A BASELINE STUDY OF THE TELEPHONE TERMINAL AND SWITCHING EQUIPMENT INDUSTRY

Report to the Subcommittee on Trade of the Committee on Ways and Means of the U.S. House of Representatives on Investigation No. 332-92 Under Section 332 of the Tariff Act of 1930, as Amended

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Note.--The whole of the Commission's report to the Subcommittee on Trade of the Committee on Ways and Means may not be made public since it contains certain information that would result in the disclosure of the operations of individual concerns. This report is the same as the report to the Subcommittee except that the above-mentioned information has been omitted. Such omissions are indicated by asterisks.

Executive Summary

In recent years the telephone industry has been characterized by rapid advances in technology and a movement from regulated monopolization to limited regulated competition. Both the provision of telephone service and the manufacture of telephone equipment have been affected by these changes. Because the industry is in a state of transition, Congress requested the International Trade Commission to undertake a baseline study of the telephone terminal and switching equipment industry. The intent of the baseline study is to establish a reliable data base, that is, to gather accurate shipment, export, import, and related data in order to provide a reference point for future studies which may be requested. The report explores barriers to trade in the international area, in particular, nontariff barriers limiting U.S. exports and internal U.S. barriers to exporting. The impact of technological advances on the telephone industry is also examined.

The subject industry produces, imports, and exports essential telephone equipment in the instrument and switching equipment area, such as telephone sets, private branch exchanges, central office switching equipment, and parts and subassemblies of the above. The study identified 54 firms in the industry, and all of these firms contributed information to the study. In 1977, there were 38 firms producing telephone terminal and switching equipment in the United States. The U.S. industry exhibits a high concentration ratio, with four producers accounting for 90 percent of all shipments in 1977.

Data were gathered for 3 years. The 1977 data provide the statistical base and a profile of the industry; 1976 and 1972 figures are shown as benchmark points. Data for 1972 are incomplete since several firms were unable to report with accuracy for this year. In light of this, presentation of trends based on Commission data is considered inappropriate.

U.S. shipments in 1977 were * * * Significant differences exist between shipment, import, and export data collected by the Commission and data compiled by the Department of Commerce. These differences may be attributed to classification and valuation variances in data collection. For comparability, the Commission gathered all data on a hardware basis only and carefully defined the equipment under study. In contrast, official statistics include service costs in export value and a number of undefined products in shipment data.

U.S. exports of telephone instrument and switching equipment represented * * * percent of shipments in 1977. U.S. exports are directed chiefly to developing countries. Europe and Japan restrict market access for terminal and switching equipment imports. Exports are restricted by nontariff barriers which protect the essentially state-owned telephone systems in most of the

world. Preferential treatment afforded to domestic suppliers through local content requirements and standards based on a national supplier's products was identified as the major trade barrier by exporters in the survey.

The import penetration ratio for all terminal and switching equipment was * * * percent in 1977. Federal Communications Commission (FCC) rulings in 1968 permitted telephone instruments to be customer-owned and installed. The import penetration ratio in the telephone instrument market was * * * percent in 1977.

The study found that the current balance of trade in telephone terminal and switching equipment is negative, with a trade deficit of approximately $53 million in 1977. By product line, all equipment except telephone key sets and central offices showed imports in excess of exports.

The market for telephone equipment consists of regulated and unregulated companies. While regulated common carriers represent the largest segment of the users' market, unregulated firms account for a large share of private branch exchange purchases. In 1977, * * * percent of all PBX shipments were directed to businesses and other unregulated companies.

Shipments to parties unrelated to the manufacturer shed some light on the size of the interconnect market which is composed of firms selling primarily customer-owned equipment. This market excludes shipments of the two largest equipment manufacturers, American Telephone & Telegraph Co. (AT&T) and General Telephone & Electronics Corp. (GTE), to their own operating companies. Shipments in the non-captive market are expanding rapidly and totalled $618 million in 1977.

Import competition is centered in the non-captive market. The import penetration ratio of 17.1 percent in this market is * * * larger than the overall import ratio of * * * percent in 1977.

The Commission profiled the industry by value added. Nineteen firms reported U.S. labor value added to imported material, and the ratio of labor value added to imported material averaged 7.5 percent in 1977.

Employment of production and related workers was * * * 51,870, and 58,015 in 1972, 1976, and 1977, respectively. Data for 1972 are understated.

The U.S. manufacturing industry is undergoing significant technological change. High-technology, computer-like equipment is superseding electro-mechanical equipment. In 1972, shipments of electromechanical branch exchanges outnumbered shipments of electronic equipment by a ratio of 13 to 1. In 1977, new technology shipments were three times those of electro-mechanical design. Technology flow as measured by royalty payments is outward in a ratio of about 30 to 1.

Introduction

On January 13, 1978, the United States International Trade Commission, in response to a request from the Subcommittee on Trade, Committee on Ways and Means, instituted investigation No. 332-92, A Baseline Study of the Telephone Terminal and Switching Equipment Industry.

In connection with the investigation, notice of a public hearing to be held in Washington, D.C., on September 26, 1978, was issued. Notice of the investigation and the public hearing was given by posting copies of the notices at the Office of the Secretary, U.S. International Trade Commission, Washington, D.C., and at the Commission's office in New York City and by transmitting the notices to the Federal Register (43 F.R. 2775, January 19, 1978).

On March 13, 1978, the Commission provided to the Subcommittee on Trade an interim report which contained a profile of the U.S. telephone equipment industry and a discussion of critical issues affecting the industry. In addition, certain products were described and suggested as representative products for detailed analysis in the completed study due on December 20, 1978. With the concurrence of the Subcommittee, the Commission proceeded.

The Commission has collected data, by questionnaire, from firms in the United States which produced, exported, or imported telephone terminal and switching equipment in the years 1972, 1976, 1977. The data are not intended to indicate trends but rather they are to serve as a guide for future studies.

