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Primary Aromatics

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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 of those bearing on the competitiveness of U.S. industries in domestic and foreign markets.[1]

This report on primary aromatics covers the period 1989–93 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 chemicals and textiles sectors.

USITC publication number	*Publication date*	*Title*
Chemicals:		
2458	November 1991	Soaps, Detergents, and Surface–Active Agents
2509	May 1992	Inorganic Acids
2548	August 1992	Paints, Inks, and Related Items
2578	November 1992	Crude Petroleum
2588	December 1992	Major Primary Olefins
2590	February 1993	Polyethylene Resins in Primary Forms
2598	March 1993	Perfumes, Cosmetics, and Toiletries
2736	February 1994	Antibiotics
2739	February 1994	Pneumatic Tires and Tubes
2741	February 1994	Natural Rubber
2743	February 1994	Saturated Polyesters in Primary Forms
2747	March 1994	Fatty Chemicals
2750	March 1994	Pesticide Products and Formulations
2823	October 1994	Primary Aromatics
Textiles and apparel:		
2543	August 1992	Nonwoven Fabrics
2580	December 1992	Gloves
2642	June 1993	Yarn
2695	November 1993	Carpets and Rugs
2702	November 1993	Fur Goods
2703	November 1993	Coated Fabrics
2735	February 1994	Knit Fabric

[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 contains information regarding benzene, toluene, and mixed xylenes (hereinafter referred to collectively as BTX) for chemical conversion for the 5-year period 1989-93. BTX are primary petrochemicals and often are referred to as primary aromatic hydrocarbons or primary aromatics. They are produced from crude petroleum during the refining process and as a byproduct from the production of ethylene in olefin plants. The BTX petrochemicals are raw materials used in the manufacture of many organic chemicals, plastic resins, synthetic fibers, solvents, and plasticizers.

Benzene, the largest-volume aromatic covered by this summary, accounts for about half of U.S.-produced BTX. Approximately 50 percent of benzene is derived from catalytic reformate, which is the highly aromatic product of a petroleum refining process known as "catalytic reforming." In this process, non-aromatic hydrocarbons at high temperature and pressure are passed over a catalyst (e.g., platinum) to produce aromatic hydrocarbons. The product, catalytic reformate, is used primarily as a gasoline component. Because of their high octane values, most of the aromatics in reformate are not extracted but are left in the gasoline pool. Catalytic reformate not destined for the gasoline pool is the main source of BTX. From this aromatic material, benzene, toluene, and mixed xylenes are selectively separated.

Another 25 percent of domestic benzene is derived from pyrolysis gasoline, which is an aromatic byproduct produced in olefin plants during ethylene production. When naphtha or gas oil, both produced during petroleum refining, are used as ethylene feedstocks, significant quantities of pyrolysis gasoline in addition to ethylene, propylene, and other major primary olefins are produced. When catalytic reformate and pyrolysis gasoline sources are inadequate for benzene demand, toluene (methylbenzene) is used as an additional source. In the hydrodealkylation (HDA) process, toluene is demethylated to benzene and methane. This process accounts for as much as 25 percent of U.S. benzene supply when the price differential between benzene and toluene is large enough for the conversion to be profitable. Benzene derived from coal provides less than two percent of domestic production.

Benzene demand is dominated by the production of three derivatives: ethylbenzene (50 percent of demand), cumene (20 percent), and cyclohexane (15 percent). Ethylbenzene is converted to styrene, which is used to produce polystyrene resins. Phenol, which is used in the production of phenolic resins, is derived from cumene. Phenolic resins have many applications in the construction, automobile, and appliance industries. Cyclohexane is a precursor to adipic acid and caprolactam, which are used to produce nylon fiber.

Toluene accounts for slightly more than 25 percent of U.S.-produced BTX. Almost 90 percent of toluene is from catalytic reformate. Pyrolysis gasoline provides less than 10 percent of U.S. supply. Toluene is used to increase the octane rating of unleaded gasoline and, therefore, has significant value as a gasoline blending component. Its largest chemical use is the production of benzene by the HDA process. Toluene has many applications as a solvent in paints and surface coatings. It is also used in the manufacture of explosives and in the production of toluene diisocyanate, a raw material for polyurethane foams. Chemical intermediates such as benzoic acid and benzyl chloride also are derived from toluene.

