8.94	12.30	72.7	14.08	19.30	73.0
1966/67	9.85	12.60	78.2	14.96	19.60	76.3
1967/68	10.54	13.00	81.1	15.67	20.30	77.2
1968/69	10.53	14.00	75.2	15.96	21.50	74.2
1969/70	11.15	14.70	75.9	14.72	22.30	66.0
1970/71	11.67	15.60	74.8	16.87	23.20	72.7
1971/72	12.25	16.60	73.8	17.45	24.60	70.9
1972/73	12.64	19.20	65.8	18.00	28.00	64.3
1973/74	21.97	22.10	99.4	31.68	32.00	99.0
1974/75	49.64	31.20	159.1	48.86	40.50	120.6
1975/76	21.50	33.10	65.0	27.60	43.20	63.9
1976/77	15.20	33.30	45.6	21.00	43.50	48.3
1977/78	17.70	35.90	49.3	24.20	47.10	51.4
1978/79	19.50	40.00	48.8	25.20	51.80	48.6
1979/80	26.00	44.00	59.1	33.90	57.00	59.5
1980/81	38.50	52.00	74.0	47.20	65.50	72.1
1981/82	24.90	52.70	47.2	29.20	66.20	44.1
1982/83	26.50	53.60	49.4	35.40	67.00	52.8
1983/84	27.80	55.20	50.4	37.00	68.20	54.3
1984/85	28.20	48.80	57.8	3/ 34.70	63.30	54.8
1985/86	26.70	47.90	55.7	33.80	61.40	55.0
1986/87	27.30	49.90	54.7	35.90	63.60	56.4
1987/88	29.30	53.20	55.1	38.20	67.70	56.4

1/ Includes Government payments.

2/ July parity (1910-14 = 100) for the following year.

3/ Includes bankruptcy compensation payments of \$0.80 per net ton of sugarbeets.

Source: U.S. Dept. Agr., Economic Research Service.

Appendix table 10--U.S. farmer-related programs for sugar, 1970/71-1987/88

Crop year	Direct or deficiency 1/		Diver-sion	Disaster	CCC operations						
	Sugar-cane	Sugar-beets			Storage	Outlays		Redemptions		Net	
						Cane sugar	Raw sugar	Beet sugar	Raw cane sugar	Beet sugar	Raw cane sugar
Million dollars											
1970/71	29.6	54.2	---	---	---	---	---	---	---	---	
1971/72	29.4	56.2	---	---	---	---	---	---	---	---	
1972/73	31.4	57.9	---	---	---	---	---	---	---	---	
1973/74	2/ 29.1	50.4	---	---	---	---	---	---	---	---	
1974/75	29.2	47.4	---	---	---	---	---	---	---	---	
1975/76	---	---	---	---	---	---	---	---	---	---	
1976/77	---	---	---	---	---	---	---	---	---	---	
1977/78	3/ 125.2	3/ 111.0	---	---	5.4	113.6	264.7	59.0	264.7	54.6 0	
1978/79	---	---	---	---	4.3	319.4	472.9	253.0	399.2	66.4 73.7	
1979/80	---	---	---	---	---	171.0	333.4	171.0	333.4	0 0	
1980/81	---	---	---	---	---	---	---	---	---	---	
1981/82	---	---	---	---	---	---	---	---	---	---	
1982/83 4/	---	---	---	---	---	---	---	---	---	---	
1982/83 5/	---	---	---	---	---	188.5	567.8	188.5	567.8	0 0	
1983/84	---	---	---	---	---	125.3	487.5	125.3	487.5	0 0	
1984/85	---	6/ 17.5	---	---	11.0	248.8	584.6	141.2	505.4	107.6 7/ 51.4	
1985/86	---	---	---	---	---	385.0	601.6	385.0	601.6	0 0	
1986/87	---	---	---	---	---	234.9	533.5	234.9	533.5	0 0	
1987/88	---	---	---	---	---	282.6	704.1	282.6	704.1	0 0	

--- = Not applicable.

1/ Represents payments made under the Sugar Act of 1948, as amended, and includes abandonment and deficiency payments.

2/ Estimated.

3/ Represents payments made under the Food and Agriculture Act of 1977 and includes both grower and processor portions.

4/ Purchase agreements totaling \$412.7 million (\$306 million beet sugar and \$106.7 million cane sugar were filed. However, none of the agreements were executed.

5/ Loan program, 1982-87.

6/ Reflects bankruptcy compensation payments paid to growers.

7/ Excludes \$27.8 million transferred to CCC accounts receivable.

Source: U.S. Dept. Agr., Economic Research Service.

Appendix table 11--U.S. per capita consumption of caloric and low-calorie sweeteners, 1975-89

Calendar year	Refined sugar <u>1/</u>	Corn sweeteners <u>2/</u>				Pure honey	Edible syrups	Total caloric sweeteners	Saccharin	Aspartame	Total of low-calorie sweeteners <u>3/</u>	Total of all sweeteners
		HFCS	Glucose syrup	Dextrose	Total							
-----Pounds, dry basis-----								--Pounds, sugar-sweetness-equivalent---			Pounds dry basis	
1975	89.2	4.9	17.5	5.0	27.4	1.0	0.4	118.0	6.1	0	6.1	124.1
1976	93.4	6.9	17.5	5.0	29.4	.9	.4	124.1	6.1	0	6.1	130.2
1977	94.2	9.1	17.6	4.1	30.8	1.0	.4	126.4	6.6	0	6.6	133.0
1978	91.5	11.2	17.8	3.8	33.8	1.1	.4	126.8	6.9	0	6.9	133.7
1979	89.3	14.4	17.9	3.6	35.9	1.0	.4	126.6	7.3	0	7.3	133.9
1980	83.6	18.0	17.6	3.5	39.1	.8	.4	123.9	7.7	0	7.7	131.6
1981	79.4	22.2	17.8	3.5	43.5	.8	.4	124.1	8.0	.2	8.2	132.3
1982	73.6	26.7	18.0	3.5	48.2	.9	.4	123.1	8.4	1.0	9.4	132.5
1983	71.0	31.1	18.0	3.5	52.6	.9	.4	124.9	9.5	3.5	13.0	137.9
1984	67.6	37.3	18.0	3.5	58.8	1.0	.4	127.8	10.0	5.8	15.8	143.6
1985	63.4	44.1	18.0	3.5	65.6	1.0	.4	130.4	6.0	12.0	18.0	148.4
1986	60.8	46.0	18.0	3.5	67.5	1.0	.4	129.7	5.5	13.0	18.5	148.2
1987	62.4	47.1	18.0	3.5	68.6	1.0	.4	132.4	5.5	13.5	19.0	151.4
1988	61.7	48.0	18.0	3.6	69.6	1.0	.4	132.7	6.0	14.0	20.0	152.7
1989 <u>4/</u>	61.4	47.7	18.0	3.6	69.3	1.0	.4	132.1	NA	NA	NA	NA

