Industry & Trade Summary

Telecommunications Equipment

USITC Publication 2820
October 1994

OFFICE OF INDUSTRIES
U.S. International Trade Commission
Washington, DC 20436

UNITED STATES INTERNATIONAL TRADE COMMISSION

COMMISSIONERS

Peter S. Watson, Chairman
Janet A. Nuzum, Vice Chairman
David B. Rohr
Don E. Newquist
Carol T. Crawford
Lynn M. Bragg

Robert A. Rogowsky
Director of Operations

Vern Simpson
Director of Industries

This report was prepared principally by

Lori Hylton Brown

Electronic Technology and Equipment Branch
Services and Electronics Division

Address all communications to
Secretary to the Commission
United States International Trade Commission
Washington, DC 20436

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 telecommunications equipment covers the period 1989 through 1993 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 electronic equipment and technology sector.

USITC publication number	*Publication date*	*Title*
2445	January 1992	Television receivers and video monitors
2648	July 1993	Measuring, testing, controlling, and analyzing instruments
2674	September 1993	Medical goods
2708	December 1993	Semiconductors
2728	February 1994	Capacitors
2730	February 1994	Navigational and surveying instruments
2820	October 1994	Telecommunications equipment
2821	October 1994	Computers, components, and peripherals
2822	Ocotber 1994	Audio and video recording and reproducing equipment

[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.

CONTENTS

CONTENTS—*Continued*

INTRODUCTION

The global telecommunications equipment industry is undergoing significant transformation as regulatory authorities liberalize restrictions, governments privatize domestic service providers, equipment manufacturers introduce new technologies, and carriers offer new services. This report examines developments in the $127 billion[1] worldwide telecommunications equipment industry during the 1990s, with reference to developments in the telecommunications service industry as appropriate. The report covers developments in both the U.S. and foreign telecommunications equipment industries and major telecommunications equipment markets. The foreign industries covered include those in Japan, Canada, and Western Europe. The report also addresses tariff and nontariff issues affecting trade in these products.

The telecommunications equipment industry can be divided into two functional sectors: (1) network or carrier equipment, and (2) customer premises equipment (CPE), as shown in figure 1. Network equipment can be subdivided into transmission equipment and switching equipment. Figure 1 also distinguishes between equipment that is joined to the traditional wireline networks, and that which is joined to the newer wireless (or mobile) networks. For the purposes of this report, transmission equipment is defined as any product used to transport a signal. For wireline networks, transmission equipment includes copper wire, coaxial cables, fiber optic cables, repeaters, and multiplexers.[2] The wireline telecommunications industry has been upgrading its transmission equipment from copper wire to fiber optic cable over recent years, thus making fiber optics the fastest growing segment of the network equipment market. For wireless networks, transmission equipment includes microwave radio equipment, radio base station equipment, and satellites.

Switching equipment completes connections between callers by routing signals, such as a telephone number, through the network transmission system to the receiver. This segment of the equipment market has undergone rapid change in recent years. Central office (CO) switches, the largest segment of the network equipment market, have evolved from electromechanical switches to primarily electronic switches. Many carriers currently are replacing analog switches with digital switches in anticipation of new technologies and services. Cellular switches are similar in construction to CO switches, but rely on more advanced software to perform additional functions, such as locating mobile phone units and determining whether they are operable.

The United States is a net exporter of network equipment, maintaining large trade surpluses in switches, satellites, and fiber optics.[3] Primary purchasers of network equipment are common carriers, independent service providers, and companies with private communications networks.

Customer premises equipment encompasses a variety of products that are connected to the communications network. CPE includes terminal equipment, which initiates and receives signals transported over the network, as well as some switching apparatus. Products included in this category are telephone sets (both wireline and wireless), key systems, private branch exchanges (PBXs), and modems. More recently, products such as facsimile (fax) machines, answering machines, and voice response and voice messaging systems have been included in this category. The United States imports the majority of its customer premises equipment, maintaining a trade deficit in PBXs, answering machines, fax machines, and cellular and cordless handsets.[4] While businesses are the primary purchasers of CPE, individual consumers are increasingly buying modems, answering machines, and cellular phones to increase their personal and professional accessibility. This trend is growing as telecommuting from remote offices becomes more popular.

U.S. manufacturers are particularly competitive in the high-end segments of the industry, such as transmission and switching equipment. They are also competitive in high-end CPE products, such as voice processing systems. The manufacturing process for these types of products is capital-intensive, demanding high levels of skill and sophisticated software input. On the other hand, the manufacture of most low-end customer premises equipment (e.g., telephone handsets and answering machines) has moved overseas. Following the route of consumer electronics products, the manufacture of low-end CPE has shifted primarily to countries with lower production costs. These products are more labor intensive and are assembled using commodity electronic components.

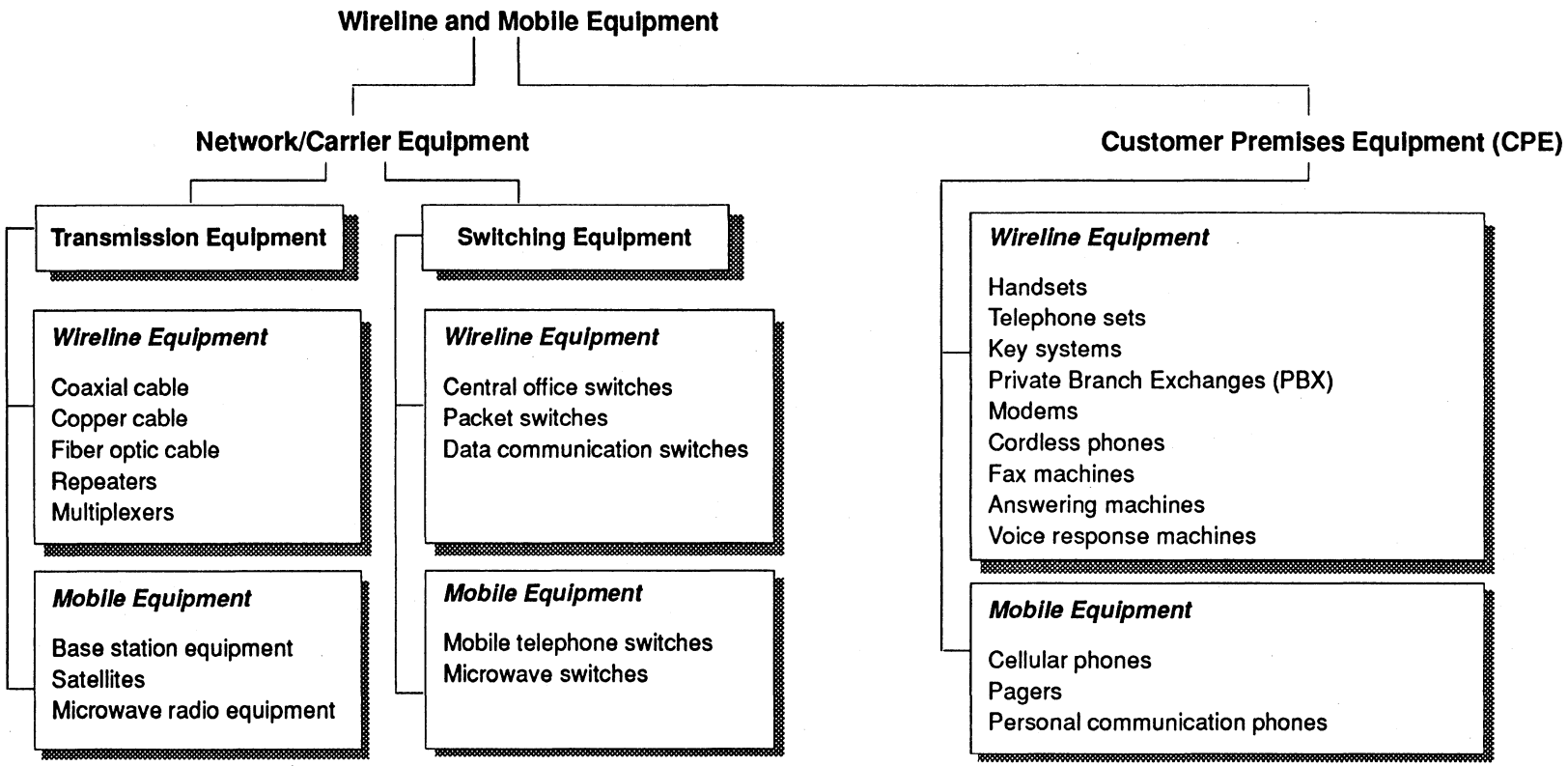
[1] Based on revenues of the top 50 global communications equipment suppliers. Robert Preston, "Product, Geographic Diversity Evident in Manufacturer Ranking," *Communications Week International*, Sept. 20, 1993, p. 23.

[2] See Appendix C for a glossary of selected technical terms used in this report.

[3] Data compiled from official statistics of the U.S. Department of Commerce.

[4] Data compiled from official statistics of the U.S. Department of Commerce.

Figure 1
TELECOMMUNICATIONS EQUIPMENT INDUSTRY



Source: USITC staff.

Two significant trends are influencing the evolution of the telecommunications equipment industry. First, demand for new and better services is fueling purchases of advanced telecommunications hardware and equipment. The private and public sectors are becoming increasingly aware of the competitive advantage imparted by efficient communications infrastructure. Businesses, in an effort to increase productivity through technology, are turning to videoconferencing, on-line information services, and enhanced mobile communications. Table 1 lists a few of the many technologies and products emerging in response to more demanding consumers. Some products improve the speed and quality of transmission. For example, fiber optic cable and asynchronous transfer mode (ATM) switching will move data and voice signals rapidly and simultaneously across the network. Other products are designed with new services in mind. For example, personal communications services (PCS) will require light-weight portable handsets. These new services are in various stages of deployment, with equipment manufacturers carefully gauging commercial viability.

The second major trend affecting the telecommunications equipment industry is the changing regulatory environment. In more open markets, such as the United States, competitive access providers (CAPs) and cable companies are being allowed to move into sectors once reserved for a single carrier; this phenomenon creates new sales opportunities for equipment manufacturers. Globally, countries are privatizing domestic wireline carriers and licensing new cellular carriers, thus allowing foreign equipment manufacturers to challenge traditional domestic supplier relationships. This trend is likely to continue as governments see competition and privatization as means to upgrade national infrastructures and stimulate investment.[5]

U.S. INDUSTRY PROFILE

Industry Structure

The structure of the U.S. telecommunications equipment industry has changed dramatically over time, particularly since the break up of American Telephone and Telegraph (AT&T) in 1984. Prior to 1984, AT&T was the principal supplier of U.S. local and long distance telephone services. Early regulation of the telecommunications industry protected the vertically integrated Bell System from competition. AT&T and the local Bell telephone companies, the largest purchasers of network equipment, bought most of their equipment from Western Electric, an AT&T subsidiary. Likewise, independent phone company GTE also had a captive manufacturing unit. Some industry experts have asserted that this system prevented competition, slowed innovation, and inflated equipment prices.[6]

The *Carterfone* decision by the Federal Communications Commission (FCC) in 1968 is generally regarded as the first step toward opening the equipment industry to competition.[7] This decision allowed customers to connect non-telephone company equipment to the network, thus opening the customer premises equipment market to competition from non-AT&T manufacturers.[8] The most significant action opening the industry was the Modified Final Judgment (MFJ) in 1984, which called for the divestiture of AT&T's local operating companies.[9] This engendered a new wave of competition in the long-distance market. Five new nation-wide companies, including MCI and Sprint, initiated or expanded their long-distance infrastructures; this, in turn, increased the market for network equipment suppliers. Similarly, the seven newly-created Regional Bell holding companies (RHCs) that emerged from divestiture also expanded networks. Because the RHCs were no longer obligated to purchase equipment from AT&T, the opportunities for new suppliers of telecommunications equipment increased significantly. Today, the RHCs purchase approximately half their network equipment from companies other than AT&T.[10] In 1993, U.S. manufacturers' shipments of telecommunications equipment reached $35 billion.[11]

---

[5] Approximately 27 countries around the world have announced plans to privatize their telecommunications networks within the next several years. Included in this list are Portugal, Sweden, Ireland, the Netherlands, Denmark, Belgium, Germany, Hungary, the Czech Republic, Slovakia, Poland, Israel, Saudi Arabia, Turkey, South Africa, Kenya, Nigeria, Malaysia, Mongolia, Singapore, and South Korea. North American Telecommunications Association (NATA), *Telecommunications Market Review and Forecast 1994*, p. 254.

[6] Gerald R. Faulhaber, *Telecommunications in Turmoil: Technology and Public Policy*, (Cambridge: Ballinger Publishing Co., 1987), pp. 9-11; and Statement of Robert E. Allen, Chairman of AT&T, before the Subcommittee on Telecommunications and Finance, House Committee on Energy and Commerce, Mar. 24, 1993.

[7] Datapro Information Services Group, "A History of Telecommunications Regulations," (Delran, NJ: McGraw Hill, Inc., 1992), pp. 5-6.

[8] Under the Carterfone decision, AT&T had the right to require a protective connecting device between the network and the non-AT&T product.

[9] See section on "Regulations" for further discussion of the MFJ. See also Appendix C, "Glossary of Terms."

[10] Faulhaber, pp. 9-11.

[11] U.S. Department of Commerce data. This figure encompasses SIC product codes 36611 (switching and switchboard equipment), 36613 (carrier line equipment and modems), 36614 (other telephone equipment and components), 36631 (mobile/cellular systems equipment) and 36693 (intercommunications systems). Some studies define telecommunications as all trade in SIC 3661 and 3663, which includes some radio products not used in

Table 1
Examples of emerging technologies, services, and equipment in the telecommunications industry

Selected new services & technologies	Description	Selected products related to new technologies
Digital Services	Networks are converting from analog to digital transmission. Digital systems offer better sound quality and can accommodate more applications and services.	Digital switches Digital cellular phones
Integrated Services Digital Network (ISDN)	Technology that supports voice, data, and image transmission. Important for multimedia and high levels of data transmission.	ISDN terminal equipment
Asynchronous Transfer Mode (ATM)	A switching and transmission protocol based on fast-packet switching technology. For data transmission, ATM switching is more efficient than circuit switching and will therefore serve as the basis for ISDN services.	Intelligent hubs ATM switches Adapter cards
Advanced Intelligent Network (AIN)	An "intelligent network" has computers and sophisticated software attached to the network to handle calls in special ways, e.g., re-routing.	Sophisticated software Computers and databases
Computer-Telephone Integration (CTI)	Integration of telephones with computer terminals to allow services such as number identification, customer record display, and sales processing.	PBXs Automatic Call Distributors (ACD) Predictive dialers Key systems Packaged telephony software systems
Personal Communication Services (PCS)	Ubiquitous wireless communication through micro-cellular technology. Requires less power than cellular transmission.	PCS handsets PCS subscriber equipment
Wireless Services	The extension of mobile communication to all facets of the business office, from LANs to PBXs. Designed to increase flexibility and accessibility.	Wireless key systems Wireless PBXs Wireless LANs
Multimedia Services	Services associated with the transmission of data, voice, and image over the same lines. This could include video on demand, interactive shopping, etc.	Fiber optics Video conferencing equipment T1 and T3 multiplexers
Enhanced Paging Services	Paging services that offer more than the standard tone alert. These services include digital displays, voice mail, and response options.	Tone & voice pagers Alphanumeric pagers
Global Mobile Communications Services	Satellite transmission systems offering global communications via low-powered handsets.	Low Earth Orbit (LEO) satellites Mobile handsets

Source: USITC staff.

Types of Companies

The types of domestic companies involved in the production of telecommunications equipment today range from small niche players to global corporations. Although the total number of firms reaches into the thousands, there is a high level of concentration among several large U.S. firms, including AT&T, Motorola, and GM Hughes (see figure 2).[12] Most of these large producers are multinational and multi-product corporations.[13] AT&T, for example, is a strong producer in all three equipment categories—transmission, switching, and CPE—although the majority of its revenues stems from network equipment.[14] Motorola also offers products in all segments, from high-end customer premises equipment (e.g., digital cellular phones and paging devices) to

[11]—*Continued*
telecommunications. This figure was $35.5 billion in 1993.

[12] Northern Telecom (Canadian) holds a substantial share of the U.S. telecommunications market and is often covered in discussions of the U.S. industry. However, for the purposes of this summary, it will be discussed in the section on Canada.

[13] In addition to manufacturing different types of communications equipment, many of these companies also manufacture non-telecommunications products. For example, both AT&T and Motorola produce other types of electronics products, such as computers and semiconductors. In some cases, communications equipment accounts for only half of the revenues generated by these firms.

[14] American Telephone and Telegraph (AT&T), *Annual Report*, 1992, p. 22.

Figure 2
Selected U.S. firms in the telecommunications equipment industry

Company name	Selected products
ADC Telecommunications Inc.	Network equipment
Allen Group Inc.	Antennae for mobile communications
American Telephone and Telegraph (AT&T)	Network and CPE Equipment
Aydin Corp.	Microwave transmission equipment
Broadcast International, Inc.	Satellite communication systems
California Microwave Inc.	Satellite communication products
Cisco Systems	Data networking systems
Datron	Satellite communication terminals
Digital Microwave Corp.	Fiber optic communication systems
DSC Communications Corp.	Network and CPE equipment
Executone Information Systems Inc.	Voice processing systems
General Datacomm Industries, Inc.	Data communication systems
General Electric	Satellites and mobile products
GM Hughes	Satellites and mobile systems
GTE	Markets cellular products
Harris Corp.	Digital switches
Motorola	Mobile communication products
Network Equipment Technologies, Inc.	ATM products
Octel Communications Corp.	Voice and image processing systems
PI Holdings Inc.	Voice/data communication products
Pitney Bowes	Voice processing systems
Proteon Inc.	Intelligent hubs
Qualcomm Inc.	Mobile communication systems
Rockwell International	Commercial telecommunication systems
Scientific Atlanta Inc.	Earth station antennae
Spectrum Information Technologies, Inc.	Data transmission products
Superior Teletec, Inc.	Fiber optic telephone cable
Telco Systems, Inc.	Fiber optic transmission equipment
Tellabs Inc.	Data multiplexers, teleconferencing equipment
Tie Communications, Inc.	Multifeature telephone systems
Titan Corp.	Advanced satellite terminals
U.S. Robotics Inc.	Data communications, e.g., modems

Source: SEC Disclosure Information Service and USITC staff.

transmission products, such as radio base stations. In addition to these multi-product vendors, many companies specialize in just one or two segments of the communications industry. For example, GM Hughes focuses on satellites and mobile systems, and Corning concentrates on optical fibers. All of these companies are active in international markets.

Research and Development Expenditures

Spending on research and development (R&D) as a percent of sales for the telecommunications equipment industry as a whole rose slightly between 1989 and 1992, reflecting an effort to keep pace with the latest technologies entering the market (see figure 3).[15] Compared to R&D expenditures by other information technology industries, telecommunications equipment manufacturers traditionally have dedicated a slightly lower percentage of overall sales to research (figure 3). By 1992, however, spending levels among these industries were converging. Because many telecommunications products compete on the basis of quality and performance, companies are constantly striving to improve underlying technology. For example, U.S. manufacturers carry out intensive research on software development, semiconductor technology, and lightwave transmission. Most research takes place in the United States, although Motorola reportedly has plans to open a research facility in France to develop technology specific to the needs of the European market.