The term "mixed xylenes" describes a commercial mixture of ethylbenzene and the three xylene isomers, ortho-xylene, meta-xylene, and para-xylene. Mixed xylenes account for slightly under 25 percent of U.S.-produced BTX. Over 95 percent of mixed xylenes are derived from catalytic reformate. Pyrolysis gasoline and the disproportionation process provide the remainder. In disproportionation, toluene is converted to benzene and mixed xylenes. The main commercial use of mixed xylenes is as a source for the three isomers. Para-xylene is consumed in the manufacture of dimethyl terephthalate (DMT) and terephthalic acid (TPA). DMT and TPA are intermediates in the manufacture of polyester resins, which are used to produce polyester fibers, film, and fabricated items such as beverage bottles. Ortho-xylene is used to produce phthalic anhydride, which is converted to phthalate plasticizers used in flexible polyvinyl chloride (PVC). Flexible PVC products include furniture upholstery, shower curtains, and tablecloths. Meta-xylene is converted to isophthalic acid, which is used primarily in the manufacture of polyester resins.

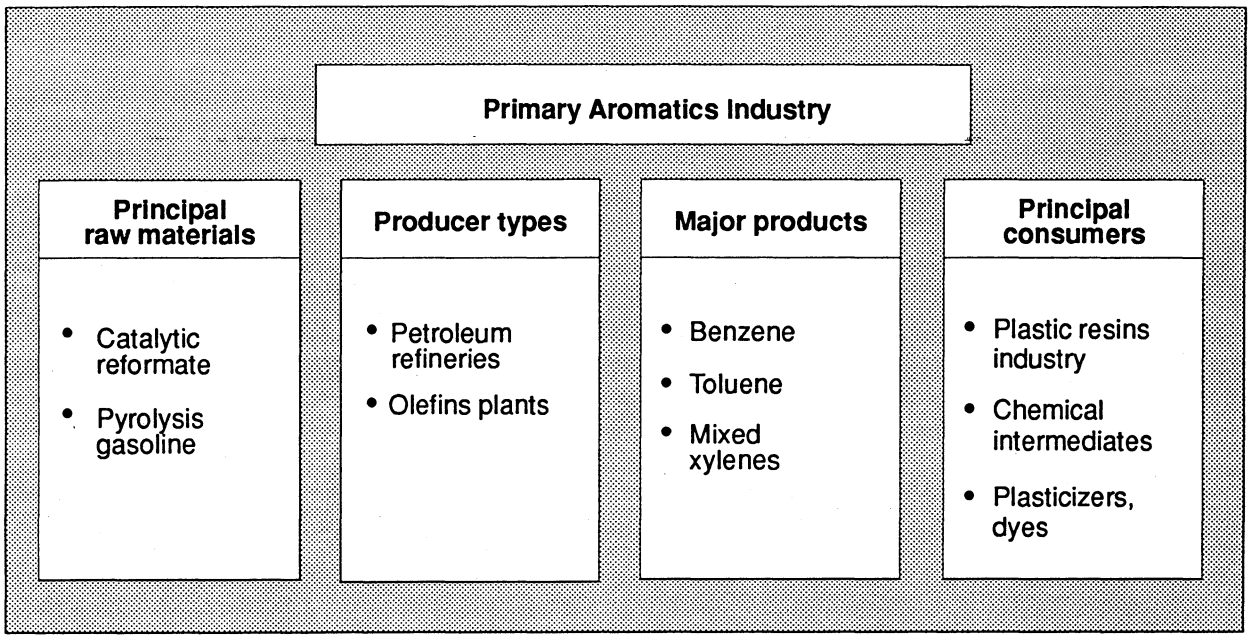
U.S. INDUSTRY PROFILE

Industry Structure[1]

The raw materials, producer types, major products, and principal consumers of the U.S. primary aromatics industry are shown in figure 1. In the United States,

[1] Primary aromatics (BTX) produced in chemical plants are classified in SIC 2865, Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments. Production of BTX in petroleum refineries is included as part of SIC 2911, Petroleum Refining.

Figure 1
U.S. primary aromatics industry: Principal raw materials, producer types, major products, and principal consumers



Source: Compiled by the U.S. International Trade Commission staff from various sources.

BTX chemicals are produced by both petroleum companies and chemical companies. In 1993, there were 27 firms producing primary aromatics, of which 24 were petroleum companies and 3 were chemical companies. The major domestic producers of BTX are multinational petroleum companies, such as Exxon Corporation and Shell Oil Co., with plants located in the Gulf States of Texas and Louisiana and along the east and west coasts. The geographical concentration of the domestic industry is a result of the need to locate plants in regions with access to deep-water ports to provide for the unloading of oceangoing crude petroleum tankers. These tankers are carriers of the feedstock for the petroleum products from which the petrochemicals covered by this summary are produced. The domestic producers of BTX are generally vertically integrated companies involved in all phases of refining of crude petroleum, petroleum products, and petrochemical production. In petrochemicals, they are vertically integrated through the production of downstream products, such as plastic resins and chemical intermediates.

