

Industry & Trade Summary

Natural Sweeteners

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PREFACE

In 1991 the United States International Trade Commission initiated its current *Industry and Trade Summary* series of informational reports on the thousands of products imported into and exported from the United States. Each summary addresses a different commodity/industry area and contains information on product uses, U.S. and foreign producers, and customs treatment. Also included is an analysis of the basic factors affecting trends in consumption, production, and trade of the commodity, as well as those bearing on the competitiveness of U.S. industries in domestic and foreign markets.¹

This report on natural sweeteners covers the period 1987 through 1991 and represents one of approximately 250 to 300 individual reports to be produced in this series during the first half of the 1990s. Listed below are the individual summary reports published to date on the agriculture sector.

<i>USITC publication number</i>	<i>Publication date</i>	<i>Title</i>
2459(AG-1)	November 1991	Live Sheep and Meat of Sheep
2462 (AG-2)	November 1991	Cigarettes
2477 (AG-3)	January 1992	Dairy Produce
2478 (AG-4)	January 1992	Oilseeds
2511 (AG-5)	March 1992	Live Swine and Fresh, Chilled, or Frozen Pork
2520 (AG-6)	June 1992	Poultry
2524 (AG-7)	August 1992	Fresh or Frozen Fish
2545 (AG-8)	November 1991	Natural Sweeteners

¹ The information and analysis provided in this report are for the purpose of this report only. Nothing in this report should be construed to indicate how the Commission would find in an investigation conducted under statutory authority covering the same or similar subject matter.

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INTRODUCTION

This summary report covers nutritive (caloric) sweeteners, which include the following: sugar; maple sugar and syrup; honey; corn syrups, including high fructose corn syrup (HFCS); and flavored sugars and syrups, molasses, and blended syrups. All of these products are provided for in chapter 17 of the Harmonized Tariff Schedule of the United States (HTS), with the exception of honey, which is included in chapter 4 of the HTS. The structure of the U.S. and foreign nutritive sweetener industries, domestic and foreign tariff and nontariff measures, and the competitive condition of the U.S. nutritive sweetener industry in domestic and foreign markets for the general period 1987-91 are presented in this summary.

The United States has the most diverse sweetener market in the world. U.S. shipments of caloric sweeteners amounted to over \$7 billion in 1991. Corn sweeteners, such as HFCS, glucose syrup, and dextrose accounted for over one-half (53 percent) of the volume of shipments, while refined sugar made up 46 percent of shipments. Honey and edible syrups accounted for less than 1 percent of nutritive sweetener shipments. The tabulation at the bottom of this page shows total U.S. consumption of caloric sweeteners for the calendar years 1987-91 (million short tons, dry basis).

The U.S. Government maintains sugar and honey programs that affect not only the prices of these two products but indirectly affect the prices of other caloric sweeteners as well. The honey program is a price-support program that smooths out price fluctuations and provides a market for honey at an assured price. The U.S. sugar program operates through nonrecourse¹ loans and regulation of imports. A new tariff-rate quota system was enacted in October 1990 to bring the U.S. sugar import policy into line with the General Agreement on Tariffs and Trade (GATT). A fee of 1 cent a pound for imported refined sugar is provided for under section 22 of the Agricultural Adjustment Act, as amended. The 1990 Farm Bill will allow for a marketing allotment program for the 1991-95 U.S. sugar crop. A sugar re-export program, which permits cane refiners to import raw sugar not under quota and export refined sugar, is also in operation.

¹ A nonrecourse loan in this case means that if the sugar processor chooses not to redeem the loan, the sugar that was used as collateral for the loan can be forfeited to the Commodity Credit Corporation as full compensation for the loan.

Sugar, which in its pure form is a naturally occurring organic chemical known as sucrose, may be produced from either sugarcane or sugar beets. In trade, when the term "sugar" is used, it is understood to mean sucrose. Sugarcane is a tall perennial grass that may be grown in tropical or semitropical climates. Sugarcane takes 12-24 months to mature after the planting of cane stalk cuttings. Two to four "ratoon" crops may be harvested from the original planting. The cane must be taken within hours of cutting to a sugarcane mill, which is generally near the fields to minimize transportation costs and sucrose loss. Sugarcane is converted to raw sugar through the extraction of the juice from the stalk. The juice is clarified, boiled, and then crystallized to 96- to 99-percent purity. The resulting raw sugar is shipped to a refinery for further processing into refined sugar. The refining of sugar consists of washing and melting the sugar, filtering the melted sugar syrup, and finally drying and packaging the remaining product.

Sugar beets may be grown in a variety of climates and soil types, and are generally produced in a 3- to 5-year rotation with other crops. Production of refined sugar from sugar beets occurs at one plant in a process consisting of six steps: (1) diffusion, (2) juice purification, (3) evaporation, (4) crystallization, (5) pulp drying, and (6) recovery of sugar from molasses. Refined beet sugar is chemically the same as refined cane sugar and is purchased by the same users. Sugar is used by consumers directly, and by a host of food industries such as bakery, cereal, confectionery, and dairy processors.

The term "molasses" generally refers to the byproduct of the extraction of sugar from sugarbeets or sugarcane, or the refining of raw sugar. Molasses is a viscous, dark-colored liquid with a significant sugar content generally over 48 percent. However, "molasses" may also refer to products that are not byproducts, such as high-test or invert molasses, or the byproducts of the extraction of dextrose from corn syrup and the concentration of frozen orange juice. Although it may be used as a sweetening ingredient, most molasses is used primarily as an ingredient in mixed feeds for livestock. Molasses is also used in the production of citric acid, yeast, vinegar, and in alcohol distillation.

High fructose syrups are produced by an enzymatic conversion of some of the naturally occurring glucose

Calendar Year	Refined sugar	HFCS	Glucose syrup	Dextrose	Pure honey	Edible syrups
1987	7.57	5.74	2.24	0.52	0.12	0.05
1988	7.61	5.88	2.30	0.52	0.13	0.05
1989	7.76	5.98	2.37	0.54	0.13	0.05
1990	8.06	6.12	2.45	0.56	0.13	0.05
1991 ¹	8.15	6.26	2.51	0.57	0.13	0.05

¹ U.S. Department of Agriculture (USDA) estimates.

in starches to fructose². High fructose syrups may be produced from starch obtained from corn, rice, wheat, and other sources. In the United States, high fructose syrup and other starch sweeteners are almost without exception produced from corn. The value of corn wet-milling byproducts such as oil, meal, and gluten feed is equivalent to about half of corn purchase costs.³ Significant commercial use of corn sweeteners such as HFCS began after the introduction of a continuous-use enzyme that converts the glucose of the starch to fructose at low cost. HFCS-55 (55-percent fructose), which is as sweet as sugar, has almost entirely replaced liquid sugar in beverages. HFCS-42 (42-percent fructose) is roughly 90-percent as sweet as sugar, and is mainly used in baking, dairy, and processed foods. HFCS-55 and -42 account for approximately 70 percent of the corn sweeteners used in the U.S. market.

Other major corn-derived sweeteners are glucose corn syrup, dextrose, and crystalline fructose. Glucose syrup is an incompletely converted corn starch having a minimum of 20 percent of the starch converted to a dextrose equivalent on a dry basis.⁴ Glucose syrup is the lowest priced corn sweetener on the market and can be manufactured with different characteristics, allowing for special uses. For example, glucose syrup in ice cream prevents crystal formation and in catsup prevents oxidation, which would turn the tomato mixture brown. Glucose corn syrup is also a low-cost source of carbohydrates for yeast in brewing.

Dextrose, also known as corn sugar, is obtained from the complete hydrolysis⁵ of starch. Refined dextrose is composed of 92-percent dextrose and 8-percent water of crystallization. Dextrose and dextrose syrup are produced by treating a warm slurry of starch (generally cornstarch in the United States) with diluted hydrochloric acid or enzymes. Dextrose and dextrose syrup may be used as sweeteners and/or conditioners in foods and beverages. Dextrose has particularly become important in "light" beer brewing, where it acts as a food for the yeast, yet completely ferments and adds no additional calories to the beverage. Dextrose is also used in other types of fermentation processes and in pharmaceuticals.

² Although the terms glucose and dextrose are scientifically synonymous, commercially they have come to have separate and distinct meanings. "Glucose" commercially means corn syrup or another glucose-type syrup obtained from wheat, sorghum, or potato starch. "Dextrose" has traditionally been obtained from corn starch, and in trade refers to refined corn syrup.

³ Robert D. Barry, Luigi Angelo, Peter J. Buzzanell, and Fred Gray, USDA, Economic Research Service (ERS), *Sugar: Background for 1990 Farm Legislation*, Feb. 1990, p. 25.

⁴ Fred Gray, USDA, ERS, *Sugar and Sweetener: Situation and Outlook Report*, Sept. 1991, p. 26.

⁵ Hydrolysis is a chemical reaction in which a substance reacts with water and subsequently changes into one or more other substances.

Crystalline fructose is a relatively new corn sweetener on the market. Crystalline fructose is a dry sweetener, as opposed to most other corn sweeteners, and provides a greater sensation of sweetness in combination with other sugars than the sugars or fructose alone would provide. The sweetness enhancement characteristic combined with the fact that crystalline fructose is a humectant (controls humidity, thus adding shelf life) is increasing product usage, although usage is not yet widespread.

Honey is a sweet, viscous fluid derived by bees from the nectar of flowers. Color, flavor, and chemical and physical composition of honey depend upon the flora from which the nectar for the honey was taken. The principal components of honey are fructose, glucose, and water. Honey generally ranges from 28- to 44-percent fructose, 22- to 40-percent glucose, and 17-percent water; the higher the fructose content the sweeter and more valuable the honey. Nearly all honey is extracted from the comb, although small quantities are consumed in the form of comb honey or chunk honey. Honey then may be sold in liquid or creamed form and is used in many food products. Although not usually directly substitutable for sugar, honey is a widely used sweetening agent in the bakery, cereal, and confection industry, and often included in foods for its own properties and flavor. When the flavor of honey is unimportant, HFCS is a near perfect substitute in industrial uses.

Honey is graded according to color and floral source, the lighter colors usually being the most valuable. Consumers tend to prefer light, mild honey for table use. Most honey for industrial use in baked goods and other prepared foods is dark honey.

Maple syrup and maple sugar may be made by boiling down the sap of any type of maple tree, although production primarily is from the sugar maple. For syrup, the evaporation continues until the solution is approximately 65- percent sugar, at which time saturation is nearly complete. For sugar, the syrup is further evaporated, forming a solid cake of maple sugar when cooled. The Food and Drug Administration maintains a Standard of Identity (21 CFR 168.140) for maple syrup. Maple sugar and syrup are for the most part used in products that bear their unique taste, such as table syrup (whether pure maple or blended), candy, and other confections.

The remainder of the products covered in this digest consist of flavored sugars, syrups, and molasses, and blended syrups. These products include a wide variety of flavored sugars and syrups and flavored or unflavored syrups composed of blends of other sweeteners. The flavors used in these products may or may not be natural. Flavored syrups are used by soft drink bottlers, for dessert toppings, for fountain use, for making ice cream, and for making beverages at home. Flavored sugars are used in dessert powders, dry soft drink bases, dry ice cream mixes, and similar products. The only known flavored molasses of commercial use is molasses flavored with salt, which is known as "thick soy sauce" and used in oriental cooking.

Blended syrups, flavored or unflavored, are largely for table use, with the principal blends containing maple syrup, sugar syrup, corn syrup, or HFCS.

U.S. INDUSTRY PROFILES

U.S. Sugar Industry

Structure Of Industry

The structure of the U.S. sugar industry is illustrated in figure 1. The Standard Industrial Classification (SIC) categories applicable to the industry are 2063, beet sugar; 2061 sugar, cane: made from sugarcane; 2062, sugar, cane: refined—made in refineries from purchased sugar; and, 2099, sugar grinding.

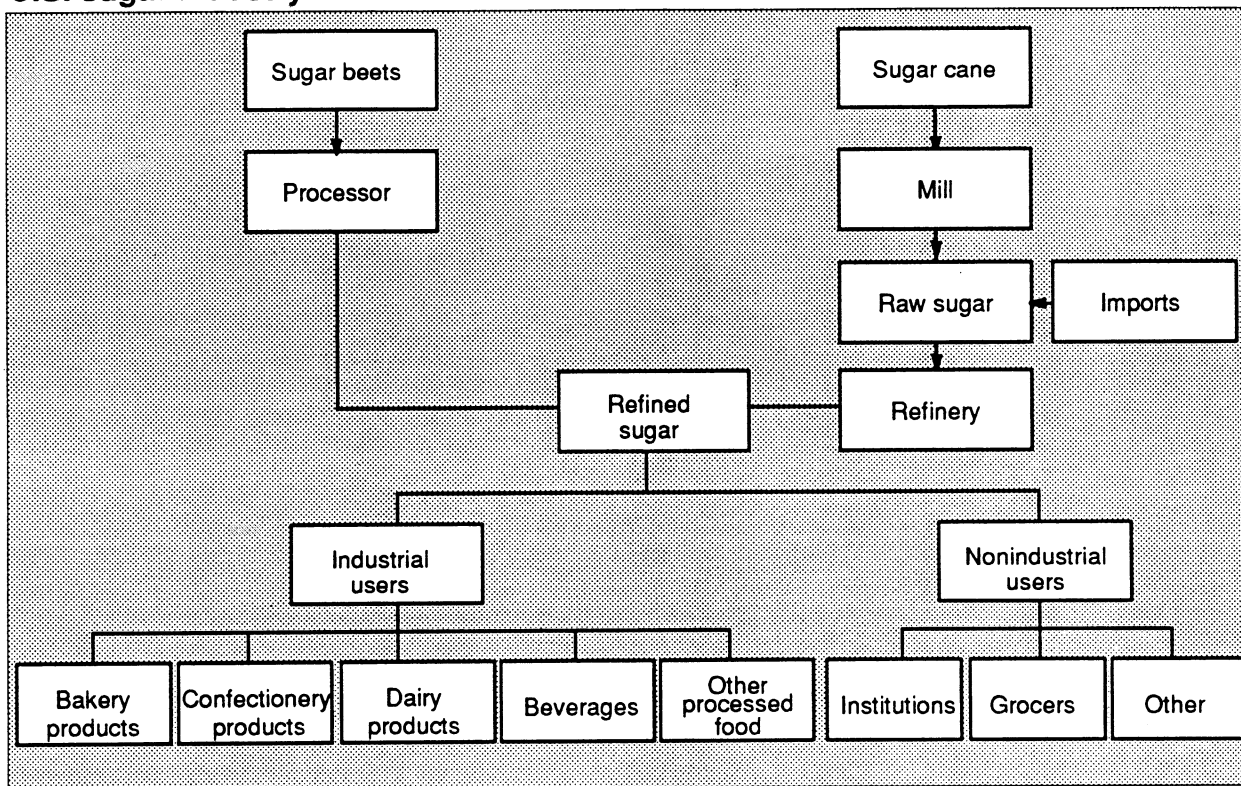
Number of Firms, Concentration Among Firms, and Geographic Distribution

Sugar beets were grown on approximately 9,900 U.S. farms in 1991. Since 1987, harvested acreage of sugarbeets has climbed from 1.3 million acres to 1.4 million acres (table 1). This increase in acreage reverses a downward trend in planting and harvesting

that began in the mid-1970s, resulting in only 1.0 million acres of sugar beets being harvested in 1982. The decline in planted acreage of sugarbeets reflected an approximately 3 million-ton loss in domestic sugar use between the mid-1970s and 1990, which stemmed from increased use of alternative sweeteners and a change in the health consciousness of the American consumer. It also reflected the closing of old processing facilities. The relatively recent increase in production results from higher industry productivity, population increases, and price assurances through the support programs in the 1981, 1985, and 1990 farm bills.

Sugar beets are currently grown in 14 States (table 2), with Minnesota, North Dakota, Idaho, and California constituting almost two-thirds of production. Because of the ability to grow sugar beets in a variety of climates, there are many competing crops, including alfalfa, corn, wheat, and vegetables. Sugar beet yields vary according to their diverse growing conditions. In the eastern and more central areas of the United States, which are for the most part dependent upon rain rather than irrigation, yields average approximately 18 tons per acre. In the Western States, where irrigation is prevalent for growing sugar beets, yields average about 25 tons per acre.

Figure 1
U.S. sugar industry structure



Source: Industry sources.

Table 1
U.S. sugarbeets: Area, production, and yield, 1987-91

Crop year	Area		Production 1000 st	Yield per acre		Production actual weight 1000 st	Refined beet sugar, raw value
	Planted	Harvested		Planted	Harvested		
1987	1,267	1,252	28,072	22.2	22.4	3,736	
1988	1,327	1,301	24,810	18.7	19.1	3,278	
1989	1,324	1,295	25,131	19.0	19.4	3,217	
1990	1,399	1,376	27,538	19.7	20.0	3,588	
1991	1,421	1,386	28,178	19.8	20.3	3,805	

Source: *Sugar and Sweetener Situation and Outlook Yearbook*, USDA, ERS, June 1991 and *Sugar and Sweetener Situation and Outlook Report*, USDA, ERS, Mar. 1992.

Table 2
U.S. sugarbeets: Acreage planted, by States and regions, 1987-91

Region and State	1987	1988	1989	1990	1991
	1,000 acres				
Far West:					
California ¹	219.0	215.0	176.0	172.0	160.0
Idaho	163.0	168.0	179.0	188.0	196.0
Oregon	13.9	14.3	15.9	17.2	18.9
Washington	—	—	(²)	(²)	(²)
Total	395.9	397.3	370.9	377.2	374.9
Central:					
Colorado	37.4	39.1	40.6	40.8	39.4
Minnesota	311.0	339.0	342.0	368.0	369.0
Montana	49.2	49.6	52.7	55.2	56.6
Nebraska	61.6	63.9	70.1	75.1	82.0
New Mexico	0.6	0.7	(²)	(²)	(²)
North Dakota	163.3	177.8	180.2	193.9	195.0
Texas	32.8	34.0	36.6	41.9	41.5
Wyoming	54.1	56.5	61.8	65.0	69.0
Total	710.0	760.6	784.0	839.9	811.0
Eastern:					
Michigan	144.0	152.0	154.0	160.0	171.0
Ohio	16.8	17.3	13.6	20.0	20.3
Total	160.8	169.3	167.6	180.0	191.3
Other:	—	—	1.9	2.3	2.3
U.S. Total	1,266.7	1,327.2	1,324.4	1,399.4	1,421.0

¹ Related to year of intended harvest except for overwintered spring planted beets in California.