NA = Not available.

1/ Sugar consumption is the total of U.S. sugar deliveries and sugar imported in blends and mixtures.

2/ Dry basis.

3/ Assumes saccharin is 300 times sweeter than sugar and aspartame is 200 times sweeter than sugar.

4/ Preliminary.

Source: U.S. Dept. Agr., Economic Research Service.

Appendix table 12--U.S. total consumption of caloric sweeteners, calendar years, 1980-89

Calendar year	Sugar <u>1/</u>		Corn sweeteners				Pure honey	Edible syrups	Total caloric sweeteners
	Raw value	Refined basis	HFCS <u>2/</u>	Glucose syrup	Dextrose	Total			
<u>Million short tons, dry basis</u>									
1980	10.189	9.522	2.050	2.004	0.399	4.453	0.091	0.046	14.112
1981	9.769	9.130	2.550	2.047	.403	5.000	.092	.046	14.268
1982	9.160	8.561	3.100	2.091	.407	5.598	.105	.046	14.310
1983	8.917	8.334	3.650	2.110	.410	6.170	.106	.047	14.657
1984	8.569	8.008	4.425	2.130	.414	6.969	.118	.047	15.142
1985	8.110	7.579	5.275	2.161	.418	7.854	.120	.048	15.601
1986	7.861	7.347	5.550	2.171	.425	8.146	.121	.048	15.662
1987	8.137	7.605	5.740	2.190	.430	8.360	.122	.049	16.136
1988	8.133	7.601	5.914	2.215	.440	8.569	.123	.049	16.342
1989 <u>3/</u>	8.170	7.636	5.936	2.235	.450	8.621	.124	.050	16.431

1/ Sugar consumption is the total of U.S. sugar deliveries and sugar imported in blends and mixtures.

2/ Includes U.S. imports of HFCS.

3/ Preliminary.

Source: U.S. Dept. Agr., Economic Research Service.

Appendix table 13--U.S. sugar deliveries to industrial and nonindustrial users, 1980-88

Type of user	Calendar year									January-June		
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1987	1988	1989
	<u>1,000 short tons, refined</u>											
Industrial users	6,004	5,665	5,199	4,992	4,684	4,218	4,026	4,252	4,179	2,105	2,053	2,142
Food use	3,843	3,813	3,616	3,744	3,776	3,878	3,760	4,040	3,942	1,993	1,919	2,024
Bakery and cereal products	1,337	1,306	1,296	1,387	1,404	1,494	1,432	1,513	1,541	748	760	764
Confectionery products	932	983	940	1,087	1,115	1,059	1,051	1,146	1,107	556	539	569
Dairy products	450	459	404	385	408	456	447	449	411	223	198	214
Processed foods	535	484	450	454	433	428	387	398	354	192	163	165
Other	589	581	526	431	416	441	443	534	529	274	259	312
Beverage use	2,161	1,852	1,583	1,248	908	340	266	212	237	112	134	118
Nonindustrial users	3,353	3,421	3,214	3,076	3,053	3,123	3,075	3,199	3,316	1,461	1,546	1,478
Institutions	303	259	177	195	209	204	142	163	175	79	86	91
Eating and drinking	96	90	85	94	108	85	84	91	89	50	41	51
Other <sup>1/</sup>	207	169	92	101	101	119	58	72	86	29	45	40
Wholesalers and retailers	3,050	3,162	3,037	2,881	2,844	2,919	2,933	3,036	3,141	1,382	1,460	1,387
Wholesalers, jobbers, and sugar dealers	1,881	2,001	1,951	1,713	1,744	1,874	1,867	2,040	2,200	916	1,040	945
Retail grocers, chain stores and supermarkets	1,169	1,161	1,086	1,168	1,100	1,045	1,066	996	941	466	420	442
Total food and beverage use	9,357	9,086	8,413	8,068	7,737	7,341	7,101	7,451	7,495	3,566	3,599	3,620
Total other use <sup>2/</sup>	120	126	106	131	127	131	138	149	121	70	59	61
All uses, continental												
United States	9,477	9,212	8,519	8,199	7,864	7,472	7,239	7,600	7,616	3,636	3,658	3,681
Hawaii and minor adjustments	45	-81	35	37	37	37	38	33	36	18	19	18
Total refined, including Hawaii	9,522	9,131	8,554	8,236	7,901	7,509	7,277	7,633	7,652	3,654	3,677	3,699
Total, raw value basis	10,189	9,770	9,153	8,812	8,454	8,035	7,786	8,167	8,188	3,910	3,934	3,958
Consumer-size packages <sup>3/</sup>	2,347	2,425	2,310	2,314	2,274	2,185	2,298	2,144	2,084	990	952	1,190
Redistributed to industrial and other users <sup>4/</sup>	703	737	727	567	570	734	635	892	1,057	392	508	197
Total wholesalers and retailers <sup>5/</sup>	3,050	3,162	3,037	2,881	2,844	2,919	2,933	3,036	3,141	1,382	1,460	1,387

<sup>1/</sup> Includes deliveries to Government agencies and the military.