The four largest producers of BTX in 1992, all of which are petroleum companies, accounted for about 43 percent of U.S. production, while the top eight producers accounted for almost 65 percent. The four largest producers consistently have reflected similar shares of U.S. production. The primary aromatics industry is characterized by improving process technology that is capital-intensive and that requires skilled production workers. The estimated total employment of the primary aromatics industry is 2,400 people, about two-thirds of whom are production workers.[2] During 1989-93, output per production worker hour (productivity) decreased an average of 0.1 percent annually. Wage rates for production workers increased an average 3.4 percent annually during the same period, from average hourly earnings of $17.77 in 1989 to $20.32 in 1993.[3]

Feedstock cost is by far the most significant component of the variable costs of production of these chemicals, averaging around 80 percent during 1989-93. Benzene prices, which are closely tied to petroleum prices, are about the most volatile for any chemical. In 1989, due to reduced demand for derivative products, prices dropped from 48 cents per liter to 26 cents per liter. In the first few months of 1990, due largely to lost production from cold weather,

[2] Estimated from *1987 Census of Manufactures and 1991 Annual Survey of Manufactures.*
[3] Estimated from "Petroleum Refining," *U.S. Industrial Outlook, 1994.*

benzene prices were in the 40 cents per liter range. Following the August 1990 increase in petroleum prices, largely because of the Iraqi invasion of Kuwait and of the resulting embargo of Iraqi petroleum, benzene prices were 53 cents per liter in October, up from about 34 cents per liter in July. By February 1991, with a drop in petroleum prices, the price of benzene was 38 cents per liter. With continued weak demand for derivatives, the price dropped further to 28 cents per liter by July. Because of supply problems during September-October 1991, the price rose to 34 cents per liter. Following the lead of petroleum prices, benzene pricing was again down to 28 cents per liter in February 1992, but climbed to 34 cents per liter by July. With the markets for benzene derivatives—styrene, phenol, and cyclohexane—sluggish during 1992, the price of benzene steadily dropped until bottoming out in October at 24 cents per liter. During the remainder of 1992 and most of 1993, prices stabilized at 26 cents per liter as derivative demand improved. In December 1993, benzene's price dropped to 22 cents per liter, indicative of its low value as an octane enhancer in gasoline.

Because product differentiation and quality differences are almost nonexistent for the aromatics in this summary, each product is marketed on the basis of price. The major cost determinant affecting this market or contract price is the current or anticipated feedstock cost to produce the primary aromatic.

BTX producers in the United States are privately operated, but subject to Government regulations under various statutes designed to protect and improve health, safety, and the environment. Among the laws covering this industry are the Emergency Planning and Community Right-to-Know Act, the Clean Air Act, the Resource Conservation and Recovery Act (RCRA), and the Superfund legislation. Also, the industry must meet standards set by the Occupational Safety and Health Administration.

The Emergency Planning and Community Right-to-Know Act, which is set forth in title III of the Superfund Amendments and Reauthorization Act, requires emergency planning in virtually all communities. The law also provides communities with a right to know more about hazardous materials that an industry or business produces, stores, buys, or ships in or through the community. The act sets specific reporting requirements and deadlines. The reported data are maintained in an Environmental Protection Agency (EPA) computerized data base that can be accessed by the public. Covered industries, including BTX producers, so far have reported environmental releases, including toxic spills, made from 1987 through 1991.

The Clean Air Act prohibits hazardous air pollutant discharges in excess of emission standards. The Clean Air Act Amendments Act of 1990 impose new standards on the chemical industry.[4] The act as amended requires that controls for industrial sources of 41 pollutants must be in place by 1995, for example the benzene content of gasoline will be limited to 1 percent by volume.

RCRA, enacted in 1976, governs the management of hazardous waste from generation to disposal.[5] In 1984, major changes were made to RCRA, including a complete ban on land disposal of hazardous waste unless no migration from the waste facility will occur. In 1990, the Environmental Protection Agency (EPA) implemented the land-disposal prohibitions on hazardous waste required under the 1984 amendments.

The Toxic Substances Control Act of 1976 (TSCA), provides EPA with authority to regulate the manufacture, distribution, and use of chemical substances.[6] The act permits EPA to gather information about the toxicity of chemicals and the extent to which people and the environment are exposed to them. Appropriate actions to control unreasonable risks vary from requiring hazard-warning labels on some chemicals to outright bans on the manufacture or use of others.

The Superfund Amendments and Reauthorization Act of 1986, which established a $9 billion, 5-year fund to pay for the continued cleanup of hazardous waste sites, was reauthorized in 1990.[7] Most of the revenues for the fund are generated by taxes on industry sectors, including the primary aromatics industry. These regulations influence the industry processes and production costs. They also affect business operations and investment decisions. Research and development funds in the U.S. primary aromatics industry are mainly directed toward cost-cutting process improvements.