Much of the data, even though aggregated, is confidential since disclosure would reveal the operations of individual firms. Nonconfidential data and background statistics on the industry are contained in 29 preliminary tables which were made available to interested parties at the public hearing held September 26, 1977.

The Telephone System and Equipment

Telephone system

The telephone system conveys information by voice communication between people, data communication between computers, and pictures (facsimile) between subscriber sets. The principal feature of the telephone system is the ability of one party to contact virtually any other party who subscribes to telephone service. The connection time to reach another party is measured in seconds, while information conveyed through the telephone system travels slightly slower than the speed of light.

There are in excess of 160 million telephones in service in the United States (table B-1, appendix B). It is estimated that over 70 percent of these telephones are single party private lines.

A simplified schematic of a rudimentary telephone system and its important parts is shown in figure 1.

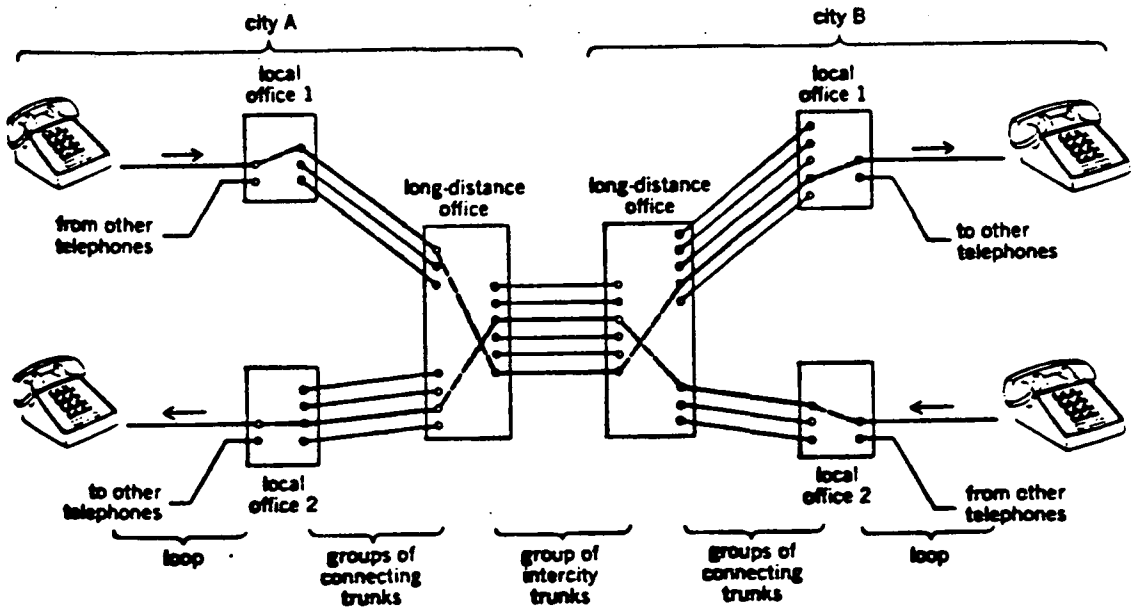


Figure 1.--Basic Telephone System (Courtesy AT&T)

Terminals, usually telephones, connect end users to the telephone system. A terminal may be a telephone instrument (fig. 1 and 2), a computer, an internal private intercommunications system within a building, or other device for transferring information. A terminal may in itself be a complete telephone system. The private branch exchange (PBX) and key set telephone system shown in figure 2 are such systems.

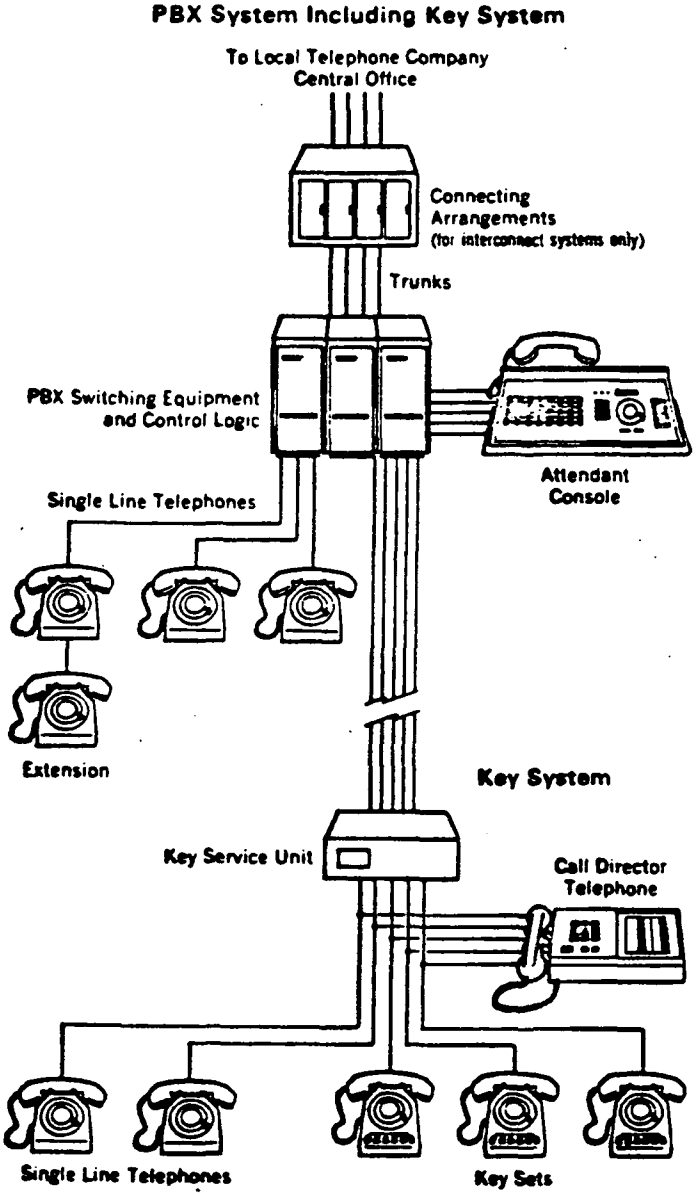


Figure 2.--Telephones, Key Systems, and Private Branch Exchange (PBX) (Courtesy SRI International, Menlo Park, Calif.)