<sup>2/</sup> Used largely for pharmaceuticals and some tobacco.

<sup>3/</sup> Less than 50 pounds. Excludes Hawaii.

<sup>4/</sup> Includes some deliveries to institutions. Excludes Hawaii.

<sup>5/</sup> Continental United States only.

Source: U.S. Dept. Agr., National Agricultural Statistics Service.



Appendix table 14--U.S. sugar imports under quotas, by country, 1984-89

Country	1984/85 <sup>1/</sup>		1985/86 <sup>2/</sup>		1987 <sup>3/</sup>		1988 <sup>4/</sup>		1989/90	
	Quota allocation	Actual imports	Quota allocation	Actual imports	Quota allocation	Actual imports	Quota allocation	Actual imports	Quota allocation <sup>5/</sup>	Actual imports <sup>6/</sup>
	Short tons, raw value									
Argentina	109,220	109,219	73,788	72,917	39,130	38,720	43,175	43,175	101,776	53,022
Australia	210,820	210,820	142,428	142,428	75,530	75,530	83,335	83,438	196,453	97,350
Barbados	17,780	17,800	12,500	11,678	7,500	7,500	8,205	8,205	16,569	8,236
Belize	27,940	28,104	18,876	18,876	10,010	10,010	16,692	16,692	26,036	13,060
Bolivia	20,320	21,544	13,728	13,728	7,500	7,500	8,230	8,230	18,935	8,494
Brazil	368,300	368,300	248,820	248,820	131,950	131,950	145,590	145,462	343,201	63,014
Canada	27,940	27,918	18,876	18,902	10,010	9,749	11,045	10,375	26,036	5,438
Colombia	60,960	57,175	41,184	41,184	21,840	21,840	24,100	24,102	56,806	42,286
Congo	12,500	12,499	12,500	12,500	7,500	7,500	8,000	8,000	15,669	776
Costa Rica	52,302	52,302	34,713	34,713	17,583	17,583	19,577	19,547	48,391	23,428
Cote D'Ivoire	12,500	12,500	12,500	12,151	7,500	7,500	8,000	8,000	15,669	8,068
Dominican Republic	447,040	447,040	302,016	302,016	160,160	159,319	176,710	169,190	416,576	242,944
Ecuador	27,940	28,033	18,876	18,876	10,010	10,010	11,045	7,903	26,036	13,200
El Salvador	74,561	74,561	50,000	48,133	26,020	25,893	28,815	28,815	69,271	25,511
Fiji	17,780	17,955	12,500	12,500	25,190	25,190	9,035	9,200	21,231	10,672
Gabon	12,500	3,461	12,500	12,322	7,500	7,500	8,000	8,000	15,669	858
Guatemala	121,920	122,439	82,368	82,368	43,680	43,347	48,185	48,962	113,612	52,159
Guyana	30,480	30,362	20,592	20,592	10,920	10,920	374	374	28,403	7,912
Haiti	12,500	12,112	12,500	12,500	7,500	7,500	8,000	7,600	15,669	8,420
Honduras	50,017	50,014	32,713	32,713	15,917	15,917	17,877	17,896	46,006	22,596
India	20,320	20,320	13,728	13,728	7,500	7,500	8,230	6,026	18,935	9,165
Jamaica	27,940	28,686	18,876	18,876	10,010	10,010	16,692	16,426	26,036	12,999
Madagascar	12,500	12,593	12,500	12,462	7,500	7,500	8,000	7,934	15,669	7,978
Malawi	35,400	36,317	17,160	17,142	9,100	9,100	10,045	10,045	23,563	11,736
Mauritius	27,940	27,970	30,592	30,592	10,920	10,920	12,050	12,050	28,368	23,235
Mexico	12,500	13,361	12,500	12,500	7,500	7,500	8,000	8,000	15,669	13,720
Mozambique	33,020	31,545	22,308	22,290	11,830	11,830	13,055	13,055	30,770	15,089
Nicaragua	6,000	6,000	0	0	0	0	0	0	0	0
Panama <sup>7/</sup>	73,660	73,814	49,764	49,625	26,390	26,390	---	210	33,949	0
Papua New Guinea	12,500	12,118	12,500	12,500	7,500	7,416	8,000	8,000	15,669	8,077
Paraguay	12,500	12,781	12,500	12,190	7,500	5,787	8,000	8,017	15,669	8,567
Peru	104,140	104,108	70,356	68,686	37,310	36,883	41,165	28,580	97,043	37,117
Philippines	342,900	325,129	246,999	243,880	143,780	143,780	158,640	158,640	373,972	182,881
St. Christopher-Nevis	12,500	12,519	12,500	12,500	7,500	7,500	8,000	8,086	15,669	8,040
South Africa	58,420	58,321	24,129	24,129	0	0	0	0	0	0
Swaziland	40,640	40,604	27,456	27,456	14,560	14,560	16,065	16,065	37,871	18,484
Taiwan	30,480	30,338	20,592	19,976	10,920	10,920	12,050	12,050	28,403	14,161
Thailand	35,560	35,524	24,024	23,993	12,740	12,637	14,055	9,806	33,136	16,186
Trinidad-Tobago	17,780	17,683	12,500	12,500	7,500	7,500	8,588	8,588	16,569	8,159
Uruguay	12,500	12,347	12,500	12,500	7,500	7,500	8,000	8,000	15,669	205
Zimbabwe	30,480	30,481	20,592	20,592	10,920	10,920	12,050	12,050	28,403	25,030
Subtotal	2,675,000	2,646,717	1,848,054	1,845,352	1,001,430	997,131	1,054,675	1,024,791	2,489,070	1,122,121
Specialty sugars	1,840	280	1,840	306	2,000	NA	2,000	NA	2,000	NA
Grand total	2,676,840	2,646,997	1,849,894	1,845,658	1,003,430	997,131	1,056,675	1,024,791	2,491,070	1,122,121

--- = Not applicable.  
NA = Not available.