A number of U.S. firms are subsidiaries of foreign multinational companies. Foreign chemical firms currently favor entering the U.S. market by purchasing U.S. firms and facilities. The main reasons for these acquisitions are the continued globalization of petrochemical markets and the view by foreign

[4] Public Law 101-549, 104 Stat. 2399, 42 U.S.C., Sec. 7412, Nov. 15, 1990.
[5] Public Law 94-580, 90 Stat. 2795, 42 U.S.C., Sec. 6901 et seq., Oct. 21, 1976.
[6] Public Law 94-469, 90 Stat. 2003, 15 U.S.C.A. 2601, Oct. 11, 1976.
[7] U.S. Department of Commerce, International Trade Administration, *U.S. Industrial Outlook, 1992*, "Chemicals and Allied Products," pp. 11-4, 11-5, 11-6.

chemical concerns that the U.S. market is the biggest and most promising. Currently, three foreign multinationals operate in the U.S. primary aromatics industry. In 1992, these multinational firms accounted for about 13 percent of total U.S. BTX production.

Consumer Characteristics and Factors Affecting Demand

The domestic industries consuming primary aromatics are those producing plastic resins, chemical intermediates, plasticizers, and dyes (figure 1). The products manufactured by the firms in these industries include polystyrene, phenolic, polycarbonate, and epoxy resins. Aniline, toluene diisocyanate, benzoic acid, benzyl chloride, phthalate plasticizers, and polyester resins are also produced. From these intermediate products thousands of other products are manufactured, including polyurethane foams and elastomers, paint and surface coating solvents, nylon and polyester fibers, beverage bottles, dyes, and detergents. As can be inferred from the array of products derived from primary aromatics, demand shifts for BTX chemicals tend to follow the expansion and contraction phases of the general economy.

FOREIGN INDUSTRY PROFILE

In addition to the United States, which accounted for about 36 percent of global BTX production in 1993, the other major BTX producers are the EU countries and Japan. The EU accounted for about 21 percent of world production, while Japan's output was about 13 percent of the total. "Other" regions represented 30 percent of production, with Central Europe accounting for the largest share.

In the United States, catalytic reformate, produced primarily as a gasoline component, accounts for over 80 percent of BTX feedstock. In the EU and Japan, with the product emphasis of their petroleum refining industries on heating oils, gasoline is an important secondary product. The reverse has been true in the United States. As a result, catalytic reformate represents, respectively, about 45 percent and 40 percent of BTX feedstock in the EU and Japan. In the EU the largest source of aromatics is pyrolysis gasoline. However, the quantity of BTX available from this source is largely dependent on the feedstock chosen for ethylene manufacture. Naphtha and gas oil yield significantly higher aromatics content than natural gas liquids. Since many ethylene producers have made feedstock switching more feasible and efficient, the amount of BTX produced from pyrolysis gasoline will fluctuate depending on the relative economics of using the various ethylene feedstocks. During 1992, pyrolysis gasoline provided 52 percent of the EU's BTX supply. In Japan, it provided 40 percent of BTX capacity, equaling catalytic reformate as a source of primary aromatics.

Primary aromatics companies in the EU tend to be major multinational firms. They are vertically integrated back to the production of feedstock in petroleum refineries and forward to the production of intermediate or final consumer goods. Currently, about 40 percent of the EU petrochemical industry is government-owned. Many of the Japanese primary aromatics producers are vertically integrated forward to the production of plastics resins and synthetic fibers. Because Japan possesses no domestic petroleum resource base, the Japanese Ministry of International Trade and Industry (MITI) reportedly provides strong administrative guidance to the domestic BTX industry in an attempt to ensure stability in meeting domestic demands.

U.S. TRADE MEASURES[8]

Tariff and Nontariff Measures

Table 1 shows the rates of duty, as of January 1, 1994, applicable to imports of primary aromatics under the *Harmonized Tariff Schedule of the United States* (HTS). The Column 1 general duty rate for countries considered for most-favored-nation (MFN) treatment is zero on imports of primary aromatics. The duty-free status of benzene, toluene, and mixed xylenes was provided for in the Tariff Act of 1930. There are no domestic nontariff import restrictions on primary aromatics.

U.S. Government Trade-Related Investigations

In 1986-87, at the request of the Senate Committee on Finance, the Commission conducted a factfinding investigation under section 332 of the Tariff Act of 1930 (19 U.S.C. 1332), Investigation No. 332-230, "U.S. Global Competitiveness: Building-Block Petrochemicals and Competitive Implications for Construction, Automobiles, and Other Major Consuming Industries." The report identified primary aromatics as major building-block petrochemicals.[9] The study found that the most important factor explaining changes in the competitiveness of the primary petrochemical industries of different nations is change in world prices of crude petroleum. As the price of petrochemical feedstocks increases, energy-rich nations with petrochemical processing operations are relatively more competitive than petrochemical processing nations not considered energy rich.