Switches (an abbrevation for switchboard) located in local central offices perform the routing of information from terminal to terminal within the area served by the local switch over local lines or "loops." Calls to be completed beyond the area served by the local switch are routed to a long distance switch via a trunk. Note that the PBX, which is considered terminal equipment, contains all the elements of the basic telephone system (fig. 2). This switch, however, may be located on the customers' premises instead of the central office.

Trunks may be multiconductor cables, fiber wave guides, microwave radio relay links, or satellite relay links. In most cases the trunks require some form of amplification or restructuring of the information transmitted in order to communicate over long distances between the switches.

Equipment under study

Telephone instruments and switching systems of telephone systems are the products selected for this study. Telephone instruments and branch exchanges constitute the largest share of user-owned and operated equipment connected to the public-switched networks. The transmission systems such as wires, poles, cables, radios, radio receivers, satellites, and satellite-earth receivers and terminals other than telephones are not part of the study. For a detailed discussion of product definitions see appendix C.

Regulation

Costly inefficiencies involved in duplication and nonstandardization of telephone service led Congress to approve consolidation and limited monopolization of telephone service in 1921. Thirteen years later Congress provided for regulation of the telephone industry by the FCC. Until the late 1960's, the FCC endorsed a policy of end-to-end communication service, with telephone equipment owned and supplied by the telephone operating companies. Since 1968 the FCC has encouraged decontrol and limited competition in the industry. A discussion of Congressional legislation and FCC regulatory decisions pertaining to terminal and switching equipment are presented in appendix D.

In the terminal equipment area, the FCC has approved complete decontrol. Customers may now purchase and install their own registered phone terminal equipment. Such equipment as covered by this study--PBX's, telephones, and key sets, as well as other terminal equipment, such as answering devices, automatic dialers, music-on-hold, data sets, and others--may be connected directly to the public-switched network. For many of these items, however, the local phone company must be notified when they are connected. Customer ownership implies total responsibility for the maintenance of the equipment by the owner. The importation, manufacture, distribution, or sale of nonregistered terminal equipment is not prohibited; the FCC prohibits only the use of nonregistered equipment.

Industry Profile

In order to provide an industry profile, the Commission mailed in excess of 110 questionnaires to firms engaged in telecommunications equipment manufacturing, importing, and exporting. Positive responses were received from 54 firms. It was verified that the remaining firms did not manufacture, import, or export the specific products which are the subject of this study.

In 1977, of the 54 reporting firms, 33 reported importing material directly or for their own accounts. Nineteen firms added value to imported material, and 14 firms imported for direct sale only. Of the firms showing value added to imported material, 13 are foreign-owned subsidiaries operating in the United States. There were 19 firms which reported use of no imported material, indicating that their products were completely of U.S. origin. 1/ Respondents which reported exports totaled 25; of these, 2 firms exported exclusively. Responses by firms given for 1977 are shown in the following tabulation:

Firms importing for direct sale only	14
Firms exporting only	2
Firms manufacturing	38
No reported import content	19
Use of some imported material	19
Total respondents	54

Of the 38 firms in 1977 which manufactured or assembled equipment in the United States, 22 firms produced telephone instruments; 23 produced branch exchange equipment, 10 produced central office equipment, and 17 firms indicated production of other types of equipment, principally subassemblies and key system switching equipment.

Concentration

The telephone instrument and switching equipment industry is highly concentrated. The two largest producers are vertically integrated firms, represented in both the manufacture of equipment and the provision of telecommunications. AT&T and GTE operate common-carrier telephone companies which in large part are supplied by their manufacturing affiliates. AT&T's subsidiary, Western Electric, dominates the telephone equipment industry, accounting for * * * percent of shipments in 1977. The second largest producer, GTE, holds about * * * percent of the telephone equipment market. The four largest firms together account for 90 percent of telephone instrument and switching equipment production. Approximately 50 firms serve the remainder of the market.

Concentration in the telephone industry was higher in 1972 than in 1977. In 1972 the top four firms represented 98 percent of domestic shipments. AT&T accounted for almost * * * percent of total shipments, and combined shipments of AT&T and GTE represented approximately * * * percent of domestic output. The decrease in industry concentration between 1972-77 may be attributed to the competitive policies of the FCC which have encouraged more firms to enter the market. Shipment data for 1972, however, may be incomplete.

1/ While these firms did not import directly, the country of origin of articles purchased from distributors is not always identifiable, and it is possible that such articles may have been imported. These purchases are estimated to be small in overall terms.

Figure 3 graphically shows the distribution of * * * in domestic shipments of telephone terminal and switching equipment in 1977. The concentration ratio for the industry, based on domestic shipments, is 90 percent; however, the Herfindalh index, 1/ based on total shipments, is exactly 0.5. 2/ Eight firms account for 96.1 percent of domestic shipments. Shipments of Western Electric are almost * * * the shipments of its nearest competitor. * * *

Western Electric directs its sales to the domestic market and has entered the export or foreign markets only recently. * * *
Within the eight top-ranked U.S. firms are five firms with considerable international holdings. * * *
Figure 4 shows industry concentration with the data for Western Electric removed and domestic and export shipments totaled. This presents another analysis of concentration in the telephone equipment industry in 1977.