Note: Imports are reported on an actual weight basis adjusted by Customs upward by a factor of 1.035. When final polarization results are received or when adjustments are made to raw value on final vessels, cumulative import data are adjusted accordingly. A country's excess of cumulative entries and adjustments over its quota allocation is carried over to and against the country's allocation for the next quota period. To convert to metric tons, divide by 1.10231125.

<sup>1/</sup> Oct. 1, 1984 - Nov. 30, 1985.

<sup>2/</sup> Dec. 1, 1985 - Dec. 31, 1986.

<sup>3/</sup> Quota period Jan. 1, 1987, to Dec. 31, 1987.

<sup>4/</sup> Quota period Jan. 1, 1988, to Dec. 31, 1988.

<sup>5/</sup> Quota period Jan. 1, 1989, to Sept. 30, 1990. Quota was increased Sept. 12 and again on Nov. 24.

<sup>6/</sup> Imports as of Sept. 30, 1989.

<sup>7/</sup> Panama's 1989 quota allocation of 33,949 short tons is suspended and is not allowed to be shipped at this time. Panama's initial allocation of 33,661 short tons, raw value, was suspended pursuant to section 565 of H.R. 4637 and subsequently reallocated on Sept. 12, 1989.

Source: U.S. Dept. Agr., Foreign Agricultural Service.

Appendix table 15--U.S. sugar production and deliveries for use by region, 1980-88

Region 1/	1980	1981	1982	1983	1984	1985	1986	1987	1988
<u>1,000 short tons, raw value</u>									
<b>New England:</b>									
Production	325	310	295	290	195	180	180	180	40
Use 2/	344	336	309	295	280	249	248	257	253
Balance	-19	-26	-14	-5	-85	-69	-68	-77	-213
<b>Middle Atlantic:</b>									
Production	1,599	1,575	1,050	1,050	950	850	840	835	875
Use 2/	1,628	1,622	1,506	1,456	1,435	1,388	1,317	1,364	1,349
Balance	-29	-47	-456	-406	-485	-538	-477	-529	-474
<b>North Central:</b>									
Production	1,626	1,637	1,522	1,567	1,289	1,385	1,503	1,563	1,855
Use 2/	3,449	3,429	3,160	2,954	2,810	2,832	2,722	2,927	2,984
Balance	-1,823	-1,792	-1,638	-1,387	-1,521	-1,447	-1,219	-1,364	-1,129
<b>South:</b>									
Production	4,099	3,497	3,357	3,654	3,626	3,298	3,207	3,084	2,783
Use 2/	2,949	2,595	2,734	2,675	2,586	2,325	2,306	2,349	2,301
Balance	1,150	902	623	979	1,040	973	901	735	482
<b>West:</b>									
Production	2,531	2,751	2,929	2,251	2,394	2,322	2,056	2,505	2,635
Use 2/	1,810	1,788	1,444	1,432	1,343	1,241	1,193	1,270	1,301
Balance	721	963	1,485	819	1,051	1,081	863	1,235	1,334
<b>U.S. Total:</b>									
Production	10,180	9,770	9,153	8,812	8,454	8,035	7,786	8,167	8,188
Use 2/	10,180	9,770	9,153	8,812	8,454	8,035	7,786	8,167	8,188
Balance	0	0	0	0	0	0	0	0	0

Notes: 1979/80 production is combined with 1980 deliveries, 1980/81 output with 1981 deliveries, and so on for subsequent years. "Production" is regional output plus raw cane imports for refining.

1/ States are grouped into regions as follows:

New England--Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont

Mid-Atlantic--New Jersey, New York, and Pennsylvania.

North Central--Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

South--Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

West--Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

2/ Consists of deliveries for food and beverage use, polyhydric (nonfood) use, and the sugar re-export program.

Source: Commodity Information, Inc., and U.S. Dept. Agr., National Agricultural Statistics Service.

Appendix table 16--HFCS supply and use, 1975-89

Calendar year	Supply						Utilization										
	Domestic shipments			Imports	Total	Net change in stocks	Total use	Exports			Non-food use	Domestic disappearance for food use					
	HFCS-42	HFCS-55 1/	Total					To foreign countries	To Puerto Rico	Total		Total			Per Capita		
				HFCS-42	HFCS-55	Total	HFCS-42				HFCS-55	Total					
-----1,000 short tons, dry weight-----																	
1975	532	---	532	---	532	4	528	---	---	---	3	525	---	525	4.9	---	4.9
1976	787	---	787	---	787	33	754	---	---	---	4	750	---	750	6.9	---	6.9
1977	1,011	53	1,064	---	1,064	58	1,006	1	---	1	5	950	50	1,000	8.6	0.5	9.1
1978	1,087	121	1,208	---	1,208	-50	1,258	2	---	2	6	1,150	100	1,250	10.3	.9	11.2
1979	1,339	335	1,674	---	1,674	35	1,639	3	1	4	10	1,300	325	1,625	11.5	2.9	14.4
1980	1,530	650	2,180	---	2,180	106	2,074	7	2	9	15	1,400	650	2,050	12.3	5.7	18.0
1981	1,603	1,069	2,672	---	2,672	69	2,603	8	3	11	42	1,500	1,050	2,550	13.1	9.1	22.2
1982	1,554	1,554	3,108	---	3,108	-44	3,152	1	4	5	47	1,600	1,500	3,100	13.8	12.9	26.7
1983	1,622	1,982	3,604	28	3,632	-81	3,713	1	10	11	52	1,650	2,000	3,650	14.1	17.0	31.1
1984	1,610	2,684	4,294	124	4,418	-70	4,488	1	16	17	46	1,725	2,700	4,425	14.5	22.8	37.3
1985	1,825	3,388	5,213	185	5,398	62	5,336	1	19	20	41	1,825	3,450	5,275	15.3	28.8	44.1
1986	1,872	3,485	5,357	224	5,581	-32	5,613	1	17	18	45	1,950	3,600	5,550	16.2	29.8	46.0
1987	2,027	3,595	5,622	203	5,825	11	5,814	1	22	23	51	2,075	3,665	5,740	17.0	30.0	47.1
1988	2,342	3,531	5,873	184	6,057	27	6,030	4	25	29	87	2,258	3,656	5,914	18.3	29.7	48.0
1989 2/	2,424	3,487	5,911	178	6,089	29	6,060	18	26	44	80	2,394	3,542	5,936	19.2	28.5	47.7

--- = Zero or negligible.