Telecommunications manufacturers are expected to maintain or increase R&D expenditures as competition in the industry intensifies. Manufacturers are expected to focus scarce R&D dollars on current technological issues, such as advanced switching, wireless communications, and multimedia transmission.

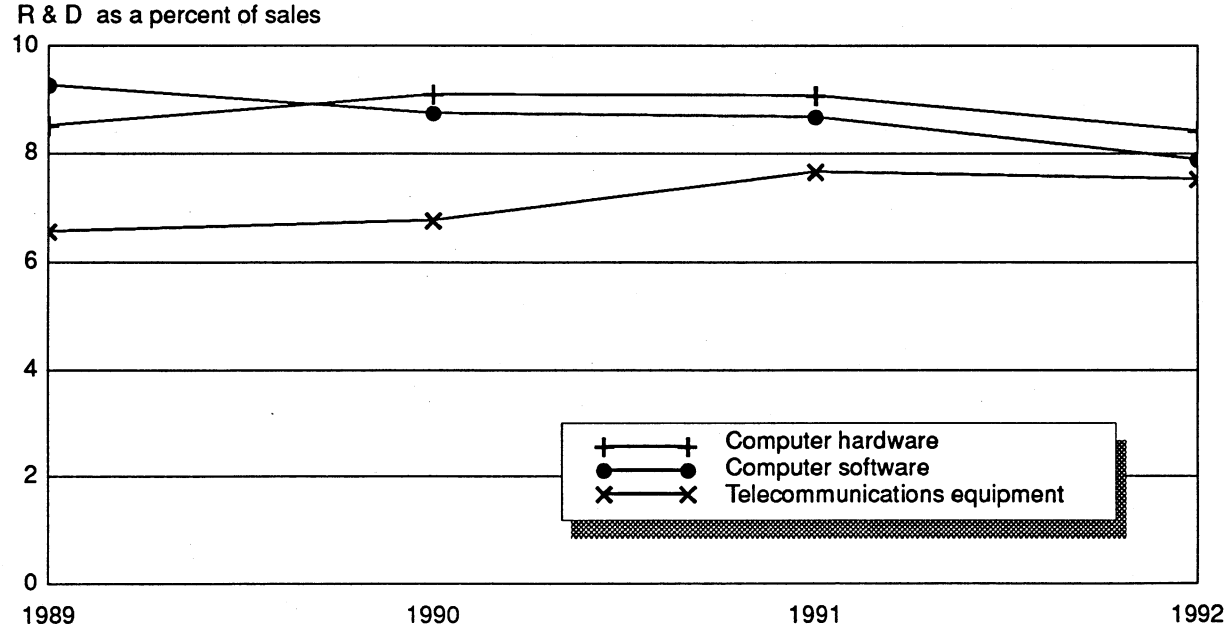
Distribution

Telecommunications equipment is distributed through a number of different channels. Vendors include equipment manufacturers, independent distributors, Bell Operating Companies (BOCs), and value-added resellers. Equipment manufacturers are the predominant distributors, accounting for the majority of the network equipment market and 45 percent of the CPE market in 1993.[16]

[15] Information Technology Association of America (ITAA), *U.S. Information Technology Industry Profile 1992*, p. II-28. This figure includes SIC 3661 and 3662, Telephone and Telegraph Apparatus and Radio and Television Broadcasting Equipment. Among major producers, both Motorola and DSC increased expenditures as a percent of sales between 1990 and 1992. DSC reportedly spent nearly 13 percent of sales on R&D in 1992. DSC Communications Corp., *Annual Report*, 1992.

[16] NATA, *Market Review 1994*, pp. 220-22.

Figure 3
Selected information technology industries: R & D spending as a percent of sales, 1989-92



Source: ITAA, *U.S. Information Technology Industry Profile.*

Distribution patterns in customer premises equipment are changing. In the market for PBXs and key systems, independent distributors have lost market share discernibly in recent years.[17] This is largely due to increasing competition in the market from BOCs and manufacturers, and resulting lower prices.[18] As declining prices lowered returns for independent distributors, many had to diversify their businesses or exit the market. Equipment manufacturers have facilitated market exit by acquiring independent suppliers.

In the market for voice, data, and video CPE, value-added resellers have been increasing market share at the expense of both independent distributors and equipment manufacturers. Traditionally, independent distributors have been significant suppliers of voice CPE, while value-added resellers have distributed data communications equipment. As the markets for voice, data, and video equipment merge, however, customers are demanding one-stop-shopping. Many businesses prefer to purchase everything from a PBX to a voice mail system from one vendor. Resellers are expected to increase their share of the distribution chain as demand for integrated voice, data, and video communications systems expands.[19]

[17] In 1986, approximately 34 percent of PBXs and key systems were supplied by independent distributors, while 41 percent were supplied by manufacturers. In 1993, manufacturers were supplying 48 percent of the market, while the share of independent distributors dropped to just 25 percent. NATA, *Market Review 1994*, p. 220.

[18] Price pressure on PBX equipment is due, in large part, to increasing competition from Centrex services.

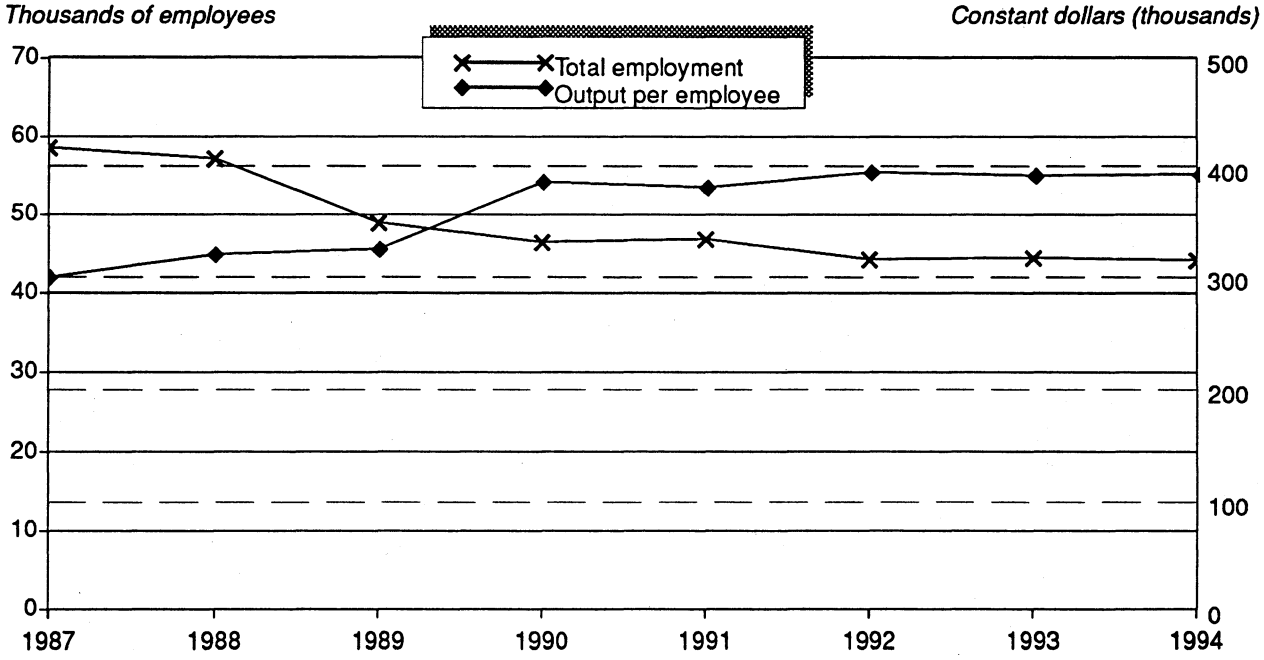
[19] Equipment manufacturers were responsible for 45 percent of distribution in 1993, value-added resellers 31 percent, independent distributors 16 percent, and retailers 6 percent. NATA, *Market Review 1994*, p. 222.

Employment, Industry Automation, and Manufacturing Locations

Reflecting efforts by U.S. manufacturers to keep production costs low, total employment in the telecommunications equipment industry decreased by approximately 2.4 percent per year on average over the last five years, falling to an estimated 44,500 in 1993 (see figure 4).[20] Meanwhile, wages for telecommunications equipment workers increased at a nominal rate of 3.7 percent between 1985 and 1990. The decrease in employment, combined with relatively stable shipments, is the result of higher productivity levels during this period.

[20] This figure reflects trends among production employees in SIC 3661 (telephone and telegraph apparatus) only. Employment of all telecommunications workers declined at an average annual rate of 2.8 percent over the same period, reaching 86,000 in 1993. U.S. Department of Commerce, *U.S. Industrial Outlook 1994*, p. 30-3.

Figure 4
Telecommunications equipment: Trends in employment and productivity, 1987-94[1]



[1] Includes production employees in SIC 3661, Telephone and Telegraph Apparatus.

Source: U.S. Department of Commerce, *Industrial Outlook 1994.*

Overall, U.S. companies have not emphasized automated manufacturing as much as their Japanese and European counterparts.[21] U.S. plants do not employ robotics to the same degree as Japanese companies because industry officials do not see substantial savings in time or productivity levels. Moreover, U.S. manufacturers note that much of the network equipment produced domestically relies on sophisticated software and customized production methods that are not easily automated. Strength in software development helps U.S. manufacturers remain globally competitive providers of advanced telecommunications equipment.

The location of manufacturing facilities of U.S. firms, currently distributed across the country and overseas, is reportedly determined by the degree of labor intensity, skill requirements, and component inputs required by individual products. Capital-intensive products requiring high-skilled labor and high-technology components (e.g., digital switches) generally are manufactured domestically. Products incorporating commodity electronic components and labor-intensive manufacturing processes often are produced by overseas subsidiaries located in low-wage regions. For example, both AT&T and Motorola have manufacturing facilities for communications products in Korea, Taiwan, and other countries with lower production costs.

Globalization

The globalization of telecommunications equipment suppliers has been a fairly recent phenomenon; traditional supplier relationships in this industry remained stable for decades. Today, however, many of the top 50 communications equipment manufacturers are global, with most deriving more than 30 percent of their overall revenues from foreign markets.[22] Three basic trends are driving globalization in the U.S. telecommunications equipment industry. First, overseas demand for equipment is increasing in response to the liberalization of telecommunications service markets and privatization of service providers. Second, as many countries work to establish or update telephone infrastructures, U.S. equipment manufacturers are establishing joint ventures and subsidiaries overseas. Finally, leading equipment producers continue to shift production, usually that of low-end customer premises equipment, to low-wage overseas locations.

[21] Industry officials, interviews with USITC staff, March 1991.

[22] Robert Preston, "Product, Geographic Diversity Evident in Manufacturer Ranking," *Communications Week International*, Sept. 20, 1993, p. 23.

Liberalization of service markets has provided new opportunities for equipment suppliers. For instance, the 1992 decision by the Canadian Radio-Television and Telecommunication Commission (CRTC) to license a new long-distance provider, Unitel, ended the virtual service monopoly enjoyed by Bell Canada. Consequently, Northern Telecom, Bell Canada's preferred equipment supplier, lost market share when Unitel turned to U.S. manufacturers as suppliers.[23] U.S. manufacturers are now significant suppliers for the newly licensed carrier in that country.[24]

Globalization also has occurred as U.S. suppliers establish operations in developing economies to meet growing local demand for updated telecommunications equipment. Foreign governments, recognizing that advanced communications networks attract business and investment, are increasing efforts to establish or upgrade telecommunications infrastructure. U.S. companies have located production facilities in many of these new markets to better serve them. For example, AT&T has undertaken a joint venture in Beijing to produce fiber optic cable that will be used to modernize and expand China's infrastructure.[25] In addition, AT&T has purchased an 80 percent stake in the Polish telecommunications equipment manufacturer, Telfa, which will serve as a primary supplier to Poland's telecommunications service providers.[26] The availability of relatively low-cost labor in these markets provides additional incentive to invest in overseas facilities.

Regulations and Standards Affecting the Industry

While the U.S. telecommunications service industry continues to be highly regulated at the Federal and State level, only a few regulations directly affect the telecommunications equipment industry.[27] The

[23] Telecommunications Industry Association (TIA), "Market Access for Telecommunications Equipment in Canada," Dec. 1992, p. 4.

[24] AT&T acquired a 20 percent equity stake in Unitel and provides the company with intelligent network equipment. *Telecommunications Reports*, Jan. 11, 1993; and AT&T, Form 10-K, *Annual Report to the Securities and Exchange Commission*, 1993, p. 8.

[25] While companies may locate manufacturing facilities in new markets to improve market access, some countries—such as China—require that manufacturing take place in-country so that the host country benefits in terms of jobs, skills, and technology transfer.

[26] AT&T, *Annual Report*, 1992, p. 17.

[27] FCC regulations may also affect the equipment industry indirectly. Such regulations include depreciation schedules mandated for the local telephone service companies. Depreciation schedules, which are regarded by the industry as long, reportedly slow service providers' capital investments in new products. On the other hand, the FCC's 1990 decision requiring the BOCs to eventually upgrade networks for ISDN capabilities likely will prove beneficial for manufacturers of ISDN-compatible equipment.

primary regulation affecting both wireline and wireless telecommunications equipment stems from the Modified Final Judgment (MFJ).[28] Implemented in 1984, the MFJ prohibits the Regional Bell holding companies from manufacturing telecommunications equipment. The manufacturing ban was designed to encourage competition and innovation in the equipment sector by preventing the captive supplier arrangement that allegedly had existed under AT&T. The ban continues today, though many of the RHCs have requested that this portion of the MFJ be overturned. Two telecommunications regulatory reform bills addressing the elimination of the manufacturing ban were reviewed in Congress during 1994.[29] Although Congressional action on this issue was halted in September 1994 with the withdrawal of the Senate bill, similar legislation likely will be reintroduced next year.[30] In addition to Congressional action, four RHCs filed a motion with the U.S. District Court in Washington in July 1994 requesting that the "counterproductive" MFJ be overturned.[31] Some industry officials believe that, given recent trends toward deregulation of the industry overall, it is likely that the manufacturing ban will be removed eventually.[32]

In recent years, government regulations have been particularly important in the development of wireless equipment. Transmission standards and FCC licensing of cellular operators are two areas that have affected manufacturers directly. Following the development of analog cellular communications in the early 1980s, a number of transmission standards emerged worldwide.[33] In the United States, the FCC mandated adherence to the "Advanced Mobile Phone Service" (AMPS) transmission standard. The existence of one standard, based on technology developed by U.S. manufacturers and service providers, reportedly conferred benefits on the domestic cellular equipment industry. Large economies of scale enabled manufacturers to offer products at relatively low prices, thereby encouraging several other countries to adopt the AMPS standard as well. As digital cellular technology has developed, however, several transmission standards have emerged in the United States. In this instance, the FCC has chosen to remain neutral, leaving the market to determine the predominant digital cellular standard.[34]

There are currently two competing digital cellular standards in the U.S. market, Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA).[35] Although telecommunications manufacturers are developing "dual-mode" equipment able to service both AMPS and one of the two digital standards, the continued use of two competing digital standards may prevent firms from achieving the economies of scale necessary to produce low-cost equipment. Some analysts speculate that the U.S. industry may experience a slower transition to digital technology than other countries because of its failure to select one standard. Other analysts maintain that permitting the market to set the prevailing standard will prevent companies from adopting a technology that could be rendered obsolete or inefficient in a few years.

Other regulations that indirectly affect the equipment industry include FCC rulings on cellular licenses and spectrum allocations.[36] When the FCC

---

[28] *United States v. American Telephone and Telegraph Co., 552 F. Supp. 131 (D.D.C. 1982), aff'd sub nom., Maryland v. United States,* 460 U.S. 1001, 103 S. Ct. 1240, 75 L. Ed. 2d 472 (1983). This decree was technically a modification of the final judgment (MFJ) that settled an earlier antitrust case in 1956.

[29] In the House, Representatives Jack Brooks (D-TX) and John Dingell (D-MI) introduced a bill addressing the MFJ ban in 1993 (H.R. 3626). Among other things, the bill would allow the RHCs to petition the Attorney General for permission to enter the manufacturing business. The RHCs would face a 1- to 2-year waiting period after enactment of the legislation. In the Senate, Chairman of the Commerce Committee Ernest Hollings (D-SC) introduced a bill (S. 1822) that would allow the RHCs to manufacture equipment. The House passed H.R. 3626 in June 1994. Charles Mason, "House Passes Telecom Bills as Senate Girds for Showdown," *Telephony,* July 4, 1994, p. 6. Senator Hollings withdrew his bill (S. 1822) in September 1994 in response to increasing opposition on certain issues. Dan O'Shea, "Wait 'til Next Year," *Telephony,* Oct. 3, 1994, p. 6.

[30] Dan O'Shea, "Wait 'til Next Year," *Telephony,* Oct. 3, 1994, p. 6.

[31] The motion states that the MFJ restrictions place an unnecessary burden on RHCs, consumers, and the U.S. economy. "Motion of Bell Atlantic Corporation, BellSouth Corporation, Nynex Corporation, and Southwestern Bell Corporation to Vacate the Decree," Civil Action No. 82-0192, United States District Court for the District of Columbia, (July 6, 1994).

[32] Industry officials, telephone interview with USITC staff, June 7, 1994.

[33] For more information on the different analog and digital standards, see U.S. International Trade Commission (USITC), *Global Competitiveness of U.S. Advanced Technology Industries: Cellular Communications* (inv. No. 332-329), USITC publication 2646, June 1993; and USITC, "Technical Standards and International Competition: The Case of Cellular Communications," *Industry, Trade, and Technology Review,* Oct. 1993, p. 11.

[34] Digital transmission offers a much higher call capacity than analog transmission. Thus, as cellular subscribership grows and pushes service areas towards full capacity, carriers generally are switching to digital systems.

[35] TDMA technology, by splitting a frequency channel into different time slots, can transport an estimated 6 times as many calls over a channel than analog transmission technology. CDMA technology, by scattering call packets over a wide range of frequencies, reportedly increases call capacity by 10 to 20 times analog levels.

[36] The FCC regulates all non-government use of radio spectrum in the United States.

divided the U.S. cellular service market into 306 Metropolitan Statistical Areas (MSAs) and 428 Rural Service Areas (RSAs) in 1989, it authorized the issuance of licenses to two carriers within each area, one to the existing wireline carrier,[37] and one to an unaffiliated wireless operator (a "pure-play" provider). While this structure is viewed as having served competition well in many respects, it also is seen as having some drawbacks.[38] The main equipment-related complaint was made by wireline BOC carriers. They assert that, unlike their "pure-play" competitors, they have been unable to manufacture customized equipment specific to the needs of their service areas due to the MFJ ban on manufacturing. Similarly, some industry analysts note that the wireline service providers effectively have been discouraged from expanding overseas, since many foreign governments prefer to offer cellular licenses to companies that may provide both services *and* equipment.