Labor value added to imported material

Differences between importers and U.S. manufacturers are indistinct with respect to the amount of value added. There are no set guidelines to determine whether or not sufficient value has been added to an imported article to qualify the finished product to be of U.S. manufacture. 3/ Recognizing this problem, the Commission asked in the questionnaire for labor value added to imported material and the value of such imported material used. This technique yields improved accuracy of data and provides a profile of the industry rather than an arbitrary classifications of firms. 4/ In-plant discussions with representatives of major importing/manufacturing firms gave confidence in the validity of the technique. This was supported by the data received.

The relationship between labor value added and employment levels within the telephone terminal and switching equipment industry may be important but available Commission data do not reveal the exact nature of the relationship. However, it may merit evaluation in the event future studies are conducted.

1/ The sum of the squares of the market share of each firm.
2/ In other countries the telephone industry is more concentrated.
3/ When collecting data for the Current Industrial Series, Census requires only that material imported for direct sale or distribution without further modification not be reported as a U.S. shipment. A firm which imports articles and adds a minimum of value (for instance, labels in English) might qualify as a U.S. manufacturer. This causes an overstatement of the number of U.S. manufacturers in any given industry.
4/ Even these types of data may not yield a complete picture of importers and manufacturers since U.S. manufacturers which buy articles from distributors may not know the origin of the material. This is particularly true for generic bits and pieces. However, such purchases are believed to be small in terms of overall purchases.

Figure 3.--Concentration of domestic shipments, 1977

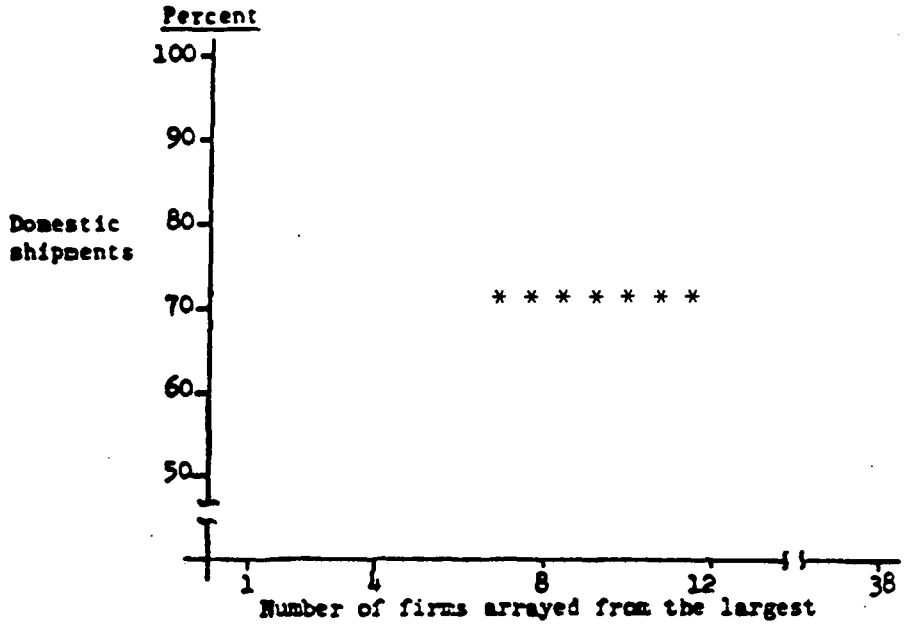
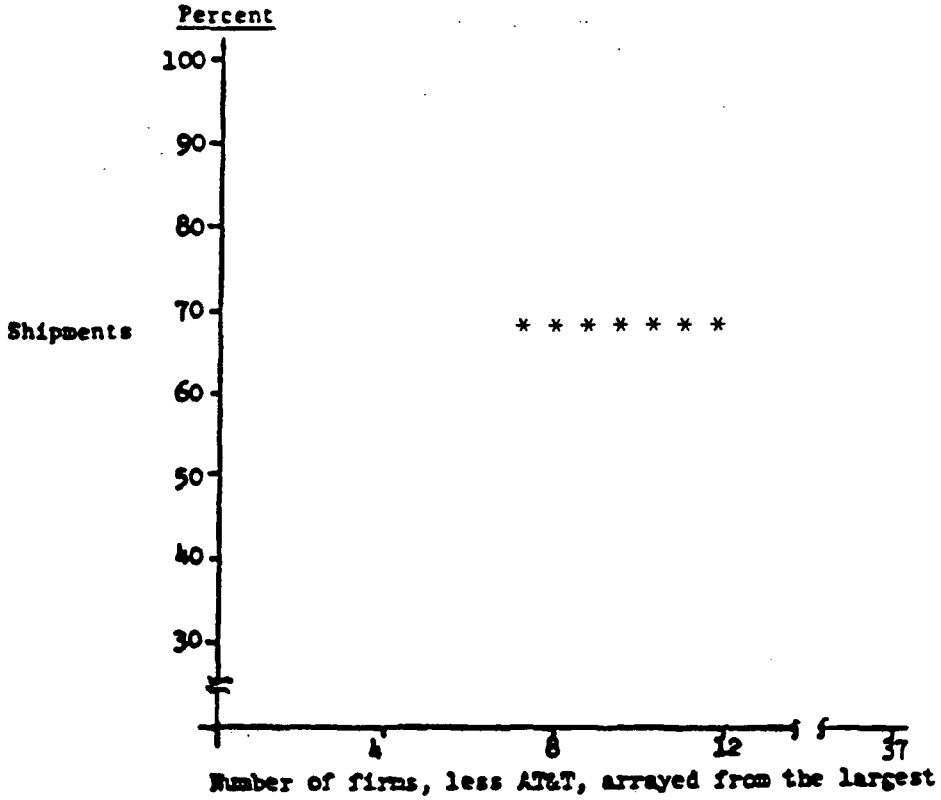


Figure 4.--Concentration of total (domestic plus export) shipments, less AT&T, 1977



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Value added by all firms.--Data from the 19 firms which reported U.S. labor value added to imported material are shown in tables A-1 and A-2, appendix A. On the average, labor value added was from 5.5 to 7.5 percent of the value of imported material for manufacture in the years for which the data were collected. As would be expected, there is variation in value added according to the type of product. Imported material which was further processed accounted for 65 to 75 percent of all imported material. Thus, only 25 to 35 percent of imports were sold directly. The ratio of finished, ready-for-sale imports to domestic shipments was approximately * * * percent in 1977. In light of the small percentage of U.S. labor value added relative to imported material, these firms may be described more accurately as importers rather than U.S. producers.