1/ HFCS (55-percent fructose content) was not commercially produced prior to 1977.

2/ Forecast.

Source: Estimates for domestic HFCS production and nonfood use are based on confidential trade sources. Imports, exports, and shipments to Puerto Rico are from Bureau of the Census. Estimates of net change in stocks and domestic disappearance for food are from U.S. Dept. Agr., Economic Research Service.

Appendix table 17--U.S. production capacity for HFCS, by company, 1980-90

Company	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990E
<u>1,000 short tons, dry basis</u>											
<b>HFCS-42</b>											
ADM	650	650	638	690	675	675	675	675	675	675	675
American Fructose <u>1/</u>	68	68	63	65	73	123	150	128	128	230	230
Amstar <u>2/</u>	150	150	151	68	80	NA	NA	NA	NA	NA	NA
Cargill <u>3/</u>	132	107	206	180	250	360	355	355	425	425	425
CPC <u>4/</u>	178	268	360	345	413	320	213	213	245	285	285
Coors	NA	NA	NA	NA	NA	18	18	18	22	22	22
Heinz(Hubinger)	125	125	126	160	115	115	120	120	130	130	130
Holly Sugar <u>5/</u>	50	50	51	NA	NA	NA	NA	NA	NA	NA	NA
Nabisco Brands <u>6/</u>	335	248	81	NA	NA	NA	NA	NA	NA	NA	NA
Staley	425	213	216	408	418	355	355	355	355	355	355
Total	2,112	1,877	1,892	1,915	2,023	1,965	1,885	1,863	1,979	2,122	2,122
<b>HFCS-55</b>											
ADM	275	625	680	875	1,200	1,200	1,200	1,200	1,200	1,200	1,200
American Fructose <u>1/</u>	NA	125	125	123	160	250	315	348	348	268	268
Amstar <u>2/</u>	NA	NA	NA	65	65	NA	NA	NA	NA	NA	NA
Cargill <u>3/</u>	NA	134	268	290	290	475	540	540	655	655	655
CPC <u>4/</u>	NA	NA	50	45	113	225	348	348	348	365	365
Coors	NA	NA	NA	NA	NA	38	38	38	50	54	54
Heinz(Hubinger)	75	75	75	110	128	133	130	130	138	138	138
Nabisco Brands <u>6/</u>	150	230	130	NA	NA	NA	NA	NA	NA	NA	NA
Staley	308	809	809	750	875	1,155	1,250	1,250	1,250	1,250	1,250
Total	808	1,998	2,137	2,258	2,830	3,475	3,820	3,853	3,988	3,929	3,929
Grand Total	2,920	3,875	4,028	4,173	4,853	5,440	5,705	5,715	5,967	6,051	6,051

E = Estimate.

NA = Not available.

1/ Amalgamated joint venture bought out by American Maize, now called American Fructose.2/ Amstar HFCS sold American-Maize in 1985.3/ Cargill data include added capacity of Eddyville, IA, plant as of first quarter 1985.4/ CPC data do not include Canadian plant potential of 300 million pounds. However, data include Argo, IL, capacity for 1986.5/ Holly Sugar closed its facilities in January 1982.6/ As of June 14, 1982, Nabisco Brands was leased to ADM.

Source: Wheat First Securities.

Appendix table 18--U.S. corn wet milling: Prices of corn and byproducts and net cost of corn starch, 1980-88

Calendar year	Corn byproducts				Byproduct credits				Net corn cost	Net starch cost
	Corn	Corn oil	Corn gluten feed	Corn gluten meal	Corn oil	Corn gluten feed	Corn gluten meal	Total byproduct		
	Dollars per bu.	Cents per lb.	Dollars per short ton		-----Cents per bushel-----				Dollars per bu.	Cents per lb.
1980	3.01	26.34	124.74	255.48	42.14	77.97	31.94	152.05	1.49	4.69
1981	3.16	23.76	115.06	257.03	38.02	71.91	32.13	142.06	1.74	5.53
1982	2.48	23.82	113.53	235.31	38.11	70.96	29.42	138.48	1.10	3.49
1983	3.12	24.69	123.83	267.15	39.50	77.39	33.39	150.28	1.62	5.13
1984	3.11	29.81	94.05	243.12	47.69	58.78	30.39	136.86	1.74	5.53
1985	2.52	26.28	75.63	200.40	42.05	47.27	25.05	114.37	1.37	4.35
1986	1.95	18.49	94.78	213.92	29.58	59.24	26.74	115.56	.79	2.51
1987	1.59	21.54	98.28	251.62	34.47	61.42	31.45	127.34	.32	.99
1988	2.36	23.56	122.01	306.14	37.70	76.26	38.27	152.23	.84	2.65

Note: Calculation of byproduct credits assumes 1 bushel of corn weighs 56 pounds and produces 1.6 lbs. of crude corn oil, 12.5 lbs. of corn gluten feed, 2.5 lbs. of corn gluten meal, and 31.5 lbs. of corn starch, dry basis.

Source: No. 2 yellow corn. Central, IL., No. 15 elevators. Crude corn oil, wholesale price, Decatur, IL., National Provisioner. Corn gluten feed, Chicago, IL., 21 percent minimum protein, Feed Market News. Corn gluten meal, Chicago, IL., 60 percent minimum protein, Feed Market News.