Finally, FCC spectrum allocation decisions also affect U.S. equipment production. In early 1994, the FCC finalized its efforts to structure licensing areas and allocate spectrum for Personal Communications Services (PCS). Auctions for narrowband PCS licenses took place in July 1994, and auctions for broadband services are scheduled to occur in December 1994. With the regulations surrounding this new industry close to completion, nearly all equipment manufacturers are endeavoring to develop PCS product lines. There was some concern, however, that delays during the PCS allocation process would affect certain U.S. suppliers detrimentally.[39] For example, since spectrum already had been allocated in other countries (e.g., Great Britain and Germany), some observers suggested that these countries would have an advantage in developing PCS products.[40]

Another factor influencing PCS manufacturers, particularly manufacturers of data PCS products, is the degree to which allocated spectrum is already populated by fixed microwave users. The FCC originally allocated a heavily populated band of spectrum to data PCS providers.[41] It was estimated that the time and expense required to relocate the microwave users currently in that band could delay deployment for five years; this expectation delayed development of data PCS products.[42] In June 1994, however, the FCC revised its rules and decided to allocate a less populated band of spectrum for data PCS.[43]

Consumer Characteristics and Factors Affecting Demand

Consumers of telecommunications equipment vary depending on the types of products involved. Consumers of network equipment are primarily common carriers, owners of private networks (e.g., large corporations), and competitive access providers (e.g., Teleport Communications Group, Metropolitan Fiber Systems). Consumers of CPE equipment, on the other hand, include common carriers, businesses, government, and individual residential customers. The primary factors affecting purchases of both types of equipment are quality, features, and price, although the latter is more important for CPE equipment.

Demand for network equipment is largely affected by the emerging technologies and potential service offerings referred to above (see table 1). Because the cost of replacing transmission equipment and central office equipment is high, many common carriers reportedly are waiting to determine which services customers will demand before they upgrade networks. New equipment will need to incorporate features that are compatible with the new service offerings.

Consumers of customer premises equipment, such as telephone sets and PBXs, rely largely on price and quality in deciding which type of product to purchase. Price is a strong factor in the purchase of commodity telephone sets for the home, and even for cellular phones. Although cellular reception reportedly is better with digital transmission, many consumers likely will continue to use analog service and equipment until the price of digital handsets declines.[44] As new service

[37] In most cases, the existing wireline carrier was a Bell Operating Company.

[38] USITC, *Cellular Communications*, USITC publication 2646, pp. 4-1 to 4-4.

[39] Delays included FCC-mandated time for testing emerging technologies, revisions to original spectrum allocation decisions, and debates over auction rules.

[40] Jonathan Friedland, "Will You Accept," *Far Eastern Economic Review*, Feb. 17, 1994, p. 43; and Kurt A. Wimmer, "Global Development of Personal Communications Services," *Communications Lawyer*, Summer 1992, p. 7.

[41] Software Publishers Association, "Federal Communications Commission Allocates Spectrum for Licensed PCS Providers and Unlicensed Data-PCS Devices," *Government Affairs Briefing*, Oct. 1993.

[42] Most countries have allocated spectrum in the 2 GHz range for PCS. This range currently is used for microwave communications by utilities, railroads, and the petroleum industry. The FCC requires PCS licensees to bear the cost for relocating incumbent spectrum users. (FCC, *ET Docket No. 92-9*, Sept. 17, 1992.) In Japan and Europe, microwave incumbents are responsible for the cost of relocating to a different frequency.

[43] The revised rules also provide certain advantages for manufacturers of voice PCS equipment. For example, the decision to allocate a contiguous band of spectrum rather than an upper and a lower band will preclude the need for dual-band PCS handsets. For more information, see FCC, *Memorandum Opinion and Order*, GEN Docket No. 90-314, June 9, 1994.

[44] While price is the key factor affecting purchases of cellular carphones, purchasers of portable phones cite size, weight, and features (such as speed dialing, alphanumeric memory, and other "productivity enhancers") as key factors affecting demand. For further information see, USITC, *Cellular Communications*, USITC publication 2646, pp. 3-8 to 3-9.

offerings become available, however, customers likely will compare features and upgrade options when deciding to purchase CPE. For example, phones that digitally display a phone number are necessary for the new "caller ID" service offered by many phone companies. Similarly, as businesses purchase PBXs, many are looking for equipment that is compatible with new applications in messaging, voice processing, and computer-telephone integration.

FOREIGN INDUSTRY PROFILE

Most of the major non-U.S. suppliers of telecommunications equipment are located in Canada, Europe, and Japan (see table 2). Many companies headquartered in these countries manufacture low-end customer premises equipment in East Asia, due to the availability of low wage labor in this region. Just as U.S. manufacturers are affected by the demands of new technologies and services, so, too, are major foreign producers. Manufacturers in these countries are focusing production strategies on digital equipment and advanced software products. Further, the trend toward privatization and liberalization of national telecommunications services is affecting the producers of telecommunications equipment in these countries, encouraging them to focus on export markets. Each region is discussed individually below.

Canada

Canada is home to Northern Telecom (Northern), one of the five largest telecommunications equipment suppliers in the world (see figure 5).[45] Northern is a vertically integrated, multinational company that produces a full range of telecommunications products.[46] In addition to Northern, there are a number of smaller equipment suppliers headquartered in Canada. For example, Gandalf, Glenayre, Mitel, and Newbridge offer a narrow range of telecommunications products, generally targeted at new technologies and applications. Most of Canada's equipment manufacturing takes place in Ontario and Quebec, but Northern Telecom has plants and/or affiliates in each Canadian province. In addition to these domestic companies, several non-Canadian multinational firms have located manufacturing or R&D facilities in Canada, including Ericsson, Alcatel, and Motorola. Total production of telecommunications equipment in Canada reached $2.2 billion in 1992.[47]

The Canadian telecommunications industry accounts for 25 percent of total Canadian electronics output.[48] Production has declined slightly in recent years as competition from foreign firms has intensified and smaller companies have consolidated production.[49]

[45] Approximately 40 percent of Northern's manufacturing and administrative costs, and 60-70 percent of its R&D costs, were incurred in Canada in 1991. However, the company has operated extensive facilities in the United States since 1971. Industry, Science, and Technology Canada, *Industry Profile—Telecommunications Equipment*, (Ontario, 1991), p. 4.

[46] In 1992, 50 percent of Northern's revenues were from sales of central office switching equipment, 25 percent from business communications systems, and 11 percent from transmission systems. Northern Telecom Limited, *Annual Report*, 1992, p. 28.

[47] The production figures used in this section refer to equipment classified in HTS headings 8517 and 8520. Because this does not include cellular, fiber optic, or satellite production, some estimates may appear conservative. Elsevier, *Yearbook of World Electronics Data 1993*, pp. 14-15. Other sources report that Canadian production reached $3.9 billion in 1990. Canada, *Industry Profile*, p. 2.

[48] Elsevier, *Yearbook of World Electronics Data 1993—Volume 2, America, Japan, & Asia Pacific*, p. 57.

[49] Canada, *Industry Profile*, pp. 3-4.

Table 2
Telecommunications equipment: International production trends, 1990-93[1]

	1990	1991	1992	1993	CAGR[2] '90-'93	CAGR[2] '92-'93
	Million dollars				Percent	
Western Europe	28,000	28,416	28,156	28,593	0.7	1.6
Japan	14,614	15,496	13,985	13,622	-2.3	-2.6
Canada	2,409	2,234	2,191	2,209	-2.8	0.8
Korea	1,756	1,884	1,920	1,960	3.7	2.1
ASEAN countries	1,344	1,592	1,674	1,960	13.4	17.1
China	897	1,070	1,230	(3)	[4]17.1	[5]15.0
Mexico	374	355	373	(3)	[4]-0.1	[5]5.1
India	617	529	476	498	-6.9	4.6

[1] Includes HTS heading numbers 8517 and 8520.
[2] Compound annual growth rate.
[3] Not available.
[4] Compound annual growth rate 1990-92.
[5] Compound annual growth rate 1991-92.

Source: Elsevier, *Yearbook of World Electronics Data*, 1993.

Figure 5
Telecommunications equipment: Top 15 major producers and global communications revenues, 1992

		($ millions)
(1)	Alcatel *[France]*	$15,558
(2)	Siemens *[Germany]*	$11,877
(3)	AT&T *[U.S.]*	$10,809
(4)	Motorola *[U.S.]*	$ 8,374
(5)	Northern Telecom *[Canada]*	$ 8,029
(6)	Ericsson *[Sweden]*	$ 7,693
(7)	NEC *[Japan]*	$ 7,591
(8)	IBM *[U.S.]*	$ 5,300
(9)	Fujitsu *[Japan]*	$ 3,738
(10)	Bosch Group *[Germany]*	$ 2,692
(11)	GEC *[U.K.]*	$ 2,648
(12)	Italtel *[Italy]*	$ 2,239
(13)	Philips *[Netherlands]*	$ 2,185
(14)	GTE *[U.S.]*	$ 2,000
(15)	GM Hughes *[U.S.]*	$ 1,900

Source: *Communications Week International,* Sept. 1993.

Overall, however, the industry has remained stable due to several factors. First, Canada enjoys a sophisticated market of 27 million people which, although small, interacts closely with the larger U.S. market.[50] Second, Northern and other equipment suppliers consider R&D a top priority and are concentrating efforts on new and emerging technologies.[51] Northern's expenditures on R&D, largely focused on high-speed digital transmission over optical fibers, were equal to 11 percent of sales in 1992.[52] By comparison, U.S. firms' expenditures ranged from 5 to 12 percent of sales in 1992.[53] Finally, Canadian producers are taking advantage of other countries' liberalized markets to expand exports and overseas investment.

In recent years, Northern has established several strategic alliances and joint ventures with foreign companies as a means of market entry, and thus is becoming a key supplier in many foreign regions.[54] In 1992, revenues from non-Canadian sources amounted to 73 percent of the company's total revenues. Revenue from Europe alone increased from 3 percent of Northern's total revenue in 1990 to 16 percent in 1992, principally reflecting increased sales in the liberalized U.K. market.[55] Northern continues to be one of the largest suppliers to the U.S. market, ranking second only to AT&T in many product segments.[56]

Western Europe

In 1992, 10 of the top 20 world producers of communications equipment were based in Europe, including number one-ranked Alcatel of France (see figure 5). Alcatel's acquisition of several other equipment manufacturers allowed it to overtake AT&T and become the world's largest producer in late 1991. Siemens of Germany is now the second largest producer in the world. Other Europe-based top 20 producers are Ericsson, the Bosch Group, GEC, Italtel, Philips, Ascom Group, Nokia, and Matra Hachette. Both Alcatel and Siemens enjoy a strong competitive position in markets for wireline transmission and public switching equipment. Ericsson and Nokia, meanwhile, hold a strong position in the market for mobile equipment. Overall, transmission and switching equipment account for over half of European production of telecommunications equipment. Customer premises equipment, less capital-intensive than transmission and switching equipment, accounts

[50] The U.S. market accounted for 54 percent of Northern's total revenues in 1992 ($4.5 billion), while Canada accounted for only 27 percent of the total ($2.24 billion). Northern Telecom Limited, *Annual Report*, 1992, p. 27.

[51] Northern Telecom Limited, *Annual Report*, 1992, p. 22.

[52] Northern Telecom Limited, *Annual Report*, 1992, p. 22. In some cases, Northern has joined forces with other companies. For example, after collaborating with U.S.-based Bellcore for 3 years, the companies demonstrated a high quality end-to-end system for delivering video-on-demand to the home in November 1992. Ibid., p. 22.

[53] Based on data from Annual Reports of AT&T, DSC, and Motorola; and ITAA, *U.S. Information Technology Industry Profile 1992*, p. II-28.

[54] Northern entered a strategic alliance with Matra Communications of France, and established joint ventures with Agroman Inversiones S.A. of Spain, Elwro of Poland, and Netas of Turkey. In addition, Northern has entered into numerous supplier agreements with telecommunications service providers all over the globe.

[55] Northern Telecom Limited, *Annual Report*, 1992, p. 27.

[56] NATA, *Market Review 1994*.

for less than 20 percent of Western European production.[57] Like the United States, European countries largely import CPE products from East Asian countries.

Between 1990 and 1993, production of telecommunications equipment in Europe increased at an average annual rate of less than 1 percent, reaching $28.6 billion by 1993.[58] Production stagnated somewhat in the late 1980s with the slowing of the economies in many European countries. However, production reportedly will increase as Greece, Portugal, and Spain upgrade their telecommunications systems, and as Central European countries develop modern infrastructures.

Production costs in European countries often are higher than those found in Japan or East Asia, but are similar to those in the United States. Compared to Japanese firms, European firms tend to be slightly less automated, and the cost of labor generally is higher. Employment in the European telecommunications industry, as in the U.S. industry, is falling due to higher productivity rates and industry consolidation.[59]

European manufacturers benefit from pan-European standardization and regulation of the industry. The European Telecommunications Standards Institute (ETSI) was established in the 1980s to develop standards for manufacturers of telecommunications equipment. ETSI's effort to set a pan-European digital standard for cellular communications equipment, the Global System for Mobile Communications (GSM),[60] has proved beneficial for European manufacturers.[61] Because Europe's early decision on this issue resulted in a commercially viable system, several countries outside Europe have adopted the GSM standard. This is expected to increase economies of scale and reduce production costs for European equipment manufacturers.[62] Other pan-European decisions that benefit the equipment industry include the European Union's terminal equipment directive,[63] which simplifies the type-approval process necessary for bringing CPE to market, and ETSI's work toward a European ISDN system.[64]

Research and development expenditures by European companies have varied over recent years. Both Alcatel and Ericsson have reported growth in spending, with R&D accounting for approximately 9 percent and 15 percent of net sales, respectively, in 1991.[65] In many cases, alliances are formed to share technology for high-cost development processes, such as those required to develop new switches for public networks. For EU-based companies, certain government programs support collaborative R&D for the development of telecommunications equipment. For example, the EU Framework for Research and Development program plans to invest approximately $2.2 billion on information technologies over the next 5 years.[66]

The opening of European markets to competition is forcing domestic equipment suppliers to compete with foreign companies. To take advantage of opportunities, foreign firms (including U.S. firms) are locating manufacturing plants in Europe. In many cases, production facilities are located in southern Europe where labor and startup costs tend to be lowest and sufficient skilled labor is available.[67] In response to increased competition from non-EU companies, European manufacturers are expanding their export

---

[57] Percentages based on 1991 figures. Commission of the European Communities (EC), *Panorama of EC Industry 93*, p. 10-21.

[58] Elsevier, *Yearbook of World Electronics Data 1993*, vol. 1, West Europe, pp. 14-15.

[59] During 1989-92, employment in the telecommunications industry in the European Union (EU) declined at an average annual rate of 1.4 percent. This is slightly lower than the 3.3 percent decline in U.S. employment during the same time period. EC, *Panorama*, pp. 10-22 to 10-24.

[60] This standard originally stood for "Groupe Speciale Mobile" but the name was changed to promote the standard beyond European borders. USITC, *Cellular Communications*, USITC publication 2646, p. 4-14.

[61] While Europe endured a variety of standards for analog cellular communications, it has decided to encourage one standard for digital cellular transmission. EC, *Panorama*, p. 10-23.

[62] All manufacturers benefit from the economies of scale generated by the single standard. Motorola plans to double the capacity of its mobile telephone plant in Scotland in 1994, due to spiralling demand for GSM handsets. Richard Wilson, "GSM Demand Hastens Motorola Expansion," *Electronics Weekly*, Dec. 1, 1993, p. 4.

[63] *Council Directive on the Approximation of the Laws of the Member States Concerning Telecommunications Terminal Equipment, Including Mutual Recognition of Their Conformity, Directive* 91/263/EEC, *Official Journal*, No. L 128, (May 23, 1991), p. 1.

[64] Ellen O'Brien Martz, "ISDN Deployment Moves Slowly but Surely," *TE&M*, Aug. 15, 1993, p. 30. Telecommunications service providers in Europe agreed to implement a standardized "Euro-ISDN" to prevent piecemeal market development within each country. This contrasts with the U.S. demand-driven approach to ISDN, which is less centralized. Ibid., p. 30.

[65] Alcatel, *Prospectus*, 1992, p. 49; Ericsson, *Annual Report*, 1992, p. 19.

[66] Denise Claveloux, "EC Details Fourth Framework Funding Guidelines," *Electronics*, Mar. 28, 1994, p. 12. Funded by EU governments, the overall goal of the framework program is to increase the competitiveness of EU industries through collaborative R&D. Ibid., p. 12.

[67] For example, both Ericsson and AT&T have manufacturing facilities in Spain. EC, *Panorama*, p. 10-24.

focus with the United States and Japan as the principal export markets.

Japan

The telecommunications equipment industry in Japan has expanded significantly since the privatization of telecommunications services.[68] In 1992, 4 of the 20 largest world suppliers of telecommunications equipment were headquartered in Japan. The four, NEC, Fujitsu, Matsushita Electric, and Toshiba, are all significant players in the global industry (see figure 5). Three other large Japanese suppliers, Hitachi, Sumitomo, and Oki Electric, fall within the top 25 global suppliers. Most of these firms manufacture a combination of transmission and switching equipment and CPE. Overall, production decreased slightly during 1991-93, primarily due to economic recessions in Japan and several overseas markets.

The major Japanese producers are similar in many respects to major U.S. telecommunications equipment producers. The above-mentioned Japanese companies are multi-product firms, with revenue from sales of telecommunications equipment accounting for only 10 to 40 percent of overall revenue.[69] Expenditures on research and development by Japanese firms generally mirror the range of spending by top U.S. suppliers. The overall level of R&D spending as a percentage of total revenues reported by Japanese companies ranged from Ricoh's low of 5.5 percent to a high of 17 percent reported by NEC in 1991.[70] Most major Japanese telecommunications companies have reported stable or increasing R&D expenditures in recent years.

Like U.S. companies, Japanese firms are responding to new technologies and service options in the industry. Japanese suppliers are working to meet the growing demand for mobile telephones and pagers. Subscription to these services increased by 43 percent and 14 percent, respectively, during 1991-92.[71] In addition, the Ministry of Posts and Telecommunications is promoting a new "info-communications services infrastructure," which will provide a wide range of communications services across Japan. To this end, the country is working to extend optical fiber to all homes by 2010.[72]

While all large Japanese equipment manufacturers are important suppliers to Japan's primary communications service operator, Nippon Telephone and Telegraph (NTT), most are trying to expand their export focus to take advantage of opportunities in other liberalized and growing markets. For example, NEC is a highly globalized company with subsidiaries and affiliates in 28 countries, including the United States.[73] NEC recently announced plans to transfer its production of ATM switches from Japan to its facility in the western United States, in anticipation of better access to the growing demand in the U.S. market. Fujitsu also is expanding its global presence and has established R&D facilities in Texas and London. In spite of these global efforts, most Japanese production is consumed domestically. NEC, ranked seventh among global equipment suppliers in 1992, receives 75 percent of its overall revenue from domestic sales.[74]

Other Asian Countries

In recent years, Asian countries have become important sites for the production of telecommunications equipment.[75] A considerable portion of Asian production is accounted for by subsidiaries of foreign multinationals, taking advantage of these countries' low production costs and advanced manufacturing skills.[76] Recently, however, local

[68] Over the years, the service industry in Japan has changed from being a government-controlled monopoly, to a public corporation regulated by the Ministry of Posts and Telecommunications (MPT). The public corporation, Nippon Telephone and Telegraph (NTT), was privatized in 1985, following the enactment of the "NTT Corporation Law." Liberalization of the industry was encouraged by Japan's Ministry for International Trade and Industry (MITI), which reportedly expressed fear that the monopoly structure of the industry was hindering innovation among Japanese manufacturers of communications equipment. Industry official, interview with USITC staff, 1991.

[69] Elsevier, *Profile of the Worldwide Telecommunication Industry*, (Oxford, 1992).