² Combined to avoid disclosures of individual operations, includes New Mexico and Washington.

Source: *Sugar and Sweetener Situation and Outlook Yearbook*, USDA, ERS, June 1991, and USDA, National Agricultural Statistics Service (NASS).

The number of operating factories processing sugar beets remained stable at 36 between 1987-91, staying the decline in the factory numbers that has been relatively steady since 1950, when there were 72 operating sugar beet factories (table 3). Average daily slicing capacity has increased from 4,033 tons to 4,694 tons since 1981.⁶ Eight of the plants are in California, five are in Michigan, and the rest are divided among Idaho, Minnesota (4 each), Wyoming, North Dakota, Nebraska (3 each), Colorado, Montana (2 each), Texas, and Ohio (1 each). Slicing and extraction rates have remained relatively unchanged since 1987.

In 1991, sugarcane was grown on approximately 1,040 farms. Harvested acreage of sugarcane for sugar increased from 751,000 acres in 1986/87 to a forecasted 785,000 acres in 1991/92 (table 4). Only 726,000 acres were harvested in 1990, largely as a result of the severe frost affecting Louisiana in December 1989. Unlike the beet sugar industry, which has a variety of competing crops, the cane sugar industry did not experience a decline in production in the last two decades. Rather, sugarcane production has continued to expand almost yearly since the United States ceased importing Cuban sugar in 1960. In the last decade, Florida has become the leading domestic cane-producing State with about 57 percent

of output compared with Hawaii's 26 percent. A decade ago, the two States were virtually equal in production, each accounting for 38 percent of the U.S. total. Although Hawaii remains the world leader in sugarcane yields, high costs of production, especially labor and transportation costs, have contributed to the decrease in production.

In addition to Florida, Hawaii, and Louisiana, sugarcane is also grown in Texas. Yields vary among the four growing states. As mentioned, the highest yields in the world are obtained in Hawaii, with a 1990/91 yield of 90.8 tons per acre. Florida followed with a significantly lower yield of 35.5 tons per acre, and Texas and Louisiana had yields of 26.5 and 20.6 tons, respectively.

Within hours of being cut, sugarcane must be processed into raw sugar in order to prevent sucrose breakdown. To minimize transportation costs and sucrose loss, sugarcane mills are near the cane fields. In 1991, 40 raw sugar mills processed the U.S. harvest (table 5). Although the number of mills has declined from 42 in 1986, daily grinding capacity has increased 7 percent to 289,800 tons in 1988, the last year for which these data were available.⁷

⁶ USDA, ERS, *U.S. Sugar Statistical Compendium*, Aug. 1991, p. 6.

⁷ USDA, ERS, *U.S. Sugar Statistical Compendium*, Aug. 1991, p. 4.

Table 3
U.S. sugarbeet processors: Company, factory locations, and capacity, 1988

Company	Factory location	Slicing capacity	
		Short tons per day	
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	
American Crystal Sugar Co.	Crookston, MN	4,500	
	Drayton, ND	5,400	
	East Grand Forks, MN	6,700	
	Hillsboro, ND	4,500	
Minn-Dak Farmers Cooperative	Moorhead, MN	4,400	
	Wahpeton, ND	5,500	
Southern Minnesota Beet Sugar Coop.	Renville, MN	7,200	
Western Sugar Co.	Bayard, NE	2,250	
	Ft. Morgan, CO	3,800	
	Greeley, CO	2,200	
	Mitchell, NE	2,250	
	Scottsbluff, NE	3,200	
	Billings, MT	4,000	
	Lovell, WY	2,500	
	Holly Sugar Corp.	Torrington, WY	4,000
		Hereford, TX	7,500
		Brawley, CA	7,500
Hamilton City, CA		3,700	
Tracy, CA		4,800	
Betteravia, CA ¹		5,500	
The Amalgamated Sugar Co.	Sidney, MT	5,000	
	Worland, WY	3,400	
	Rupert, ID	7,000	
	Twin Falls, ID	5,000	
	Nampa, ID	10,000	
Delta Sugar Corp.	Nyssa, OR	7,000	
	Clarksburg, CA	3,000	
Spreckels Sugar Co., Inc.	Manteca, CA	4,200	
	Mendota, CA	4,200	
	Woodland, CA	3,600	
Total United States		168,700	

¹ Union Sugar Division.
Source: *Sugar: Background for 1990 Farm Legislation*, USDA, ERS, Feb. 1990.

Table 4
U.S. sugarcane: Area, production, and yield, 1987-91

Crop year	Sugarcane ¹		Sugar, raw value			
	Area harvested	Production	Yield per acre	Production	Yield per harvested acre	Recover- ed per ton
	1,000 acres	1,000 short tons	Short tons	1,000 short tons	Short tons	Per-cent
1986/87	750.7	28,936	38.5	3,281	4.37	11.34
1987/88	778.3	28,026	36.0	3,333	4.28	11.89
1988/89	793.6	28,479	35.9	3,398	4.28	11.93
1989/90	803.3	28,069	34.9	3,176	3.95	11.31
1990/91	726.4	26,475	36.4	3,152	4.34	11.91

¹ Excludes sugarcane for seed.
Source: Crop production, USDA, NASS.

Table 5
U.S. sugarcane mills: Number of mills and milling capacity, 1987-91

Crop year	Florida	Hawaii	Louisiana		Texas	Daily milling capacity - 1,000 short tons
			Number of mills			
1987	7	12	21	1	1	289
1988	7	12	21	1	1	289
1989	7	12	20	1	1	NA
1990	7	12	20	1	1	NA
1991	7	12	20	1	1	NA

Source: ERS, USDA.

Raw sugar is refined in 12 U.S. refineries, which were owned by 8 companies in 1988. At that time, the four largest companies accounted for 78 percent of total refining capacity in the United States. U.S. refineries are near the east and Gulf coasts, with the exceptions of one in Hawaii, one in Texas, and one in California.

Employment

Sugar beet farming provides the equivalent of almost 26,000 full-time jobs.^{8,9} Over 19,000 persons are engaged in sugarbeet farming full-time, and 38,000 are occupied part-time.¹⁰ The largest percentage of full-time growers are in California (23 percent), followed closely by Michigan (20 percent). California also has the highest percentage of full-time equivalent workers—23 percent. However, unlike other sugar-beet-growing States, California reports few, if any, full-time hired laborers for sugar beets. In 1989, Montana and Nebraska employed the largest number of full-time hired laborers (1,030 and 1,054, respectively), while California employed the largest number of seasonal workers (7,000).¹¹

Sugar beet factories employ over 7,000 full-time workers and over 9,500 part-time workers, the latter with a full-time equivalency of more than 4,000 full-time workers.¹²

Sugarcane growing and harvesting employed over 18,000 people full-time in the United States in 1989. Seasonal employment involved approximately 12,500 people in 1989, with a full-time equivalency of about 2,000.¹³ Employment in Hawaii continues to decline—from a total of 8,600 in 1981 to 6,100 in 1988—as unprofitable sugarcane acreage is eliminated and the number of man-hours required per ton of sugar decreases.¹⁴

⁸ *The Importance of the Sugar and Sweetener Industry to the US Economy*, Landell Mills Commodities Studies, Aug., 1989.

⁹ Employment estimates are believed to have remained relatively stable between 1989 and 1991.

¹⁰ *Ibid.*

¹¹ *Ibid.*

¹² *Ibid.*

¹³ *Ibid.*

¹⁴ U.S. Department of Agriculture, Economic Research Service, *Sugar and Sweetener: Situation and Outlook Report*, Mar., 1990, p. 18.

Sugar milling in 1989 provided employment for over 6,000 full-time workers and 2,070 seasonal workers. Hawaiian sugar mills employed the greatest number of full-time employees—approximately 2,800—and Texas mills the fewest—approximately 250.¹⁵

The 12 cane sugar refineries in the United States employ around 4,000 full-time workers and over 100 seasonal workers.¹⁶ The greatest concentration of workers are in Maryland and New York, where three large refineries are situated.

Labor Skill Levels, Level of Automation, and Productivity

For the majority of sugar beet farmers, the beets are not the only crop produced, but rather one of a series of crops usually rotated. The number and variance of crops produced by beet farmers indicate that while sugar beet production itself may not require a high labor skill level, the ability to balance and rotate production of different crops may. U.S. sugar beet mills are highly automated and thus require relatively skilled labor for production.

Both sugar beet farms and mills have benefitted from technological advances resulting from continuous research and development in the industry. The most notable advance in the sugar beet industry at this time is the introduction of molasses desugaring equipment at four mills throughout the country. According to industry sources, the new technology will increase the amount of sugar extracted from sugar beets by about 10 percent through a second extraction of sugars from the molasses byproduct of beet refining.

In the United States, most sugarcane production and harvesting operations are mechanized. However, Florida continues to have over half of its cane cut by hand, a process requiring some degree of skill. It is often accomplished by importing cane cutters from Caribbean countries. As with sugar beets, the processing of sugarcane is greatly automated, requiring some skill to operate.

¹⁵ Landell Mills Commodities Studies, *The Importance of the Sugar and Sweetener Industry to the U.S. Economy*, Aug., 1989, p. 13.

¹⁶ *Ibid.*, p. 13.

All segments of the domestic sugar industry have experienced substantial restructuring in the cause of greater efficiencies in the past decade. Sugar beet yields per acre rose from 19.9 tons in the 1970s to 20.5 tons in the 1980s, and beet sugar yield per harvested acre rose from 2.59 tons to 2.73 tons during the same period. Sugarcane underwent similar yield increases in sugar, from 3.89 short tons, raw value (STRV) in the 1970s to 4.17 STRV in the 1980s, although yield per acre of cane actually experienced a slight decline (37.49 tons to 37.13 tons). The number of individual beet-processing factories and sugarcane mills has declined, but output has increased; the number of sugarcane mills has contracted by about 40 percent since the mid-1970s while domestic raw cane sugar output has increased by over 25 percent.

While modernization and restructuring have occurred throughout the industry, only the cane-sugar-refining industry has actually experienced a net loss in capacity. In 1981, under optimal conditions of plant operations of 260 days per year, the industry could refine over 8.5 million tons in its 21 cane refineries. In 1988, under the same conditions, the remaining 11 cane sugar refineries could produce only 5.5 million tons.¹⁷

Degree of Integration with Foreign Suppliers

Farms that produce sugar beets and, to a lesser extent, sugarcane, generally are not integrated with foreign firms, although Castle and Cook (United Kingdom) maintains sugarcane acreage in Hawaii for its company, Waialua Sugar Co., on Oahu. Some of the processing plants and marketing operations are owned by multinationals, such as the British-based sugar company Tate and Lyle. However, U.S. sugar operations rely on basic supply from foreign operations only in the cane-refining sector. Cane sugar refineries are the principal importers of raw sugar into the United States. Imports of raw sugar for re-export are needed to help maintain optimal conditions for efficient plant operations because of the decline in U.S. imports of raw sugar for consumption stemming from the sugar programs of the recent decades. Conditions for these imports will be discussed in later sections of the report.

Vertical and Horizontal Integration

Because sugar beets are rotated with other crops in order to increase yield through replenishment of the soil and reduction of diseases, processors do not generally produce their own beets, and are thus not vertically integrated. Processors rely on independent growers or members of grower cooperatives in their area for sugar beet supply and the independent growers or cooperative members generally grow their beets under contract to the processing plants. The four largest companies operate 24 of the sugar beet

factories, which account for approximately 70 percent of U.S. beet sugar production (table 3). The remaining 12 factories are owned by 8 companies, 3 of which are grower cooperatives.

Unlike sugar beet processing facilities, many sugarcane mills grow their own sugarcane, supplementing their production with that of independent growers, and show a relatively high degree of vertical integration. There are also cooperatives that process members' cane and producer/processors that process only their own harvest. The 40 mills currently in operation are owned by 39 companies. In Florida, the three largest processing companies account for approximately 75 percent of the raw sugar produced. Five companies account for over 90 percent of Hawaii's raw sugar production, and the 5 largest of the 21 Louisiana milling operations account for over 50 percent of raw sugar production. The cane refineries, for the most part, own at least some—if not all—of the mills from which they purchase raw sugar.

Horizontal integration between beet and cane operations does exist. One of the best examples of such integration is Imperial Holly Sugar Co. of Sugar Land, Texas. Imperial Holly not only operates the cane refinery at that location, but also owns eight sugarbeet processors under the name Holly Sugar Corp. Savannah Foods and Industry, Inc., which operates two cane refineries, also owns two sugarbeet processors—Michigan Sugar Co. and Great Lakes Sugar Co.—with five factories.

Marketing Methods, Pricing Practices, and U.S. Government Programs

Cane sugar refiners and beet refiners market sugar to grocery stores, to wholesalers, and to further processors of foods (e.g., bakery and cereal products, confectionery products, etc.). Historically, price-support programs for the U.S. sugar industry have been mandated to protect the domestic sugar producers from unstable world prices. The U.S. Government regulated domestic sugar production and imports from 1934 to 1974. From 1975/76 through 1980/81, world prices were high enough to allow domestic production to continue unregulated.

Currently, the U.S. Government sugar program involves the provision of minimum price supports through the use of nonrecourse loans and use of a tariff-rate quota to administer imports. In the United States, there is a minimum processor price for raw cane sugar (18 cents per pound) and a support price for beet sugar at a "fair and reasonable level" in relation to the support price of cane sugar (usually around 21 cents per pound). The USDA support price for refined beet sugar is based on the historical relationship between net selling prices of refined beet sugar and raw cane sugar. Loan rates may vary from region to region. As mentioned, loans under the sugar price-support program are nonrecourse loans, meaning that the sugar processor can elect to forfeit to the CCC the sugar held as collateral on the loan and not be liable for any additional amounts. There have been no forfeitures of

¹⁷ USDA, ERS, *Sugar: Background for 1990 Farm Legislation*, p. 13.

sugar since the 1984/85 marketing year because the market price has been high enough to encourage redemption of the loans.

The Food, Agriculture, Conservation, and Trade Act of 1990 allows for a marketing allotment program for the 1991-95 U.S. sugar crops. The Secretary of Agriculture will implement the marketing allotment program if it is determined that imports of sugar for consumption, as a result of domestic production, will be less than 1,250,000 short tons, raw value. The Secretary establishes the allotments, when needed, based on past marketings of sugar, processing and refining capacity, and the ability of processors to market the sugar.

A 1-percent marketing assessment—"program service fee"—for sugar was included in the October 1990 deficit reduction package.

A new tariff-rate quota system was implemented in October 1990, to bring the U.S. sugar program into line with the General Agreement on Tariffs and Trade. Under the new system, an allocated amount of sugar is allowed to enter the United States subject to the minimum duty of 0.625 cent per pound, with the beneficiaries of the Generalized System of Preferences and the Caribbean Basin Initiative having zero duty. Any sugar imported in excess of the allocated amount has a second-tier duty of 16 cents per pound, raw value.

The United States also maintains a quota-exempt refined sugar re-export program. Eligible refiners are able to import raw sugar at world prices, refine the sugar, and then re-export it to the world market. Exporters may tap a duty drawback.¹⁸

Research and Development Expenditures and High-Tech Processes

Expenditures on research and development (R&D) in the sugar sector amount to millions of dollars annually. As mentioned earlier, four U.S. beet processing facilities recently installed the newly developed molasses desugaring equipment. The Hawaiian Sugar Planters' Association (HSPA) is recognized as a world leader in breeding technology for sugarcane. The U.S. Department of Agriculture

¹⁸ In drawback, the Government returns part or all (generally 99 percent) of the duties paid to import the original product upon re-export of the same product or a further processed product. Prior to the adoption of the tariff rate quota in October 1990, imports outside of the U.S. sugar quota were allowed for re-exporting the sugar in refined form or in sugar-containing products, with drawbacks of the duties upon re-export of the further processed product. Drawbacks continue to be allowed under the tariff rate quota and all new regulations governing the drawback provisions that went into effect Aug. 7, 1991, are contained in 7CFR Part 1530 "Sugar Import Licensing." Sugar refiners have a 90-day turnaround time to re-export sugar in refined form, 180 days to manufacture and export sugar-containing products, 90 days to claim drawback on high duty sugar, and 3 years after export to claim a drawback on minimum duty sugar.

estimates that around one-third of the HSPA's 1990 \$8.6 million budget went to genetic and plant pathology. Several projects underway at HSPA include an attempt to identify genetic markers in sugarcane which would lead to improved ability to genetically control cane characteristics; a project aimed at reducing the need for labor and acres currently used to raise seed cane; and additional experimentation with harvesting times and drip irrigation.

U.S. Corn Sweetener Industry

Structure Of Industry

The structure of the U.S. corn sweetener industry is illustrated in figure 2. Wet-milling establishments, which produce the corn sweeteners, are classified in the SIC industry 2046.

Number of Firms, Concentration Among Firms, and Geographic Distribution

There are currently seven U.S. companies producing HFCS, the main corn sweetener in use in the United States. Although one firm has closed its operation in the past 10 years, the other companies have maintained or increased capacity for production of HFCS, particularly HFCS-55. These increases in capacity largely reflect the commercial introduction in 1977 of HFCS-55, which rapidly displaced liquid sugar in beverages, owing to its lower production cost.

In 1991, there were 7 companies with 11 wet-milling facilities producing glucose syrup. At the same time, there were three wet-milling companies producing crystalline dextrose and one company producing liquid dextrose.

Number 2 yellow corn, which is the main ingredient in the production of corn sweeteners, has the greatest concentration of growth in the Midwest. The location of corn wet-milling operations reflects this concentration, with the largest percentage of wet-milling operations in Indiana, Illinois, and Iowa. Additional factories are in North Carolina, Tennessee, Alabama, Ohio, Minnesota, Colorado, Texas, and California.