Appendix table 19--U.S. corn sweeteners: Corn grind and share of corn crop and area, 1980-89 calendar years

Item	Unit	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989 <sup>1/</sup>
HFCS production	Million short tons	2.2	2.7	3.1	3.6	4.3	5.2	5.4	5.6	5.9	5.9
Equivalent corn grind	Million bushels	131	160	186	216	258	313	321	337	352	355
Share of corn crop	Percent	2.0	2.0	2.3	5.2	3.4	3.5	3.9	4.8	7.2	4.7
Average yield	Bushels per acre	91.0	108.9	113.2	81.2	106.7	118.0	119.3	119.4	84.6	116.6
Area needed for HFCS output	Million acres	1.44	1.47	1.64	2.66	2.42	2.65	2.69	2.82	4.16	3.04
Total corn sweeteners production <sup>2/</sup>	Million short tons	4.6	5.1	5.6	6.1	6.8	7.8	8.0	8.2	8.5	8.6
Equivalent corn grind	Million bushels	276	306	336	366	408	468	480	492	510	514
Share of corn crop	Percent	4.2	3.8	4.1	8.8	5.3	5.3	5.8	7.0	10.4	6.8
Area needed for corn sweeteners output	Million acres	3.03	2.81	2.97	4.51	3.82	3.97	4.02	4.12	6.03	4.41

<sup>1/</sup> Preliminary.

<sup>2/</sup> HFCS, glucose corn syrup, and dextrose.

Source: U.S. Dept. Agr., Economic Research Service.

Appendix table 20--Sugar production, area, and yield, for world and selected countries

Item	Beet Sugar						Cane Sugar							
	World	EC	USSR	Eastern Europe	China	United States	World	India	Brazil	Cuba	China	Australia	Thailand	United States
<u>Million metric tons</u>														
Production:														
1978/79-80/81 average	34.16	13.93	8.15	5.15	0.46	2.82	54.15	6.26	7.76	7.46	2.23	3.06	1.54	2.45
1988/89	37.15	14.78	8.90	4.82	1.00	3.18	68.43	10.15	8.58	8.10	4.10	3.68	4.02	3.04
Percent change	8.8	6.1	9.2	-6.4	117.4	12.8	26.4	62.1	10.6	8.6	83.9	20.3	161.0	24.1
<u>Million hectares</u>														
Area:														
1978/79-80/81 average	8.85	2.00	3.74	1.52	.37	.48	9.71	1.66	1.50	1.30	.51	.27	.47	.28
1988/89	8.61	1.84	3.36	1.36	.71	.53	13.19	3.35	1.95	1.35	.98	.33	.66	.32
Percent change	-2.7	-.8	-10.2	-10.5	91.9	10.4	35.8	101.8	30.0	3.8	92.2	22.2	40.4	14.3
<u>Tons per harvested hectare, raw value</u>														
Yield:														
1978/79-80/81 average	3.85	6.96	2.18	3.40	1.23	5.84	5.57	3.77	5.17	5.74	4.37	11.33	3.28	8.75
1988/89	4.32	8.04	2.65	3.54	1.41	6.04	5.19	3.03	4.40	6.00	4.50	11.25	6.10	9.50
Percent change	12.2	15.5	21.6	4.1	14.6	3.4	-.7	-19.6	-14.9	4.5	3.0	-.1	86.0	8.6

Source: U.S. Dept., Agr., Foreign Agricultural Service.

Appendix table 21--Sugar per capita consumption for world and selected regions, selected years

Calendar year	World	North America	Central America	South America	Europe	Africa	Asia	Oceania
<u>Kilograms, raw value</u>								
1974	20.7	47.6	39.5	39.6	42.0	12.8	8.6	49.7
1979	21.2	43.5	41.8	43.7	43.7	14.5	9.8	47.2
1985	20.2	31.5	45.9	39.1	39.1	14.7	10.9	41.8
1986	20.6	30.6	43.8	44.8	41.6	14.7	11.0	44.2
1987	21.2	31.7	44.8	42.2	42.1	15.3	11.8	43.8

Source: International Sugar Organization.

Appendix table 22--Sugar consumption for world and selected countries, selected years

Marketing year	World	Brazil	China	India	Indonesia	Mexico	Pakistan	EC	Japan	United States	USSR
<u>Million metric tons, raw value</u>											
1974/75	76.71	4.51	2.63	4.95	1.27	2.40	0.60	12.15	2.77	8.59	11.27
1979/80	90.12	6.10	3.70	6.67	1.74	3.13	0.82	12.11	3.27	9.62	12.78
1984/85	97.44	6.30	6.05	9.12	1.57	3.47	1.38	11.74	2.94	7.31	13.08
1988/89	107.10	6.60	7.60	11.00	2.31	3.84	2.12	12.23	2.83	7.46	14.00
1989/90	108.14	6.70	7.80	11.00	2.35	3.85	2.19	12.14	2.85	7.53	13.90

Source: U.S. Dept. Agr., Foreign Agricultural Service.

Appendix table 23--Retail sugar price comparisons in selected world capitals 1/

Capital cities	1983	1984	1985	1986	1987	1988	1989 2/
<u>U.S. dollars per kilogram 3/</u>							
Bern	0.72	0.58	0.66	0.81	0.89	0.86	0.85
Bonn	.74	.65	.74	.95	1.16	1.07	1.08
Brasilia	.37	.42	1.87	.31	.41	.44	.47
Buenos Aires	.41	.63	.47	.75	.66	1.03	.47
Canberra	.72	.64	.49	.61	.55	.75	.71
London	.77	.61	.66	.66	.93	.96	.96
Madrid	.60	.60	.64	.79	1.03	1.04	1.04
Mexico City	.19	.30	.15	.19	.17	.32	.39
Ottawa	.41	.72	.33	.33	.34	.37	.53
Paris	.68	.62	.78	.95	1.17	1.13	1.09
Pretoria	.54	.48	.39	.60	.56	.50	.53
Rome	.54	.70	.73	.94	1.10	1.03	.99
Seoul	.76	.83	.78	.70	.76	.86	.72
Stockholm	.84	.86	.92	.98	1.19	1.17	1.13
Tokyo	1.16	1.13	1.30	1.48	1.77	1.96	1.79
Washington, DC	.99	.99	1.04	.73	.79	.99	.84

Note: 1 kilogram equals 2.205 pounds.