Value added by foreign-owned firms.--Of the 19 firms which added value to imported material, 13 firms are at least 70-percent-owned subsidiaries of foreign companies. These subsidiaries are owned by some of the largest of foreign telecommunication companies. Among them are * * * Table A-3 shows imported material and labor value added to imports by these firms in 1977. On the average, the ratio of labor value added to imported material was 7.5 percent for the 13 firms, approximately the same ratio as for all 19 firms. The foreign-owned firms used about 50 percent of all U.S. imports in their assembly or further manufacture processes. As shown in table A-4, total domestic shipments from the 13 firms were valued at * * * percent of total domestic shipments in 1977. Most of the foreign-owned firms acquired U.S. manufacturing facilities recently, and many firm officials stated that 1978 will be the first year for full output.

Users

PBX's, key system switching equipment, and central office equipment, while functionally similar, are technically and architecturally separate types of equipment. Furthermore, the markets are distinct. Central office switching equipment is sold to, and operated by, public common carrier utilities. The equipment is, in general, much larger in scale than private branch exchange equipment 1/ and is not offered for sale or rental to the general public where there is no market. In contrast, the private branch exchange is considered local-customer-premises equipment as is key set switching equipment. PBX's and key system switching equipment are sold to private businesses, telephone companies, and the Government.

Regulated and unregulated markets.--The users' market for telephone equipment may be divided into regulated and unregulated markets. Telephone common-carrier companies, whose rates are subject to State Commission approval, compose the regulated market, while businesses which purchase their own telephone systems are part of the unregulated market. Hotel and motel chains, airline companies, utility companies, and banks are major customers in the unregulated market.

1/ Recently private branch exchanges have been built with about the same capacity as smaller central office switches. However, they are still distinct products and have different markets.

In the regulated common-carrier market AT&T and its subsidiaries form the Bell System, which operates 82 percent of the telephones in service in the United States (derived from table B-1). Telephone companies in the Bell System buy primarily from their manufacturing affiliate, Western Electric. Independent carrier companies compose the other segment of the regulated market and account for approximately 18 percent of all telephones in service and 18 percent of all telephone company plant investment (derived from table B-2). Independent operating companies numbered 1,556 in 1977, with subsidiaries of GTE accounting for the largest share of the independent market when measured in terms of telephones in service.

Regulated common-carrier companies represent the bulk of the users' market in telephone equipment. * * * percent of all telephone instrument and switching equipment shipments were directed to regulated-carrier companies in 1977. Purchases in the unregulated market are principally of private branch exchanges. In 1977, of PBX shipments, * * * percent went to unregulated companies. Almost one-half of the telephone equipment manufacturers identified in the ITC survey sell to both the regulated and unregulated markets. AT&T, however, because of the terms of the consent decree of 1956, sells only in the regulated market, but leases equipment to end users in the unregulated market.

Related and unrelated party transactions.--In addition to the regulated and unregulated market segments, the users' market in telecommunications may be analyzed in terms of related and unrelated party transactions. Related party transactions (transactions between financially affiliated companies) primarily cover shipments between the large manufacturing firms of AT&T and GTE and their common-carrier affiliates. Unrelated party transactions refer to transactions between companies with no financial affiliation and include most shipments of telephone equipment firms with no common-carrier subsidiaries.

A distinction is made between the captive and non-captive markets because the non-captive market is readily accessible to independent producers and importers. The concentration of imports in the non-captive market affects this sector measurably whereas it is barely discernible in the large captive market or in the total market. Thus, this segmentation of the market is necessary to assess the impact of imports on small producers serving the rapidly growing non-captive market.

Transactions between unrelated firms also provide information on the interconnect industry 1/ or those firms which primarily sell subscriber-owned equipment. As defined by Stanford Research Institute, the telephone interconnect industry comprises the manufacturers which produce telephone equipment and the suppliers which sell or lease, install, and service private-business telephone systems for the end user. These systems are offered in place of Bell and independent telephone company equipment. 2/ (This definition is somewhat imprecise for several interconnect firms sell to independent telephone companies, which in turn sell or lease the equipment to the end user.)

1/ The term "interconnect industry" is commonly used in the field of telecommunications.

2/ Stanford Research Institute, Telephone Interconnect Industry, 1974.

Data on transactions between unrelated companies serve as a good indicator of the interconnect industry. These transactions, however, cover more than the interconnect industry; shipments of vertically integrated firms to users other than their subsidiaries are also included. Unrelated party transactions offer a manufacturer-oriented analysis of the interconnect or non-captive manufacturing industry.

Distribution network

In the unregulated market, telephone equipment is marketed primarily through independent distributors and interconnect suppliers. Distributors and interconnect companies perform marketing and service functions in selling, installing, and maintaining manufacturers' products. On the retail level and for large businesses, manufacturers may use their own sales representatives to establish accounts. Sales in the regulated market are usually made directly to telephone companies. In order to avoid double counting of shipments, distributors were not surveyed except for imports or exports.