[8] See appendix A for an explanation of tariff and trade agreement terms.

[9] USITC publication 2005, August 1987.

Table 1
Primary aromatics: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of Jan. 1, 1994; U.S. exports, 1993; and U.S. imports, 1993

HTS subheading	Description	Col. 1 rate of duty As of Jan. 1, 1994 General	Special[1]	U.S. exports, 1993	U.S. imports, 1993
				Million dollars	
2902.20.00	Benzene	Free	(1)	1	94
2902.30.00	Toluene	Free	(1)	51	55
2902.44.00	Mixed xylene isomers	Free	(1)	93	19

[1] Not applicable.

Source: U.S. exports and imports compiled from official statistics of the U.S. Department of Commerce.

FOREIGN TRADE MEASURES

During 1989-93, the major foreign markets for U.S. producers of BTX were Taiwan, the EU, Canada, and Korea. Foreign tariff rates for primary aromatics range from duty free on BTX exported from the United States to Canada and the EU, to 5-percent ad valorem, plus a 5-percent value-added tax, and a 0.5 percent harbor tax on primary aromatics exported from the United States to Taiwan. The foreign tariff rate on some U.S. primary aromatics entering Korea is 5-percent ad valorem. The Uruguay Round Agreements (URA) are unlikely to change existing BTX trading patterns due to the low levels of domestic and foreign tariffs. There are no known nontariff measures affecting U.S. exports of primary aromatics to major foreign markets.[10]

U.S. MARKET

Consumption

The value of U.S. apparent consumption of BTX increased to $4.3 billion in 1990, an increase of 8.7 percent from 1989 (see table 2). During 1990-92, however, apparent consumption decreased to $3.4 billion. In 1993, consumption was $3.8 billion. The value share of domestic consumption accounted for by imports peaked at 5.5 percent during 1991-92, up from 2.9 percent during 1989-90. In 1993, the value ratio of imports to consumption fell to 4.4 percent. In terms of quantity, however, apparent consumption increased 14.8 percent, from 12.2 billion liters in 1989 to 14.0 billion liters in 1993. The imports-to-consumption ratio increased from 2.9 percent in 1989 to 5.2 percent in 1992. In 1993, the ratio was 5.0 percent.

The different value and quantity trends that emerge for apparent consumption of primary aromatics during the period covered are the result of large price increases during 1989-90. BTX prices increased from an average of 25 cents per liter in 1988 to 32 cents per liter in 1989, a 28-percent increase. During 1990, as a result of increased petroleum prices, BTX prices averaged 34 cents per liter, an additional 6-percent increase. Though price decreases during 1991-92 indicated a 19-percent value decrease in consumption from 1990 to 1992, the quantity consumed actually increased 4 percent. According to industry sources, the sluggish nature of BTX consumption during 1989-92 is a reflection of mediocre derivative demand during this period, particularly for styrene, phenol, and cyclohexane. During 1993, derivative demand improved and apparent consumption increased 11 percent in value and 8.0 percent in quantity from 1992 levels.

Production

U.S. production (quantity) of primary aromatics ranged from 12.4 billion liters to 12.8 billion liters during 1989-92. As with U.S. apparent consumption, these production levels reflect relatively stagnant derivative demand during this period. BTX production in 1993 is estimated at 14.0 billion liters, a 10-percent increase from 1992. This increased production reflects improved derivative demand during 1993. During

[10] See appendix A for an explanation of tariff and trade agreement terms.

Table 2
Primary aromatics: U.S. production, exports of domestic merchandise, imports for consumption, and apparent consumption, 1989-93

Year	U.S. production	U.S. exports	U.S. imports	Apparent U.S. consumption	Ratio of imports to consumption
	Million dollars				*Percent*
1989	3,980	182	115	3,913	2.9
1990	4,404	276	124	4,252	2.9
1991	3,500	105	196	3,591	5.5
1992	3,347	106	187	3,428	5.5
1993	[1]3,774	145	169	3,798	4.4
	Million liters				*Percent*
1989	12,426	544	358	12,240	2.9
1990	12,753	650	388	12,491	3.1
1991	12,360	306	629	12,683	5.0
1992	12,672	365	669	12,976	5.2
1993	[1]13,980	661	700	14,019	5.0

[1] Estimated by the staff of the U.S. International Trade Commission.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

1994-98, with an anticipated expansion in the U.S. economy and continued growth in demand projected for BTX derivatives, primary aromatics production is expected to grow from 2 percent to 3 percent annually.

