

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.

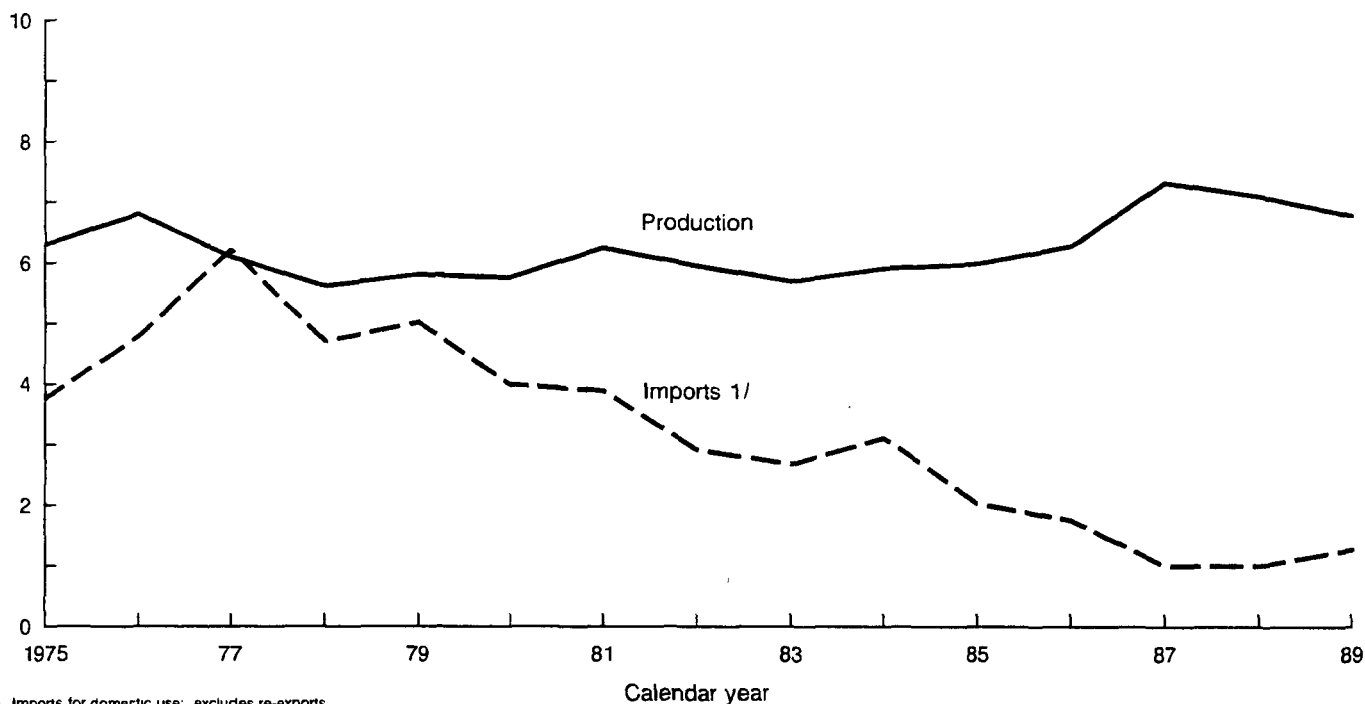
1/ Stocks in hands of primary distributors and CCC. 2/ Receipts and import data compiled by USDA's National Agricultural Statistics Service differ from U.S. Census/U.S. Customs data. 3/ Calculated as a residual.

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.