Although sales procedures vary among firms, most manufacturers sell equipment without installation service. Interconnect suppliers (distributors) or buyers' representatives perform the site-engineering and installation requirements. Two-thirds of the firms which returned questionnaires to the Commission showed 100 percent of sales on an equipment-only basis.

Producers with no telephone common-carrier affiliates sell principally in the unregulated market. Survey responses showed that the unregulated market accounted for about 75 percent of all unrelated party shipments of telephone sets. Sales of branch exchanges and subassemblies to unregulated companies amounted to 60 percent of total non-captive sales of this type of equipment. Central office equipment, because of its specialized use, is sold almost exclusively to telephone carrier companies. About 4 percent of all non-captive shipments of this equipment was sold to unregulated users.

U.S. Shipments

The value of U.S. shipments (excluding exports) of telephone terminal and switching equipment for the years 1972, 1/ 1976, and 1977, increased from * * * (table A-5). Table A-6 shows domestic shipments in constant-dollar terms. Domestic output increased by 23 percent in constant dollars from 1972 to 1977, compared with a 47-percent growth rate in current dollars (derived from tables A-5 and A-6 and shown in fig. 5).

In current dollars, the value of each product group, except central office switches, increased substantially for the 3 years. The value of shipments of telephone sets increased 89 percent; branch exchanges, 73 percent (shown in fig. 6); central office switches, 18 percent; and parts and subassemblies, 97 percent. These increases occurred despite a strong downturn in shipments in 1975 and only a weak recovery in 1976.

1/ Some respondents to the Commission's questionnaire were unable to report data for 1972. Thus, the data for 1972 are understated.

Figure 5.--Domestic shipments of telephone terminal and switching equipment in current and constant dollars, 1972, 1976, and 1977

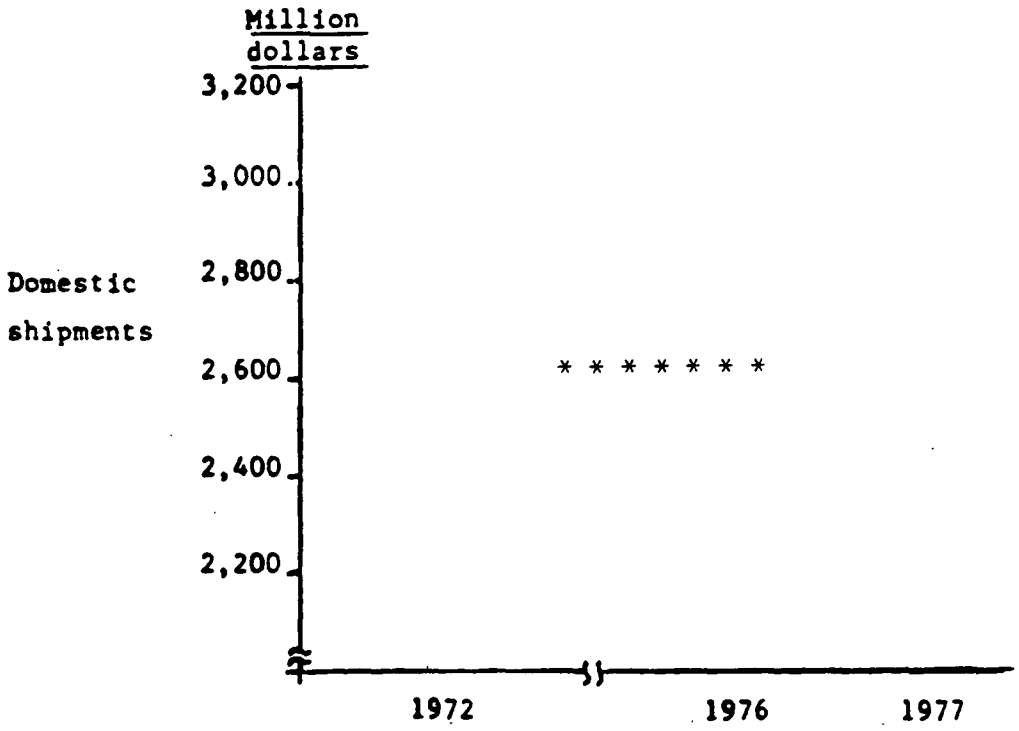
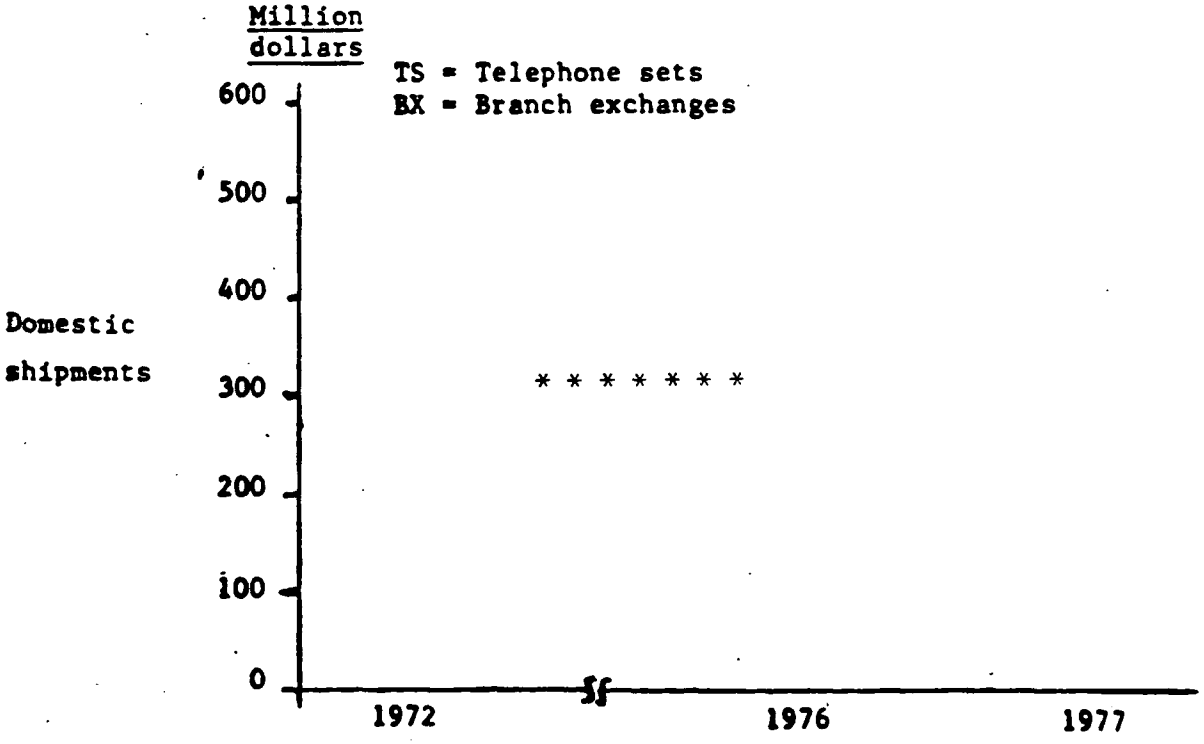