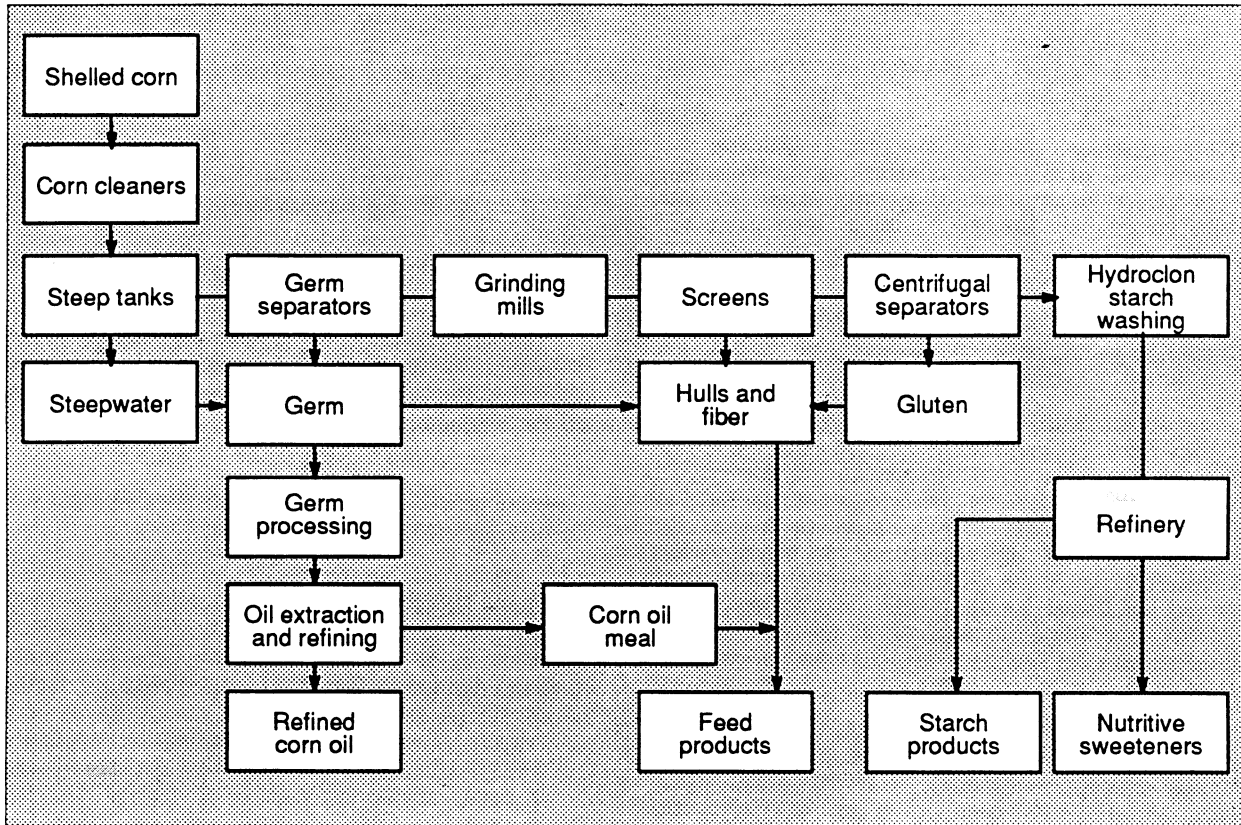
Employment

Full-time employment in the corn sweetener industry in the United States was approximately 7,000 in 1990, including transportation.¹⁹ This figure does not include the farmers who produced the corn used in the wet-milling. HFCS, glucose, and dextrose accounted for 45 percent of corn used for food, seed, and industrial uses in 1991.²⁰ Specific data are not

¹⁹ Corn Refiners Association, *Corn Annual: 1990*, compiled statistics.

²⁰ Corn Refiners Association, *Corn Annual: 1991*, p.16.

Figure 2
U.S. corn wet-milling industry structure



Source: Corn Refiners Association.

available on the increase in employment in the corn sweetener industry in the 1980s. Industry sources indicate that while employment did increase, it was not as dramatic as the increase in production suggests. This situation largely results from the high level of automation in corn wet-milling operations.

Labor Skill Levels, Level of Automation, and Productivity

Competitive refining requires a high level of automation combined with an overall high level of labor skills for such complex processing steps as acid or enzyme conversion, isomerization, and saccharification. Although the industry does have lower labor skills requirements in aspects such as transportation, the modern corn-refining plants require programmers and systems engineers, as well as chemical, electrical, and mechanical engineers. Research and development in the corn wet-milling industry employs many scientists, as new uses for corn wet-milling products are explored.

Industry sources indicate that while throughput rates of the largest refineries now are four times what they were in the mid-1970s and equipment sizes have

almost tripled, manpower has approximately only doubled. As the following tabulation shows, domestic production of the most widely used corn sweetener, HFCS, increased from 5.6 million short tons, dry basis in 1987 to 6.4 million short tons, dry basis in 1991²¹:

Calendar year	Domestic Production		
	HFCS-42	HFCS-55	Total
1987	2,027	3,595	5,622
1988	2,339	3,534	5,873
1989	2,365	3,505	5,870
1990	2,539	3,644	6,183
1991	2,612	3,739	6,351

The increase in HFCS production reflects continued growth in domestic use of HFCS in foods and beverages. As total HFCS use grew in the 5 years examined, HFCS-42 garnered a larger share of the HFCS market, increasing from an HFCS market share of 36 percent in 1987 to 41 percent in 1991. The reduction in HFCS-55 market share stems from the

²¹ USDA, ERS, *Sugar and Sweetener: Situation and Outlook Report*, Mar. 1992, p. 64.

almost exclusive use of HFCS in the beverage industry—particularly the soft drink industry. While HFCS-55 growth is tied to beverage consumption growth, new product applications for HFCS-42 continue to be found.

Prior to the explosive expansion of HFCS use in the early 1980s, glucose syrup and dextrose were the primary U.S. corn sweeteners. Although HFCS has the largest share of the corn sweetener market, glucose syrup and dextrose have steadily increased in production, as the following tabulation shows (1,000 short tons, dry basis):

Calendar year	Domestic Production		
	Glucose syrup	Dextrose	Total
1987	2,522	651	3,173
1988	2,629	679	3,308
1989	2,733	699	3,432
1990	2,904	730	3,634
1991	3,000	740	3,740

Domestic production of glucose syrup increased from 2.5 million short tons in 1987, dry basis to 3.0 million short tons, dry basis in 1991.²² Dextrose production rose from 651,000 short tons, dry basis in 1987 to 740,000 short tons, dry basis in 1991.²³ Use in malt beverages, processed foods, and dairy products mainly have contributed to the increased consumption of glucose syrup. The increased consumption of dextrose stemmed largely from increased use in the beverage industry (light beer) and confectionery products.

Degree of Integration with Foreign Suppliers

Farms that produce corn and corn wet-milling operations generally are not integrated with foreign firms. Although corn wet-millers may purchase some of their high-tech equipment from foreign suppliers, the corn used is almost exclusively domestically produced. Furthermore, the overwhelming majority of innovations in the corn wet-milling industry are the result of domestic research and development. However, one large HFCS manufacturer, Staley, is owned by the British company, Tate & Lyle. U.S. firms are believed to own most of the refineries in Canada.

Vertical and Horizontal Integration

Corn wet-millers purchase their corn directly from farmers or grain storage elevators. Wet-millers rarely grow their own corn for milling, although one company in Minnesota that produces glucose syrup is cooperative-owned. The seven companies currently producing HFCS for the most part own more than one corn-processing plant. Several of these processors, particularly Coors, Heinz, Staley, and ADM, not only

market their corn sweeteners, but also use them in products they produce in their other operations.

There is only one known example of horizontal integration of the corn sweetener industry with the sugar industry, and that is the aforementioned ownership of Staley by Tate & Lyle, which also has sugar operations in Hawaii.

Marketing Methods, Pricing Practices, and U.S. Government Programs

Corn sweeteners and their byproducts are mainly marketed to further processed foods manufacturers, beverage manufacturers, institutional users, and fast-food outlets. Very little corn sweetener production is marketed directly to consumers. As mentioned, many of the corn sweetener manufacturers use the sweeteners in their own processed products, which are then marketed to consumers.

HFCS-55 (55 percent fructose), which is as sweet as sugar, has almost entirely replaced liquid sugar in beverages. HFCS-42 (42-percent fructose) is approximately 90-percent as sweet as sugar, and is mainly used in baking, dairy products, and processed foods. HFCS-55 and -42 account for approximately 70 percent of corn sweeteners used. The other major corn-derived sweeteners are glucose corn syrup, dextrose, and crystalline fructose, the uses of which were described earlier.

Although corn sweetener manufacturers do not directly benefit from U.S. farm programs, they are indirectly affected by U.S. Government programs for feedgrains (including corn) and sugar. Farmers producing basic commodities, including feedgrains (corn, sorghum, oats, and barley), wheat, rice, and upland cotton, are eligible to receive a government payment based on the difference between a target price and the market price or the loan rate, whichever difference is less.²⁴ The loan rate is the rate at which the Government will provide a loan to a farmer in order to enable him to hold his crops for sale at some later date. The loans are "nonrecourse." Therefore, the U.S. market price for corn seldom falls below the Government loan rate because at any lower price, the farmers will forfeit their corn to the Government rather than sell it on the market. In addition, the Acreage Reduction Program coupled with the Conservation Reserve Program reduces the U.S. surplus of corn, and thus increases the domestic price to corn wet-millers.

U.S. Government programs for feedgrains increase the input costs to corn refiners, but the U.S. sugar program helps increase the price wet-millers are able to charge for their product. Corn sweeteners are able to substitute for sugar in a wide range of products, particularly beverages, where HFCS almost entirely displaced sugar in the 1980s. Corn sweeteners, particularly HFCS, generally have a significantly lower cost of production relative to that of sugar. Therefore, corn sweetener prices are usually strategically below sugar prices, and move with the sugar price. As

²⁴ The payment is contingent upon farmer participation in the program, meaning that they must have officially assigned base acres and program yield, as well as complying with any "Acreage Reduction Program."

²² Ibid., p. 20.

²³ Ibid., p. 20.

described earlier in this summary, the U.S. Government maintains a sugar program that provides a minimum processor price for raw cane sugar of 18 cents per pound and a comparable support price for beet sugar. The Government support prices are almost always above the world price for sugar, and the tariff-rate quota inhibits imports of sugar. The tabulation at the bottom of the page shows HFCS prices and their discount to sugar, midwest market.

Research and Development Expenditures and High-Tech Processes

Corn refiners have benefitted from high-technology processes, particularly in the area of automation systems and enzymes. Automation systems in the corn refineries have made it possible to control complex operations such as isomerization and evaporation with greater efficiency. Such precision allows the regular production of uniform high-quality products.

The development of enzymes to replace acids in the conversion processes used to make corn syrups has led to the feasible production of HFCS as well as the development of new uses for enzymes in the brewing, textile, and fuel alcohol industries. Additionally, the first genetically engineered food ingredient to be accepted by the FDA was a starch-processing enzyme development by the wet-milling industry.

One of the largest areas of research and development in the corn sweetener industry continues to be starch modification. A variety of products can be produced from corn milling, including fuel alcohol (of which there was no production in 1977 and over 900 million gallons in 1991²⁵), biodegradable plastics, and gum arabic substitutes. Biochemical production using corn-derived feedstocks is also another area covered in corn refiners' research and development.

²⁵ Corn Refiners Association, *Corn Annual: 1991*, p. 19.

U.S. Honey Industry

Structure Of Industry

The SIC category applicable to the honey industry is 2099: syrups, sweetening, including honey, maple syrup, and sorghum. The structure of the U.S. honey industry is illustrated in figure 3.

Number of Firms, Concentration Among Firms, and Geographic Distribution

Beekeeping is a highly specialized field requiring hands-on application of such subjects as genetics and botany. Therefore, although there are packing and marketing firms, actual honey production is an industry composed mostly of individual beekeeping operations. A relatively small group of firms makes up the packing and marketing segment of the honey industry, and almost all of these firms purchase their honey for processing and resale.

The U.S. Department of Agriculture estimates that there are approximately 212,000 beekeepers in the United States. The number of beekeepers is estimated to have remained relatively stable in the past 5 years. Beekeepers are generally classified into the following categories: hobbyists (owning fewer than 25 colonies), part-time beekeepers (owning 25-299 colonies), and commercial beekeepers (owning 300 or more colonies). In the United States, there are about 200,000 hobbyists, 10,000 part-time, and 2,000 commercial beekeepers.

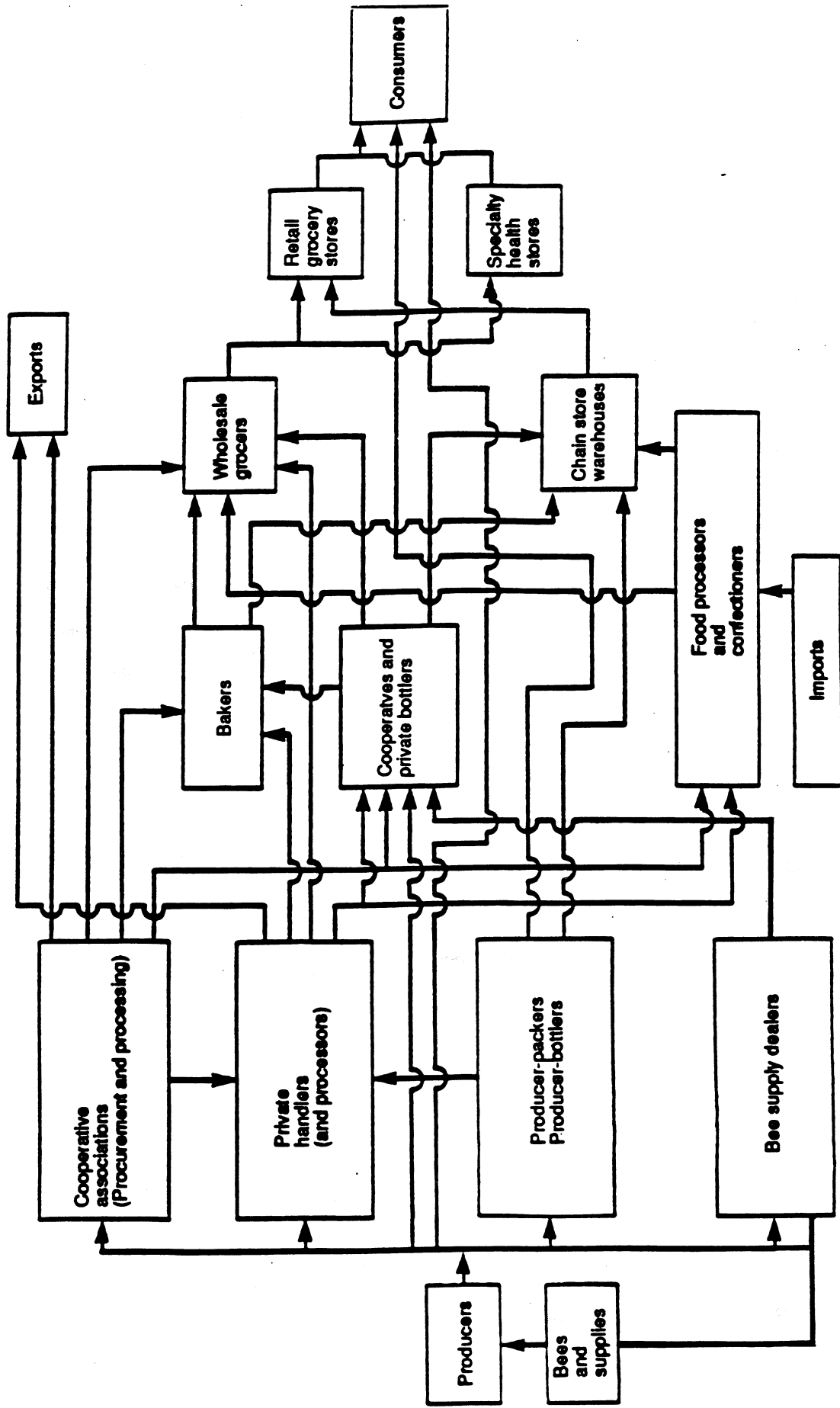
Honey is produced in every State in the United States, although production varies from region to region and from year to year depending on environmental factors such as rainfall, temperature, and crops. North Dakota, South Dakota, California, and Florida usually have the largest percentages of U.S. bee colonies, and, consequently, the largest percentages of U.S. honey production.

Employment

The employment in the honey industry almost directly corresponds to the number of beekeepers. The majority of beekeepers are hobbyists and part-timers, who generally do not employ others. Additional employment other than that already accounted for by

Calendar year	HFCS		Refined beet sugar	Price discount to sugar	
	HFCS-42	HFCS-55		HFCS-42	HFCS-55
	Cents per pound dry basis			Percent	
1987	16.50	17.46	23.60	30.1	26.0
1988	16.47	18.68	25.49	35.4	26.7
1989	19.24	21.41	29.38	34.5	27.1
1990	19.69	21.88	30.90	36.3	29.2
1991	21.04	23.32	25.84	18.6	9.8

Figure 3
Flow chart of the U.S. honey industry



the hobbyists and part-time beekeepers occurs in the commercial beekeeping operations and the packing industry. Although data are not available for additional employment aside from beekeeping, employment in the commercial beekeeping and packing operations is estimated not to be over 5,000.

Labor Skill Levels, Level of Automation, and Productivity

Beekeeping requires knowledge not only of the bees themselves, but also of diseases that can affect hives, flora of the surrounding area, and honey extraction. The nature of beekeeping virtually excludes the industry from any type of automation except that applied to extracting and blending the honey. Extracting and packing facilities are highly automated, however, and require less skill than beekeeping.