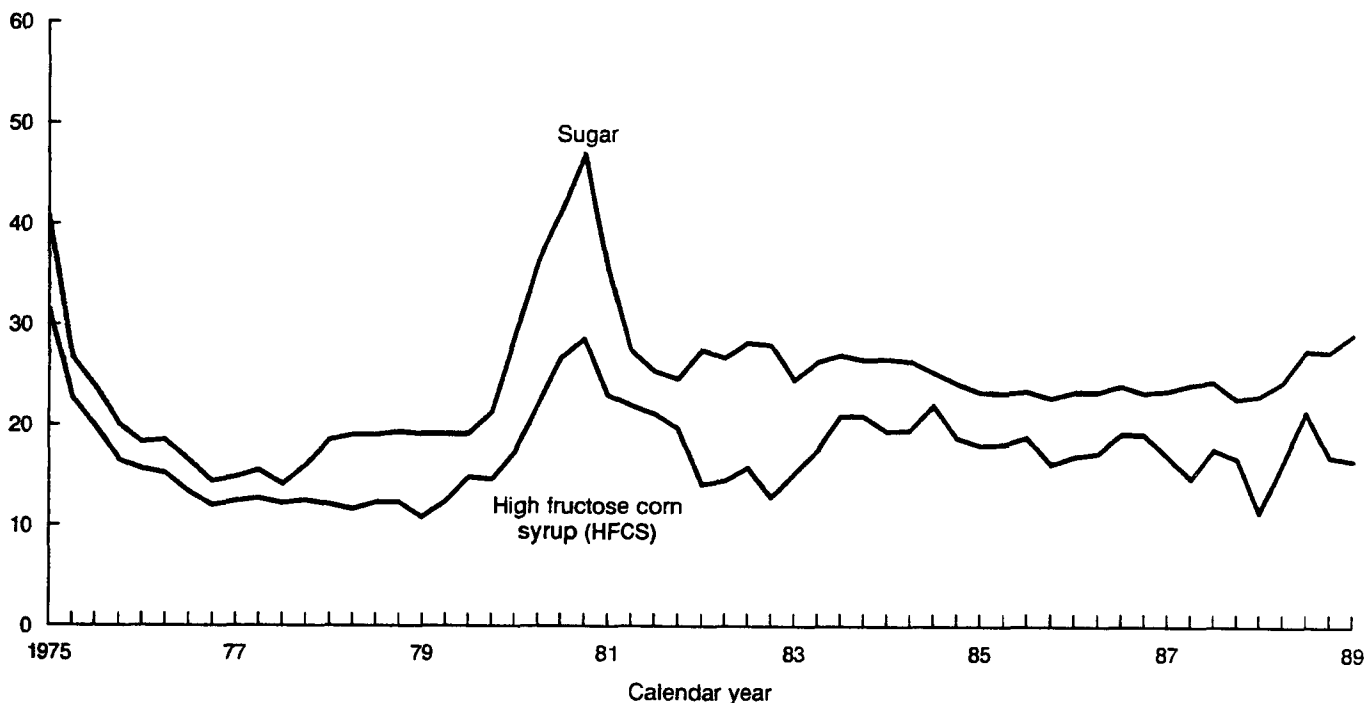
HFCS consumption climbed sharply during 1979-85, with growth averaging over 600,000 tons or nearly 5 pounds per capita each year. Most of this growth was at the expense of sugar (and some displacement of dextrose and glucose corn syrup), but HFCS also generated new uses and was the primary impetus in 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.