Imports

During 1989-93, U.S. imports increased from 358 million liters, valued at $115 million, to 700 million liters, valued at $169 million (table 3). This 96-percent quantity increase and the 47-percent value increase were mainly the result of increased imports from Canada. During the coverage period of this summary, import penetration in terms of quantity ranged from 2.9 percent to 5.2 percent of U.S. consumption. Average import penetration for the period was 4.3 percent.

Although toluene accounts for about 25 percent of U.S.-produced BTX, its proportion of BTX imports averaged 37 percent during the period covered. Its main uses as an octane enhancer in gasoline and as a source of benzene account for its importance in international trade. With the limitations imposed by the Clean Air Act on the benzene content of gasoline, toluene's importance as an octane enhancer is likely to grow in the immediate future.

The principal suppliers of imported BTX to the United States during 1989-93 were Canada and the EU. In 1993, Canada supplied 49 percent of U.S. primary aromatic imports. The principal consumers of imported BTX are the chemical companies producing plastics resins, plasticizers, dyes, and chemical intermediates.

Table 3
Primary aromatics: U.S. imports for consumption, by principal sources, 1989-93

Source	1989	1990	1991	1992	1993
			Quantity (1,000 liters)		
Canada	85,990	127,832	325,966	355,239	337,337
Brazil	15,003	18,746	35,340	61,147	111,210
Korea	39,974	44,846	49,385	53,259	110,258
Mexico	18	0	0	25,124	59,638
Spain	2,276	0	8,355	15,742	19,326
Venezuela	33	0	16,963	20,420	15,606
Netherlands	91,812	83,826	94,944	67,788	11,574
China	0	0	0	0	13,233
Germany	2,425	9,436	5,651	13,268	11,612
All other	120,213	103,422	92,345	57,465	9,726
Total	357,744	388,108	628,949	669,452	699,520
			Value (1,000 dollars)		
Canada	24,225	47,180	100,387	102,127	83,357
Brazil	4,352	5,367	11,985	17,820	27,000
Korea	10,435	14,767	12,935	13,136	23,304
Mexico	5	0	0	7,576	14,680
Spain	589	0	1,450	3,125	4,775
Venezuela	8	0	5,938	5,415	3,766
Netherlands	35,997	18,683	32,845	17,381	3,263
China	0	0	0	0	3,074
Germany	704	3,595	1,807	3,289	2,675
All other	38,222	34,538	28,531	16,804	2,789
Total	114,537	124,130	195,878	186,673	168,683
			Unit value (cents per liter)		
Canada	28	37	31	29	25
Brazil	29	29	34	29	24
Korea	26	33	26	25	21
Mexico	28	-	-	30	25
Spain	26	-	17	20	25
Venezuela	24	-	35	27	24
Netherlands	39	22	35	26	28
China	-	-	-	-	23
Germany	29	38	32	25	23
All other	32	33	31	29	29
Average	32	32	31	28	24

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

FOREIGN MARKETS

Foreign Market Profile

The predominant foreign markets for U.S. exports of primary aromatics during 1989-93 were Taiwan, the EU, Canada, and Korea (table 4). These markets received over 70 percent of U.S. exports during this period. A buildup in Far East synthetic fiber capacity created much of the demand for U.S. primary aromatics by Taiwan and Korea.

In 1993, U.S. exports of BTX to Italy were valued at $13 million and represented 9 percent of such exports. Italy is currently reducing its primary aromatics capacity and is augmenting domestic supply with imports of U.S. BTX. Canada until recently was one of the largest markets for U.S. primary aromatics. However, Canadian imports of U.S. BTX (predominantly benzene) have dropped dramatically since 1990, from 156 million liters that year to 6 million liters in 1993. Canadian benzene consumption has declined in recent years because of reduced demand in the Canadian ethylbenzene/styrene market. Styrene is the precursor to polystyrene and Canadian polystyrene production has decreased 25 percent since 1990. Sagging polystyrene exports are cited as the main reason for the diminished Canadian production. As a result of reduced domestic

Table 4
Primary aromatics: U.S. exports of domestic merchandise, by principal markets, 1989-93