Honey production varies among regions and years according to factors such as rainfall, soil conditions, crop patterns, and management. The peak of honey production occurred in 1952 with domestic production of 272 million pounds. There has been a downward trend in honey production since the 1950s, largely because of increased competition with imported honey and resulting lower prices, decreased amounts of accessible flora, and rising costs of operations. Honey production over the past decade varied considerably, from a low of 150 million pounds in 1985 to a high of 230 million pounds in 1982. Yield per colony showed a decided increase in the second half of the decade, from an average of 46.56 pounds in the first half to 69.52 from 1986-90. The tabulation on this page shows honey production from 1980 through 1991.

Degree of Integration with Foreign Suppliers

Integration with foreign suppliers in the honey industry varies according to the level of industry. At the beekeeping level, there is very little integration in the form of trade in bees themselves because of the prevalence of phytosanitary laws governing the movement of bees into most countries in an effort to stem the travel of diseases and parasites. There is some use of bee equipment from foreign suppliers, but this is minimal.

Honey bottlers usually purchase their honey from both domestic and foreign sources, often blending the products in order to produce a honey of uniform color and flavor. Honey imports will be further discussed in a later section of the summary.

Vertical and Horizontal Integration

The nature of beekeeping makes the industry a very individualized one with little horizontal integration at the production level. As mentioned, the majority of beekeepers are hobbyists, although hobbyists accounted for only approximately 1 percent of commercial production, with most of their honey used for home consumption. Part-time and commercial beekeepers, which account for about 40 and 60 percent of production respectively, may pack their honey themselves, may sell bulk honey to cooperatives, or may sell to bottlers. The producer/packers who bottle and sell their own honey at roadside stands and local stores and farmers' markets display a high degree of vertical integration but do not represent a majority of commercial sales of honey. The cooperative marketing organizations, which process, pack, and sell their members' honey, sell not only to retail stores but also to the large industrial users of honey such as the baking industry. In addition, some cooperatives export honey. The large bottling firms, which generally purchase their honey from the producer rather than operate their own beekeeping enterprises, distribute the advertised brands of honey and the private-label honey found on grocery store shelves. In addition, these firms sell to industrial users. The National Honey Board estimates that there are approximately 700 producer/packers in the United States and 150 packer/handlers, although these numbers probably contain some overlap.

Marketing Methods, Pricing Practices, and U.S. Government Programs

As described above, the majority of honey commercially marketed comes from cooperatives and bottlers. These marketing organizations provide honey to retail stores, industrial users, and institutional users. The major industrial users of honey are the dairy, baking, cereal, and confectionery industries.

<i>Crop year</i>	<i>Colonies</i>	<i>Yield</i>	<i>Production</i>
	<i>(Thousands)</i>	<i>(Pounds per colony)</i>	<i>(Million pounds)</i>
1980	4,141	48.2	199.8
1981	4,213	44.1	185.9
1982	4,250	54.1	230.0
1983	4,275	48.0	205.0
1984	4,300	38.4	165.1
1985	4,325	34.7	191.2
1986	3,205	62.5	200.4
1987	3,190	71.1	226.8
1988	3,219	66.4	197.7
1989	3,443	51.4	177.0
1990	3,188	61.5	196.0
1991	3,200	62.6	200.6

There is a difference in marketing practices depending on the type of honey marketed. Dark, strong-flavored honey is generally used industrially for further processing in products. Light honey is considered "table-grade" honey and is sold for direct consumption. Approximately half the honey commercially produced is bottled, usually in 1-pound jars, and sold for table use. The other half of commercial honey production is blended and sold as bakery-grade honey in bulk.

Honey is an industry in which brand loyalty and recognition do not contribute as much to consumer preference as in other products. Part of this lack of brand loyalty stems from the fact that honey taste varies according to the flora composition at the site of production, and individual consumers seem to prefer the uniqueness of unblended honey for direct consumption. For those preferring blended honey, the product is very homogenous, and therefore many commercial brands of honey are not distinguishable from competitors' blended honey.

The U.S. Government operates a honey price-support program that assists beekeepers by providing a market for honey at an assured price, thus smoothing out price fluctuations. Since 1952, the Government assistance has consisted of a loan program and a purchase program. Loans at the applicable price support rate are available from April 1 of the crop year through January 1 of the following crop year to producers complying with the program. The loans are granted for up to 90 percent of the honey pledged as collateral in eligible farm storage, and for 95 percent of the honey stored in a CCC-approved warehouse. When the loan is settled, price support is granted for the additional 5 to 10 percent of honey. Producers store their honey and wait for better market prices, with the loan maturity date being the limit on the waiting period. Maturity dates are staggered according to the month of loan disbursement in order to prevent all honey coming onto the market at the same time.

If the honey in storage is sold on the market, the loan is repaid with interest. If loan recipients choose not to sell on the market, the honey is forfeited to the CCC and the loan is considered paid in full. The tabulation at the bottom of the page shows U.S. honey prices and price-support loan activity.

Starting with the 1989 honey crop, a \$250,000 limit was placed on the amount of forfeitures a producer can make. The Food Security Act of 1985 did allow beekeepers to repay loans at lower than the announced rate with the permission of the Secretary of

Agriculture. Lower loan rates entail the repayment of principal only on the loan.

In the 1980s, the Government support prices generally exceeded domestic and world market prices. Consequently, approximately 90 percent of the yearly U.S. honey crop in the 1980s was placed under loan. Lower repayment rates were announced for the 1986, 1987, 1988, and 1989 crops. Honey forfeited under loan is disposed of through domestic food assistance programs. The current shortage of honey in North America, largely a result of the infestation of the several mites and diseases in bee colonies, coupled with the 1986 reduction in the loan rate, has caused market prices in many cases to rise above the loan repayment rate. Industry sources indicate that in 1990 and 1991, honey transactions were more dependent on market forces and less on the Government than in recent years. U.S. net government expenditure for the honey program dropped significantly in 1991, as shown in the tabulation below.

Research and Development Expenditures and High-Tech Processes

Research and development in the honey industry can be divided into two distinct types: product research and bee research. Product research is most notably done by the National Honey Board. The National Honey Board is composed of industry representatives appointed by the Secretary of Agriculture to administer the Honey Research, Promotion and Consumer Information Order.²⁶ Approximately one-quarter of the gross budget of the National Honey Board (about \$2.5 million in 1991) goes toward research and development of marketing strategies and market uses for honey.

The U.S. Government, through research grants and its own research conducted by the U.S. Department of Agriculture, has actively engaged in study of a number of diseases and parasites that are affecting honeybees in the United States. Parasites infecting honeybees include the tracheal mite (*Acarapis woodi*), and the Varroa mite (*Varroa jacobsoni*). Diseases affecting bees are chalkbrood (caused by a fungus), American

²⁶ The Honey Research, Promotion and Consumer Information Order was approved in May 1986 by a referendum of honey producers and importers. The National Honey Board Promotion Program is funded by an assessment of 1 cent per pound of honey entering the market channel, except for those who produce, handle, or import less than 6,000 pounds of honey or donate their honey to charity.

Calendar year	Domestic average price	National average price support rate	Quantity placed under loan	CCC take-over	Net Government expenditure
	Cents per pound		Million pounds		\$ millions
1986	51.1	64.0	155.2	52.8	89.4
1987	50.3	61.0	172.6	78.6	72.6
1988	50.0	59.1	249.8	55.9	100.1
1989	49.8	56.4	173.3	47.7	41.7
1990	52.8	53.8	195.9	12.6	46.7
1991	54.4	53.8	151.4	8.6	18.6

foulbrood (caused by a bacterium), and Nosema (caused by a protozoan). Thus far, efforts to eradicate these diseases have been unsuccessful.

The appearance of the Africanized honeybee (*Apis mellifera scutellata*) in the United States generated a great deal of publicity. The first Africanized honey bee swarm in the United States was found near Hidalgo, TX in October 1990. Since that time, a number of swarms have been located along the U.S.-Mexico border, and at least three deaths have been attributed to the Africanized bees. The U.S. Department of Agriculture, through its Extension Service, has been providing special need funding to the Texas Agricultural Extension Service in order to conduct education programs on the Africanized bee, and collect information on infestation. The potential impact of the Africanized honey bees on the U.S. beekeeping industry is the subject of industry debate.

Special Considerations

Although the monetary receipts from honey and beeswax exceed fees for pollination services, bees' greatest contribution to the U.S. economy is as

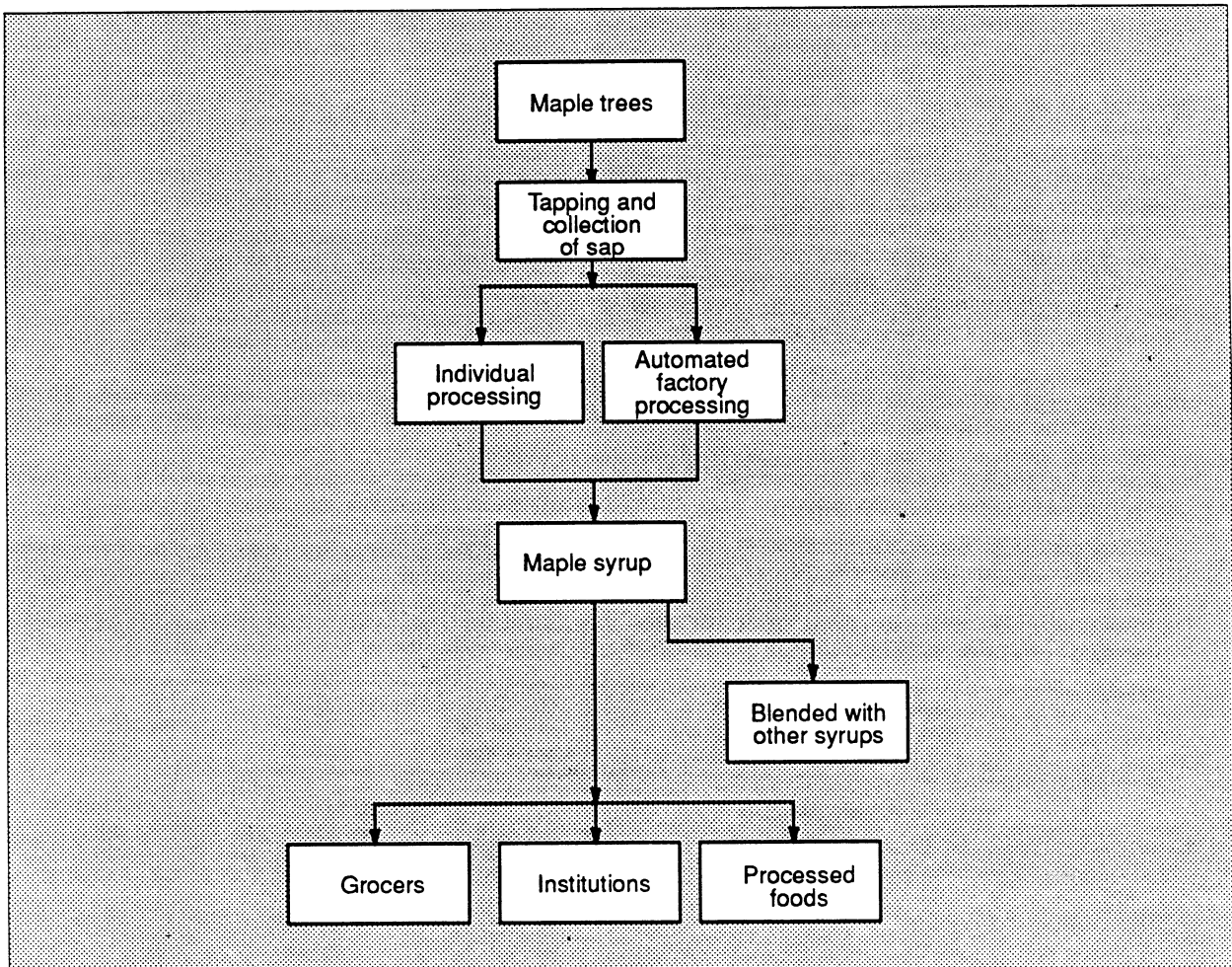
pollinators of U.S. crops. Large commercial beekeepers in the United States rent bees for pollination services, transporting the bee colonies to crop sites. Large renters of honeybees for pollination include tree fruit growers and vegetable growers.

U.S. Flavored Sugars, Syrups, Molasses, and Blended Syrups Industry

Structure Of Industries

The industries that are the principal producers of the products considered in this section are the flavoring extract and syrup industry (SIC 2087) and the food preparations industry (SIC 2099). The diversity of products does not permit a comprehensive figure of industry structure, but figure 4 demonstrates the industry structure of the best known of these sweetening products, maple syrup.

Figure 4
U.S. maple syrup industry structure



Source: Industry sources.

Number of Firms, Concentration Among Firms, and Geographic Distribution

Data from the 1987 Census of Manufactures (the latest year for which detailed information is available) indicate that there are 280 establishments in the United States producing flavoring extracts and syrups. However, not all of the products of these industries are sweetening products, such as food colorings and fruit concentrates. The largest number of these establishments (44) are in California, followed by Illinois (27), and New Jersey (26).

The 1987 Census of Manufactures showed over 1,600 establishments involved in the production of food preparations. As with the flavoring extracts and syrups industries, not all of the products of these industries are sweetening products. Sweetening products included in this industry are mainly sweetening syrups and molasses. Although the Census of Manufactures includes HFCS and other corn syrups in the products covered, these products will not be covered in this section of the summary.

Maple syrup, the best known of these sweetening products, is commercially produced in five main states: New Hampshire, New York, Maine, Massachusetts, and Vermont. Vermont is the largest maple syrup-producing State, with an average of over 372,000 gallons a year during 1987-91; New York is the second-largest, with an average of 283,400 gallons over the same period (table 6).

Employment

Employment in the flavoring and sweetening syrups industries is estimated to be approximately 5,000, with little change during the past 5 years.

Labor Skill Levels, Level of Automation, and Productivity

The majority of the products covered in this section of the summary are produced with a high level of automation requiring a relatively high level of labor skill. The one product clearly differentiated according to method of production is maple syrup.

Maple syrup requires the tapping of individual sugar maple trees in order to obtain the sap that is the base of production. Tapping cannot be automated and

thus is very labor-intensive. The sap that is collected from the trees also cannot be automated for pickup and therefore requires much labor for transportation to the site of further processing. Processing can occur in automated factories, although a large percentage of further processing into maple syrup continues to be done by individuals.

Despite continued deterioration of U.S. sugar maples as a result of acid rain and the infestation of pear thrips in Vermont 3 years ago, maple syrup production has been increasing since 1986 (table 6). A phenomenon of the pollution of sugar maples by acid rain is that the sugar content of the sap has increased, contributing to increased production.

Degree of Integration with Foreign Suppliers

Production of flavoring and sweetening syrups generally does not require any type of integration with foreign firms, although some packaging and concentrates—particularly fruit—used in production come from foreign sources. Several of the processing plants and operations that market maple syrup are owned by foreign companies, particularly Canadian processors.

Vertical and Horizontal Integration

About half of the production of flavoring and sweetening syrups is further processed by the producers themselves as ingredients in value-added products. The beverage industry is an excellent example. There is a high degree of horizontal integration among the processors of prepared foods and beverages, which are two of the largest users of flavoring and sweetening syrups.

Maple syrup is often directly marketed to the consumer by individual producers. A relatively large number of maple syrup producers are totally vertically integrated and sell maple sugar and syrup directly to retail consumers. However, the "maple syrup" purchased in retail stores, which is often a blend of syrups, comes from producers that generally exhibit a high degree of vertical and horizontal integration.²⁷

²⁷ As mentioned earlier, The Food and Drug Administration maintains a Standard of Identity—21 CFR 168.140—for what may be labelled "maple syrup."

Table 6
U.S. maple syrup: Production, by State, 1987-1991

State	1987	1988	1989	1990	1991
--Thousand gallons--					
Maine	5	76	103	98	112
Massachusetts	28	44	24	29	44
New Hampshire	47	74	56	63	81
Vermont	275	370	400	375	440
New York	225	310	325	249	308
Other ¹	212	294	306	274	332
Total	792	1,168	1,214	1,088	1,317

¹ Includes Pennsylvania, Ohio, Michigan, and Wisconsin.
Source: USDA.

These producers may have their own tapping operations, and almost all have their own processing operations. They market their syrups, usually consisting almost exclusively of blends, throughout the United States under familiar brand names.

Marketing Methods, Pricing Practices, and U.S. Government Programs

Flavoring and sweetening syrup producers market their products to grocery stores, producers of further processed foods, institutional users, and fast-food outlets.

Although there are no U.S. Government programs directly targeted to the flavoring and sweetening syrup producers, the producers are naturally affected by programs for key ingredients such as the sugar program and the feedgrains programs. The maple syrup industry has received indirect assistance through U.S. Government research programs on the effect of acid rain on sugar maples.

Research and Development Expenditures and High-Tech Processes

Data on expenditures for research and development in the flavoring and sweetening syrups industries per se are not available. However, these industries profit directly from the research and development and the high-tech processes involved in the production of sugar syrups and corn syrups.

Consumer Characteristics and Factors Affecting Demand

The principal U.S. consumers for sweeteners include producers of foods such as the baking industry, beverage producers, households, restaurants, and other institutional users (table 7). Consumers of sweeteners are throughout the United States.

According to the USDA, total caloric sweetener consumption in the United States has steadily increased since 1987, from 16.23 million short tons to 17.67 million short tons, dry basis. Consumption of HFCS increased by 10 percent, and consumption of sugar, on a refined basis, also increased 10 percent. The displacement of sugar for beverages and some other uses by lower cost HFCS temporarily retarded U.S. consumption of sugar in the early 1980s. However, sugar consumption currently is increasing along with U.S. population and income growth. HFCS consumption growth has slowed as substitution has reached the saturation point unless further developments occur. Sweetener consumption growth has resulted largely from increased deliveries to the confectionery and bakery/cereal industries, which account for approximately 75 percent of industrial deliveries. Natural sweeteners face increasing competition from noncaloric, high-intensity sweeteners such as aspartame (Nutrasweet). These low-calorie sweeteners not only appeal to the diet-conscious U.S. consumer, but also are intensely sweet, so that the same

sweetness can be obtained from a fraction of the weight of sugar needed.