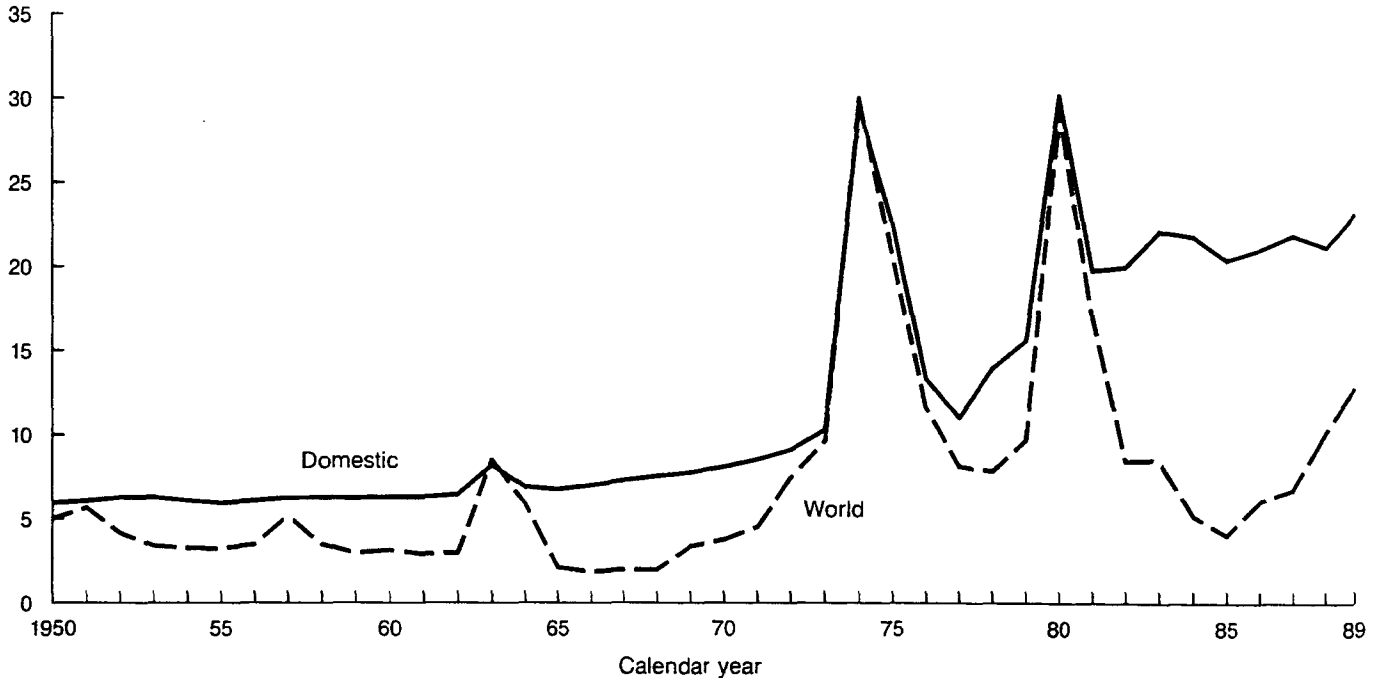
Increases in production capacity during the high-price phase of the sugar cycle take several seasons to be absorbed by relatively steady but slow consumption growth. Processing facilities are expensive to construct and require large size to capture scale economies. Consequently, once in place, there 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).