Market	1989	1990	1991	1992	1993
			Quantity (1,000 liters)		
Korea	37,593	68,705	22,558	62,274	268,183
Taiwan	154,932	156,574	81,888	91,038	127,147
Italy	24,547	235	10,139	39,154	53,726
Japan	51,779	85,043	39,270	18,859	30,428
Venezuela	7,917	13,512	3,074	5,475	41,133
Chile	1,376	2,052	4,531	3,972	7,158
United Kingdom	6,567	375	9,433	8,899	15,566
China	19	33	8,563	2,007	16,243
Mexico	10,067	5,456	13,210	22,455	13,578
Canada	74,497	156,246	67,282	12,381	5,857
All other	174,597	162,059	45,869	98,433	81,904
Total	543,891	650,290	305,817	364,947	660,923
			Value (1,000 dollars)		
Korea	14,511	40,364	6,974	15,393	47,255
Taiwan	44,930	52,527	21,934	23,579	27,948
Italy	6,486	87	2,180	10,288	12,591
Japan	23,066	34,864	11,872	9,687	7,445
Venezuela	3,019	4,943	931	1,524	6,280
Chile	568	845	3,877	1,068	5,237
United Kingdom	2,493	226	2,752	2,558	4,967
China	99	73	2,249	585	3,410
Mexico	4,437	1,000	4,235	4,884	3,241
Canada	27,403	78,971	28,521	4,989	2,203
All other	54,905	62,160	19,453	31,698	24,790
Total	181,917	276,060	104,978	106,253	145,367
			Unit value (cents per liter)		
Korea	39	59	31	25	18
Taiwan	29	34	27	26	22
Italy	26	37	22	26	23
Japan	45	41	30	51	24
Venezuela	38	37	30	28	15
Chile	41	41	([1])	27	([1])
United Kingdom	38	60	29	29	32
China	([1])	([1])	26	29	21
Mexico	44	18	32	22	24
Canada	37	51	42	40	38
All other	31	38	42	32	30
Average	33	42	34	29	22

[1] Not meaningful.

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

demand for benzene and a generally weak economy, Canada has been a net exporter of benzene in recent years.

Industry analysts have indicated that it is unlikely that the further integration of the EU market or the shift of countries in Central Europe and the Commonwealth of Independent States to market economies will have a significant effect on international trade in primary aromatics in the foreseeable future. However, BTX from Central Europe and Russia could temporarily undermine West European pricing of primary aromatics.

Under the North American Free Trade Agreement (NAFTA), the immediate or gradual phasing out of Mexican duties on BTX imports should increase U.S. BTX exports to Mexico. This nation has had higher duty rates for BTX imports than the United States, which imposes no tariffs on BTX imports from Mexico. The effect of duty reductions agreed to in the recently completed Uruguay Round of trade negotiations on the U.S. net trade balance in primary aromatics is expected to be positive. Most current U.S. trade is with member countries of the GATT (General Agreement on Tariffs and Trade), most of whom maintain relatively low duty rates. A further reduction in rates by these countries should result in a greater increase in U.S. exports than U.S. imports.

U.S. Exports

During 1989-93, U.S. exports of primary aromatics as a percentage of production ranged from 2.5 percent to 5.1 percent, by quantity. In 1993, the ratio was 4.7 percent.

Although mixed xylenes comprise less than 25 percent of U.S. BTX production, U.S. BTX exports usually include a greater proportion of mixed xylenes than of the other aromatics. Polyester resins, which are used to produce polyester fibers and film, are derived from mixed xylenes. Demand for fibers and film is the driving force behind the preponderance of mixed xylenes in the U.S. primary aromatics export mix, especially to Korea and Taiwan.

U.S. exports of primary aromatics increased from 544 million liters, valued at $182 million, in 1989 to 650 million liters, valued at $276 million, in 1990. This represented a quantity increase of 19 percent and a value increase of 52 percent. In 1991, U.S. exports decreased to 306 million liters, valued at $105 million, but increased to 365 million liters, valued at $106 million, in 1992. The principal cause of the decrease in exports since 1990 is reduced exports to Canada, Korea, and Taiwan. However, in 1993, U.S. exports increased to 661 million liters, valued at $145 million. This development was due largely to an unexpected increase in U.S. exports of mixed xylenes to Korea for use by their synthetic fibers industry. The Korean demand increase was caused by problems within their petrochemical industry, which created supply shortfalls in primary aromatics. Petroleum companies, such as Exxon and Shell, are the principal exporters of primary aromatics.

U.S. TRADE BALANCE

The United States had a negative trade balance for primary aromatics during 1991-93 (table 5), 3 of the 5 years covered in this summary. During 1989-90, the United States had positive trade balances of $67 million and $152 million, respectively. The positive trade balances in 1989-90 were largely the result of strong exports to Canada, Korea, and Taiwan.

Recent negative BTX trade balances largely reflect a decline in U.S. exports to Taiwan and Canada relative to 1989-90 levels. The development of petrochemical industries (BTX producing facilities) in the Far East resulted in lower levels of U.S. exports of BTX to Taiwan after 1990. However, the U.S. trade deficits of $91 million in 1991, $81 million in 1992, and $24 million in 1993, are mainly the result of negative trade balances with Canada. U.S. imports of Canadian BTX increased by 117 percent from 1990 to 1992 and remained high in 1993, whereas Canadian imports of U.S. BTX fell by 97 percent during 1990-93. U.S. demand for toluene as an octane enhancer in gasoline, and demand for mixed xylenes as a source of polyester fibers, film, and fabricated plastics, as well as lower Canadian demand for U.S. BTX due to reductions in Canada's ethylbenzene/styrene market are the main reasons for the current negative trade balance with Canada. It is noteworthy that although the U.S. trade balance with Canada in 1993 was an $81 million deficit, the overall U.S. trade balance for BTX was a $24 million deficit. An improving Canadian economy resulting in increased demand for U.S. BTX will go far toward generating a positive balance in U.S. trade in these commodities.