Three high-intensity sweeteners currently are approved for use in the United States: saccharin, aspartame, and acesulfame-K. Of the high-intensity sweeteners on the market, saccharin is the oldest. Saccharin is primarily used as a table sweetener and in soft drinks, and is 30 times as sweet as sugar. In sugar-sweetness equivalent, saccharin costs only about 1 cent per pound.²⁸

Acesulfame-K, which is 200 times as sweet as sugar, is the newest high intensity sweetener on the market. Acesulfame-K is used in beverage mixes, as a table sweetener, and in chewing gum.

Aspartame, known in the United States under the brand name "Nutrasweet," is the most widely used high-intensity sweetener, and is 180 times as sweet as sugar. Despite its prevalence in soft drinks and desserts, Nutrasweet has limitations for use because it breaks down under certain conditions. Currently, the price of aspartame is 30 to 40 cents per pound, sugar-sweetness-equivalent (sse), but analysts predict a sharp drop in prices, possibly down to 10-15 cents per pound, sse, following the expiration of Nutrasweet's U.S. patent in December 1992.

The FDA approval is pending on three other high-intensity sweeteners: sucralose (600 times as sweet as sugar), cyclamate (30 times as sweet as sugar), and alitame (2,000 times as sweet as sugar). Cyclamate was used in blends primarily in soft drinks in the United States prior to 1970, when it was banned pending further study.

U.S. per capita consumption of high-intensity sweeteners almost tripled in the 1980s, capturing approximately 12 to 14 percent of the U.S. sweetener market from around 5 percent in the 1970s.²⁹ Aspartame commands approximately 70 percent of the high-intensity sweetener market.³⁰ Though a lack of bulk and other qualities may prevent use in some products, blending high-intensity sweeteners with other high-intensity sweeteners or natural, caloric sweeteners can often rectify the problem. Furthermore, many of these sweeteners have a synergistic effect when blended, meaning that the sensation of sweetness is greater when blended than when alone. Noncaloric sweeteners continue to command a higher price than most natural sweeteners, and along with usage-limitations, this has restricted demand.

FOREIGN INDUSTRY

The U.S. sweetener market is the most diverse market in the world, with a wide variety of sweeteners from which consumers may choose. HFCS use throughout the world is expanding, but the sweetener still has significant consumption in only a few

²⁸ USDA, ERS, *Sugar and Sweeteners: Situation and Outlook Report*, Dec. 1990, p. 16.

²⁹ *Ibid.*, Jan. 1989, p. 40.

³⁰ *Ibid.*, p. 40.

Table 7
U.S. sugar deliveries: Industrial and nonindustrial uses, by regions and types of user, 1980 and 1990

Type of user	New England		Mid-Atlantic		North Central		South		West	
	1,000 short tons, refined		1,000 short tons, refined		1,000 short tons, refined		1,000 short tons, refined		1,000 short tons, refined	
	1980	1990	1980	1990	1980	1990	1980	1990	1980	1990
Industrial uses:										
Bakery, cereal, and allied products	26	34	223	243	583	715	307	378	187	236
Confectionery and related products	37	25	337	425	359	475	95	231	144	121
Ice cream and dairy products	32	27	79	75	149	143	108	139	102	76
Beverages	83	1	276	38	649	118	760	57	360	14
Canned, bottled, and frozen foods	9	2	59	31	168	111	146	84	288	102
All other food use	15	7	63	60	276	352	82	142	90	80
Nonfood use	3	1	16	13	62	48	32	40	3	5
Total industrial use	205	99	1,052	884	2,245	1,962	1,530	1,071	1,174	634
Nonindustrial use:										
Hotels, restaurants, and institutions	4	0	6	3	22	27	34	39	25	37
Wholesale grocers	74	91	283	320	643	746	587	647	307	317
Retail grocers	37	25	156	119	281	223	492	464	132	260
All other deliveries	1	2	24	15	33	15	113	21	27	22
Total nonindustrial use	117	117	469	458	979	1,011	1,226	1,171	490	635
Total use	322	216	1,521	1,342	3,223	2,973	2,756	2,242	1,664	1,269

Note: Data are for continental United States only.

Source: USDA, ERS, *Sugar and Sweetener Situation and Outlook Yearbook*, June 1991, p. 74.

countries. Sugar continues to be the major sweetener produced and traded throughout the world (figure 5).

India in 1990/91 was the largest world sugar producer, although the combined countries of the EC did produce more (figure 6). India has in the last 5 years moved from the third-largest individual sugar-producing nation to the first, representing 10 percent of world production. Thailand has had the largest percentage increase in production during the latter half of the 1980s, increasing production 34 percent, from 2.59 million metric tons to 3.90 million metric tons, raw value in 1990. Production in 1990/91 was 3.95 million metric tons.

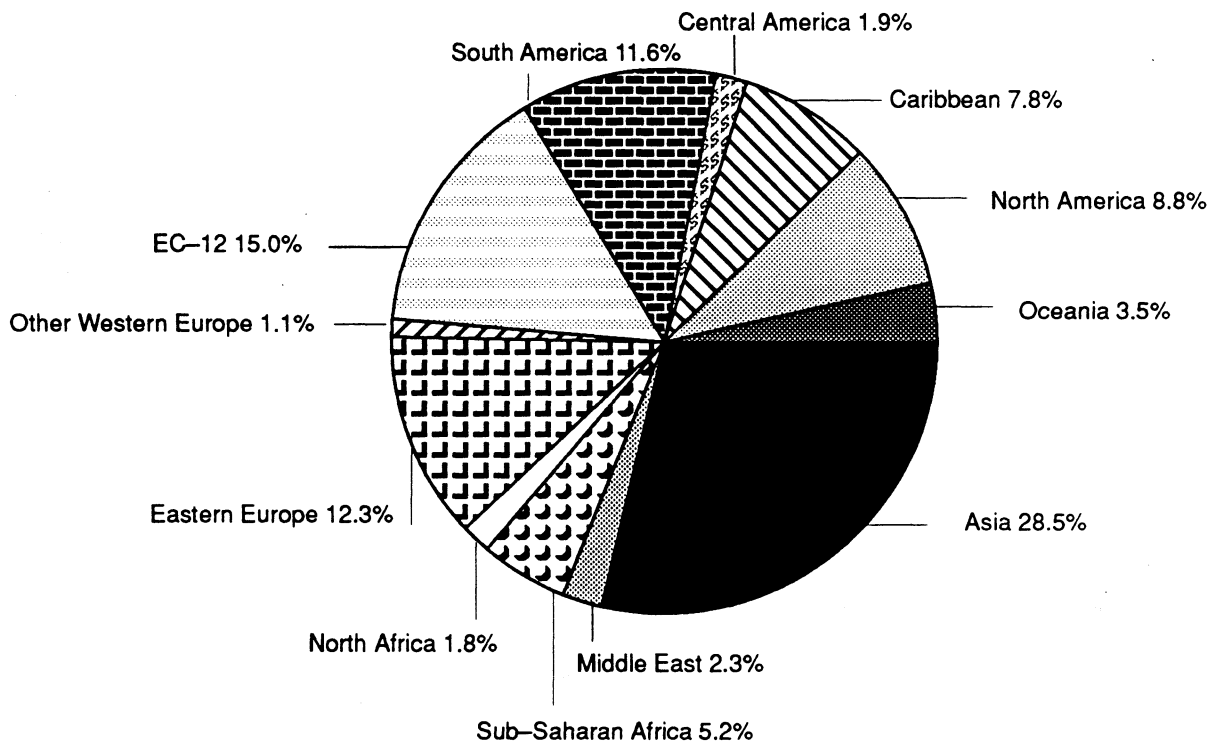
World exports in the 1990/91 marketing year were approximately 25 percent of production, showing a decline of 5 percent of production exported since the 1985/86 marketing year. The world export market for sugar is restricted by the fact that most countries limit imports of sugar, and because many of the large sugar-producing countries are also large sugar-consuming countries. The import restrictions of many of the more developed countries such as the EC and the United States have helped expand production in these countries, and have also hindered exports from

many developing-country producers. Although the EC has one of the highest costs of production for sugar in the world, EC exports of sugar comprise about 23 percent of the sugar on the world market. The large percentage of EC sugar on the world market is directly attributable to the EC agricultural programs. Cuba continues to be the largest exporter of sugar to the world market, exporting approximately 88 percent of its production.

HFCS is the sweetener most often substituted for sugar, and consumption is currently equal to approximately 7 percent of world sugar consumption.³¹ The United States, Japan, Canada, the EC, Korea, and Argentina are the major producers and users of HFCS. The EC maintains production quotas on HFCS. The syrupy HFCS is difficult to transport and must be used quickly, usually within several weeks of production. Consequently, world trade in HFCS is relatively small, except for trade between the United States and Canada.

³¹ U.S. Department of Agriculture, Economic Research Service, *Sugar and Sweetener: Situation and Outlook Yearbook*, June 1991, p. 15.

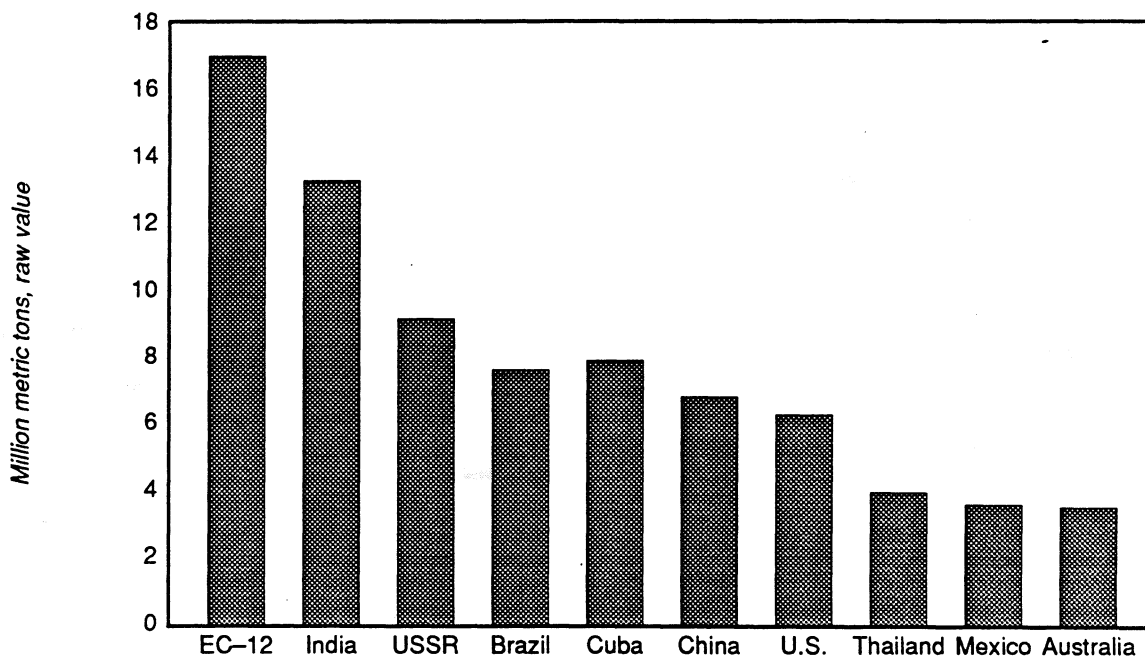
Figure 5
Global sugar production, 1990/91¹



¹ Total may not add to 100% due to rounding.

Source: USDA.

Figure 6
Major sugar-producing countries, 1990/91



Source: USDA.

U.S. TRADE MEASURES

Tariffs

Appendix A shows the column 1 rates of duty, as of January 1, 1992, for the articles included in this summary, and U.S. exports and imports for 1991. An explanation of tariff and trade agreement terms is shown in appendix B. The aggregate trade-weighted, average rate of duty for all products covered in this summary, based on 1991 trade figures, was less than 1 percent ad valorem equivalent, although only maple sugar and maple syrup are duty-free.

Nontariff Measures

Quotas

Three broad categories (sweetened cocoa, sugar-containing flour mixes and doughs, and certain miscellaneous edible preparations) of the approximately 200 sugar-containing product import items in the Harmonized Tariff Schedule of the United States are subject to import quotas under section 22 of the Agricultural Adjustment Act (7 U.S.C. 624). In 1989, the European Community challenged before the GATT the U.S. use of section 22 import restrictions on sugar-containing products. A GATT panel later that

year found that the use of section 22 to restrict sugar-containing products did not violate the GATT.

Tariff-Rate Quotas

Proclamation No. 4334 of November 16, 1974 (39 FR 40739), established rates of duty and an absolute import quota effective January 1, 1975, for the articles currently classified in HTS subheadings 1701.11.00, 1701.12.00, 1701.91.20, 1701.99.00, 1702.90.30, 1806.10.40, and 2106.90.10. The quantitative limits were in the form of headnote 3 of subpart A, part 10, schedule 1 of the Tariff Schedules of the United States (TSUS). Since the switch to the Harmonized Tariff Schedule of the United States, the provisions of headnote 3 to subpart A, part 10, schedule 1 of the TSUS now are contained in additional U.S. note 3 to chapter 17 of the HTS.

The Council of the GATT on June 22, 1989, concluded that the absolute quota on imports of sugars under U.S. note 2 to chapter 17 of the HTS was not in conformity with the GATT. Consequently, with consideration taken of section 902(a) of the Food Security Act of 1985 (99 Stat. 1443; 7 U.S.C. 1446 note), requiring the operation of the sugar program at no cost to the Federal Government through the prevention of forfeitures to the Commodity Credit Corporation, the President issued Proclamation 6179 on September 13, 1990, effective October 1, 1990.

Proclamation 6179 established a "tariff-rate quota" for imports of sugar. Allocations of the quota are based on the historical exports to the United States during 1975-81. Countries having an allocation are able to export sugar to the United States under the first tier of the duty for sugar, which is 0.625 cent per pound. The tabulation on the next page shows the country-by-country allocations.

Imports from Generalized System of Preferences (GSP) countries and the countries addressed in the Caribbean Basin Economic Recovery Act are duty-free on these allocations. Sugar imported into the United States above the first-tier quota allocation is subject to a 16-cents-per-pound, raw value, duty. Exceptions on sugar imports in excess of the first tier quota are given for inputs for quota-exempt sugar-containing product re-exports, polyhydric alcohol production, and refined sugar re-exports. Quota shipments must be accompanied by Certificates of Quota Eligibility. These certificates cover shipments of sugar produced (grown) in the country having a sugar quota allocation. Certificates are distributed according to authorized shipping patterns for the quota period. Australia, Brazil, the Dominican Republic, the Philippines, Argentina, Guatemala, Panama, and Peru all received their certificates in conformance to established shipping patterns for the 1990/91 quota year. For all other quota-holding countries, certificates could be disbursed at any time, allowing shipment of quota sugar at any time. Sugar from Cuba is embargoed. Table 16 shows U.S. sugar imports by country from 1987 through the 1990/91 quota year.

Additional U.S. note 3 to chapter 17 of the HTS also contains a provision for the importation of specialty sugars as defined by the United States Trade Representative (USTR). These specialty sugar imports, which mainly are used in the manufacture of certain types of confectionery and bakery products, are allocated to the following countries by the USTR at the volume of 72 metric tons, raw value each, annually:

Belgium	Kenya
Burma	Luxembourg
Cameroon	Netherlands
Denmark	Netherlands Antilles
Federal Republic of Germany	Peoples Republic of China
France	Republic of Korea
Hong Kong	Suriname
Indonesia	Sweden
Ireland	Switzerland
Italy	United Kingdom
Japan	Venezuela
	Republic of Yemen

Other specified countries that may ship specialty sugars at an amount determined by the USTR include Congo, Cote d' Ivoire, Gabon, Haiti, Madagascar, Mexico, Papua New Guinea, Paraguay, Saint Kitts and Nevis, and Uruguay. Table 16 shows the annual specialty sugar quotas and actual shipments from 1987 through 1990/91.

Classification Criteria

The General Rules of Interpretation of the HTS are the criteria used to classify the commodities contained

in this summary. Rule number 3 (b), in particular, is used to classify some of the flavorings and syrups, which gain their essential character from sweeteners such as sugar. Further classification criteria are given in the Additional U.S. Notes for Chapter 17 of the Harmonized Tariff System.

Section 22 Fees

On December 23, 1981, the President issued Proclamation 4887 pursuant to the emergency provisions of section 22 of the Agricultural Adjustment Act, providing a system of additional import fees to protect the sugar price-support program and setting a formula for the calculation of a market stabilization price, which is the price determined necessary to protect the price support level (market price required to discourage forfeiture of sugar to the Government). The Secretary of Agriculture was given the authority to establish import fees, on a quarterly basis. Proclamation 4940, issued on May 5, 1982, fixed the fee for refined sugar at 1 cent above that for raw sugar, and modified the method for establishing the market stabilization price. This fee can be adjusted upward, but not above 50 percent ad valorem. On March 29, 1985, the President issued Proclamation 5313 suspending the fee for raw sugar and setting the fee for refined sugar at 1 cent per pound.

U.S. Government Trade-Related Investigations

In response to requests by the President, in 1985 the Commission undertook investigations pursuant to section 22 of the Agricultural Adjustment Act concerning sugar and products containing sugar. At the time the investigations were requested the President took emergency action under section 22 authority, resulting in quotas for three sugar-containing articles and the suspension of the fee for imports of raw sugar and the setting of the fee at 1 cent per pound for refined sugar. No final action has been taken on investigations No. 22-48 and 22-49, and the reports have not been released.

On September 9, 1982, the Government of Australia requested that the United States review its countervailing duty order on the sugar content of certain articles from Australia. The Commission instituted investigation No. 104-TAA-26 under section 104(b) of the Trade Agreements Act of 1979, and released *Sugar Content of Certain Articles From Australia*, USITC publication 1748, in September 1985. However, the final report did not cover any sweeteners or sweetener products, as the Commission terminated the investigation as to all products other than canned peaches, pears, and fruit mixtures following a finding that no domestic industry would be materially injured or threatened with material injury, nor would the establishment of a domestic industry be materially retarded by the revocation of the countervailing duty orders.