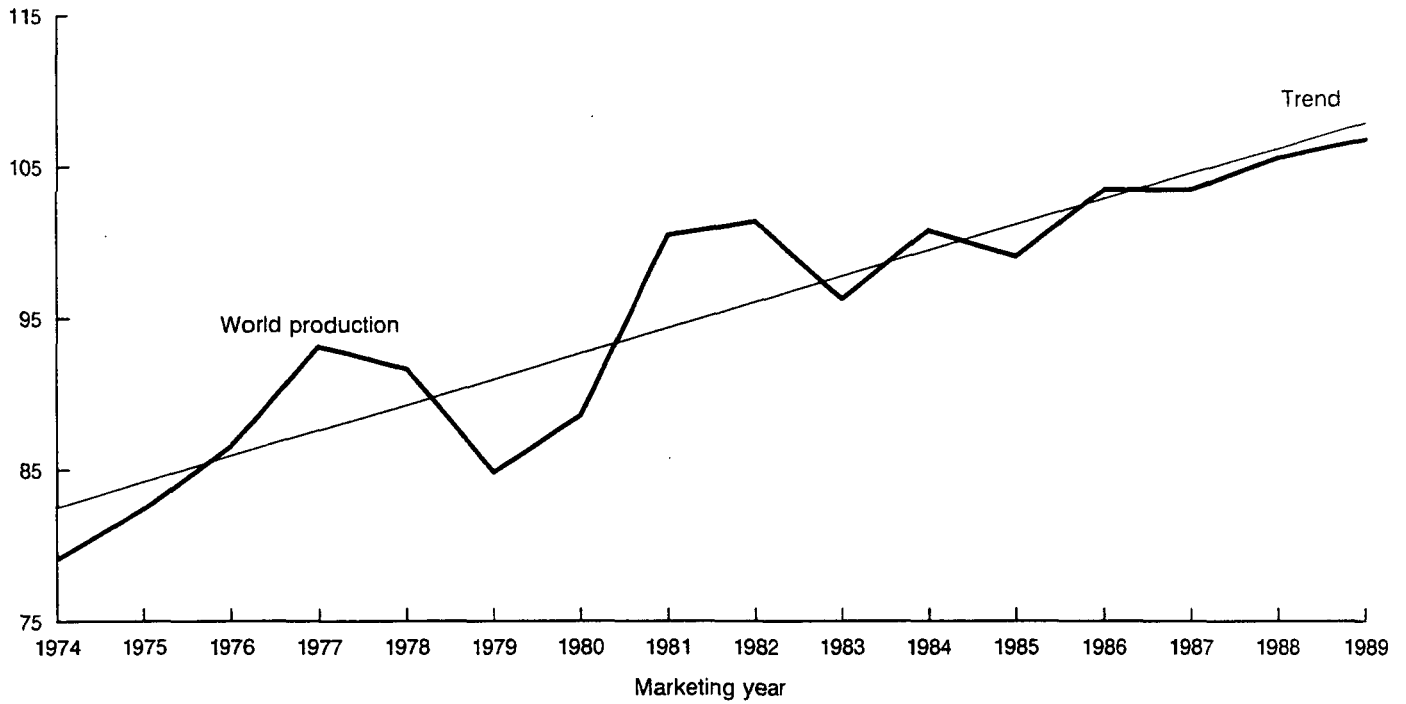
Global consumption is relatively steady year to year, reflecting the stability of the human diet. In contrast, substantial fluctuations can occur in production because of weather factors. In any year, production and consumption can also be influenced by decisions of producers, traders, consumers, and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