[70] These figures represent total spending on R&D, not R&D specifically for communications products. Elsevier, *Profile of the Worldwide Telecommunication Industry*, (Oxford, 1992). Estimates suggest NEC spent 19 percent of net sales on R&D in 1992; 18 percent of R&D spending went directly to research on communications products. Domicity Ltd., *NEC: A Strategic Analysis*, p. 3-4.

[71] Figures compare Sept. 1992 to Sept. 1991. MPT, *Communications in Japan 1993, Summary*, p. 3.

[72] U.S.-Japan Telecommunications Infrastructure Council, Meeting, Sept. 22, 1993. This differs from the U.S. concept of an information superhighway in its treatment of the "fiber-to-the-home" (FTTH) concept. While Japan is promoting FTTH as a mandatory component of the country's infrastructure, the United States has suggested that the private sector should determine the most effective method of providing homes with necessary services. FTTH is not a central component of the U.S. discussion for a superhighway. Ibid., Sept. 22, 1993.

[73] Elsevier, *Profile of the Worldwide Telecommunication Industry*, p. 123.

[74] Motorola, on the other hand, generated approximately 60 percent of its revenues from overseas sales. Motorola Inc., *Annual Report*, 1992, p. 34.

[75] These countries include Hong Kong, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan, and Thailand.

[76] Even within Asia, however, production costs vary. AT&T's decision to transfer the production of its cordless telephones from Singapore to the Indonesian island of Batam is largely due to increasing land and labor costs in Singapore. *East Asian Executive Reports*, Oct. 1991, p. 8.

companies have prospered, taking advantage of Asia's growing and increasingly liberalized market.[77] Although industry officials suggest it is difficult for small start-up companies in Asian countries to compete with established subsidiaries of foreign firms, many are making in-roads through one of three methods: establishing niche markets, building on OEM relationships,[78] or forming partnerships with Western companies.

The sale of niche products has proven successful for firms such as Hong Kong's NUTS Technologies and Champion Technology, which sell desktop videoconferencing systems and multilingual pagers, respectively. Other firms have entered the market by building on existing OEM relationships. These companies initially manufactured products only for other firms, but later marketed products under their own names after establishing a good reputation in the industry. This strategy has reduced the start-up costs traditionally associated with manufacturing new products.

Asian telecommunications firms also rely on partnerships with Western or Japanese companies to establish themselves. Asian firms supply the plant and labor, whereas Western companies generally provide the technology. Companies such as Ericsson, Siemens, and AT&T have entered into joint ventures to increase their presence in the growing Asian market.[79] For example, production in China has increased substantially in recent years as multinationals establish joint manufacturing to supply the rapidly expanding Chinese marketplace. Asian governments facilitate these relationships because they encourage local production and high-tech R&D.

Asian governments are actively encouraging the establishment of globally competitive telecommunications industries.[80] Singapore's government is considering the establishment of a research complex ("TeleTech Park") to be dedicated exclusively to telecommunications and information technology. Tenants of the park would share marketing and testing facilities. Korea's Government, along with Goldstar, Samsung, Daewoo, and Otelco, supports the Electronics and Telecommunications Research Institute, which has developed a digital switching exchange known as "IDX."

U.S. TRADE MEASURES

Tariff Measures

U.S. tariff rates on telecommunications products are comparable to those in many industrialized countries and are low relative to those in many developing countries. The U.S. trade weighted average tariff on telecommunications equipment in 1993 was 4.1 percent ad valorem (see table 3). Under the North American Free Trade Agreement (NAFTA), which entered into force on January 1, 1994, U.S. tariffs on most telecommunications imports from Mexico and Canada were eliminated.[81] Tariffs also will be reduced as a result of the Uruguay Round Agreement (URA).[82] Under the URA, the United States will reduce its telecommunications tariffs by up to 50 percent, depending on the product.[83] The resulting U.S. trade-weighted duty for this sector is expected to decline to approximately 1.6 percent ad valorem.[84]

Nontariff Measures

The U.S. market for telecommunications equipment generally is regarded as open. However, the EU asserts that certain U.S. standards requirements impose unnecessarily high costs on European network equipment suppliers; the EU also asserts that some U.S. standards setting processes lack transparency.[85]

---

[77] Nick Ingelbrecht, "Busy Signals All Over Asia," *Asian Business*, Sept. 1993, p. 57. Regional sales of telecommunications products are expected to reach $16.6 billion by 1995. There are plans for liberalizing telecommunications markets in India, the Philippines, Indonesia, Malaysia, and Singapore. Ibid., p. 57.

[78] Original equipment manufacturers (OEMs) are companies that manufacture products to be sold under another company's name. Harry Newton, *Newton's Telecom Dictionary*, p. 736.

[79] For example, AT&T has formed several joint ventures in Taiwan, including AT&T Taiwan Telecommunications Co. and United Fiber Optic Communications, Inc. AT&T, Form 10-K, *Annual Report to the Securities and Exchange Commission*, 1993, p. 6.

[80] This is particularly true in Singapore, Korea, Hong Kong, and Taiwan. The Government of Singapore, for example, is trying to promote the manufacture of more value-added goods in its country, rather than just labor-intensive products. Singapore officials, interview with USITC staff, May 25, 1994.

[81] U.S. tariffs on telecommunications products imported from Canada were already eliminated, due to the 1989 U.S.-Canada Free Trade Agreement (CFTA). For more information on NAFTA, see USITC, *Potential Impact on the U.S. Economy and Selected Industries of the North American Free-Trade Agreement* (inv. No. 332-337), USITC publication 2596, Jan. 1993.

[82] For more information on the impact of this agreement on the U.S. telecommunications sector, see USITC, *Potential Impact on the U.S. Economy and Industries of the GATT Uruguay Round Agreements* (inv. No. 332-353), Volume I, USITC publication 2790, June 1994.

[83] There are a limited number of products whose tariffs have not been reduced at all, including the majority of fiber optic equipment. Many industry representatives would like to see all telecommunications tariffs worldwide reduced to zero. Industry officials, telephone interviews with USITC staff, Mar. 3 and 4, 1994.

[84] The Uruguay Round Agreement has not yet been approved by Congress.

[85] *1994 Report on U.S. Barriers to Trade and Investment*, (Brussels: Services of the European Commission, 1994), pp. 99-100.

Table 3
Telecommunications equipment: 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 & export 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	
8517.10.00	Telephone sets	8.5%	Free (A*,B,CA,E,IL,J,MX)	189	997
8517.20.00	Teleprinters, including teletypewriters	4.7%	Free (A,CA,E,IL,J,MX)	7	(2)
8517.30.15	Central office switching apparatus	8.5%	Free (A,CA,E,IL,J,MX)	249	49
8517.30.20	Private branch exchange switching apparatus	8.5%	Free (A,CA,E,IL,J,MX)	160	32
8517.30.25	Electronic key telephone systems	8.5%	Free (A,CA,E,IL,J,MX)	8	20
8517.30.30	Other telephonic switching apparatus	8.5%	Free (A,CA,E,IL,J,MX)	102	21
8517.30.50	Telegraphic switching apparatus	4.7%	Free (A,CA,E,IL,J,MX)	191	18
8517.40.10	Modems, of a kind used with data processing machines of heading 8471	4.7%	Free (A,CA,E,IL,J,MX)	443	174
8517.40.50	Other telephonic apparatus, for carrier–current line systems	8.5%	Free (A,B,CA,E,IL,J,MX)	209	206
8517.40.70	Other telegraphic apparatus, for carrier–current line systems	4.7%	Free (A,CA,E,IL,J,MX)	28	13
8517.81.00	Other telephonic apparatus (including intercoms)	8.5%	Free (A,B,CA,E,IL,J,MX)	135	167
8517.82.00	Telegraphic apparatus nesi	4.7%[3]	Free (A,CA,E,IL,J)	158	1,159
8517.82.40	Facsimile machines	4.7%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.82.80	Other telegraphic apparatus	4.7%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.04	Parts of facsimile machines specified in additional U.S. note 7 to this chapter	4.7%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.05	Parts of central office telephonic switching apparatus	8.5%[3]	Free (A,CA,E,IL,J)	(4)	234
8517.90.08	Other parts of facsimile machines	4.7%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.10	Parts of private branch exchange telephonic switching app	8.5%[3]	Free (A,CA,E,IL,J)	(4)	136
8517.90.12	Parts for telephone sets, incorporating printed circuit assemblies	8.5%	Free (A,B,CA,E,IL,J,MX)	(4)	(5)
8517.90.15	Parts of other telephonic switching apparatus	8.5%[3]	Free (A,CA,E,IL,J)	(4)	98
8517.90.16	Parts for teleprinters, including teletypewriters, incorporating printed circuit assemblies	4.7%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.20	Parts of telephonic switching apparatus	(6)		1,008	(7)
8517.90.24	Parts for telephonic switching or terminal apparatus, incorporating printed circuit assemblies	8.5%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.26	Parts for telegraphic switching apparatus, incorporating printed circuit assemblies	4.7%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.30	Parts of telephone sets	8.5%[3]	Free (A,B,CA,E,IL,J)	(4)	122
8517.90.32	Other parts for articles of subheadings 8517.20, 8517.30, 8517.40.50 and 8517.81, incorporating printed circuit assemblies	8.5%	Free (A,B,CA,E,IL,J,MX)	(4)	(5)
8517.90.34	Other parts, incorporating printed circuit assemblies	4.7%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.35	Parts of other telephonic terminal apparatus	8.5%[3]	Free (A,CA,E,IL,J)	(4)	9

See footnotes at end of table.

Table 3—Continued
Telecommunications equipment: 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 & export 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	
8517.90.36	Printed circuit assemblies for telephonic switching or terminal apparatus (other than telephone sets)	8.5%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.38	Printed circuit assemblies for other telephonic apparatus	8.5%	Free (A,B,CA,E,IL,J,MX)	(4)	(5)
8517.90.40	Parts of telephonic apparatus, nesi	8.5%[3]	Free (A,B,CA,E,IL,J)	(4)	566
8517.90.44	Printed circuit assemblies for telegraphic apparatus	4.7%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.48	Parts for printed circuit assemblies for telephonic switching or terminal apparatus (other than telephone sets)	8.5%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.50	Parts of other telephonic apparatus	(6)		633	(7)
8517.90.52	Other parts for printed circuit assemblies for telephonic apparatus	8.5%	Free (A,B,CA,E,IL,J,MX)	(4)	(5)
8517.90.55	Parts of modems of subheading 8517.40.10	4.7%[3]	Free (A,CA,E,IL,J)	(4)	26
8517.90.56	Parts for printed circuit assemblies for telegraphic apparatus	4.7%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.58	Other parts for telephonic switching or terminal apparatus (other than telephone sets)	8.5%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.60	Parts of telegraphic switching apparatus	4.7%[3]	Free (A,CA,E,IL,J)	(4)	12
8517.90.64	Other parts for telephonic apparatus, nspf	8.5%	Free (A,B,CA,E,IL,J,MX)	(4)	(5)
8517.90.66	Other parts for telegraphic apparatus, nspf	4.7%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8517.90.70	Parts of telegraphic terminal apparatus	4.7%[3]	Free (A,CA,E,IL,J)	(4)	8
8517.90.80	Parts of telegraphic apparatus, nesi	4.7%[3]	Free (A,CA,E,IL,J)	(4)	164
8517.90.90	Parts of telegraphic apparatus	(6)		153	(7)
8518.30.10	Telephone handsets	8.5%	Free (A,B,CA,E,IL,J,MX)	8	13
8518.40.10	Audio–frequency electric amplifiers for use as repeaters in line telephony	8.5%	Free (A,B,E,IL,J,MX)	56	7
8518.90.10	Parts of telephone handsets and repeaters	8.5%	Free (A,B,CA,E,IL,J,MX)	8	14
8520.20.00	Telephone answering machines	3.9%	Free (A,E,IL,J,MX) 1.5% (CA)	108	279
8522.90.45	Printed circuit assemblies for use in telephone answering machines	3.9%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8522.90.55	Other parts of telephone answering machines	3.9%	Free (A,CA,E,IL,J,MX)	(4)	(5)
8522.90.60	Parts of telephone answering machines	3.9%[3]	Free (A,CA,E,IL,J)	(4)	5
8525.10.60	Transmitters for radiotelephony and radiotelegraphy	6.0%	Free (A,B,C,CA,E,IL,J,MX)	169	40
8525.10.80	Other transmission apparatus for radiotelephony and radiotelegraphy	6.0%	Free (A,B,C,CA,E,IL,J,MX)	164	42
8525.20.30	Other transceivers	6.0%	Free (A,B,C,CA,E,IL,J,MX)	1,131	533
8525.20.50	Cordless handset telephones	6.0%	Free (A,B,C,CA,E,IL,J,MX)	166	1,054
8525.20.60	Other transmission apparatus incorporating reception apparatus	6.0%	Free (A,B,C,CA,E,IL,J,MX)	1,018	774

See footnotes at end of table.

Table 3—Continued
Telecommunications equipment: 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 & export 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	
8527.31.05	Radiobroadcast receivers designed for connection to telegraphic or telephonic apparatus or instruments or to telegraphic or telephonic networks, combined with sound recording or reproducing apparatus	4.9%	Free (CA,E,IL,J,MX)	(4)	2
8527.90.40	Radiotelephony or radiotelegraphy receivers designed for connection to telegraphic or telephonic apparatus or instruments or to telegraphic or telephonic networks	4.9%	Free (CA,E,IL,J,MX)	26	2
8527.90.80	Other radiotelephonic or radiotelegraphic receivers, nspf	6.0%	Free (A,B,C,CA,E,IL,J,MX)	259	234
8529.10.60	Other antennas and antenna reflectors of all kinds; parts suitable for use therewith	6.0%	Free (A,B,C,CA,E,IL,J,MX)	283	172
8529.90.50	Other parts suitable for use solely or principally with the apparatus of heading 8525 or 8527	5.9%[3]	Free (A,B,CA,E,IL,J)	1,300	581
8529.90.99	Other parts suitable for use solely or principally with the apparatus of heading 8525 or 8527	5.9%	Free (A,B,CA,E,IL,J,MX)	(4)	(5)
8531.80.00	Electrical sound or visual signaling apparatus	2.7%[3]	Free (A,B,C,CA,E,IL,J)	54	357
8531.80.40	Paging alert devices	2.7%	Free (A,B,C,CA,E,IL,J,MX)	(4)	(5)
8543.80.60	Articles designed for connection to telegraphic or telephonic apparatus or instruments or to telegraphic or telephonic networks, nspf	3.9% 2.1%	Free (A,B,CA,E,IL,J,MX) (CA)	(4)	56
8544.20.00	Coaxial cable and other coaxial electric conductors	5.3%	Free (A,B,E,IL,J,MX)	295	116
8544.70.00	Optical fiber cables made up of individually sheathed fibers	8.4%	Free (A,E,IL,J,MX) 3.3% (CA)	163	11
8802.50.30	Communications satellites	Free		371	0
8803.90.30	Parts of communications satellites	Free		155	92
9001.10.00	Optical fibers, optical fiber bundles and optical fiber cables (other than those made up of individually sheathed fibers)	8.4%	Free (A,E,IL,J,MX) 3.3% (CA)	162	79

[1] Programs under which 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 Systems of Preferences (A or A*) Automotive Products Trade Act (B); Agreement on Trade in Civil Aircraft (C); NAFTA, Goods of Canada, under the terms of general note 12 to this schedule (CA); Caribbean Basin Economic Recovery Act (E); United States–Israel Free Trade Area (IL); Andean Trade Preference Act (J); and NAFTA, Goods of Mexico, under the terms of general note 12 to this schedule (MX).
[2] Less than $500,000.
[3] This tariff classification was removed as of Jan. 1, 1994. However, imports during 1993 used this subheading.
[4] No export subheading exists for this HTS classification.
[5] These are new tariff classifications as of Jan. 1, 1994 and no trade occurred under these subheadings in 1993.
[6] There is no Col. 1 rate of duty for this classification because it is an export number only.
[7] No HTS subheading exists for this export classification.

In the area of procurement, the EU and the United States are trying to expand the GATT Government Procurement Code to include utilities, but negotiators currently disagree on coverage for telecommunications products.[86] There is also disagreement on whether government entities at the sub-federal level should be subject to the Procurement Code.[87] The EU also contends that the 6 percent "Buy American" price preference that may be applied by the Department of Defense (DOD) and by Rural Telephone Cooperatives (RTCs)[88] is a nontariff barrier.[89]

U.S. Government Trade-Related Investigations

In recent years, the U.S. International Trade Commission has conducted investigations related to the telecommunications industry under several different authorities. It has conducted six investigations under the U.S. antidumping law (19 U.S.C. 1673), three investigations with respect to allegations of patent infringement under section 337 of the Tariff Act of 1930 (19 U.S.C. 1337), and four fact-finding studies under section 332 of the Tariff Act of 1930 (19 U.S.C. 1332) (see table 4 for a list). The antidumping investigations involved imports of paging devices from Japan, cell-site radio transceivers and cellular mobile telephones from Japan, and telephone systems and subassemblies from Japan, Korea, and Taiwan.[90] The U.S. Department of Commerce found dumping and the Commission made affirmative injury determinations in all six antidumping cases. As a result, Commerce issued antidumping orders. Table B-1 in Appendix B lists the products involved in these cases, along with the original and current dumping margins.

In 1989, the Commission investigated allegations of patent infringement involving certain cellular and radiotelephones, subassemblies, and components. Motorola alleged that Nokia Corp. and Tandy Corp. were infringing seven U.S. patents pertaining to cellular phones. Although the Commission initially issued a temporary limited exclusion order and a temporary cease and desist order, these orders were vacated after the parties reached a settlement agreement. In a 1992 investigation, SGS-Thomson alleged that imports of certain telecommunications chips and products containing these chips infringed several U.S. patents. The Commission found that imports infringed two of the three patents and issued a limited exclusion order in mid-1993. Finally, Farrallon Computing Inc. alleged in 1993 that imports of certain devices for connecting computers via telephone lines were infringing a patent owned by Farrallon. Although many of the respondents (Taiwanese manufacturers, resellers, and U.S. importers) have settled, Farrallon continues to seek a general exclusion order from the Commission.

At the request of the Senate Committee on Finance for a series of studies on the global competitiveness of U.S. advanced-technology manufacturing industries, the Commission has completed two recent reports on telecommunications. The first, issued in 1991, covers communications technology and equipment. The second study, published in 1993, addresses the cellular communications industry.

FOREIGN TRADE MEASURES

Tariff Measures

Tariff treatment of telecommunications equipment by primary U.S. trading partners varies significantly. Japan and Canada, the largest foreign markets for U.S. exports, impose no tariffs on telecommunications equipment.[91] However, tariffs for most

[86] EU and U.S. officials, telephone interviews with USITC staff, May and June 1994.

[87] The EU seeks to have private telecommunications providers included under the GATT Government Procurement Code (the Code) if they operate under monopoly or dominant conditions. Conversely, the United States contends that only public agencies should be subject to the Code. Further, the EU seeks to extend the Code to cover entities at the sub-federal level, including U.S. state and city governments. (EU official, telephone interview with USITC staff, May 1994.) Bilateral negotiations on this issue are linked to U.S. concerns over the European Utilities Directive, which permits price discrimination in favor of EU telecommunications products in public procurement bids (see section on Foreign Nontariff Measures).