1/ Survey conducted each November by agricultural attaches assigned to U.S. embassies in capital cities.

2/ May data.

3/ Local currencies converted to U.S. dollars at exchange rates when survey was conducted.

Source: U.S. Dept. Agr., Foreign Agricultural Service.

Appendix table 24--World imports of raw and refined sugar, 1970 and 1979-89

Year	Raw	Refined	Total	Refined imports as percentage of total imports
<u>Million metric tons, raw value</u>				
1970	16.80	5.34	22.14	24.1
1979	17.96	7.08	25.04	28.3
1980	17.65	9.04	26.69	33.9
1981	17.83	10.11	28.20	35.8
1982	18.79	10.54	29.34	35.9
1983	17.62	10.41	27.15	38.4
1984	17.83	9.46	27.57	34.3
1985	17.05	9.27	26.31	35.2
1986	16.17	10.08	26.25	38.4
1987	16.37	9.91	26.28	37.7
1988	16.40	10.36	26.76	35.9
1989 1/	16.75	10.45	27.20	38.2

1/ Forecast.

Source: Landell Mills Commodity Studies, Inc.



Appendix table 25--Sugar imports for major sugar importers, selected years

Year	World Total	USSR	United States <u>1/</u>	Japan	China	EC <u>2/</u>	Five-leading importers' share of world imports
							Percent
-----Million metric tons-----							
1974/75	22.85	3.24	4.38	2.72	0.41	4.58	67.1
1979/80	29.23	4.99	4.32	2.59	1.17	2.93	54.7
1984/85	28.33	4.52	2.57	1.93	1.89	3.00	49.1
1988/89	29.08	5.33	1.78	1.85	2.50	2.69	48.8
1989/90 <u>3/</u>	29.72	5.18	1.79	1.89	3.00	2.63	48.8

1/ Based on foreign offshore receipts.2/ Includes intra-EC trade.3/ Forecast.

Source: U.S. Dept. Agr., Foreign Agricultural Service.

Appendix table 26--Sugar exports for major sugar exporters

Year	World total	Australia	Brazil	Cuba	EC <u>1/</u>	Thailand <u>2/</u>	Five-leading exporters share of world exports
							Percent
-----Million metric tons-----							
1974/75	22.62	2.14	2.42	5.76	1.88	0.49	56.1
1979/80	27.85	2.32	2.33	6.70	5.02	0.57	60.8
1984/85	30.08	2.68	3.44	7.51	5.17	1.83	68.6
1988/89	28.63	2.86	1.37	7.30	5.69	2.95	70.5
1989/90 <u>3/</u>	28.29	2.93	1.30	7.30	5.64	3.00	71.3

1/ Includes intra-EC trade.2/ The Philippines was a major exporter through the early 1980's.3/ Forecast.

Source: U.S. Dept. Agr., Foreign Agricultural Service.

Appendix table 27--European Community: Sugar production, supply, and distribution, 1974/75-1989/90

Marketing year	Beginning stocks	Sugar production	Imports	Total supply/ distribution	Exports	Domestic consumption	Ending stocks
Million metric tons, raw value							
1974/75	1.08	9.77	4.58	15.43	1.88	12.15	1.39
1975/76	1.39	11.39	4.23	17.01	3.01	12.35	1.65
1976/77	1.65	12.28	3.57	17.50	3.17	11.74	2.58
1977/78	2.58	13.67	3.12	19.37	4.68	11.89	2.80
1978/79	2.80	13.84	3.17	19.81	4.40	12.33	3.08
1979/80	3.08	14.00	2.93	20.01	5.02	12.11	2.88
1980/81	2.88	13.99	2.68	19.55	5.61	11.91	2.04
1981/82	2.04	17.09	2.78	21.91	6.48	12.00	3.43
1982/83	3.43	16.08	2.51	22.02	6.48	11.67	3.87
1983/84	3.87	13.03	3.14	20.04	5.63	11.70	2.72
1984/85	2.72	14.44	3.00	20.16	5.17	11.74	3.25
1985/86	3.25	14.52	2.99	20.75	5.60	11.64	3.51
1986/87	3.51	14.99	2.44	20.94	5.41	12.07	3.46
1987/88	3.46	14.16	2.80	20.41	5.45	12.29	2.67
1988/89	2.67	14.79	2.60	20.06	5.58	12.25	2.22
1989/90 <u>1/</u>	2.22	14.62	2.64	19.48	5.36	12.22	1.91

1/ Forecast.

Source: U.S. Dept. Agr., Foreign Agricultural Service.

Appendix table 28--USSR: Sugar production, supply, and distribution, 1974/75-1989/90

Marketing year	Beginning stocks	Sugar production	Imports	Total supply/ distribution	Exports	Domestic consumption	Ending stocks
<u>Million metric tons, raw value</u>							
1974/75	1.47	8.53	3.24	13.24	0.06	11.27	1.91
1975/76	1.91	8.09	3.76	13.76	.08	11.63	2.05
1976/77	2.05	6.70	4.79	13.54	.09	11.89	1.56
1977/78	1.56	8.88	3.99	14.43	.18	12.09	2.17
1978/79	2.17	9.35	4.09	15.61	.25	12.35	3.01
1979/80	3.01	7.93	4.99	15.93	.17	12.78	2.98
1980/81	2.98	7.17	5.24	15.39	.18	12.87	2.34
1981/82	2.34	6.41	7.37	16.13	.27	13.01	2.85
1982/83	2.85	7.39	6.02	16.27	.17	13.02	3.08
1983/84	3.08	8.70	5.77	17.55	.21	13.30	4.04
1984/85	4.04	8.59	4.52	17.15	.18	13.08	3.89
1985/86	3.89	8.26	5.18	17.34	.33	13.40	3.61
1986/87	3.61	8.70	5.06	17.37	.17	14.49	2.70
1987/88	2.70	9.56	5.00	17.26	.20	14.56	2.50
1988/89	2.50	8.90	5.80	17.20	.18	14.10	2.93
1989/90 <u>1/</u>	2.93	9.50	5.03	17.45	.18	14.05	3.23

1/ Forecast.