Table 5
Primary aromatics: U.S. exports of domestic merchandise, imports for consumption, and merchandise trade balance, by selected countries and country groups, 1989-93[1]

(Million dollars)

Item	1989	1990	1991	1992	1993
U.S. exports of domestic merchandise:					
Canada	27	79	29	5	2
Korea	15	40	7	15	47
Taiwan	45	53	22	24	28
Brazil	0	0	0	0	0
Mexico	4	1	4	5	3
Italy	6	0	2	10	13
Venezuela	3	5	1	2	6
Japan	23	35	12	10	7
China	0	0	2	1	3
Netherlands	28	31	3	11	3
All other	30	32	23	24	32
Total	182	276	105	106	145
EU-12	44	36	13	29	25
OPEC	12	12	5	5	8
ASEAN	4	12	1	3	1
CBERA	5	6	4	6	9
Central Europe	0	0	0	0	0
U.S. imports for consumption:					
Canada	24	47	100	102	83
Korea	10	15	13	13	23
Taiwan	0	0	0	0	0
Brazil	4	5	12	18	27
Mexico	0	0	0	8	15
Italy	0	3	0	0	0
Venezuela	0	0	6	5	4
Japan	13	2	4	1	1
China	0	0	0	0	3
Netherlands	36	19	33	17	3
All other	26	33	28	22	9
Total	115	124	196	187	169
EU-12	49	39	44	32	11
OPEC	0	1	6	5	4
ASEAN	0	0	0	0	0
CBERA	0	4	0	0	0
Central Europe	0	0	0	0	0
U.S. merchandise trade balance:					
Canada	3	32	-71	-97	-81
Korea	5	25	-6	2	24
Taiwan	45	53	22	24	28
Brazil	-4	-5	-12	-18	-27
Mexico	4	1	4	-3	-12
Italy	6	-3	2	10	13
Venezuela	3	5	-5	-3	2
Japan	10	33	8	9	6
China	0	0	2	1	0
Netherlands	-8	12	-30	-6	0
All other	4	-1	-5	2	23
Total	67	152	-91	-81	-24
EU-12	-5	-3	-31	-3	14
OPEC	12	11	-1	0	4
ASEAN	4	12	1	3	1
CBERA	5	2	4	6	9
Central Europe	0	0	0	0	0

[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 "Central Europe".

Note.—Because of rounding, figures may not add to totals shown.

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

APPENDIX A
EXPLANATION OF 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 upon 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 nonembargoed countries except those enumerated in general note 3(b) to the HTS—Afghanistan, Azerbaijan, Cuba, Kampuchea, Laos, North Korea, and Vietnam—whose goods are dutiable at the rates set forth in ***column 2***. Goods from Albania, Armenia, Belarus, Bosnia, Bulgaria, the People's Republic of China, Croatia, the Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldova, Mongolia, Poland, Romania, Russia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan are now eligible for MFN treatment. Among goods 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 September 30, 1994. 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 designated beneficiary developing countries, as set forth in general note 4 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, and reduced-duty treatment to certain other articles, which are the product of and imported directly from designated countries, as set forth in general note 7 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 (IFTA), as provided in general note 8 to the HTS. Where 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 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 Preference 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 11 to the HTS.

Preferential rates of duty in the special subcolumn of column 1 followed by the symbol "CA" are applicable to eligible goods of Canada, and those followed by the symbol "MX" are applicable to eligible goods of Mexico, under the ***North American Free Trade Agreement***, as provided in general note 12 to the HTS, effective January 1, 1994.

Other special tariff treatment applies to particular ***products of insular possessions*** (general note 3(a)(iv)), goods covered by the ***Automotive Products Trade Act*** (APTA) (general note 5) and the ***Agreement on Trade in Civil Aircraft*** (ATCA) (general note 6), and ***articles imported from freely associated states*** (general note 10).

The ***General Agreement on Tariffs and Trade*** (GATT) (61 Stat. (pt. 5) A58; 8 UST (pt. 2) 1786) is a multilateral agreement setting forth basic principles governing international trade among its 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, antidumping 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, man-made 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 many supplying countries, including the four largest suppliers: China, Hong Kong, the Republic of Korea, and Taiwan.