[88] The Buy American Act of 1933 (BAA) requires U.S. Government agencies to purchase domestic goods and services, unless such purchases are considered unreasonable or contrary to public interest. Under the Trade Agreement Act of 1979, the BAA provisions are waived for purchases by most Federal agencies for products originating in Code signatory countries, where the procurement exceeds a certain threshold. Although the Trade Agreement waiver does not apply to defense procurement that is exempted from Code coverage, the BAA preference applied by DOD can be waived through Memoranda of Understanding with NATO allies. Similar "Buy American" restrictions apply to RTCs for purchases made with loans administered by the Rural Electrification Administration (CFR, Title 7, Part 1700). In addition to Federal "Buy American" restrictions, some states also impose "Buy American" provisions.

[89] *1994 Report on U.S. Barriers to Trade and Investment,* (Brussels: Services of the European Commission, 1994), pp. 99-100.

[90] For complete cites to each of these reports, see table 4.

[91] Japan lists tariffs ranging from 0 to 4.2 percent for telecommunications equipment, but the effective rate of duty has been zero for the past several years. Canadian tariffs on telecommunications products imported from the United States were reduced to zero following the 1989 U.S.-Canada Free Trade Agreement (CFTA).

Table 4
U.S. International Trade Commission investigations related to the telecommunications industry

Report	Country	Year	Inv. Number	Report No.
Title VII Investigations				
Paging devices	Japan	1982	731-TA-102(P)	USITC 1295
Paging devices	Japan	1983	731-TA-102(F)	USITC 1410
Cell-site radio apparatus	Japan	1984	731-TA-163(P)	USITC 1488
Cell-site radio transceivers	Japan	1984	731-TA-163(F)	USITC 1618
Cellular mobile telephones	Japan	1984	731-TA-207(P)	USITC 1629
Cellular mobile telephones	Japan	1985	731-TA-207(F)	USITC 1785
Cellular mobile telephones	Japan	1989	731-TA-207(F/R)	USITC 2155
Telephone systems and subassemblies	Japan, Korea, & Taiwan	1989	731-TA-426/428 (P)	USITC 2156
Telephone systems and subassemblies	Japan &Taiwan	1989	731-TA-426 & 428 (F)	USITC 2237
Telephone systems and subassemblies	Korea	1990	731-TA-427 (F)	USITC 2254
Section 337 Investigations				
Cellular radiotelephones	Japan	1991	337-TA-297	USITC 2361
Certain integrated circuit telecommunication chips and products containing same, including dialing apparatus	Taiwan	1992	337-TA-337	USITC 2670
Certain devices for connecting computers via telephone lines	Taiwan	1993	337-TA-360	[on-going]
Section 332 Investigations				
Telecommunications industry	(1)	1984	332-172	USITC 1542
Optical fibers, technology, and equipment, U.S. competitiveness	(1)	1988	332-233	USITC 2054
Communications technology and equipment	(1)	1991	332-301	USITC 2439
Cellular communications	(1)	1993	332-329	USITC 2646

[1] Not applicable.

Source: USITC staff.

telecommunications goods entering the European Union range from 5 to 7.5 percent ad valorem.[92] Tariffs imposed by emerging markets, such as Brazil, Indonesia, Malaysia, and China range up to 30 percent ad valorem. Rates in India are substantially higher, reaching 130 percent ad valorem for some products.[93]

Under NAFTA, which entered into force on January 1, 1994, Mexico agreed to reduce tariffs on imports of U.S. telecommunications equipment. Approximately 80 percent of current U.S. telecommunications equipment exports (by value) now enter Mexico duty-free, including transmission equipment, PBXs, cellular phones, and modems. Mexican tariffs on most other U.S. telecommunications exports are to be phased out over 5 years; Mexican tariffs on certain paging devices, certain coaxial cables, and antennas are to be phased out over 10 years.[94]

Under the Uruguay Round Agreement (URA) of the General Agreement on Tariffs and Trade (GATT), foreign tariffs on telecommunications equipment are to

[92] The one exception is for radio receiver equipment, which faces a 14 percent tariff rate.

[93] Industry official, telephone interview with USITC staff, Mar. 1994.

[94] U.S. Department of Commerce, *NAFTA Opportunities, Telecommunications Sector*, p. 2. NAFTA also benefits U.S. manufacturers through its nontariff provisions. The agreement explicitly prevents the use of standards as a nontariff barrier to trade with Mexico. In addition, it improves the transparency of Mexico's standards-development process, which should ensure that the only line connection standards for telecommunications equipment are those directly related to safety. See USITC, *Potential Impact on the U.S. Economy and Selected Industries of the North American Free-Trade Agreement* (inv. No. 332-337), USITC publication 2596, Jan. 1993.

be reduced by up to 50 percent.[95] Lower foreign tariffs are expected to benefit U.S. exports, particularly in the increasingly price-sensitive area of fiber optics. In addition, as developing countries reduce traditionally high tariffs on telecommunications equipment, the ability of U.S. companies to enter these markets will be greatly enhanced.[96]

Nontariff Measures

Traditionally, government-owned telecommunications carriers have maintained exclusive supplier relationships with their domestic equipment manufacturers, thus limiting sales opportunities for foreign suppliers. Nontariff barriers such as these are being eliminated slowly as telecommunications markets are opened to competition. However, suppliers reportedly still face nontariff barriers in a number of countries, including preferential procurement policies in the European Union, Korea, and Japan. Different standards, testing, and certification requirements among countries also have acted as impediments to trade in certain markets, including Korea.[97]

European Union (EU)

On January 1, 1993 the Utilities Directive of the European Union (formerly the European Community) entered into effect.[98] This directive opened the region's government-owned utilities (water, transport, energy, and telecommunications) to competitive bidding procedures, effectively terminating the traditional preferences extended to national suppliers over other European suppliers.[99] However, the directive permits continued discrimination against non-EU firms, including U.S. firms, by allowing EU utilities to exclude bids having less than 50 percent EU content by value. Further, EU utilities must accord "European" bids a 3-percent price preference over non-EU bids. Because government-owned utilities represent the largest market for telecommunications equipment in the European Union, U.S. telecommunications producers have protested the discriminatory provisions of this directive.

The discriminatory aspects of the Utilities Directive initially were cited by the Office of the U.S. Trade Representative (USTR) in a February 1992 report on the government procurement policies of the EU.[100] In April 1992, the President announced plans to institute sanctions by January 1993 if the EU implemented the directive with its discriminatory provisions.[101] Following several rounds of unsuccessful negotiations in 1992, the EU permitted the directive to enter into force on January 1, 1993.[102] Thereafter, the President announced that he would take retaliatory action under Title VII of the Omnibus Trade and Competitiveness Act of 1988.[103] The action,

---

[95] All non-agricultural tariff reductions are scheduled to occur within four years of the implementation of the Uruguay Round Agreements. In addition to tariff reductions, the URA also is expected to benefit U.S. manufacturers through its market access provisions. Agreements to work toward harmonizing and simplifying rules of origin and to strengthen protection of intellectual property rights also are expected to improve the trading environment for U.S. companies. For further information, see USITC, *Potential Impact on the U.S. Economy and Industries of the GATT Uruguay Round Agreements* (inv. No. 332-353), Volume I, USITC publication 2790, June 1994.

[96] Industry officials, telephone interviews with USITC staff, Mar. 1994.

[97] Office of the United States Trade Representative (USTR), *1990 National Trade Estimate Report on Foreign Trade Barriers*, pp. 131-132; and USTR, *1992 National Trade Estimate Report on Foreign Trade Barriers*, p. 166.

[98] For a complete text of this EU directive, see *Council Directive of 17 September 1990 on the Procurement Procedures of Entities Operating in the Water, Energy, Transport and Telecommunications Sectors*, 90/531/EEC *Official Journal of the European Communities*, (*OJ*) No. L 297 (Oct. 29, 1990), pp. 1-47. For more information on this directive and its implications, see USITC, *The Effects of Greater Economic Integration Within the European Community on the United States: Fourth Followup Report* (inv. No. 332-267), USITC publication 2501, April 1992, p. 6-4.

[99] USITC, *The Year in Trade 1993*, USITC publication 3769, June 1994, p. 81. Government-owned utilities in the EU are not currently governed by the GATT Government Procurement Code. In the past, many EU member state governments have extended preferences to national suppliers. Ibid., p. 81.

[100] Title VII of the Omnibus Trade and Competitiveness Act of 1988 requires the President to submit annual reports to the Congress on the extent to which countries discriminate against U.S. products or services in their government procurement practices. The U.S. Government reviews global procurement practices every April. An early review took place in January 1992 on the procurement practices of the EU in telecommunications and heavy electrical equipment; this report cited discriminatory practices. USTR, *1993 National Trade Estimate Report on Foreign Trade Barriers*, p. 86.

[101] USTR, "USTR Factsheet: Title VII Announcement," press release supp., Feb. 1, 1993. The delay was to allow time for U.S. and EU negotiators to complete negotiations on the Government Procurement Code and parallel telecommunications negotiations.

[102] The EU has requested changes in U.S. procurement practices before it considers revising its Utilities Directive. The EU points to the price preferences imposed by the Buy American Act and to practices of sub-federal procurement bodies as discriminating against EU firms. European Commission Delegation, "Progress Report on EU-US Relations," Office of Press and Public Affairs, Washington, May 1994; and U.S. Department of State Telegram, Feb. 1, 1993, Brussels, Belgium, message ref. No. 01399.

[103] USTR, "Implementation of Sanctions With Respect to the European Community Pursuant to Title VII of the Omnibus Trade and Competitiveness Act of 1988," 58 F.R. 31136, May 28, 1993.

which became effective May 28, 1993 and remains in effect, prohibits U.S. federal agencies from procuring products and services from eight EU countries.[104] This action is expected to affect an estimated $20 million worth of EU goods and services annually and reportedly will remain in effect until an agreement is concluded.[105]

Korea

In 1989, the United States cited Korea for unfair trade practices regarding U.S. telecommunications equipment and designated Korea as a priority country for telecommunications negotiations under section 1374(a) of the Omnibus Trade and Competitiveness Act of 1988. U.S. officials charged that Korean telecommunications carriers provide unfair preferences to national suppliers and impede imports through nontransparent standards, testing, and certification procedures. During two years of negotiations, the United States and Korea concluded a series of telecommunications agreements. In February 1990, the United States and Korea concluded a bilateral agreement that provides for the liberalization of the Korean telecommunications market.[106] The agreement provided U.S. firms with greater access, beginning in 1992, to telecommunications contracts to be awarded by the Korean Office of Supply (OSROK), the Ministry of Communications, and the Korean Telecommunication Authority. Korea also agreed to include these entities in its GATT Procurement Code offer, which it formally submitted in June 1990. Korea also agreed to improve the transparency of its standard-setting process.[107]

[104] The sanctions prohibit procurement of EU telecommunications equipment and certain other types of products and services. The sanctions do not affect products covered by the GATT Government Procurement Code nor any products covered by defense or security-related agreements. USTR, "Implementation of Sanctions," 58 F.R. 31136, May 28, 1993. The sanctions do not affect U.S. purchases from Spain, Portugal, or Greece, since those countries have not yet implemented the directive. The United States no longer imposes sanctions against Germany, since Germany agreed not to enforce Article 29 of the directive. USTR, "U.S.-Germany Announce Bilateral Agreement on Government Procurement," press release 93-38, June 10, 1993.

[105] Negotiations currently are stalemated, but are expected to resume in the future. U.S. Government official, telephone conversation with USITC staff, June 1994.

[106] USTR, *1990 National Trade Estimate Report on Foreign Trade Barriers*, pp. 131-132; and USTR, *1992 National Trade Estimate Report on Foreign Trade Barriers*, p. 166.

[107] USTR, *1990 National Trade Estimate Report on Foreign Trade Barriers*, pp. 131-132; and USTR, *1992 National Trade Estimate Report on Foreign Trade Barriers*, p. 166.

Japan

Japanese procurement of U.S. telecommunications equipment has been the subject of numerous negotiations, bilateral agreements, and monitoring efforts. Nippon Telephone and Telegraph Corporation (NTT) was a government-owned monopoly until its privatization in 1985. NTT primarily purchased equipment from a "family" of Japanese suppliers.[108] As part of the Tokyo Round Agreement, however, Japan agreed to open procurement to foreign bidders. This commitment was strengthened in 1980 when the United States and Japan signed the NTT Procurement Procedure Agreement, which called for national treatment for foreign firms responding to NTT's procurement requests.[109] The United States and Japan have since renewed this agreement on several occasions.[110] Telecommunications was also one of four sectors targeted for market-opening discussions in 1985.[111] In 1986, U.S. and Japanese officials reached a market-oriented, sector specific (MOSS) agreement addressing a number of telecommunications market access concerns.[112]

In spite of these agreements, difficulties in gaining access to Japan's market remain. Beginning in 1985, Motorola raised concerns over the issue of standards for cellular equipment. Japan effectively restrained sales of Motorola's equipment by limiting the geographic areas that could be served by a carrier using Motorola's cellular standard. Progress was made in the 1989 Third Party Radio and Cellular Agreement, in which Japan agreed to allow access to its cellular telephone and network equipment market. In spite of this agreement, the designated Japanese carrier delayed installation of Motorola's system, allowing time for Japanese competitors to develop competitive handheld phones.[113] Following threats of sanctions,[114] an

[108] Within this family of suppliers were NEC, Fujitsu, Oki, Hitachi, and Matsushita.

[109] This agreement largely was prompted by Motorola's efforts to enter the Japanese market for pagers.

[110] Although the agreement remains in place, U.S. firms continue to report difficulties in entering Japan's public procurement market. See USTR, *1994 National Trade Estimate Report on Foreign Trade Barriers*, p. 158.

[111] In addition to telecommunications, discussions were held on electronics, pharmaceuticals/medical equipment, and forestry products.

[112] The MOSS agreement called for a reduction in the number of technical standards for radio equipment (receivers); simplification of the procedure for approval and certification of equipment; abolition or simplification of certain restrictions on the entry of new corporations into the telecommunications market; opening of the radio communications service market; and transparency in policy decision procedures. MPT, *Telecommunications Market of Japan*, Jan. 1992, p. 4.

[113] USTR, "Fact Sheet on Origin and Implementation of the 1989 Cellular Telephone Agreement by Japan," Feb. 1994.

[114] USTR, "Statement of Ambassador Michael Kantor," press release 97-07, Feb. 15, 1994.

agreement was reached in early 1994 that specified a schedule for the completion of the cellular system.[115] U.S. firms' access to the Japanese market continues to be reviewed every year under section 1377 of the Omnibus Trade and Competitiveness Act of 1988.

U.S. MARKET

Consumption

The U.S. market for telecommunications equipment is the largest in the world, reaching an estimated $34.1 billion in 1993 (see table 5). During 1989-93, the fastest growing sectors of the market included emerging technology equipment,[116] call and voice processing equipment, fax equipment, and mobile communications equipment (see table 6). For 1994-97, the fastest growing market segments are projected to be network equipment, fax equipment, and call and voice processing equipment.

The import penetration level for the industry as a whole has increased slightly in recent years, reaching an estimated 25 percent in 1993. On a sector level, import penetration is higher in customer premises equipment than in network equipment. High wages and technological expertise make the United States best suited for the manufacture of more sophisticated products, such as network equipment. By contrast, in the price sensitive market for CPE equipment, products manufactured in U.S. factories tend to be less price competitive with imports from Asia and other low-wage regions. Despite relatively low import penetration levels overall, however, U.S. subsidiaries of foreign firms producing telecommunications equipment in the United States hold significant shares of certain product markets. For example, although Motorola is the largest supplier of cellular telephones for the United States, cellular phones made by Japanese-based NEC and Oki are the second and third most widely available brands.[117] In the PBX market, AT&T dominates with a 28 percent share, but is followed by Canadian-based Northern Telecom (25 percent) and European-based Rolm/Siemens (15 percent).[118] Among vendors of central office switches, AT&T again dominates with a 42 percent share of the U.S. market, but Northern follows with 39 percent and Ericsson holds a 6 percent share. The success of foreign companies is largely due to the relative openness of the U.S. telecommunications market.

Production

U.S. production of telecommunications equipment totalled $35 billion in 1993 (see table 5).[119] Figure 6 shows the breakdown of shipments by sector. Wireline switching and transmission equipment accounted for 19 percent and 10 percent of the total, respectively.

[115] USTR, "United States - Japan Arrangement on Cellular Telephone Systems," Mar. 12, 1994.

[116] The emerging technology market includes frame relay equipment, T1 and T3 multiplexers, and fiber optic equipment. This type of equipment is necessary to operate advanced services, such as packet switching, frame relay service, and ATM service. NATA, *Market Review 1994*, p. 108.

[117] NATA, *Market Review 1994*, pp. 91. The same is true for pagers. Motorola holds 86 percent of the U.S. market for pagers, but NEC is in second place (10 percent) and Uniden and Panasonic make up the remainder. Ibid., p. 100.

[118] NATA, *Market Review 1994*, p. 153.

[119] U.S. Department of Commerce data. This figure encompasses SIC product codes 36611 (switching and switchboard equipment), 36613 (carrier line equipment and modems), 36614 (other telephone equipment and components), 36631 (mobile/cellular systems equipment) and 36693 (intercommunications systems).

Table 5
Telecommunications equipment: U.S. producers' shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1989-93

Year	Producers' shipments[1]	Exports	Imports	Apparent consumption	Ratio of imports to consumption
		Million dollars			*Percent*
1989	29,127	4,973	6,518	30,672	21.3
1990	30,846	6,220	6,545	31,171	21.0
1991	31,456	6,568	6,853	31,741	21.6
1992	33,678	7,720	7,882	33,840	23.3
1993	35,025	9,571	8,692	34,146	25.5

[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.