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

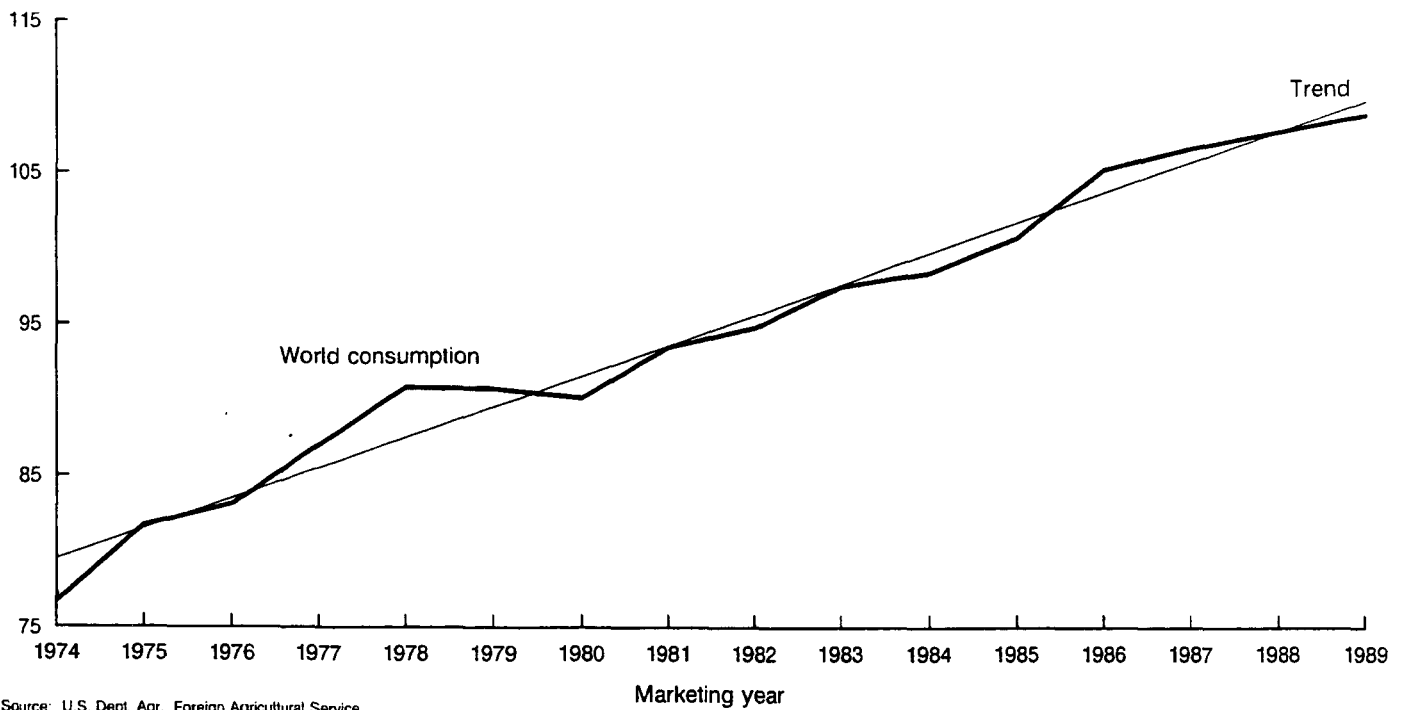


Source: U.S. Dept. Agr. Foreign Agricultural Service.

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

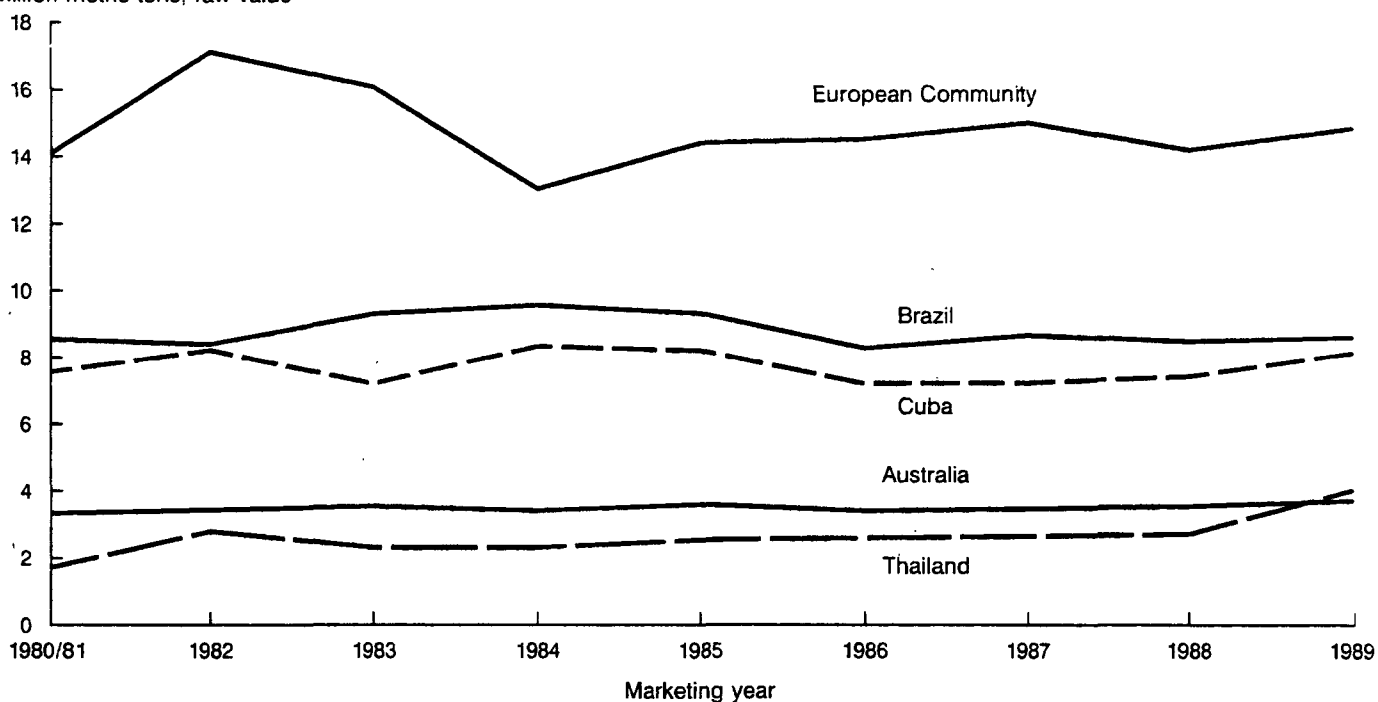
<sup>1/</sup> Forecast.