Figure 6.--Domestic shipments of telephone sets and branch exchanges, 1972, 1976, and 1977



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Shipments between related parties

The value of shipments of telephone terminal and switching equipment between related parties increased 37 percent from * * * in 1972 to * * * * * * in 1977 (table A-7 and fig. 7). Shipments between related parties comprised * * * percent of total shipments in 1972 and diminished to * * * percent in 1977. The value of each product category, except branch exchanges, diminished by a few percentage points as a share of the total shipments for their respective categories. Shipments of branch exchanges between related parties decreased from * * * percent of total shipments of branch exchanges in 1972 to * * * percent in 1977 as independent producers gathered a larger share of the domestic market through innovation and aggressive selling (derived from tables A-5 and A-7).

Shipments between unrelated parties

The value of shipments of telephone terminal and switching equipment between unrelated parties composed * * * percent of the total value of shipments in 1977. Non-captive shipments increased 111 percent, from $293 million in 1972, to $618 million in 1977 (table A-8). The largest increase was in branch exchanges which increased by more than 200 percent to $183 million in 1977. All other product categories, except central office switches, increased by more than 100 percent. Central office switches increased by 47 percent and, unlike shipments between related parties, did not decline in 1976 (derived from tables A-5 and A-8).

Shipments to regulated common carriers

The value of shipments to regulated common carriers increased 38 percent from * * * in 1972 to * * * in 1977 (see table A-9 and fig. 8). The value of these shipments follow the same trend as shipments to related parties and are heavily weighted by transactions reported by AT&T and GTE, which have within their corporate structure both manufacturers of telephone terminal and switching equipment and regulated common carriers.

The difference between shipments to related parties and shipments to regulated common carriers is an indication of the penetration of independent producers into the regulated common-carrier market. It appears that independents shipped a larger value of goods to the common carriers in 1977 than in 1972, but their penetration has been steady at about * * * percent.

Shipments to customers other than regulated common carriers

The value of U.S. shipments of telephone terminal and switching equipment to customers other than common carriers increased more than 200 percent, from $97 million in 1972 to $323 million in 1977 (table A-10 and fig. 8). Very large gains occurred in branch exchanges, telephone sets, and parts and subassemblies, but shipments of central office switches were lower in 1976 and 1977 than in 1972.

Figure 7.—Domestic shipments of telephone terminal and switching equipment to related and unrelated parties, 1972, 1976, and 1977