Table 6
Telecommunications equipment: Selected U.S. product markets, 1989-97

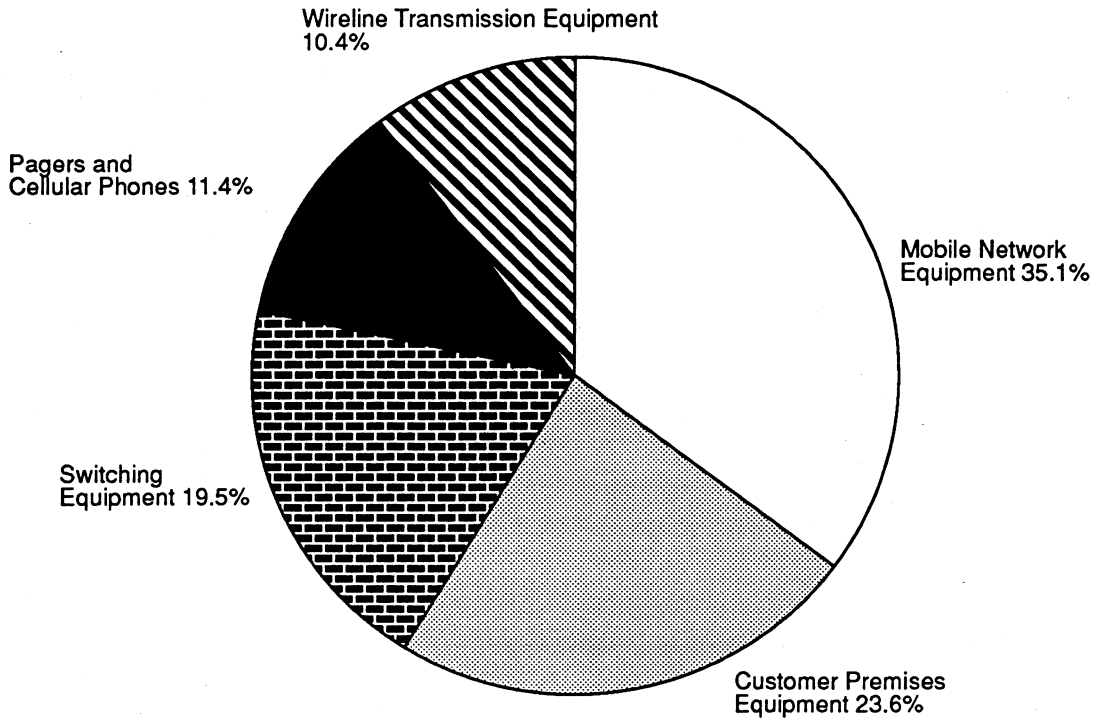
	1989	1990	1991	1992	1993	1994[1]	1995[1]	1996[1]	1997[1]	CAGR[2] '89-93	CAGR[2] '94-97
	Million dollars									*Percent*	
Network equipment	10,294	10,793	10,165	11,093	12,607	14,375	16,458	18,896	24,702	5.2	19.8
Emerging technology equipment	0	3,793	4,289	4,871	5,598	6,407	7,328	8,280	9,158	13.9	12.6
Mobile communications equipment	2,850	3,275	3,582	3,871	4,180	4,511	4,886	5,367	6,003	10.0	10.0
Facsimile equipment	2,304	2,563	2,739	3,356	4,123	5,078	6,265	7,742	8,656	15.7	19.5
Call/Voice processing equipment	1,590	2,213	2,542	2,958	3,381	3,874	4,448	5,118	5,902	20.8	15.1
Consumer telecom equipment	1,797	2,069	2,120	2,170	2,333	2,557	2,670	2,823	3,003	6.7	5.5
Private branch exchanges	2,596	2,320	2,001	1,934	1,976	2,037	2,116	2,105	2,111	-6.6	1.2
Key/Hybrid telephone systems	2,093	2,012	1,640	1,648	1,801	1,830	1,856	1,872	1,885	-3.7	1.0
Public payphones	410	438	460	462	464	466	469	471	474	3.1	0.6

[1] Data for 1994-97 are estimated.

[2] Compound annual growth rate.

Source: North American Telecommunications Association.

Figure 6
Telecommunications equipment: U.S. shipments by product type, 1992



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

Customer premises equipment accounted for 24 percent of the total, while mobile communications systems[120] and cellular equipment accounted for 35 percent and 11 percent of the total, respectively. Within the CPE sector of the industry, most shipments were in higher-end, software-intensive product areas, such as data communications equipment and voice processing equipment.

The sectors experiencing the highest growth rates in terms of shipments are newer products used to enhance the productivity of businesses and/or to transmit data, such as videoconferencing products. Each of these sectors grew at compound annual growth rates of between 20 and 40 percent during 1991-92.

Imports

U.S. imports of telecommunications equipment reached $8.7 billion in 1993 (see table 7). While the United States imports products in every segment of the industry, the largest share of imports, over 80 percent, is accounted for by low-end customer premises equipment (e.g., fax machines and cordless telephones). Imports of high-end network equipment (including switching and transmission equipment) accounted for less than 20 percent of total imports.

Reflecting the growth of the industry overall, imports increased at an average annual rate of 7.5 percent between 1989 and 1993. Imports of cordless phones and fax machines increased by more than 100 percent during 1992-93, while imports of cellular telephones increased by over 70 percent. Imports of CO switches, PBXs, and key systems declined by 8 percent on average during 1989-93.

In 1993, the major suppliers to the U.S. market were Japan, Canada, China, Malaysia, Taiwan, and Mexico. The high level of imports from Mexico and East Asia principally reflects their competitive advantage in the manufacture of low-end, price-sensitive customer premises equipment, such as telephone sets and answering machines. Japan and Canada are large suppliers of telecommunications parts for the U.S. market. Some suppliers to the U.S. market, such as Canada, Malaysia, Mexico, the Philippines, Israel, and Thailand, enjoy duty-free status for most of

[120] Includes satellites, radio base station equipment, and other communications systems.

Table 7
Telecommunications equipment: U.S. imports for consumption, by principal sources, 1989-93[1]

Source	1989	1990	1991	1992	1993
	Value (million dollars)				
Japan	2,498	2,192	2,266	2,569	2,842
Canada	650	777	825	1,005	1,210
China	314	416	492	564	776
Malaysia	264	419	531	643	678
Taiwan	460	413	361	473	411
Mexico	151	164	194	258	388
Philippines	93	125	149	212	304
Israel	133	118	147	249	294
Thailand	78	142	217	273	284
Korea	474	384	309	303	280
All other	1,403	1,394	1,363	1,331	1,225
Total	6,518	6,545	6,853	7,882	8,692

[1] Includes imports of telecommunications equipment classified in the HTS categories listed in table 3.

Note.—Due to rounding, figures may not add to the totals shown.

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

their telecommunications shipments. In 1993, 32 percent of U.S. telecommunications equipment imports entered duty free.[121]

FOREIGN MARKETS

Foreign Market Profile

Export opportunities are expanding as foreign telecommunications service markets are liberalized, as countries modernize existing telecommunications infrastructures or build new ones, and as new services (e.g., PCS and multimedia) create demand for new equipment. Table 8 shows low or negative market growth rates between 1990 and 1993; however, analysts expect higher growth rates between 1993 and 1996 as emerging markets expand and modernize infrastructures and as demand in developed countries grows for mobile communications and other new services

Canada, Mexico, Japan, and the European Union are important markets for U.S. telecommunications equipment. In addition to these established markets, however, U.S. manufacturers are also targeting emerging markets in Central Europe and Latin America. U.S. firms are well-positioned to take advantage of new market opportunities for two reasons. First, U.S. suppliers have been exposed to competition since the early 1980s and have competed within a relatively large and demanding domestic market. This experience provides an advantage over some suppliers that only recently have encountered competition in their home markets. Second, many opportunities exist for products that incorporate cutting-edge technology and advanced software (e.g., satellites, digital switches, data communications equipment), areas in which U.S. suppliers excel. This section reviews the types of opportunities that exist in both developed markets, such as Western Europe, Japan, and Canada, and in emerging markets, such as Central Europe, China, and Latin America.

Western Europe

While the telecommunications infrastructure in Western Europe is already well-developed, two trends suggest new opportunities for U.S. telecommunications equipment suppliers over the long term. First, as an increasing number of European countries open their markets, opportunities for foreign suppliers likely will grow.[122] Second, the market for mobile telecommunications is continuing to expand across Europe.

In spite of these long-term opportunities, demand for telecommunications equipment in Western Europe likely will remain weak for the short term due to slow economic growth. The anticipated average annual

[121] Mexico, Canada, Israel, GSP countries, CBERA countries, and Andean Trade Pact countries enjoy duty free status for the majority of their telecommunications shipments to the United States. GSP refers to the Generalized System of Preferences; for a complete listing of these countries, see the Harmonized Tariff Schedule of the United States. CBERA refers to the Caribbean Basin Economic Recovery Act. Countries of the Andean Trade Preference Act include Bolivia, Colombia, Ecuador, Peru, and Venezuela. See Appendix A, "Tariff and Trade Agreement Terms," for further explanation.

[122] Industry official, telephone interview with USITC staff, Mar. 3, 1994. Industry analysts note that the EU market would have expanded more rapidly for foreign suppliers if an agreement had been reached on the issue of government procurement. Ibid., Mar. 1994. See section on Foreign Nontariff Measures.

Table 8
Telecommunications equipment: International markets for selected products, 1990-96[1]

	1990	1991	1992	1993[2]	1994[2]	1995[2]	1996[2]	CAGR[3] '90-93	CAGR[3] '93-96
	Million dollars							*Percent*	
Western Europe	26,952	27,254	26,838	26,976	27,355	27,829	28,282	0.0	1.6
Japan	11,110	11,956	10,281	9,778	9,867	10,059	10,267	-4.2	1.6
Mexico	2,330	2,382	2,466	2,564	2,667	2,757	([4])	3.2	[5]3.7
Canada	2,032	2,000	1,957	1,939	1,974	1,991	1,974	-1.5	0.6
ASEAN countries	1,592	1,671	1,714	1,773	1,841	1,901	1,951	3.7	3.2
Central Europe	1,388	1,319	1,141	1,545	1,667	1,810	1,997	3.6	8.9
Korea	1,454	1,507	1,490	1,460	1,450	1,435	1,420	0.1	-0.9
Brazil	1,324	1,290	1,200	1,160	1,180	1,200	1,220	-4.3	1.7
China	900	950	1,000	1,050	1,100	1,150	([4])	5.3	[5]4.7
India	631	537	480	502	520	542	564	-7.3	4.0
Venezuela	140	147	154	161	164	167	170	4.8	1.8

[1] Includes HTS headings 8517 and 8520.
[2] Data for 1993-96 are estimated.
[3] Compound annual growth rate.
[4] Not available.
[5] CAGR for 1993-95.

Source: Elsevier, *Yearbook of World Electronics Data* 1993.

growth rate of the market is just 2 percent during 1993-96.[123] The market for fiber optic equipment reportedly is saturated, although opportunities for other types of transmission equipment, such as line terminals and multiplexers, appear promising. The market for cellular equipment is expected to expand more rapidly than the overall market. Motorola remains the dominant supplier of cellular phones for Europe (30 percent share) followed by Ericsson, Siemens, and Nokia.[124]

Canada

As competition expands in the Canadian market, new opportunities are created for U.S. exports. Two recent events have contributed to this trend. First, the Canadian Radio-Television and Telecommunication Commission (CRTC) opened Canada's long distance services to competition in 1992. The introduction of a new long-distance carrier, Unitel, to compete with Bell Canada (BC) resulted in increased opportunities for both domestic and foreign equipment suppliers. AT&T acquired a 20 percent share of Unitel in early 1993, thus establishing a foothold for its technology and equipment in Canada.[125]

The second opportunity for U.S. equipment manufacturers stems from the termination of the Bell Canada-Northern Telecom "preferred-supplier" relationship. For 55 years this relationship allowed BC, which controls 60 percent of the Canadian telecommunications market, to seek proposals from Northern before turning to outside suppliers for its equipment purchases. U.S. companies reported that this relationship made it extremely difficult to compete in the Canadian market, particularly in the area of network equipment.[126] Following considerable debate over the issue, U.S. and Canadian officials reached an understanding. Effective March 31, 1994, the Canadian Government agreed to have the CRTC ensure competitive procurement practices by BC.[127] U.S. manufacturers, already competitive with Northern's telecommunications products in the United States, expect to expand their share of the Canadian market.

NAFTA, which became effective January 1, 1994, also is expected to result in increased U.S. exports to Canada. Although the 1989 Canadian Free-Trade Agreement (CFTA) already had eliminated tariffs on telecommunications equipment, cumbersome rules of origin prevented U.S. companies from taking full advantage of the new trading environment. The rules of origin found in the NAFTA, however, are considerably clearer. U.S. companies are optimistic that NAFTA's simplified rules of origin will be beneficial for U.S. exporters to the Canadian market.[128]

Japan

The United States exports over $500 million in telecommunications equipment to the Japanese market annually. Although Japan currently is trying to recover from a recession, it continues to be an important market for many types of U.S. telecommunications equipment, particularly cellular equipment. The cellular communications industry has not been adversely affected by the economic slowdown in Japan, and U.S. manufacturers enjoy a strong competitive position in the Japanese market. The decision by the Ministry of Posts and Telecommunications (MPT) to liberalize the Japanese digital cellular service market, coupled with the country's enthusiasm for mobile communications, has led to expanded opportunities for suppliers of mobile equipment.[129] Japanese manufacturers of cellular phones (NEC and Fujitsu) and pagers (NEC and Matsushita) will therefore encounter renewed competition in the cellular market from U.S. firms.[130]

In addition to the growing cellular market, two new telecommunications projects in Japan could increase opportunities for U.S. companies. Proposals for an "Info-Communications Services Infrastructure" and a Personal Handy-phone System (PHS) system resemble U.S. strategies for an information superhighway and PCS system, respectively. Based on U.S. strengths in both fiber optics and wireless equipment, U.S. companies are considered to be well-positioned to respond to demands created by these projects.[131]

---

[123] U.S. Department of Commerce, International Trade Administration (ITA), *Report on European Telecommunications Market 1993*, Market Research Reports, Nov. 12, 1993.

[124] Department of Commerce, "Telecommunications Market Overview," *Market Research Report*, Nov. 1993.

[125] Unitel is placing powerful AT&T switches in Toronto, Vancouver, and Montreal. Daniel Briere, "AT&T and MCI Head North of the Border," *Network World*, May 3, 1993, p. 22.

[126] Industry official, telephone interview with USITC staff, Sept. 29, 1993.

[127] USTR, "Statement by United States Trade Representative Michael Kantor on the Termination of the Bell Canada/Northern Telecom "Preferred-Supplier" Relationship," Mar. 29, 1994.

[128] Industry official, telephone interview with USITC staff, Oct. 5, 1993.

[129] Japan has chosen a digital cellular standard similar to the TDMA standard. U.S. manufacturers should benefit from similar standards, though it will also benefit Japanese manufacturers wishing to penetrate the U.S. market.

[130] Department of Commerce, "Japan: Communications Equipment Imports," *Market Research Report*, July 1993.

[131] Some U.S. firms report disappointment with NTT's limited foreign procurement related to Japan's information highway, especially since fiber optic technology is an area in which U.S. firms excel. USTR, *1994 National Trade Estimate Report on Foreign Trade Barriers*, p. 159.

Central Europe and the Former Soviet Union

Opportunities for U.S. telecommunications companies abound in Central Europe and the former Soviet Union. Existing wireline infrastructures in this region are limited, with only 11 to 15 lines per 100 people (compared to 43-50 lines per 100 people in Western Europe and the United States).[132] The Soviet equipment used to create these networks is long-outdated,[133] and financial resources required for upgrades and replacement parts are scarce. Consequently, the countries of Central Europe and the former Soviet Union are working to improve the situation through two methods. First, local telecom authorities are forming joint ventures with many Western companies in order to update existing wireline systems. Second, many countries are installing cellular systems as a faster and less expensive method of developing a nation-wide telecommunications infrastructure.[134]

Joint ventures have been formed in Moscow and St. Petersburg to provide international wireline connections for businesses.[135] Western companies participating in these ventures include Alcatel, GTE, and British Telecom.[136] US West has cooperated with the Russian Ministry of Telecommunications and Intertelecom (a joint venture among regional operators) to install two digital switches in Moscow and one in St. Petersburg. These switches will service 4,500 and 3,000 lines, respectively, and are expected to double international calling capacity. Likewise, Central European cities are constructing new digital switches and installing fiber optic cables to reduce the strain on existing analog networks.[137] Western companies have been slower to invest outside of metropolitan cities, due to high risk and low profit potential.

Because of the delay and high cost associated with improving wireline networks, most private investment has been in wireless communications. Across Russia, the Baltics, and Central Europe, mobile networks are expanding rapidly, providing an interim solution to the region's antiquated communications infrastructure. Western companies are eager to supply these markets for several reasons.[138] First, telecom joint ventures provide a foothold in what is eventually expected to be a lucrative market. Second, these countries provide an outlet for older generation products, such as analog cellular phones.[139] And finally, returns for service providers are large since, for many subscribers, the cellular phone is their sole source of communication.[140]

Cellular systems have been installed in Central Europe and the former Soviet Union primarily through partnerships between local governments and foreign service providers. WesTel, a venture between US West and the Hungarian Telephone Company, received the first license for mobile operation in the region in 1989. Today, there are 11 mobile systems in operation, serving over 60,000 subscribers in Central Europe. The U.S. RHCs have been particularly successful in winning licenses in these regions, primarily because of their experience competing in the privatized U.S. market.[141]

---

[132] L. Ron Schultz, "Hello Russia; Welcome to the 21st Century of Telecom," *TE&M*, June 1, 1993, p. 57. In the former Soviet Union, only 14 percent of the population own telephones, compared to nearly 92 percent in the United States. Ibid., p. 57.

[133] These networks contain electromechanical or step-by-step switches, and most are capable only of analog transmission. Schultz, "Hello Russia," p. 57; and U.S. Department of Commerce, ITA, *Telecom Guide to the NIS*, Market Research Report, Aug. 26, 1993.

[134] Some analysts predict that construction and modernization of fixed wireline networks in this region will require investments of approximately $100 billion over the next two decades. "Eastern Europe Poised for Quantum Leap," *Financial Times Survey: World Telecommunications*, Oct. 7, 1991. Further, while some regions might be forced to wait several years for line installment, a mobile link can be constructed within a day. Mark Newman, "Only the Elite Can Afford Such Prices," *Financial Times Survey, Mobile Communications*, Sept. 8, 1993, p. xii.

[135] As foreign telecommunications companies enter the market, most concentrate on the establishment of digital overlay networks and business bypass services.

[136] Many of the equipment contracts for these joint ventures have been awarded to European manufacturers. U.S. companies hope to become more active, however, now that the export restrictions on optical fiber and digital switching equipment have been removed. These final restrictions were lifted in March 1994. Industry official, telephone interview with USITC staff, Feb.-Mar. 1994.

[137] Equipment for these networks is being supplied by AT&T, Siemens, Ericsson, Northern, and Alcatel.

[138] For more information on the subject of mobile systems and joint ventures in Central Europe, see USITC, "The Success of Cellular Communications in Eastern Europe and the Former Soviet Union," *Industry, Trade, and Technology Review*, Feb. 1993, p. 1.

[139] While digital equipment is making its way to this region of the globe, price considerations have led most countries to install, at least for the time being, analog equipment.

[140] Although some subscribers use mobile phones to supplement existing (but overloaded) wireline services, many use the cellular system as a substitute for wireline, thus average usage in minutes per month generally is higher among Central European subscribers than among Western users. Usage in Central Europe averages 250 minutes per month and is estimated to be 2 to 3 times higher than in Western Europe.

[141] Steven Titch, "Eastern Europe Warms to U.S. Telcos," *Telephony*, Mar. 11, 1991, p. 9. US West is now the partner of PTTs in 5 markets: Hungary, the Czech Republic, Slovakia, Moscow, and St. Petersburg. Newman, "Only the Elite," p. xii.

China and East Asia

China and East Asia are increasingly promising markets for all types of telecommunications equipment. While many countries in this region are still trying to expand basic services, many also are updating current structures with new digital and mobile technologies. Table 9 shows that the line penetration levels for these countries are relatively low. China, with its population of over one billion people and a line penetration of less than 2 telephones per 100 inhabitants, provides one of the largest potential markets for telecommunications equipment suppliers. In an effort to improve the country's severely limited infrastructure, China has undertaken a program to have 100 million phone lines in operation by the year 2000.[142] China's Ministry of Post and Telecommunications (MPT) also is working to modernize the country by expanding backbone trunk facilities, installing digital switches in major urban areas, and installing five fiber optic arteries to connect Beijing to other cities.