Country	Percentage	Country	Percentage
Argentina	4.3	Jamaica	1.1
Australia	8.3	Madagascar	0.3*
Barbados	0.7	Malawi	1.0
Belize	1.1	Maritius	1.2
Bolivia	0.8	Mexico	0.3*
Brazil	14.5	Mozambique	1.3
Colombia	2.4	Nicaragua ³²	2.1
Congo	0.3*	Panama	2.9
Costa Rica	1.5	Papua New Guinea	0.3*
Cote d'Ivoire	0.3*	Paraguay	0.3*
Dominican Republic	17.6	Peru	4.1
Ecuador	1.1	Philippines	13.5
El Salvador	2.6	St. Kitts & Nevis	0.3*
Fiji	0.9	South Africa ³³	2.3
Gabon	0.3*	Swaziland	1.6
Guatemala	4.8	Taiwan	1.2
Guyana	1.2	Thailand	1.4
Haiti	0.3*	Trinidad-Tobago	0.7
Honduras	1.0	Uruguay	0.3*
India	0.8	Zimbabwe	1.2

* Countries have been allocated minimum access level.

³² Nicaragua's sugar quota was reallocated in 1983 to Costa Rica, El Salvador, and Honduras.

³³ Legislation instituting sanctions against South Africa was passed by Congress in October 1988, and was effective immediately. Prior to sanction, South Africa had a 2.3-percent allocation of the sugar import quota. The Philippines received South Africa's remainder of the quota in 1988, and the entire quota allocation in the following quota years. Economic sanctions against the Republic of South Africa were lifted on July 10, 1991, and South Africa received 2.3-percent of the fiscal year 1992 quota.

FOREIGN TRADE MEASURES

Tariffs And Non-tariff Measures

License holders under the Refined Sugar Re-Export Program and the Sugar-Containing Products Re-Export Program are able to import quota-exempt raw sugar from the world market at the world price for use in the approved programs. Under the Refined Sugar Re-Export and the Sugar-Containing Product Re-Export programs, the sugar is exported from the United States as refined sugar or in sugar-containing products.

Canada and Mexico were in recent years the leading importers of U.S. sweeteners, with the largest percentage of imports comprised of sugar (table 8). Until 1990, U.S. exports to Iraq were significant. However, exports to Iraq have fallen sharply since August 2, 1990, when the United States suspended credit guarantees to Iraq under the Export Credit Program.

Mexican imports of sweeteners from the United States increased significantly between 1988 and 1989, in part due to the Government of Mexico eliminating an import permit requirement for cane and beet sugar in November 1989. The elimination of the import permit requirement was, according to the Mexican Secretariat of Commerce and Industrial Development, part of Mexico's policy of trade liberalization under GATT. Exports of U.S. sugar and sugar-containing

products to Mexico are subject to an ad valorem tariff, which is calculated monthly according to a formula. The ad valorem tariff on U.S. sugar exports to Mexico is currently averaging approximately 50 to 60 percent.

Imports of sugar into Japan are subject to a tariff of about \$300 per metric ton, as well as additional surcharges levied on imports. The levies are determined by a combination private sector/government council when imports are in excess of optimum import projections. In 1990-91, the surcharge was approximately \$17 per metric ton.

Canada and the United States are scheduled to reduce duties on sugar to zero by 1998, following the entrance into a free-trade agreement (FTA) on January 1, 1989. Article 707 of the FTA prohibits the United States from introducing or maintaining any quantitative import restriction or import fee on Canadian exports to the United States of products containing less than 10 percent of sugar. The section 22 import fee of 1 cent a pound on refined sugar imports continues, however. There is an informal "gentleman's agreement" between the United States and Canada to maintain Canadian exports of sugar to the United States at pre-FTA levels.

The countries of the European Community import very few sweetener products from the United States, largely as a result of their own sugar program and the system of variable levies that are imposed on imports from non-EC, non-African, Caribbean, and Pacific (ACP) nations that signed the Lome Convention. The

Table 8
Sugar and other sweeteners: U.S. exports of domestic merchandise, imports for consumption,
and merchandise trade balance, by selected countries and country groups, 1987-91¹
(Million dollars)

<i>Item</i>	<i>1987</i>	<i>1988</i>	<i>1989</i>	<i>1990</i>	<i>1991</i>
U.S. exports of domestic merchandise:					
Canada	51	58	56	99	100
Mexico	2	3	62	103	102
Guatemala	1	2	2	2	0
Philippines	1	1	1	1	1
Dominican Republic	2	2	1	4	0
Australia	1	1	1	2	2
Brazil	0	0	0	0	1
Argentina	1	1	0	0	0
Peru	9	0	8	6	22
Nicaragua	0	0	0	0	0
All other	122	133	145	145	134
Total	190	199	277	362	362
EC-12	27	32	45	48	27
OPEC	36	35	36	23	7
ASEAN	1	2	2	2	3
CBERA	19	23	37	46	34
Eastern Europe	0	1	0	0	0
U.S. imports for consumption:					
Canada	92	84	100	101	109
Mexico	45	43	44	13	21
Guatemala	22	30	29	71	97
Philippines	56	57	92	114	90
Dominican Republic	76	93	121	119	68
Australia	33	36	47	32	66
Brazil	57	71	34	148	64
Argentina	18	13	39	20	42
Peru	12	13	16	17	18
Nicaragua	0	0	0	7	36
All other	151	182	255	336	232
Total	561	623	776	978	844
EC-12	14	18	13	16	5
OPEC	4	9	6	7	9
ASEAN	61	62	100	123	103
CBERA	148	178	209	265	260
Eastern Europe	0	1	1	5	11
U.S. merchandise trade balance:					
Canada	-41	-26	-44	-2	-9
Mexico	-43	-40	18	90	81
Guatemala	-21	-28	-27	-69	-97
Philippines	-55	-56	-91	-113	-89
Dominican Republic	-74	-91	-120	-115	-68
Australia	-32	-35	-46	-30	-64
Brazil	-57	-71	-34	-148	-63
Argentina	-17	-12	-39	-20	-42
Peru	-3	-13	-8	-11	4
Nicaragua	0	0	0	-7	-36
All other	-29	-49	-110	-191	-98
Total	-371	-424	-499	-616	-482
EC-12	13	14	32	32	22
OPEC	32	26	30	16	-2
ASEAN	-60	-60	-98	-121	-100
CBERA	-129	-155	-172	-219	-226
Eastern Europe	0	0	-1	-5	-11

¹ Import values are based on customs value; export values are based on f.a.s. value, U.S. port of export. U.S. trade with East Germany is included in "Germany" but not "Eastern Europe".
Source: Compiled from official statistics of the U.S. Department of Commerce.

variable levies bring non-EC, non-ACP sugar up to a threshold price, which protects domestic production.

U.S. INDUSTRY PERFORMANCE IN DOMESTIC AND FOREIGN MARKETS

U.S. Consumption

Trends And Import Penetration Levels

Total U.S. consumption of caloric sweeteners between 1987 and 1991 rose from 16.23 million to 17.67 million short tons, dry basis.³⁴ Figure 7 shows the composition of sweetener consumption. Import penetration levels for the years 1987 through 1991 for caloric sweeteners ranged between approximately 3 percent for HFCS to around 61 percent for maple syrup. Import penetration for sugar averaged 27 percent for the covered period.

Conditions Of Competition Between Foreign And U.S. Sweetener Products

Price support programs are the most important factors affecting conditions of competition between

³⁴ USDA, ERS, *Sugar and Sweetener: Situation and Outlook Yearbook*, June 1991, p. 97.

foreign and U.S. sweeteners. Most major developed countries such as the United States maintain some type of sugar program with the aim of stability and maintenance of farm incomes and self-sufficiency. Intervention is also becoming widespread in developing countries, as the countries attempt to earn and/or conserve foreign exchange. These government policies, which are designed to protect producers from instability in prices, generally do not let the producers respond realistically to market demand. Consequently, whereas high world prices may lead to large increases in production, low world prices often do not lead to contractions in production due to the insular effect of the government sugar programs. Adjustment of the market occurs through large price variances on the "world market," which is composed of a rather small sector of the market.

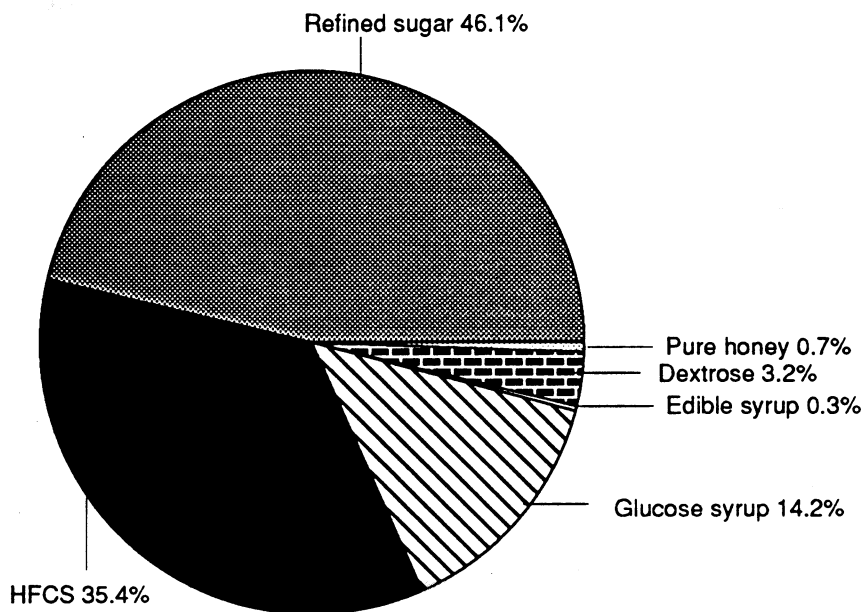
The varying government programs for sugar often extend their controlling effects to other sweeteners, including corn sweeteners.

U.S. Production

Levels And Trends

Table 9 shows U.S. production of sweeteners from 1987 through 1991. Production of both beet and cane sugar has varied considerably, largely due to weather, particularly the freeze in the southern continental

Figure 7
U.S. sweetener consumption, 1991



Source: USDA.

Table 9
U.S. sweetener production, by types, 1987-91

Calendar year	Sugar ¹	HFCS ²	Honey ³	Glucose ⁴	Dextrose ⁴	Maple syrup ⁵
1987	7,309	5,622	227	2,522	651	792
1988	7,087	5,873	198	2,629	679	1,168
1989	6,841	5,870	177	2,733	699	1,214
1990	6,063	6,183	196	2,904	730	1,088
1991	7,270	6,351	201	3,000	740	1,317

¹ 1,000 short tons, raw value.

² 1,000 short tons, dry weight.

³ Million pounds.

⁴ 1,000 short tons, dry basis.

⁵ Thousand gallons.

Source: Compiled from official statistics of the U.S. Department of Agriculture.

cane-growing regions in December 1989. Corn sweeteners have continued the growth in production that characterized the entire 1980s. In the 5-year period covered by this report, HFCS production increased 11 percent, from 5.622 million short tons, dry weight, to 6.351 million short tons, dry weight. Glucose and dextrose production increased yearly, with a resulting 16- and 12-percent overall increase in production, respectively.

Inventories

The size of the U.S. sweetener market contributes to the fact that the United States is one of the world's largest sweetener stockholders. The sweetener stocks are largely comprised of sugar, for which the United States in the 1980s maintained a stocks-to-use ratio of between 23 and 38 percent.³⁵ Stocks of other sweeteners vary greatly in the stocks-to-use ratio, with extremely small stocks of corn sweeteners while stocks of honey averaged approximately 50 percent of consumption over the period examined.

Tightening of the import quota in recent years has helped prevent forfeitures of sugar under loan to the

³⁵ USDA, ERS, *U.S. Sugar Statistical Compendium*, Aug. 1991, compiled statistics.

Commodity Credit Corporation. Commercial and Government-owned inventories (stocks) of sugar during 1987-91 are shown in the table 10.

There are no Government-owned inventories of HFCS or other corn sweeteners, and commercial production is very close to consumption, making for little commercial holding. Commodity Credit Corporation takeovers of honey placed under loan have declined since the peak 206.4 million pounds taken over by the CCC in 1983. Commercial inventories continue to represent over 75 percent of honey stocks held in the United States. The following tabulation shows the carry-in stocks for 1987-91 and the amount of honey acquired by the CCC in million pounds:

Year ¹	Carryin ²	CCC takeovers
1987	254.2	78.6
1988	197.7	55.9
1989	176.8	47.7
1990	126.6	12.6
1991	89.0	8.6

¹ For "Carry-in", the figure given is for the crop year. For Commodity Credit Corporation takeovers, the figures given are for the calendar year.

² Includes both the Commodity Credit Corporation and the commercial inventories.

Table 10
U.S. sugar stocks, 1987-91

Year ¹	Cane sugar		Mainland cane mills	Commodity Credit Corp.	Beet processors	Total stocks
	Refiners Refined	Raw				
1,000 short tons, raw value						
1987	211	516	727	177	1,304	3,222
1988	184	401	996	0	1,546	3,195
1989	187	487	1,008	0	1,372	3,132
1990	155	381	899	0	1,412	2,947
1991	168	371	539	0	1,327	2,729

¹ Inventories are as of January 1 for the year shown.
Source: USDA.

U.S. Imports

The value and sources of U.S. imports of sweeteners for 1987-91 are shown in table 8. Raw cane sugar imported under the quota has accounted for over 50 percent of sweetener imports during the represented period. HFCS imports comprised approximately 50 percent of the remaining imports, followed by honey (approximately 25 percent of remaining imports) and maple syrup and sugar (approximately 21 percent of remaining imports).

During 1987-91, the value of U.S. imports of sweeteners varied from a low of \$561 million in 1987 to a high of \$978 million in 1990. Since 1987 there had been a steady increase in imports, but total imports decreased from 1990 to 1991. Imports of sugar have moved with changes in U.S. per capita sugar consumption, which ranged from 102 pounds in 1970 to 84 pounds in 1980, down to 60 pounds in 1986, and back up to 64.5 pounds in 1991. The changes in sugar consumption have reflected changes in the American diet, the advent of HFCS on the sweetener market, and the growing popularity of noncaloric sweeteners such as aspartame.

The Dominican Republic has the largest percentage of the sugar quota held by any single country (17.6 percent) and consequently is the largest supplier of raw cane sugar to the U.S. market. The five largest quota-holding countries—Dominican Republic, Philippines, Brazil, Australia, and Guatemala—account for approximately 60 percent of quota allocations. There are no new rapidly growing import suppliers of sugar to the United States because of the tariff-rate quota allocations determined by the U.S. Department of Agriculture. In the case of the products not subject to quota, there are no new, rapidly growing suppliers because most countries cannot compete in the U.S. market with U.S. produced corn sweeteners. Canada is the largest supplier of sweeteners other than sugar to the U.S. market, with the majority of its sweetener exports to the United States comprised of HFCS and other corn sweeteners, maple syrup and sugar, and honey. Canada leads the world in the export of the former two products to the United States, and is generally among the top four exporters of honey to the U.S. market. Tables 11-16 show U.S. sweetener imports by type and major suppliers.

The principal types of U.S. importers of sweeteners vary according to the product. Most products are imported by general or wholesale importers, although cane sugar refineries import virtually all of the raw sugar for refining themselves. Eligible refiners can import raw sugar at world prices, refine the product, and then re-export it to the world market under a refined sugar re-export program explained earlier. However, this sugar does not enter the U.S. market. Large-scale processor-packers of honey and maple syrup import products directly from foreign sources, and often use the imported products in blends.

Foreign Market Profile

For the majority of countries, sugar is the major commercial sweetener on the market. The former U.S.S.R., EC, India, the United States, and China are the five largest consumers of sugar in the world, accounting for almost 50 percent of consumption and

approximately 46 percent of production in 1990 (figure 8). The former U.S.S.R. was the largest sugar-importing country in the world, with 15 percent of world imports of sugar in 1990 (figure 9). At the same time, the EC imported 2.76 million metric tons, raw value of sugar, and the United States 2.57 million metric tons, raw value of sugar, making them the second- and third-largest importers, respectively. Due to the sugar provisions in the Common Agricultural Policy (CAP), the EC is not only one of the largest sugar consuming and importing markets, but is also the second-largest sugar-exporting market, following only Cuba. In 1990/91, Cuba provided 24 percent of world sugar exports, and the EC provided 23 percent.

As explained earlier, the prevalence of government programs for sweeteners throughout the world has led to insulated, self-sufficient industries in many countries. As a result, the so-called "world market" for sugar is very small. The insulated markets of the countries with government programs do not allow the producers to directly respond to the world market demands, and consequently, the small existing world market for sugar is often highly volatile with large price swings attempting to correct the market.

The principal factors affecting the demand for U.S.-produced sweetener products in the world market are the size of the U.S. market, U.S. production costs, and the Government programs and policies that restrict imports of sweeteners into other countries. Although the United States has a large and diverse production base for sweeteners, it has never been self-sufficient in sweeteners, particularly sugar, and thus has been a net importer of sweeteners. Because most foreign sweetener markets are geared towards sugar, the United States cannot compete in the world sweetener markets with sugar produced in Cuba, Thailand, and other lower production cost sugar-exporting nations. The United States has production costs that resemble or are lower than those of other nations with tight import controls on sugar. All of these national markets are increasingly geared towards more diverse sweeteners. Japan and the EC are examples of these markets.

High fructose starch syrup (HFSS)³⁶ is the world's second most important sweetener behind sugar. According to industry and government sources, HFSS production in 1990 was estimated at 7.8 million metric tons, dry basis, compared with production of 6.3 million metric tons, dry basis, in 1985. The United States accounts for 75 percent of the world production; Japan and Canada account for 15 percent of production. Currently, the EC has production quotas of 292,000 metric tons per year. The majority of HFSS production is consumed domestically, with the only significant trade in HFSS occurring between the United States and Canada. There are relatively few restrictions between the two countries on HFSS trade, and the Canadian industry exports the bulk of its production to the higher priced U.S. market.