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.

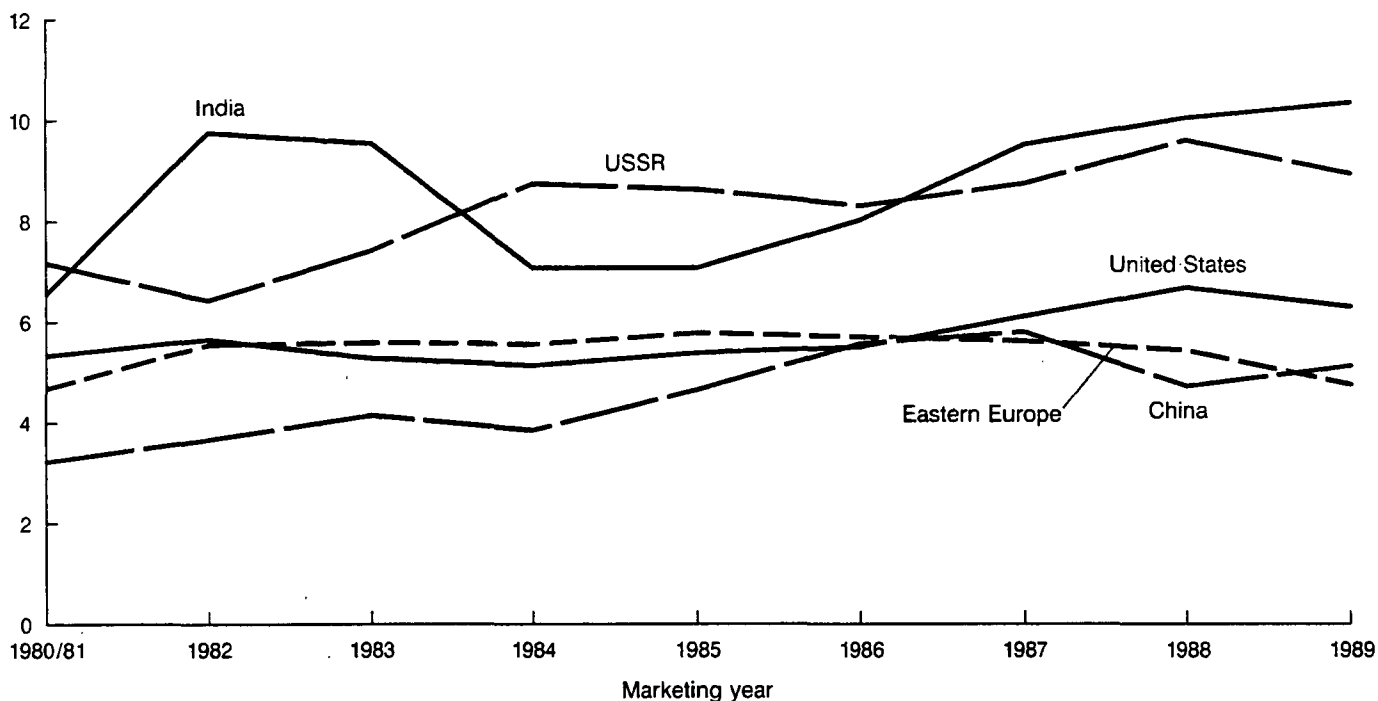
Consumption Trends

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.