Source: U.S. Dept. Agr., Foreign Agricultural Service.

Appendix table 29--U.S. and world sugar price differentials and U.S. imports in sugar-containing products, 1977-88

Calendar year	World price <u>1/</u>	U.S. price <u>2/</u>	Gap between U.S. and world price	Imports of sugar in sugar-containing products
-----Cents a pound-----				
				<u>Short tons</u>
1977	8.11	11.00	2.89	90,000
1978	7.81	13.93	6.12	99,500
1979	9.66	15.56	5.90	101,500
1980	29.02	30.11	1.09	99,800
1981	16.93	19.73	2.80	98,300
1982	8.42	19.72	11.50	110,100
1977-82 average	13.33	18.38	5.05	99,867
1983	8.49	22.04	13.55	181,300
1984	5.18	21.74	16.55	237,500
1985	4.04	20.34	16.30	257,800
1986	6.05	20.95	14.90	280,100
1987	6.71	21.83	15.12	288,600
1988	10.17	22.12	11.95	270,000
1983-88 average	6.77	21.50	14.73	252,500

1/ Jan.-Oct. 1977, Contract No. 11--f.o.b. stowed Caribbean ports (including Brazil) bulk. Nov. 1977-Dec. 1978, International Sugar Agreement Price, f.o.b. stowed Caribbean ports, in bulk. 1979-current, Contract No. 11 --f.o.b. stowed Caribbean ports (including Brazil) bulk (spot price). Does not include insurance or transportation to U.S. ports which would add 1 to 1.5 cents a pound.

2/ Jan.-Oct. 1977, Contract No. 12. Nov. 1977 through Dec. 1978, London daily price, c.i.f. U.K., bulk basis, converted to duty-paid, New York. 1979 to May 1985, Contract No. 12, c.i.f., duty/fee-paid, New York. June 1985-Dec. 1985 prices are for nearby No. 12 futures. Starting Jan. 1986 prices are for nearby No. 14 futures.

Source: Coffee, Sugar &amp; Cocoa Exchange, Inc.

Appendix table 30--U.S. imports of sugar in sugar-containing products, by category, 1977-88

Number of tariff items	Category	1977	1978	1979	1980	1981	1982	1977-82 average	1983	1984	1985	1986	1987	1988	1983-88 average
<u>1,000 short tons, refined basis</u>															
5	Confectionery and Chewing Gum	37.4	40.3	38.2	36.8	36.2	38.9	38.0	48.8	69.0	86.3	90.6	87.3	81.3	77.2
6	Miscellaneous Food Preparations	13.6	14.4	14.8	15.5	17.7	20.9	16.2	37.7	68.9	64.7	75.1	70.6	51.1	61.3
3	Bakery and Cereal Products	11.5	15.6	16.1	19.0	17.6	19.8	16.6	21.9	30.6	37.5	39.8	41.3	38.5	34.9
7	Cocoa and Chocolate	5.4	5.8	6.7	8.5	8.2	13.6	8.0	19.5	33.7	32.1	34.2	37.5	36.0	32.1
1	Flavored Sugars, Syrups, and Molasses	0.8	1.3	1.5	1.7	2.5	5.5	2.2	39.1	18.2	12.6	15.4	23.3	35.4	24.0
36	Processed Berries; Preserves; and Candied Fruit and Nuts, etc.	21.3	22.1	24.1	18.2	16.0	11.5	18.9	14.4	17.1	24.6	25.2	28.7	27.6	22.9
58	Total quantity of sugar	90.0	99.5	101.4	99.7	98.2	110.2	99.9	181.4	237.5	257.8	280.3	288.7	269.9	252.4
46	GAO midpoint estimate of total quantity of sugar						110.4					286.0			

Source: U.S. Dept. Agr., Economic Research Service.

Appendix table 31--Marketing years for centrifugal sugar for various countries

Apr/Mar	May/Apr	Jun/May	Jul/Jan	Aug/Jul	Sep/Aug	Oct/Sep	Nov/Dec	Dec/Nov	Jan/Dec
Chile Indonesia *Malawi South Africa Zimbabwe	Swaziland	Argentina Brazil Ecuador *Fiji *Mauritius	Australia Bangladesh Greece Ireland *Paraguay *Reunion Spain Tanzania	Romania	*Albania *Algeria Barbados Belize *Bolivia *Bulgaria Canada Colombia *Cote d'Ivoire *Czechoslovakia El Salvador Finland Honduras *Hungary *Iran *Iraq Italy *South Korea *Libya *New Zealand Nicaragua *Norway Philippines Portugal *Saudi Arabia *Sri Lanka Sudan Suriname Switzerland *Tunisia Turkey USSR United Kingdom *Uruguay Venezuela Yugoslavia	Austria *Belgium/Lux China Costa Rica Denmark France East Germany West Germany India Japan Netherlands Pakistan Panama Poland Sweden United States	*Cuba Dominican Rep Guatemala Mexico Nigeria Taiwan	Thailand	Egypt Guyana *Haiti Jamaica Kenya Malaysia Morocco Peru Trinidad/Tobago *Zaire

\*Countries not directly covered by USDA agricultural counselor or attache reports.

Source: U.S. Dept. Agr., Foreign Agricultural Service.

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