³⁶ High-fructose starch syrup is derived from corn, other grains, and starch sources such as potatoes. In the United States, high-fructose starch syrup is almost exclusively derived from corn, and is known as high-fructose corn syrup (HFCS).

Table 11
U.S. sweetener imports, by types, 1987-91

<i>Calendar year</i>	<i>Glucose and dextrose</i>	<i>HFCS</i>	<i>Pure maple sugar and syrup</i>	<i>Pure honey</i>	<i>Raw sugar</i>	<i>Edible molasses</i>
						<i>(1,000 gallons)</i>
<i>Quantity (metric tons)</i>						
1987	4,932	244,182	7,351	26,428	1,401,870	6,905
1988	4,527	222,436	6,444	25,370	1,259,217	7,295
1989	6,346	202,473	8,083	35,050	1,735,601	4,762
1990	8,728	176,044	9,541	34,944	2,508,209	8,500
1991	16,488	133,298	9,805	41,846	1,191,496	10,269
<i>Value (1,000 dollars)</i>						
1987	3,453	47,967	27,538	18,612	383,789	7,748
1988	5,014	45,317	25,419	15,487	442,537	7,775
1989	830	61,404	26,487	28,145	591,585	7,899
1990	498	60,056	24,927	30,292	776,480	7,788
1991	6,566	32,493	26,447	39,831	505,349	6,298
						<i>(Dollars per gallon)</i>
<i>Unit value (dollars per kilogram)</i>						
1987	0.70	0.20	3.75	0.70	0.27	1.12
1988	1.10	0.20	3.94	0.61	0.35	1.07
1989	0.13	0.30	3.28	0.80	0.34	1.66
1990	0.06	0.34	2.61	0.87	0.31	0.92
1991	0.39	0.24	2.70	0.95	0.42	0.61

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 12
Maple sugar and maple syrup: U.S. imports for consumption, by sources, 1987-91

<i>Source</i>	<i>1987</i>	<i>1988</i>	<i>1989</i>	<i>1990</i>	<i>1991</i>
<i>Quantity (metric tons)</i>					
Canada	7,351	6,441	8,035	9,541	9,767
China	0	0	17	0	0
French West Indies	0	0	0	0	0
Jamaica	0	0	7	0	0
Japan	0	0	4	0	3
Netherlands	0	(¹)	0	0	0
Pakistan	0	3	3	0	0
South Korea	0	0	0	10	34
Venezuela	0	0	17	0	2
Yugoslavia	0	0	17	0	0
Total	7,351	6,444	8,083	9,541	9,805
<i>Value (1,000 dollars)</i>					
Canada	27,538	25,414	26,429	24,927	26,410
China	0	0	13	0	0
French West Indies	0	0	1	0	0
Jamaica	0	0	6	0	0
Japan	0	0	15	0	9
Netherlands	0	1	0	0	0
Pakistan	0	4	3	0	0
South Korea	0	0	2	0	25
Venezuela	0	0	15	0	3
Yugoslavia	0	0	15	0	0
Total	27,538	25,419	26,487	24,927	26,447
<i>Unit value (dollars per kilogram)</i>					
Canada	3.75	3.95	3.29	2.61	2.70
China	-	-	.76	-	-
French West Indies	-	-	NA	-	-
Jamaica	-	-	.86	-	-
Japan	-	-	3.75	-	3.00
Netherlands	-	NA	-	-	-
Pakistan	-	1.33	1.00	-	-
South Korea	-	-	(²)	-	0.74
Venezuela	-	-	.88	-	1.50
Yugoslavia	-	-	.88	-	-
Average	3.75	3.94	3.28	2.61	2.70

¹ Less than 0.5 metric ton.

² Quantity too small to be recorded.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 13
Honey: U.S. imports for consumption, by principal sources, 1987-91

<i>Country</i>	<i>1987</i>	<i>1988</i>	<i>1989</i>	<i>1990</i>	<i>1991</i>
<i>Quantity (metric tons)</i>					
Argentina	5,116	5,325	4,746	8,817	9,269
Canada	6,439	5,193	13,422	3,454	6,425
China	8,771	8,970	11,290	11,545	20,334
Mexico	4,111	1,438	2,969	7,340	3,559
All other	1,991	4,444	2,623	3,788	2,259
Total	26,428	25,370	35,050	34,944	41,846
<i>Value (1,000 dollars)</i>					
Argentina	3,722	3,668	3,349	7,019	8,544
Canada	5,925	5,077	11,660	4,620	8,781
China	5,905	5,634	7,472	8,781	16,602
Mexico	3,060	1,108	2,510	6,007	3,012
All other	2,120	3,625	3,154	3,865	2,892
Total	18,612	15,487	28,145	30,292	39,831
<i>Unit value (dollars per kilogram)</i>					
Argentina	0.73	0.69	0.71	0.80	0.92
Canada	0.92	0.98	0.87	1.34	1.37
China	0.67	0.63	0.66	0.76	0.82
Mexico	0.74	0.77	0.85	0.82	0.85
All other	1.06	0.82	1.20	1.02	1.28
Average	0.70	0.61	0.80	0.87	0.95

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 14
HFCS-55: U.S. imports for consumption, by principal sources, 1987-91¹

<i>Country</i>	<i>1987</i>	<i>1988</i>	<i>1989</i>	<i>1990</i>	<i>1991</i>
<i>Quantity (metric tons)</i>					
Canada	116,223	101,574	193,051	139,671	42,182
All other	4,511	7,579	13	12	28
Total	120,734	109,153	193,064	139,683	42,210
<i>Value (1,000 dollars)</i>					
Canada	22,764	20,621	53,375	48,827	11,145
All other	598	1,135	2,609	455	51
Total	23,362	21,756	55,984	49,282	11,196
<i>Unit value (dollars per kilogram)</i>					
Canada	0.20	0.20	0.27	0.35	0.26
All other	0.13	0.15	² 200.00	² 37.92	1.82
Average	0.19	0.20	0.29	0.35	0.27

¹ Data before 1989 are estimated.

² Unit values indicate that there may be some misclassification of products entering the United States as HFCS-55.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 15
HFCS-42: U.S. Imports for consumption, by principal sources, 1987-91¹

<i>Country</i>	<i>1987</i>	<i>1988</i>	<i>1989</i>	<i>1990</i>	<i>1991</i>
<i>Quantity (metric tons)</i>					
Canada	117,227	104,004	3,943	32,65	91,076
Dominican Republic	254	1,975	5,298	3,633	-
All other	5,967	7,304	168	78	92
Total	123,448	113,283	9,409	36,361	91,088
<i>Value (1,000 dollars)</i>					
Canada	23,571	21,570	1,017	8,037	21,277
Dominican Republic	153	757	4,198	2,510	0
All other	881	1,234	205	227	20
Total	24,605	23,561	5,420	10,774	21,297
<i>Unit value (dollars per kilogram)</i>					
Canada	0.20	0.21	0.26	0.25	0.23
Dominican Republic	0.60	0.38	0.79	0.69	-
All other	0.15	0.17	1.22	2.91	1.67
Average	0.20	0.21	0.58	0.30	0.23

¹ Data before 1989 are estimated.
Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 16
 Sugar: U.S. sugar imports under quota and tariff-rate quota, by countries, 1987-1990/91

Country	1987/1		1988/2		1989/90 ³		1990/91 ⁴	
	Quota allocation	Actual imports	Quota allocation	Actual imports	Quota allocation	Actual imports	Quota allocation	Actual imports ⁵
	Short tons, raw value							
Argentina	39,130	38,720	43,175	43,175	124,153	118,152	96,418	96,256
Australia	75,530	75,530	83,335	83,438	239,644	239,644	186,109	186,109
Barbados	7,500	7,500	8,205	8,205	20,212	8,236	15,696	0
Belize	10,010	10,010	16,692	16,692	31,761	31,761	24,665	24,647
Bolivia	7,500	7,500	8,230	8,230	23,099	22,572	17,938	17,619
Brazil	131,950	131,950	145,590	145,462	418,656	395,795	325,130	325,130
Canada	10,010	9,749	11,045	10,375	31,761	31,768	325,130 ⁽⁶⁾	27,127
Colombia	21,840	21,840	24,100	24,102	69,296	69,296	53,883	53,492
Congo	7,500	7,500	8,000	8,000	19,075	776	8,852	0
Costa Rica	17,583	17,583	19,577	19,547	54,849	54,849	33,634	33,634
Cote d'Ivoire	7,500	7,500	8,000	8,000	19,075	19,075	8,852	8,852
Dominican Republic	160,160	159,319	176,710	169,190	508,162	508,162	394,638	392,158
Ecuador	10,010	10,010	11,045	7,903	31,761	31,761	24,665	24,665
El Salvador	26,020	25,893	28,815	28,815	78,302	78,302	58,299	58,299
Fiji	25,190	25,190	9,035	9,200	25,893	25,893	20,180	20,180
Gabon	7,500	7,500	8,000	8,000	19,075	17,058	8,852	8,852
Guatemala	43,680	43,347	48,185	48,962	138,590	138,590	107,630	107,533
Guyana	10,920	10,920	374	374	34,648	7,912	26,907	0
Haiti	7,500	7,500	8,000	7,600	19,075	12,939	8,852	8,830
Honduras	15,917	15,917	17,877	17,896	52,349	52,349	22,423	21,929
India	7,500	7,500	8,230	6,026	23,099	17,938	17,794	17,794
Jamaica	10,010	10,010	16,692	16,426	31,761	31,761	24,665	24,665
Madagascar	7,500	7,500	8,000	7,934	19,075	19,075	8,852	8,852
Malawi	9,100	9,100	10,045	10,045	28,734	28,734	22,423	22,423
Mauritius	10,920	10,920	12,050	12,050	34,602	34,585	26,907	26,907
Mexico	7,500	7,500	8,000	8,000	19,075	19,075	8,852	8,727
Mozambique	11,830	11,830	13,055	13,055	37,535	37,431	29,150	28,242
Nicaragua	0	0	0	0	59,886	54,129	47,087	46,344
Panama	26,390	26,390	0	210	82,700	80,065	65,026	64,691
Papua New Guinea	7,500	7,416	8,000	8,000	19,075	18,996	8,852	8,850
Paraguay	7,500	5,787	8,000	8,017	19,075	8,567	8,852	8,850
Peru	37,310	36,883	41,165	28,580	118,379	118,317	91,934	90,299
Philippines	143,780	143,780	158,640	158,640	456,192	454,510	354,280	351,637
St. Christopher-Nevis	7,500	7,500	8,000	8,086	19,075	8,040	8,852	0
South Africa	0	0	0	0	0	0	0	0
Swaziland	14,560	14,560	16,065	16,065	46,196	46,196	35,877	35,877
Taiwan	10,920	10,920	12,050	12,050	34,648	34,648	26,907	26,907
Thailand	12,740	12,637	14,055	9,806	40,422	40,102	31,392	31,287
Trinidad-Tobago	7,500	7,500	8,588	8,588	20,212	20,212	15,696	15,536
Uruguay	7,500	7,500	8,000	8,000	19,075	18,850	8,852	8,626
Zimbabwe	10,920	10,920	12,050	12,050	34,648	34,648	26,907	26,907
Subtotal	1,001,430	997,131	1,054,675	1,024,791	3,122,903	2,995,843	2,312,853	2,241,539
Specialty sugars	2,000	221	2,000	243	2,000	(7)	2,000	237
Total	1,003,430	997,352	1,056,675	1,025,034	3,124,903	2,995,843	2,314,853	2,241,776

Table 16—Continued

Sugar: U.S. sugar imports under quota and tariff-rate quota, by countries, 1987-1990/91

¹ Quota period Jan. 1, 1987, to Dec. 31, 1987.

² Quota period Jan. 1, 1988, to Dec. 31, 1988.

³ Quota period Jan. 1, 1989, to Sept. 30, 1990. Includes quota changes effective May 27, 1990.

⁴ Quota period Oct. 1, 1990, to Sept. 30, 1991. Includes quota changes effective Nov. 30, 1990.

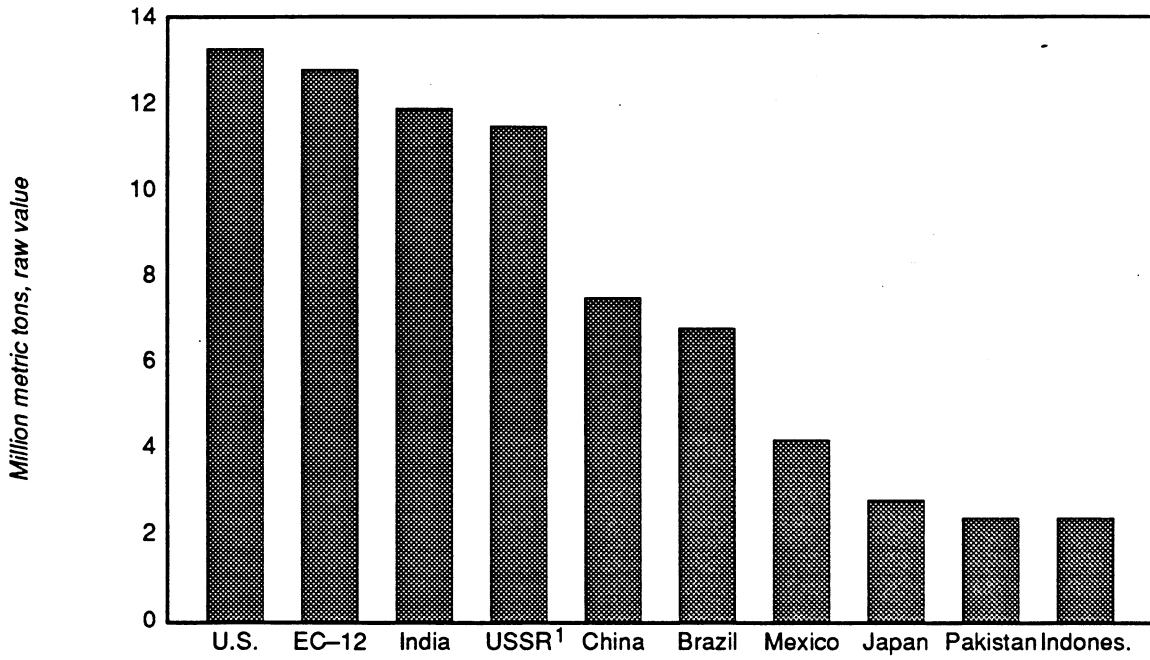
⁵ Oct. 1, 1990, to Sept. 30, 1991.

⁶ Includes imports from Canada, and high-duty imports. Canada is exempt from the tariff rate quota's second-tier duty and, therefore, faces no prohibitive duty limiting sugar shipments to the United States.

⁷ Not available.

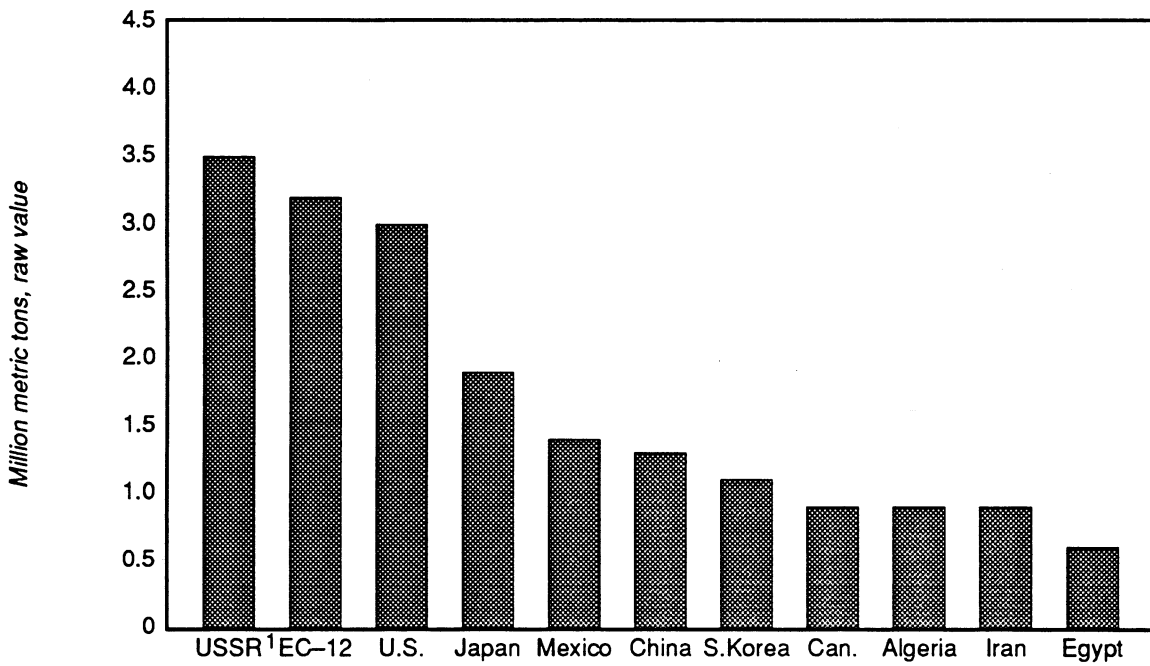
Source: U.S. Department of Agriculture, *Sugar and Sweetener Situation and Outlook Yearbook*, June 1991, p. 68.

Figure 8
Major sugar-consuming nations, 1990/91



¹ Former.
Source: USDA.

Figure 9
Major sugar-importing countries, 1990/91



¹ Former.
Source: USDA.

U.S. Exports

Most of the U.S. exports of sweeteners are refined sugar, molasses, and, recently, HFCS. During 1987-91, U.S. exports of sweeteners increased yearly, from \$190 million in 1987 to \$362 million in 1991, and remained steady at \$362 million in 1991.