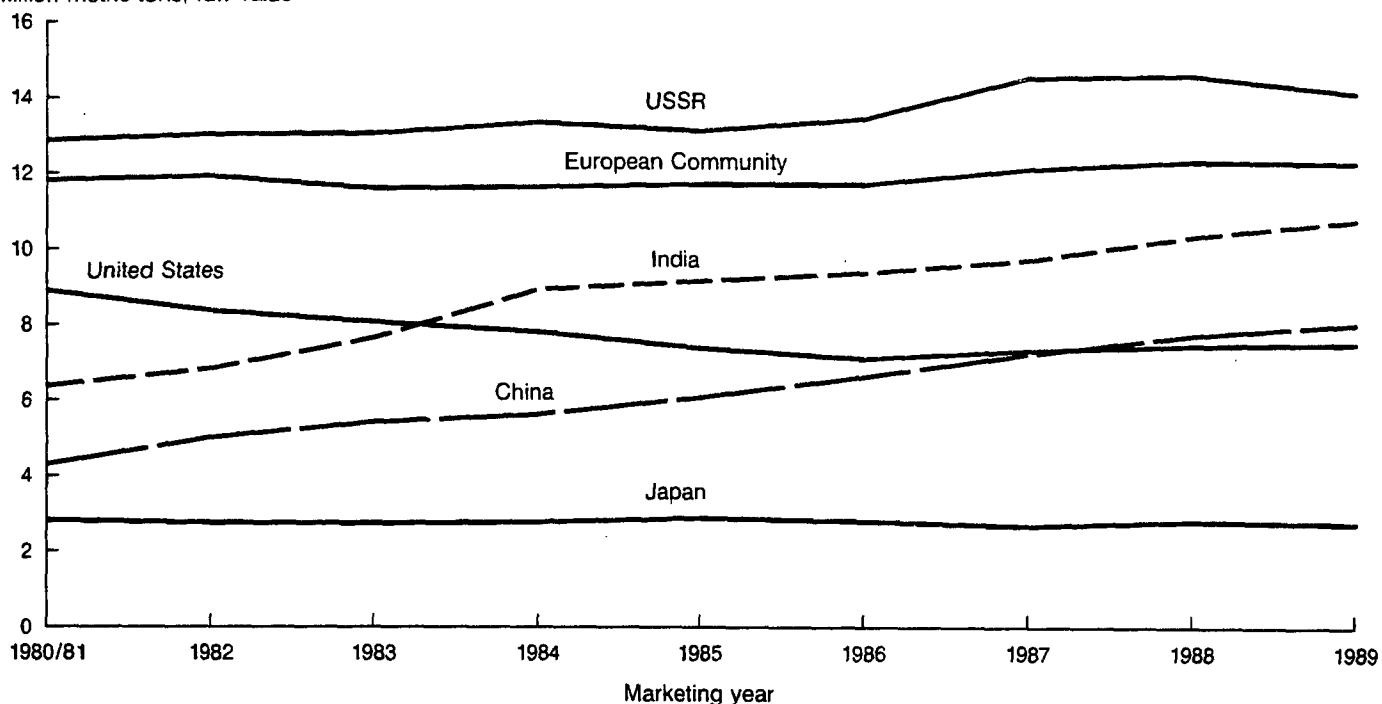
The lack of growth in imports reflects the lower level of raw sugar import requirements in the United States and Japan, increasing self-sufficiency in a number of countries, and the partial replacement of sucrose by other sweeteners. Despite contraction in import needs, both the United States and Japan 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.