Many foreign suppliers are taking advantage of the opportunities provided by these infrastructure programs. These programs provide a growing market for switch manufacturers, cellular phone manufacturers, and optical fiber suppliers. China's dominant switching equipment suppliers include Alcatel, Ericsson, Northern, Siemens, NEC, Fujitsu, and AT&T. AT&T received permission in 1993 to establish a joint venture in Qingdao to manufacture switches. In the mobile phone market, the major suppliers are Ericsson, Motorola, and Siemens. Although there are currently less than 300,000 subscribers of mobile services in China, analysts expect this sector to enjoy growth similar to that seen in developed countries, especially as business opportunities expand. Motorola is presently the dominant supplier of analog cellular phones in Beijing. The city plans to shift to a digital cellular system and is currently debating between the GSM and CDMA standards.[143]

Other countries in Asia, further along than China in terms of line penetration ratios (see table 9), also are working to expand and modernize telecommunications infrastructure. Most perceive modern communications systems as the key to becoming global business centers, and are improving their infrastructure accordingly.[144] Taiwan and Korea recently have opened their doors to foreign competition. In many cases, local production and joint venture arrangements are prerequisites for sales in these countries. Korea opened its telecommunications equipment procurement to foreign competition in 1993; AT&T won a 19.2 percent share of Korea's first international procurement.[145]

Mexico and other Latin American Countries

Increasing opportunities for U.S. suppliers of telecommunications equipment in Mexico have resulted from: (1) privatization of TELMEX (the Mexican telephone company), (2) programs to modernize Mexico's infrastructure, and (3) implementation of NAFTA. These developments should ensure continued and expanding opportunities for U.S. producers, which have been the dominant supplier of Mexico's cellular and wireline equipment for the past several years.

The market for wireline equipment in Mexico exceeds $2 billion annually. As the country strives to update its infrastructure with digital and fiber optic equipment over the next few years, demand for wireline equipment is expected to increase at an average annual rate of 10 percent. The country, which

[142] As of mid-1993, the country had 17 million lines installed. Lynne Curry, "100 Million Lines by Year 2000, China's Telephone Target," *Financial Times*, Oct. 18, 1993.

[143] U.S. Department of Commerce, ITA, *China Moving to Digital Cellular Systems*, Market Research Report, Oct. 8, 1993.

[144] Taiwan plans to add over 7 million digital local lines and over 500,000 digital trunks in the next 4 years. Korea, which has increased its installed base of lines aggressively, plans to add another 8.7 million lines and replace analog switches with digital systems. Achmad M. Chadran, "East Asia: Opportunity is Knocking," *Telecom Asia*, June 1993, pp. 15-16.

[145] Kim Nak-Hieon, "AT&T breaks into Korean Telecom Market," *Electronics*, Aug. 23, 1993, p. 10.

Table 9
Asia: Main line penetration per 100 inhabitants, 1992

Country	Main lines *(thousands)*	Population *(millions)*	Penetration
China	11,469.1	1,175.7	0.98
Korea	15,865.1	43.7	36.34
Taiwan	7,418.3	20.8	35.75
Hong Kong	2,819.8	5.8	48.62

Source: International Telecommunication Union (ITU), *World Telecommunication Development Report 1994*, pp. A-1 to A-3.

currently has less than 8 lines per 100 inhabitants, expects to have over 10 lines per 100 by the end of 1995. To date, U.S. suppliers have accounted for just under half of the import market share for these products (47 percent in 1992). Other major suppliers to the Mexican market include Japan (14 percent in 1992), Sweden (11 percent) and France (4 percent). U.S. products do very well in the Mexican market due to the geographical proximity of U.S. suppliers, high quality of U.S. products, rapid delivery time, and availability of technical assistance.[146] Prospects for suppliers of switching equipment, modems, and fiber optic cable are regarded as particularly promising.

In the mobile equipment market, prospects for U.S. suppliers are also favorable. This market has been growing at an annual rate of 6 percent in recent years, reaching $72.2 million in 1992. Growth in this market is expected to continue as improving economic conditions in Mexico lead to an increase in subscribers, and as traditional wireline communications systems are unable to keep up with communications demand. There is no domestic production of cellular equipment in Mexico. U.S. suppliers have been responsible for over 60 percent of the country's imports of cellular products since the service's inception in September 1989. Mexican purchasers cite compatibility, price, quality, availability, and access to suppliers as the primary reasons to purchase U.S. products.[147]

As noted earlier, NAFTA eliminated tariffs for most U.S. telecommunications exports to Mexico. In 10 years, all tariffs on telecommunications goods are to be eliminated (see section on tariff treatment).

Opportunities for U.S. exports of telecommunications equipment to other Latin American countries are expanding as these countries liberalize markets and modernize their infrastructures. Many telecommunications monopolies in these countries are being eliminated and many governments have implemented 4- to 5-year plans to modernize infrastructure.[148] The largest growth prospect for U.S. suppliers is in the area of mobile communications. Most Latin American companies have no domestic production of mobile equipment, leaving the market open to foreign suppliers. Brazil has the largest telecommunications market in Latin America; over 30 percent of Brazilian telecommunications imports are of U.S. origin. Although U.S. equipment continues to be noted for its quality and proximity, some European and Japanese suppliers of mobile equipment are also making inroads.

[146] U.S. Department of Commerce, *The Telecommunications Equipment Market in Mexico*, Market Research Report, Jan. 1993.

[147] U.S. Department of Commerce, ITA, *The Cellular Telecommunication Equipment Market in Mexico*, Market Research Report, Feb. 1993.

[148] Chile was the first Latin American country to abolish the state monopoly on telecommunications services.

U.S. Exports

While U.S. companies ship all types of telecommunications products, most exports are in the area of network equipment (e.g., switches, parts of switches, satellites, fiber optics, coaxial cable, and line systems). Overall, exports grew at an average annual rate of 18 percent during 1989-93, reaching $9.6 billion in 1993. Notable increases during this period included central office switches (56 percent), transceivers for radiotelephony (29 percent), fiber optics (23 percent), satellites (9 percent), and satellite parts (13 percent). With respect to customer premises equipment, U.S. exports of PBXs and modems increased by 74 percent and 12 percent, respectively. Exports of certain CPE products declined during this period, including key systems (67 percent), teleprinters (13 percent), and telephone sets (9 percent).

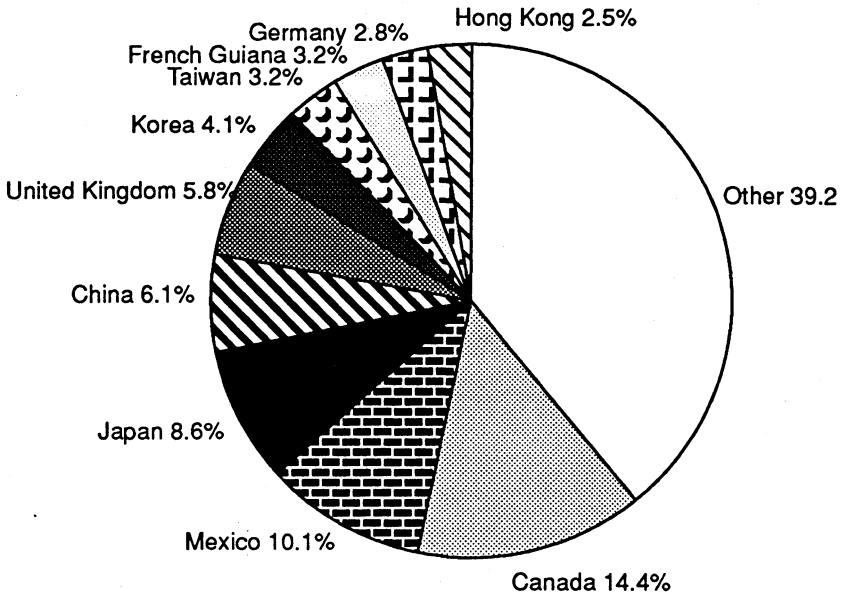
Primary export markets include Canada, Mexico, Japan, China, and the United Kingdom (see figure 7). Exports to China and Russia have expanded rapidly in recent years, increasing by 99 percent and 232 percent, respectively, during 1992-93. This reflects efforts by U.S. companies to participate in both countries' infrastructure expansion programs. Other growing markets include Latin America, where U.S. exports to Brazil and Argentina increased by 124 percent and 51 percent, respectively.

U.S. TRADE BALANCE

For the first time in 10 years, the U.S. trade balance in telecommunications equipment showed a surplus in 1993 (see table 10 and figure 8). Exports increased by 24 percent during 1992-93, shifting the balance from a deficit of $162 million in 1992, to a surplus of $879 million in 1993. The increase in exports is largely accounted for by high-end network equipment, where the United States traditionally maintains a surplus. The United States continues to maintain a deficit in most customer premises categories (see figures 9 and 10).

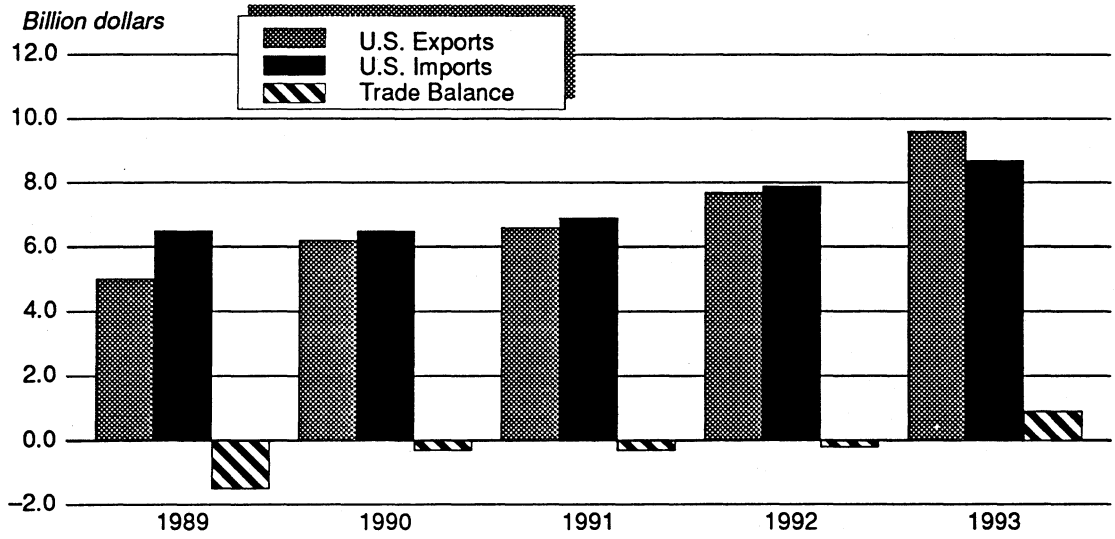
Differences in the pace and extent of domestic and foreign market liberalization underlie changes in the U.S. trade balance over time. Less liberalized markets overseas historically limited opportunities for exports from countries producing telecommunications equipment. Meanwhile, because the United States maintained one of the most open markets during the past decade, a disparity in trade flows emerged. Consequently, U.S. imports of telecommunications

Figure 7
Telecommunications equipment: Top 10 U.S. export markets, 1993



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

Figure 8
Telecommunications equipment: U.S. exports and imports, 1989-93



	1989	1990	1991	1992	1993
Exports	5.0	6.2	6.6	7.7	9.6
Imports	6.5	6.5	6.9	7.9	8.7
Trade Balance	–1.5	–0.3	–0.3	–0.2	0.9

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

Table 10
Telecommunications equipment: 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:					
Japan	519	571	693	554	821
Canada	502	744	831	1,183	1,381
China	63	102	110	295	585
Mexico	558	643	768	950	964
Malaysia	37	42	63	91	125
Taiwan	216	399	244	316	309
United Kingdom	621	509	394	476	559
Korea	182	221	280	304	393
Israel	136	108	109	106	172
Germany	136	353	279	284	273
All other	2,003	2,527	2,798	3,161	3,988
Total	4,973	6,220	6,568	7,720	9,571
EU-12	1,167	1,386	1,447	1,624	1,715
OPEC	186	182	339	390	458
ASEAN	232	308	355	604	622
CBERA	88	98	97	108	137
Central Europe	7	12	44	67	105
U.S. imports for consumption:					
Japan	2,498	2,192	2,266	2,569	2,842
Canada	650	777	825	1,005	1,210
China	314	416	492	564	776
Mexico	151	164	194	258	388
Malaysia	264	419	531	643	678
Taiwan	460	413	361	473	411
United Kingdom	99	107	139	194	125
Korea	474	384	309	303	280
Israel	133	118	147	249	294
Germany	105	109	138	142	148
All other	1,369	1,445	1,452	1,480	1,540
Total	6,518	6,545	6,853	7,882	8,692
EU-12	391	365	505	600	545
OPEC	1	5	47	68	95
ASEAN	910	1,153	1,271	1,464	1,547
CBERA	11	5	9	10	14
Central Europe	(2)	(2)	(2)	(2)	(2)
U.S. merchandise trade balance:					
Japan	-1,980	-1,620	-1,573	-2,015	-2,021
Canada	-148	-33	6	178	170
China	-251	-314	-382	-269	-191
Mexico	407	479	574	692	576
Malaysia	-228	-377	-468	-551	-553
Taiwan	-245	-14	-117	-157	-102
United Kingdom	521	401	255	282	434
Korea	-292	-163	-28	1	113
Israel	5	-11	-38	-143	-121
Germany	31	244	141	142	124
All other	634	1,082	1,346	1,681	2,449
Total	-1,545	-325	-285	-162	879
EU-12	776	1,022	942	1,024	1,170
OPEC	185	171	292	322	362
ASEAN	-678	-845	-916	-860	-924
CBERA	77	92	88	99	112
Central Europe	7	12	44	67	105

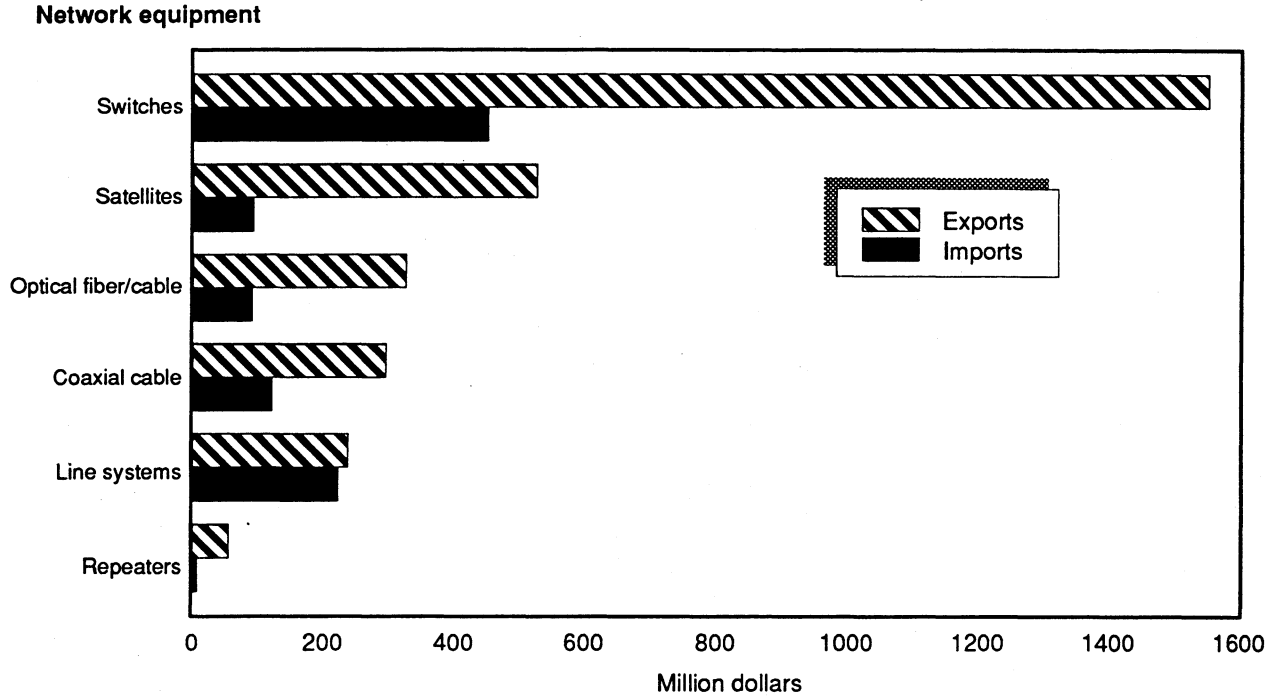
[1] Import values are based on customs value; export values are based on f.a.s. value, U.S. port of export. U.S. trade with East Germany is included in "Germany" and in EU-12 but not in "Central Europe".

[2] Less than 500,000 dollars.

Note.—Due to rounding, figures may not add to the totals shown.

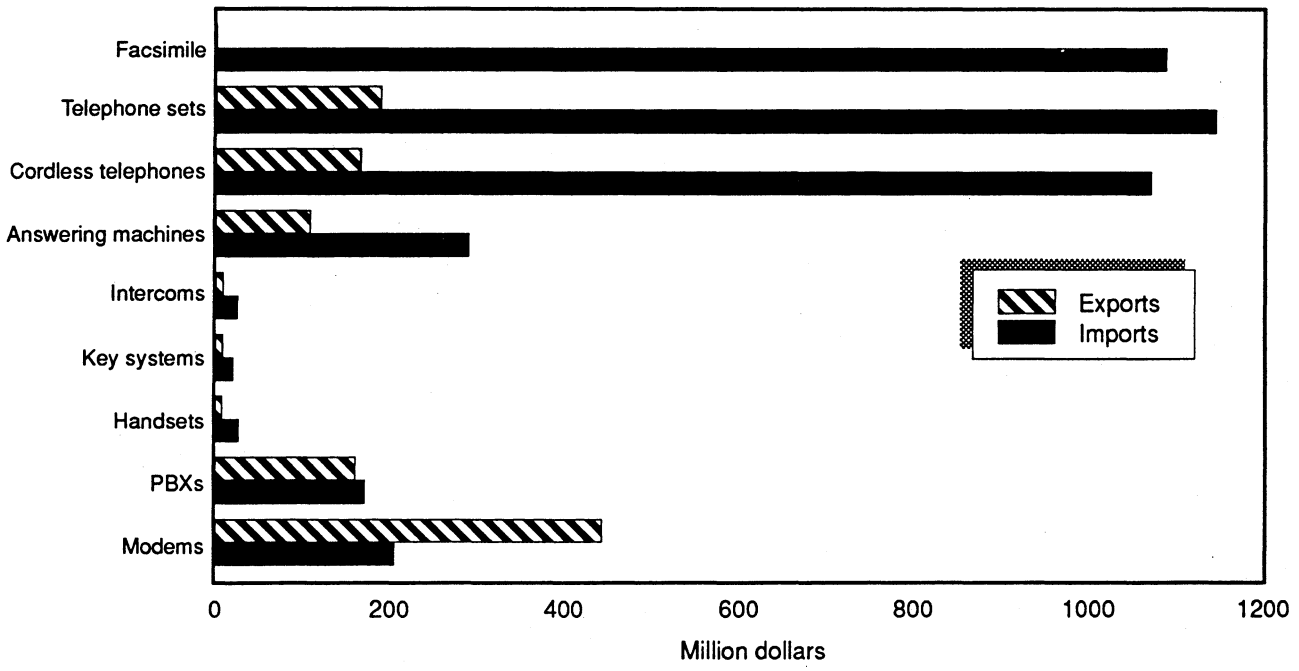
Source: Compiled from official statistics of the U.S. Department of Commerce.

Figure 9
Telecommunications network equipment: Selected U.S. exports and imports, 1993



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

Figure 10
Telecommunications customer premises equipment: Selected U.S. exports and imports, 1993.