Export Levels and Trends

The value of U.S. exports of sweeteners in 1991 was approximately 5 percent of the value of U.S. domestic shipments of sweeteners. The principal U.S. export markets have been Canada, Mexico, Japan, and Iraq. There has been a rapidly growing commercial export market for U.S. sweeteners and products containing a higher percentage of sweeteners in Mexico and Canada in particular. These countries approximately doubled their imports of U.S. sweeteners from 1987 to 1991. For Mexico, the largest percentage of the increase in imports from the United States has consisted of imports of refined sugar. Canadian imports from the United States were more diversified in their expansion, and included growth in HFCS imports, molasses imports, and imports of confections classified under chapter 17 in the HTS.

U.S. Trade Balance

From 1987 to 1991, the U.S. trade deficit in sweeteners ranged from a low of \$371 million in 1987 to a high of \$616 million in 1990 (table 8). The United States has been a net importer of sweeteners for many years. Domestic price support levels, although set at a level high enough to encourage substantial production, are not set high enough to encourage U.S. self-sufficiency. At the same time, U.S. exports of products for which it has production advantages, such as HFCS, have been limited by foreign government subsidies of sweeteners and other import practices designed to favor domestic production over imports.

Guatemala accounted for 30 percent of the U.S. trade deficit in sweeteners in 1991. The Philippines accounted for 18 percent and the Dominican Republic 14 percent. Rising costs in Canada and greater access to the Canadian market through the U.S.-Canada FTA led to a reduction in the U.S. trade deficit with Canada from \$41 million to \$2 million during 1987-90, though the deficit rose again to \$9 million in 1991. Because of trade liberalization measures in Mexico, greater access to the Mexican market resulted in the conversion of a \$43 million U.S. deficit to an \$81 million U.S. surplus during the period examined.

APPENDIX A
HARMONIZED TARIFF SCHEDULE SUBHEADINGS

**Table A-1
Sweeteners: Harmonized Tariff Schedule subheading; description; U.S. col.1 rate of duty as of Jan. 1, 1992; U.S. exports, 1991; and U.S. imports, 1991**

HTS subheading	Brief description	Col. 1 rate of duty As of Jan. 1, 1992		U.S. exports, 1991	U.S. imports, 1991
		General	Special		
0409.00.00 1701.11.01	Natural honey Cane sugar, described in paragraphs (a) and (b) of additional U.S. note 3 to chapter 17 and entered pursuant to its provisions ¹	2.2¢/kg	Free (CA,E,IL)	7,109	30,292
		1.4606¢/kg less 0.020668¢/kg for each degree under 100 degrees (and fractions of a de- gree in proportion) but not less than 0.943854¢/kg. ²	Free (A*,E*,IL) ¹ 0.8763¢/kg less 0.012400¢/kg for each degree under 100 degrees (and fractions of a degree in propor- tion) but not less than 0.566312¢/kg (CA).	12,089	508,066
1701.11.02	Cane sugar, raw, for the production of polyhydric alcohols, etc., n.e.s.o.i.	1.4606¢/kg less 0.020668¢/kg for each degree under 100 degrees (and fractions of a de- gree in proportion) but not less than 0.943854¢/kg. ²	Free (A*,E*,IL) 0.8763¢/kg less 0.012400¢/kg for each degree under 100 degrees (and fractions of a degree in propor- tion) but not less than 0.566312¢/kg (CA).	-	99,407
1701.11.03	Raw sugar not containing added flavoring or coloring matter; cane sugar; other	37.386¢/kg less 0.529¢/kg for each degree under 100 degrees (and frac- tions of a degree in proportion) not less than 24.161¢/kg. ²	0.8763¢/kg less 0.012400¢/kg for each degree under 100 degrees (and fractions of but a degree in pro- portion) but not less than 0.566312¢/kg. ²	-	212

Footnotes are at the end of the table.

**Table A-1—Continued
Sweeteners: Harmonized Tariff Schedule subheading; U.S. col.1 rate of duty as of Jan. 1, 1992; U.S. exports, 1991; and U.S.
Imports, 1991¹**

HTS subheading	Brief description	Col. 1 rate of duty As of Jan. 1, 1992		U.S. exports, 1991	U.S. imports, 1991
		General	Special ²		
1701.12.01	Beet sugar; described in paragraphs (a) and (b) of additional U.S. note 3 to chapter 17 and entered pursuant to its provisions	1.4606¢/kg less 0.020668¢/kg for each degree under 100 degrees (and fractions of a de- gree in proportion) but not less than 0.943854¢/kg. ²	Free (A*, E*, IL) 0.8763¢/kg less 0.012400¢/kg for each degree under 100 degrees (and fractions of a degree in propor- tion) but not less than 0.566312¢/kg (CA).	38	37
1701.12.02	Raw sugar not containing added flavoring or coloring matter: beet sugar	37.386¢/kg less 0.529¢/kg for each degree under 100 degrees (and frac- tions of a degree in proportion) but not less than 24.161¢/kg. ²	0.8763¢/kg less 0.012400¢/kg for each degree (and fractions of a degree in pro- portion) but not less than 0.566312¢/ kg. ²	-	0
1701.91.21	Cane/beet sugar, containing added flavoring or coloring matter: described in paragraphs (a) and (b) of additional U.S. note 3 to chapter 17 and entered pursuant to its provisions	1.4606¢/kg less 0.020668¢/kg for each degree under 100 degrees (and fractions of a de- gree in proportion) but not less than 0.943854¢/kg. ²	Free (A*, E*, IL) 0.8763¢/kg less 0.012400¢/kg for each degree under 100 degrees (and fractions of a degree in propor- tion) but not less than 0.566312¢/kg (CA). ²	1,788	9

— Thousand dollars

Footnotes are at the end of the table.

Table A-1-Continued
 Sweeteners: Harmonized Tariff Schedule subheading; description; U.S. col.1 rate of duty as of Jan. 1, 1992; U.S. exports, 1991; and U.S. Imports, 1991¹

HTS subheading	Brief description	Col. 1 rate of duty As of Jan. 1, 1992		U.S. exports, 1991	U.S. imports, 1991
		General	Special ²		
1701.91.22	Cane/beet sugar, containing added flavoring or coloring matter; other	37.386¢/kg less 0.529¢/kg for each degree under 100 degrees (and fractions of a degree in proportion) but not less than 24.161¢/kg. ²	0.8763¢/kg less 0.012400¢/kg for each degree (and fractions of a degree in proportion) but not less than 0.566312¢/kg. ²	0	68
1701.91.40	Cane/beet sugar, containing added flavoring matter whether or not containing added coloring	6%	Free (A, E, IL) 3.6% (CA).	0	7,620
1701.99.01	Cane/beet sugar, other, described in paragraphs (a) and (b) of additional U.S. note 3 to chapter 17 and entered pursuant to its provisions	1.4606¢/kg less 0.020668¢/kg for each degree under 100 degrees (and fractions of a degree in proportion) but not less than 0.943854¢/kg. ²	Free (A, E, IL) 0.8763¢/kg less 0.012400¢/kg for each degree under 100 degrees (and fractions of a degree in proportion) but not less than 0.566312¢/kg.	185,282	8,097
1701.99.02	Cane/beet sugar, refined, no flavor/color, n.e.s.o.i.	37.386¢/kg less 0.529¢/kg for each degree under 100 degrees (and fractions of a degree in proportion) but not less than 24.161¢/kg. ²	0.8763¢/kg less 0.012400¢/kg for each degree under 100 degrees (and fractions of a degree in proportion) but not less than 0.566312¢/kg. ²	0	15,863

Footnotes are at the end of the table.

Table A-1—Continued
Sweeteners: Harmonized Tariff Schedule subheading; description; U.S. col.1 rate of duty as of Jan. 1, 1992; U.S. exports, 1991; and U.S. imports, 1991¹

HTS subheading	Brief description	Col. 1 rate of duty As of Jan. 1, 1992		U.S. exports, 1991	U.S. imports, 1991
		General	Special ²		
1702.10.00	Other sugars: lactose and lactose syrup	10%	Free (E,IL) 6% (CA)	22,338	686
1702.20.20	Other sugars: maple sugar and maple syrup	6%	Free (A,E,IL) 3.6% (CA)	2,537	117
1702.20.40	Other sugars: maple sugar and maple syrup	Free		-	26,447
1702.30.00	Glucose and glucose syrup, less than 20% fructose ²			733,755	
1702.30.20	Other sugars: glucose and glucose syrup, containing in the dry state less than 20 percent by weight of fructose: blended with other sugars	6%	Free (A,E,IL) 3.6% (CA)	-	201
1702.30.40	Other sugars: glucose and glucose syrup, containing in the dry state less than 20 percent by weight of fructose: n.e.s.o.i.	3.5%/kg	Free (A,E,IL) 2.1¢/kg (CA)	-	6,364
1702.40.00	Other sugars: glucose and glucose syrup, containing in the dry state at least 20 percent but less than 50 percent by weight of fructose	6%	Free (A,E,IL) 3.6% (CA) Free (E,IL) 9% (CA)	4,004	21,298
1702.50.00	Other sugars: chemically pure fructose	15%	Free (A,E,IL) 3.6% (CA)	8,784	263
1702.60.00	Other sugars: other fructose and fructose syrup, containing in the dry state more than 50 percent by weight of fructose	6%	Free (A,E,IL) 3.6% (CA)	46,593	26,991

Footnotes are at the end of the table.

Table A-1-Continued
 Sweeteners: Harmonized Tariff Schedule subheading; description; U.S. col.1 rate of duty as of Jan. 1, 1992; U.S. exports, 1991; and U.S. imports, 1991¹

HTS subheading	Brief description	Col. 1 rate of duty As of Jan. 1, 1992		U.S. exports, 1991	U.S. imports, 1991
		General	Special ²		
1702.90.31	Other sugars: other, including invert sugar, derived from sugarcane or sugar beets, containing soluble non-sugar solids equal to 6 percent or less by weight of the total soluble solids, and described in paragraphs (a) and (b) of additional U.S. note 3 to chapter 17 and entered pursuant to its provisions				98
1702.90.32	Other sugars: other, including invert sugar, derived from sugarcane or sugar beets, containing soluble non-sugar solids equal to 6 percent or less by weight of the total soluble solids, other	Dutiable on total sugars at the rate applicable under heading 1701 to sugar testing 100 degrees. ²	Free (A,E*,IL) Dutiable on total sugars at the rate per kg applicable under heading 1701 to sugar testing 100 degrees (CA).		211
1702.90.35	Other sugars: other; invert molasses	0.77¢/liter	Free (A,E*,IL) Dutiable on total sugars at the rate per kg applicable under heading 1701 to sugar testing 100 degrees (CA).		3,846
1702.90.40	Other sugars: sugar, sugar syrup, from cane/beet, n.e.s.o.i.	0.77¢/liter	Free (A,E,IL) 0.4¢/liter (CA)		995
1702.90.45	Sugars and syrups, derived from sugar cane/beets ²			1,867	
1702.90.50	Other sugars: sugar, sugar syrup, not flavored or colored, n.e.s.o.i., including artificial honey and caramel	6%	Free (A,E,IL) 3.6% (CA)	6,246	1,085
1703.10.00	Cane molasses from extraction or refining of sugar ²			11,369	

¹Footnotes are at the end of the table.

**Table A-1—Continued
Sweeteners: Harmonized Tariff Schedule subheading; description; U.S. col.1 rate of duty as of Jan. 1, 1992; U.S. exports, 1991; and U.S. imports, 1991¹**

HTS subheading	Brief description	Col. 1 rate of duty As of Jan. 1, 1992		U.S. exports, 1991	U.S. imports, 1991
		General	Special ²		
1703.10.30	Cane molasses: Imported for (a) the commercial extraction of sugar or (b) human consumption	0.77¢/liter	Free (A, CA, E, IL)	15,716	2,396
1703.10.50	Cane molasses: subject to quota, n.e.s.o.i	0.026¢/kg of total sugars	Free (A, CA, E, IL)	16,551	45,020
1703.90.00	Molasses from extraction or refining of sugar, n.e.s.o.i. ²				
1703.90.30	Molasses: Other; imported for (a) the commercial extraction of sugar or (b) human consumption	0.77¢/liter	Free (A, E, IL) 0.4¢/liter (CA)	-	56
1703.90.50	Molasses: Other, n.e.s.o.i	0.026¢/kg of total sugars	Free (A, E, IL) 0.015¢/kg of total sugars (CA)	-	28,650

¹ Programs under which a special tariff treatment may be provided, and the corresponding symbols for such programs as they are indicated in the "Special" subcolumn, are as follows:

- Generalized System of Preferences
- United States-Canada Free-Trade Agreement. A or A*
- Caribbean Basin Economic Recovery Act. CA
- United States-Israel Free Trade Area
- IL

² Exists only as an export subheading.

Note.—Dashes indicate that this HTS subheading exists only for U.S. imports.

Source: *Harmonized Tariff Schedule of the United States (1992)*.

APPENDIX B
EXPLANATION OF TARIFF AND TRADE AGREEMENT TERMS

TARIFF AND TRADE AGREEMENT TERMS

The *Harmonized Tariff Schedule of the United States* (HTS) replaced the *Tariff Schedules of the United States* (TSUS) effective January 1, 1989. Chapters 1 through 97 are based on the internationally adopted Harmonized Commodity Description and Coding System through the 6-digit level of product description, with additional U.S. product subdivisions at the 8-digit level. Chapters 98 and 99 contain special U.S. classification provisions and temporary rate provisions, respectively.

Rates of duty in the *general* subcolumn of HTS column 1 are most-favored-nation (MFN) rates; for the most part, they represent the final concession rate from the Tokyo Round of Multilateral Trade Negotiations. Column 1-general duty rates are applicable to imported goods from all countries except those enumerated in general note 3(b) to the HTS, whose products are dutied at the rates set forth in *column 2*. Goods from Armenia, Bulgaria, the People's Republic of China, Czechoslovakia, Estonia, Hungary, Latvia, Lithuania, Moldova, Mongolia, Poland, Russia, the Ukraine and Yugoslavia are currently eligible for MFN treatment. Among articles dutiable at column 1-general rates, particular products of enumerated countries may be eligible for reduced rates of duty or for duty-free entry under one or more preferential tariff programs. Such tariff treatment is set forth in the *special* subcolumn of HTS column 1. Where eligibility for special tariff treatment is not claimed or established, goods are dutiable at column 1-general rates.

The *Generalized System of Preferences* (GSP) affords nonreciprocal tariff preferences to developing countries to aid their economic development and to diversify and expand their production and exports. The U.S. GSP, enacted in title V of the Trade Act of 1974 and renewed in the Trade and Tariff Act of 1984, applies to merchandise imported on or after January 1, 1976, and before July 4, 1993. Indicated by the symbol "A" or "A*" in the special subcolumn of column 1, the GSP provides duty-free entry to eligible articles the product of and imported directly from desig-

nated beneficiary developing countries, as set forth in general note 3(c)(ii) to the HTS.

The *Caribbean Basin Economic Recovery Act* (CBERA) affords nonreciprocal tariff preferences to developing countries in the Caribbean Basin area to aid their economic development and to diversify and expand their production and exports. The CBERA, enacted in title II of Public Law 98-67, implemented by Presidential Proclamation 5133 of November 30, 1983, and amended by the Customs and Trade Act of 1990, applies to merchandise entered, or withdrawn from warehouse for consumption, on or after January 1, 1984; this tariff preference program has no expiration date. Indicated by the symbol "E" or "E*" in the special subcolumn of column 1, the CBERA provides duty-free entry to eligible articles the product of and imported directly from designated countries, as set forth in general note 3(c)(v) to the HTS.

Preferential rates of duty in the special subcolumn of column 1 followed by the symbol "IL" are applicable to products of Israel under the *United States-Israel Free-Trade Area Implementation Act* of 1985, as provided in general note 3(c)(vi) of the HTS. When no rate of duty is provided for products of Israel in the special subcolumn for a particular provision, the rate of duty in the general subcolumn of column 1 applies.

Preferential rates of duty in the special duty rates subcolumn of column 1 followed by the symbol "CA" are applicable to eligible goods originating in the territory of Canada under the *United States-Canada Free-Trade Agreement*, as provided in general note 3(c)(vii) to the HTS.

Preferential nonreciprocal duty-free or reduced-duty treatment in the special subcolumn of column 1 followed by the symbol "J" or "J*" in parentheses is afforded to eligible articles the product of designated beneficiary countries under the *Andean Trade Preferences Act* (ATPA), enacted in title II of Public Law 102-182 and implemented by Presidential Proclamation 6455 of July 2, 1992 (effective July 22, 1992), as set forth in general note 3(c)(ix) to the HTS.

Other special tariff treatment applies to particular *products of insular possessions* (general note 3(a)(iv)), goods covered by the *Automotive Products Trade Act* (general note 3(c)(iii)) and the *Agreement on Trade in Civil Aircraft* (general note 3(c)(iv)), and *articles imported from freely associated states* (general note 3(c)(viii)).

The *General Agreement on Tariffs and Trade* (GATT) (61 Stat. (pt. 5) A58; 8 UST (pt. 2) 1786) is the multilateral agreement setting forth basic principles governing international trade among its more than 90 signatories. The GATT's main obligations relate to most-favored-nation treatment, the maintenance of scheduled concession rates of duty, and national (nondiscriminatory) treatment for imported products. The GATT also provides the legal framework for customs valuation standards, "escape clause" (emergency) actions, anti-dumping and countervailing duties, and other measures. Results of GATT-sponsored multilateral tariff negotiations are set forth by way of separate schedules of concessions for each participating contracting party, with the U.S. schedule designated as schedule XX.

Officially known as "The Arrangement Regarding International Trade in Textiles," the *Multifiber Arrangement* (MFA) provides a framework for the negotiation of bilateral agreements between importing and producing countries, or for unilateral action by importing countries in the absence of an agreement. These bilateral agreements establish quantitative limits on imports of textiles and apparel, of cotton and other vegetable fibers, wool, manmade fibers, and silk blends, in order to prevent market disruption in the importing countries—restrictions that would otherwise be a departure from GATT provisions. The United States has bilateral agreements with more than 30 supplying countries, including the four largest suppliers: China, Hong Kong, the Republic of Korea, and Taiwan.