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

equipment exceeded exports for many years and resulted in a significant trade deficit for the sector. In recent years, however, an increasing number of foreign countries have opened markets to U.S. exports. Further, many overseas markets are updating network infrastructure with sophisticated equipment, much of which is produced in the United States. As a result of these two trends, U.S. exports have been expanding more rapidly than U.S. imports over the past 5 years, decreasing the overall deficit and creating a surplus in 1993.

Between 1989 and 1993, exports increased at an average annual rate of 18 percent, while imports increased at an annual rate of only 8 percent. The growth in exports was led by increased shipments of high-end telecommunications equipment parts, radio transceivers, satellites, and central office switches

Imports have increased at a slower pace. Some attribute this to efforts by U.S. service providers to reduce capital outlays during the recession. While imports from most major trading partners increased during 1989-93, U.S. imports from Korea and Taiwan declined by 12 percent and 3 percent, respectively.

APPENDIX A
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.

APPENDIX B
UNITED STATES INTERNATIONAL TRADE COMMISSION TITLE VII INVESTIGATIONS RELATED TO TELECOMMUNICATION EQUIPMENT

Table B–1
United States International Trade Commission Title VII investigations related to telecommunications equipment

Paging devices from Japan: 1983
731-TA-102(F) USITC 1410

Product	HTS numbers[1]	Col. 1 duty[2] (ad valorem)	Original margins[3]	Current margins[4]
Radiotelephonic receivers	8527.90.80	6.0%	70.4% - 109.1%	70.4% - 109.0%
Paging alert devices	8531.80.00	2.7%	70.4% - 109.1%	70.4% - 109.0%

Cell-site radio transceivers from Japan: 1984
731-TA-163(F) USITC 1618

Product	HTS numbers[5]	Col. 1 duty[2] (ad valorem)	Original margins[6]	Current margins[7]
Receivers	8525.20.15	7.7%	59.9%	AD order revoked
Transceivers	8525.20.30	6.0%	59.9%	AD order revoked

Cellular mobile telephones from Japan: 1984
731-TA-207(F) USITC 1785

Product	HTS numbers[8]	Col. 1 duty[2] (ad valorem)	Original margins[9]	Current margins[10]
Radio cellular telephones	8525.20.60	6.0%	0.0% - 106.6%	0.4% - 5.3%
Transmission apparatus	8525.10.80	6.0%	0.0% - 106.6%	0.4% - 5.3%
Receivers	8527.90.80	6.0%	0.0% - 106.6%	0.4% - 5.3%
Parts (antennas)	8529.10.60	6.0%	0.0% - 106.6%	0.4% - 5.3%
Parts	8529.90.50	5.9%	0.0% - 106.6%	0.4% - 5.3%
Hybrid integrated circuit	8542.20.00	0.0%	0.0% - 106.6%	0.4% - 5.3%
Integrated circuit	8542.80.00	0.0%	0.0% - 106.6%	0.4% - 5.3%

[1] These items were originally classified as under the Tariff Schedule of the United States (TSUS) as 685.24 (solid state radio receivers), 685.2475 (radio receivers >30MHz), <400MHz), 685.2480 (radio receivers >500MHz, <1000) and 685.7035 (other sound signalling apparatus).

[2] Duty as of January 1, 1994.

[3] Margins ranged by manufacturers/producers/exporters. 48 FR 37059.

[4] 48 FR 37058.

[5] These items were originally classified as TSUS item numbers 685.24 and 685.29.

[6] 50 FR 307.

[7] 54 FR 47541.

[8] These items were originally classified under the TSUS as item numbers 685.28 (transceivers) and 685.33 (control units and subassemblies).

[9] Margins ranged by manufactures/producers/exporters. 50FR 45447.

[10] 57 FR 7730.

Table B–1—Continued
United States International Trade Commission Title VII investigations related to telecommunications equipment

Telephone systems and subassemblies from Japan 1989
731-TA-426 USITC 2237

Product	HTS numbers	Col. 1 duty[2] (ad valorem)	Original margins[11]	Current margins[12]
Telephone sets	8517.10.00	8.5%	137% - 179%	37% - 179%
PBX switches	8517.30.20	8.5%	137% - 179%	37% - 179%
Elec. key systems	8517.30.25	8.5%	137% - 179%	37% - 179%
Other tel. switching app.	8517.30.30	8.5%	137% - 179%	37% - 179%
Other telephonic apparatus	8517.81.00	8.5%	137% - 179%	37% - 179%
PBX switch parts	8517.90.10	8.5%	137% - 179%	37% - 179%
Other switch parts	8517.90.15	8.5%	137% - 179%	37% - 179%
Parts of telephone sets	8517.90.30	8.5%	137% - 179%	37% - 179%
Telephone handsets	8518.30.10	8.5%	137% - 179%	37% - 179%
Power supplies	8504.40.00	3.0%	137% - 179%	37% - 179%

Telephone systems and subassemblies from Taiwan: 1989
731-TA-427 USITC 2237

Product	HTS numbers	Col. 1 duty[2] (ad valorem)	Original margins[13]	Current margins[14]
Telephone sets	8517.10.00	8.5%	0% - 130%	0% - 0.7%
PBX switches	8517.30.20	8.5%	0% - 130%	0% - 0.7%
Elec. key systems	8517.30.25	8.5%	0% - 130%	0% - 0.7%
Other tel. switching app.	8517.30.30	8.5%	0% - 130%	0% - 0.7%
Other telephonic apparatus	8517.81.00	8.5%	0% - 130%	0% - 0.7%
PBX switch parts	8517.90.10	8.5%	0% - 130%	0% - 0.7%
Other switch parts	8517.90.15	8.5%	0% - 130%	0% - 0.7%
Parts of telephone sets	8517.90.30	8.5%	0% - 130%	0% - 0.7%
Telephone handsets	8518.30.10	8.5%	0% - 130%	0% - 0.7%
Power supplies	8504.40.00	3.0%	0% - 130%	0% - 0.7%

[11] Margins ranged by manufactures/producers/exporters. 54 FR 50790.
[12] 57 FR 4951.
[13] Margins ranged by manufacturers/producers/exporters. 54 FR 50791.
[14] 58 FR 6622.

Table B–1—Continued
United States International Trade Commission Title VII investigations related to telecommunications equipment

Telephone systems and subassemblies from Korea: 1990
731-TA-427 USITC 2254

Product	HTS numbers	Col. 1 duty[2] (ad valorem)	Original margins[15]	Current margins[16]
Telephone sets	8517.10.00	8.5%	13.9% - 14.8%	.03% - 2.0%
PBX switches	8517.30.20	8.5%	13.9% - 14.8%	.03% - 2.0%
Elec. key systems	8517.30.25	8.5%	13.9% - 14.8%	.03% - 2.0%
Other tel. switching app.	8517.30.30	8.5%	13.9% - 14.8%	.03% - 2.0%
Other telephonic apparatus	8517.81.00	8.5%	13.9% - 14.8%	.03% - 2.0%
PBX switch parts	8517.90.10	8.5%	13.9% - 14.8%	.03% - 2.0%
Other switch parts	8517.90.15	8.5%	13.9% - 14.8%	.03% - 2.0%
Parts of telephone sets	8517.90.30	8.5%	13.9% - 14.8%	.03% - 2.0%
Telephone handsets	8518.30.10	8.5%	13.9% - 14.8%	.03% - 2.0%
Power supplies	8504.40.00	3.0%	13.9% - 14.8%	.03% - 2.0%

[15] Margins ranged by manufacturers/producers/exporters. 55 FR 4216.
[16] 58 FR 44504.

APPENDIX C
GLOSSARY OF TERMS

GLOSSARY OF TERMS

Advanced Mobile Phone Service (AMPS)

An analog transmission technology which supports approximately 60 percent of the world's cellular subscribers and 100 percent of U.S. cellular subscribers. AMPS was developed by AT&T and became the basis for several other analog standards found in Europe, Japan, and emerging cellular markets.

Analog Transmission

The method of transmitting voice, video, and data electronically where signals correspond to the movement of the transmitted signal (similar to a continuously varying wave). The first generation of cellular communications service is based on analog technology. However, due to capacity limitations, analog systems are expected to be replaced by digital systems (see also digital transmission).

Asynchronous Transfer Mode (ATM)

ATM is a technology designed to rapidly and efficiently transmit digitized packets of voice, image, data, and full-motion video. Demand for networks capable of supporting multimedia applications is increasing as consumers expand their use of videoconferencing and data transmission. Many telecommunications equipment manufacturers are producing ATM switches to meet growing demand for these high-tech systems.

Bell Operating Companies (BOCs)

The 22 local telephone service companies that emerged following AT&T's divestiture on January 1, 1984. See also Regional Bell Holding Companies.

Broadband Transmission

A transmission facility that has a capacity (or bandwidth) capable of carrying more than just voice transmission. For example, coaxial cables carry voice, video, and data channels simultaneously. Cable companies' use of coaxial cables is enhancing their position as potential competitors in the market for broadband or multimedia services.

Broadband PCS

See Personal Communications Services.

Cell

A geographic subdivision of a cellular system's service area. Cells can vary in size depending on terrain, capacity demands, etc. Each cell is covered by its own low-power transmitter, receiver, and signaling equipment. See also microcell.

Cellular Switch

See switches.

Central Office Switch

See switches.

Centrex

Centrex is a business service provided by local phone companies. It offers such features as call forwarding, intercom, call transfer, and least cost routing. Centrex service is in direct competition with PBX equipment, which provides essentially the same features. Companies may select Centrex over in-house equipment (PBXs) to save space or to allow for easier expansion. BOCs' promotion of Centrex services in recent years has placed a great deal of price pressure on PBX systems.

Code Division Multiple Access (CDMA)

A digital cellular transmission technology that separates call packets and scatters them over a wide range of frequencies. The packets are then re-assembled at the final destination by a chip inside the cellular phone. Reportedly, systems using CDMA technology would offer 10 to 20 times the capacity of present analog systems. CDMA is one of the two digital technologies which will provide the foundation for technical standards used by the U.S. cellular communications industry (see also TDMA).

Common Carrier

Carriers are companies that provide communication circuits. Common Carriers are regulated service providers for the general public (e.g., local phone companies, AT&T, Sprint, MCI, etc.). In contrast, private carriers are not regulated and provide services to private entities. All types of carriers are significant consumers of telecommunications network equipment.

Competitive Access Provider (CAP)

A CAP is a company that bypasses local telephone companies by providing a direct link between its switching office and business customers. Bypassing local carriers may reduce costs for long distance providers or result in faster service. Providers of these services include Teleport Communications Group and Metropolitan Fiber Systems. CAPs are important customers for network equipment manufacturers.

Computer Telephone Integration (CTI)

CTI involves the connection of a computer to a telephone switch so that calls can be intelligently routed. CTI systems often are used by phone banks that want to direct certain types of callers or customers to particular phone agents. Demand is growing for systems, such as these, that increase productivity and efficiency.

Cordless Telephone

This is a telephone set that has no cord between the handset and the base of the phone. The base is connected to the wireline network and communicates with the handset via radio transmitter, receiver, and antenna. The large U.S. consumer market for cordless phones is served primarily by imports.

Customer Premises Equipment (CPE)

CPE refers to telecommunications products that are connected to the network at the customer's location. Included in this category are telephone sets (both wireline and wireless), key systems, private branch exchanges (PBXs), and modems. More recently, products such as facsimile machines, answering machines, and voice response and voice messaging systems have been included in this category. Aside from a few of the more technically advanced products (e.g., voice messaging systems), the United States imports a significant portion of its CPE.

Digital Transmission

Digital transmission is the use of binary code (ones and zeros) to encode information, rather than a continuously varying wave (as in analog transmission). Compared to analog transmission, digital transmission creates less distortion of a signal over long distances. In cellular communications, companies are moving toward digital transmission for increased capacity and sound quality (see also analog transmission).

Facsimile Machine (Fax)

A machine which allows written, typed, or drawn material to be transmitted and received across communications networks. There is a significant consumer market in the United States for fax machines, but almost all production of this commodity product is carried out overseas.

Federal Communications Commission (FCC)

Established by the Communications Act of 1934, the FCC regulates all interstate communications originating in the United States. It plays an important role in wireless communications because it is responsible for providing licenses and allocating spectrum.

Global System for Mobile Communications (GSM)

The pan-European digital cellular system standard.

Independent Service Providers

A company providing telephone service that is not affiliated with any of the "Bell" telephone companies. The estimated 1,400 independent phone companies serving the U.S. market are important consumers of telecommunications equipment.

Integrated Services Digital Networks (ISDN)

ISDN networks have been proposed as a means of providing efficient transmission of voice, data, and video. The concept suggests end-to-end digital transmission circuits with significantly more bandwidth than current networks. Although steps have been taken to implement this system, the high cost of ISDN terminal equipment and central office ISDN hardware and software has prohibited widespread adoption.

Key Systems

This equipment allows several phone lines to feed into one telephone set. The telephone set has multiple buttons, allowing the user to select lines for outgoing or incoming calls. Key systems are similar to PBXs, though they are often smaller and cannot switch calls from one line to another.

Metropolitan Statistical Area (MSA)

The FCC divided the U.S. cellular communications market into 306 MSAs and 428 Rural Service Areas (RSA). Two cellular carriers were offered operating licenses in each MSA and RSA.

Microcell

A smaller version of the cells that comprise today's cellular phone service areas. Microcells can vary in size but, unlike regular cells that can be up to several miles in diameter, microcells generally are only several hundred yards in diameter. Microcells are the key component behind proposed networks for personal communications services. They will utilize low-power transmitters and smaller, lighter portable phones.

Modulator/demodulator (MODEM)

A device that allows communications between computers by converting digital pulses into analog telephone line frequencies and then back into digital pulses for the receiving computer. Modems are popular among those who wish to communicate with other computer users not located in the same building, e.g., people who telecommute from home.

Modified Final Judgment (MFJ)

A 1982 settlement between the U.S. Department of Justice and AT&T. The MFJ was designed to separate the "competitive" long distance marketplace from the "noncompetitive" local marketplace. Effective January 1, 1984, it removed local telephone service operations from AT&T and grouped the operators into seven Regional Bell holding companies (RHCs). AT&T maintained Western Electric, Bell Labs, and its long distance services. The seven RHCs (Ameritech, Bell

	Atlantic, BellSouth, Nynex, Pacific Telesis, Southwestern Bell, and U.S. West) were limited to providing local services. They were specifically prohibited from manufacturing equipment, providing long distance services outside of their local area, and providing enhanced services. The prohibition on the provision of enhanced services was later lifted, and legislation that calls for significant revision of MFJ restrictions has been discussed in the U.S. Congress.
Multimedia	Multimedia is the communication of information through the combination of multiple types of media, including audio, video, text, telephony, and graphics. Digital technology enables the convergence of these media, reportedly creating richer and more effective communication than a single media. Demand for multimedia applications is creating demand for all types of telecommunications equipment, especially network equipment capable of transmitting data, voice, and video.
Multiplexers	Equipment that enables the transmission of more than one signal over one communications circuit at the same time. T1 and T3 multiplexers are used for high-speed digital transmission. The market for this type of equipment is expanding as demand for high capacity networks increases.
Narrowband PCS	See Personal Communications Services.
Network Equipment	For wireline networks, equipment includes switches, copper cables, fiber optic cable, and line equipment (e.g., multiplexers and repeaters). For wireless networks, equipment includes cellular switches, satellites, and cell site equipment. The United States is highly competitive in the manufacture of network equipment.
Personal Communications Service (PCS)	Two-way wireless communications using low-powered handsets, typically within microcells. It is expected to be offered in several developed country markets in the 2 Gigahertz (GHz) band. Narrowband PCS refers to two-way paging devices, while broadband PCS will consist of a cellular-like service, but with smaller and reportedly cheaper handsets. The FCC is auctioning off licenses for these services during 1994.
Private Branch Exchange (PBX)	A PBX is a private telephone switching system, generally located on the customer's premises. It connects the many individual phones in a building to a group of outgoing telephone lines. PBXs have improved over the years from basic switching devices to open architecture computers with a wide range of features, including call forwarding, intercom, and call transfer. They are in direct competition with the Centrex services offered by the BOCs. Advantages to a PBX over Centrex include individual ownership and increased flexibility (see also Centrex).
Regional Bell Holding Companies (RHCs)	The seven local telephone service companies divested by AT&T on January 1, 1984. The RHCs and their 22 Operating Companies (BOCs) were banned from manufacturing equipment as a result of the Modified Final Judgment. Today the BOCs believe that some of the MFJ restrictions, particularly the manufacturing ban, are outdated and should be lifted (see also Modified Final Judgment).
Private Network	Privately owned switching and transmission facilities that operate over leased and non-leased lines, usually connecting a series of offices.

Post Telephone and Telegraph (PTT)	PTTs refer to the telephone service providers in most foreign countries. They are usually controlled by their governments and often have agreements with national equipment suppliers. As some of these providers are privatized, however, opportunities for foreign providers of telecommunications equipment increase.
Repeaters	A device that is used to boost and amplify analog signals as they travel along a circuit. Repeaters are also used to regenerate digital signals. As networks expand in size, many repeaters are needed to ensure clear transmission of signals.
Radio Spectrum	The range of frequencies extending from 10 kilohertz (kHz) to 300 GHz. These frequencies are located below those of visible light and above those of audible sound. Spectrum is a non-depletable, finite, natural resource that is utilized by wireless communications providers.
Software	Instructions that tell a computer what to do. Software is a primary component in most high-end telecommunications equipment, enabling intelligent network systems. Software is responsible for an estimated 70 percent of the total cost of a switch.
Switches	A device that routes signals through the network by opening and closing circuits. Expanded use of software in switches in recent years has increased the types of features offered. Central office (CO) switches handle calls on the wireline network. Cellular switches transfer calls between the wireline network and the wireless (or mobile) networks. ATM switches are among the newest products on the market and will be used for switching voice, data, and video traveling along the same circuit.
Terminal Equipment	See Customer Premises Equipment.
Time Division Multiple Access (TDMA)	A digital cellular transmission technology that divides discrete amounts of time on a radio frequency into parts, and then assigns different phone conversations to each part. Reportedly, a system using TDMA technology would offer three times the capacity of present analog systems. TDMA is one of two digital technologies which will provide the foundation for technical standards used by the U.S. cellular communications industry (see also CDMA).
Value-added reseller (VAR)	VARs are businesses that combine hardware products with software solutions for specific industries. Traditionally vendors of data communications equipment, VARs increasingly distribute voice communications equipment in order to be able to offer customers complete information systems.
Voice Messaging Systems	Systems that allow voice messages to be stored, played back, and distributed. There are many levels of voice message and voice mail systems, from stand-alone versions to integrated systems. These systems are considered high-end CPE and are produced by a number of niche firms.
Voice Response Systems	Also called Interactive Voice Response Units, these systems allow callers to route their calls. A pre-recorded voice offers various menu options, then the caller selects a destination using his/her push button phone. These systems are considered high-end CPE and are produced by a number of niche firms.

Wireless Networks

Any communications system that operates without wires. In the U.S. market, it generally refers to cellular networks, wireless office systems, PCS, and paging. The international market for wireless networks is increasing rapidly. In countries where wireline infrastructures are outdated or inadequate, consumers are turning almost exclusively to wireless systems.

Wireline Networks

Any communication system that operates across wires, including copper, coaxial, and fiber optic cables. Basic telephone service in the United States operates over a wireline network, though an increasing number of consumers are supplementing wireline service with some type of wireless system.