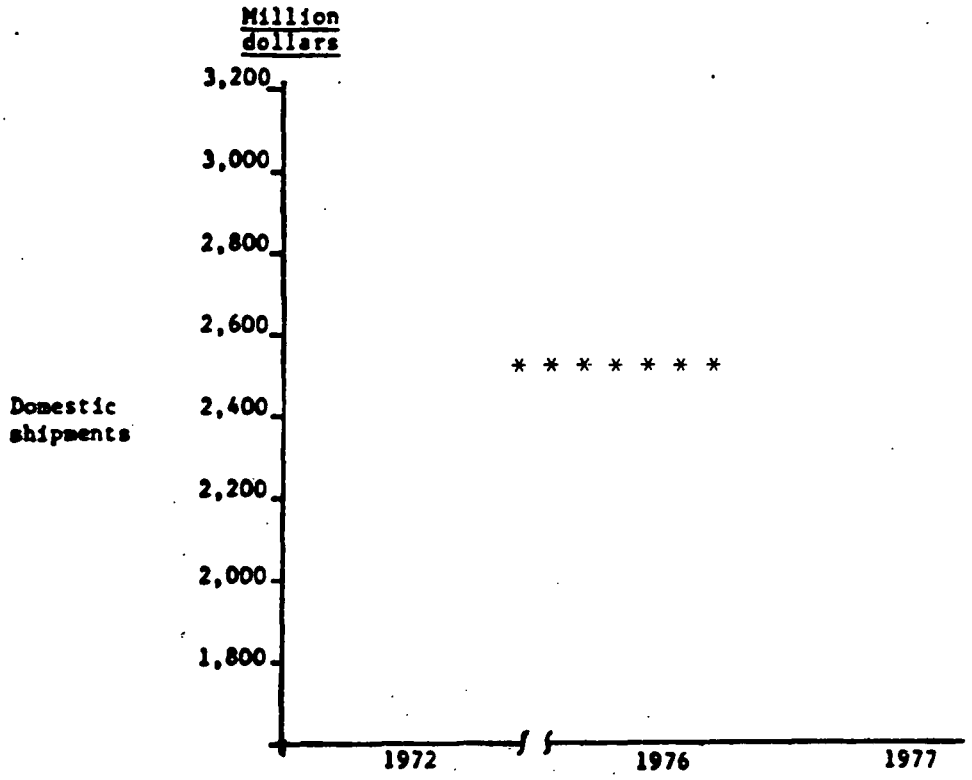
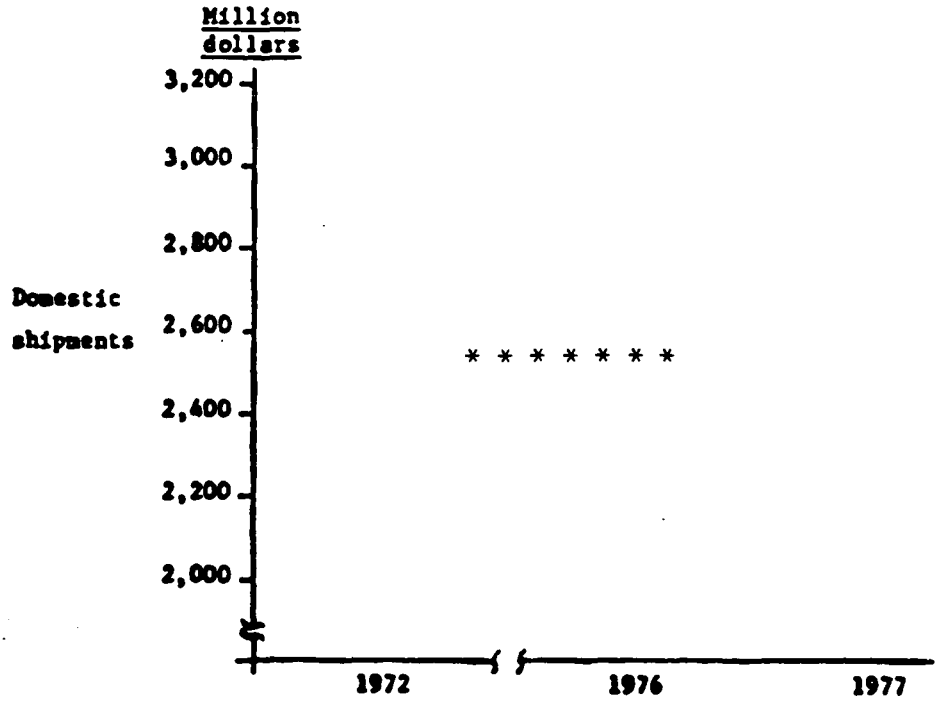


Figure 8.--Domestic shipments of telephone terminal and switching equipment to regulated telecommunications common carriers and all other purchasers, 1972, 1976, and 1977



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

These shipments were directed to businesses and other nontelephone company customers. Shipments of telephone sets to this market increased from * * * percent of total telephone set shipments in 1972 to * * * percent in 1977. Shipments of parts and subassemblies increased slightly as a percentage of total shipments; central office switches decreased to * * * percent.

Shipments by U.S. and foreign-owned firms

Thirteen foreign-owned firms with manufacturing or assembly facilities in the U.S. accounted for * * * percent of total U.S. shipments of telephone instrument and switching equipment in 1977 (table A-4). By product line, the percentage of shipments of foreign-owned firms varied but was less than * * * percent for all categories except branch exchanges, where it reached * * * percent in 1977. Foreign-owned firms enjoy a large market share in the branch exchange area because of high demand and FCC actions increasing competition in this market.

In considering shipments to unrelated parties only, higher market concentrations are shown for foreign-owned firms (see table A-11). Transactions between unrelated companies approximate the size of the interconnect industry. Foreign-owned firms in the U.S. claimed a 24-percent share of this market in 1977, on the basis of unrelated party shipments. In the branch exchange and central office product areas foreign-owned firms are well represented, accounting for 37 percent and * * * percent, respectively, of unrelated party shipments in 1977. In 1972, shipments of foreign-owned firms amounted to * * * percent of unrelated company shipments.

On a related-party basis, shipments of foreign-owned firms are insignificant, primarily because foreign firms have no affiliation with domestic operating companies (table A-12).

U.S. shipments of foreign firms are directed principally to customers other than regulated carrier companies. As depicted in table A-13, almost two-fifths of domestic branch exchange shipments to unregulated companies are made by foreign-owned firms. In central office switches, foreign-owned companies account for * * * of unregulated company shipments, but the total value of these shipments is very small. Shipments to unregulated companies appear to track the interconnect industry and these shipments show approximately the same market share breakout based on ownership as shipments between unrelated parties.

Comparison between questionnaire and Commerce data

The value of U.S. shipments of telephone terminal and switching equipment reported by respondents to the Commission's questionnaire differed significantly from that reported by the Department of Commerce. The difference is attributable to the following major variances in the collection of the data.

The Commission's questionnaire was structured to obtain consistent valuation and classification of products by all respondents. To avoid double counting of shipments, the Commission gathered information on the basis of the value of the first arms-length transaction to end users or distributors. Product definitions used in the questionnaire were based on hardware only, and the value of completed products was carefully segregated from the value of subassemblies and parts. See appendix E for a discussion of classification and valuation procedures followed by the Department of Commerce.

According to official Commerce Department statistics, the value of U.S. shipments of telephone terminal and switching equipment was $5.6 billion in 1977, 75 percent higher than in 1972 (table B-3). Of the four major categories of equipment, the value of branch exchange shipments increased 15 percent to $255 million in 1977; central office switching equipment increased 91 percent to $2.5 billion; subassemblies and parts increased 64 percent to $2.2 billion; and telephone sets increased 91 percent to $672 million.

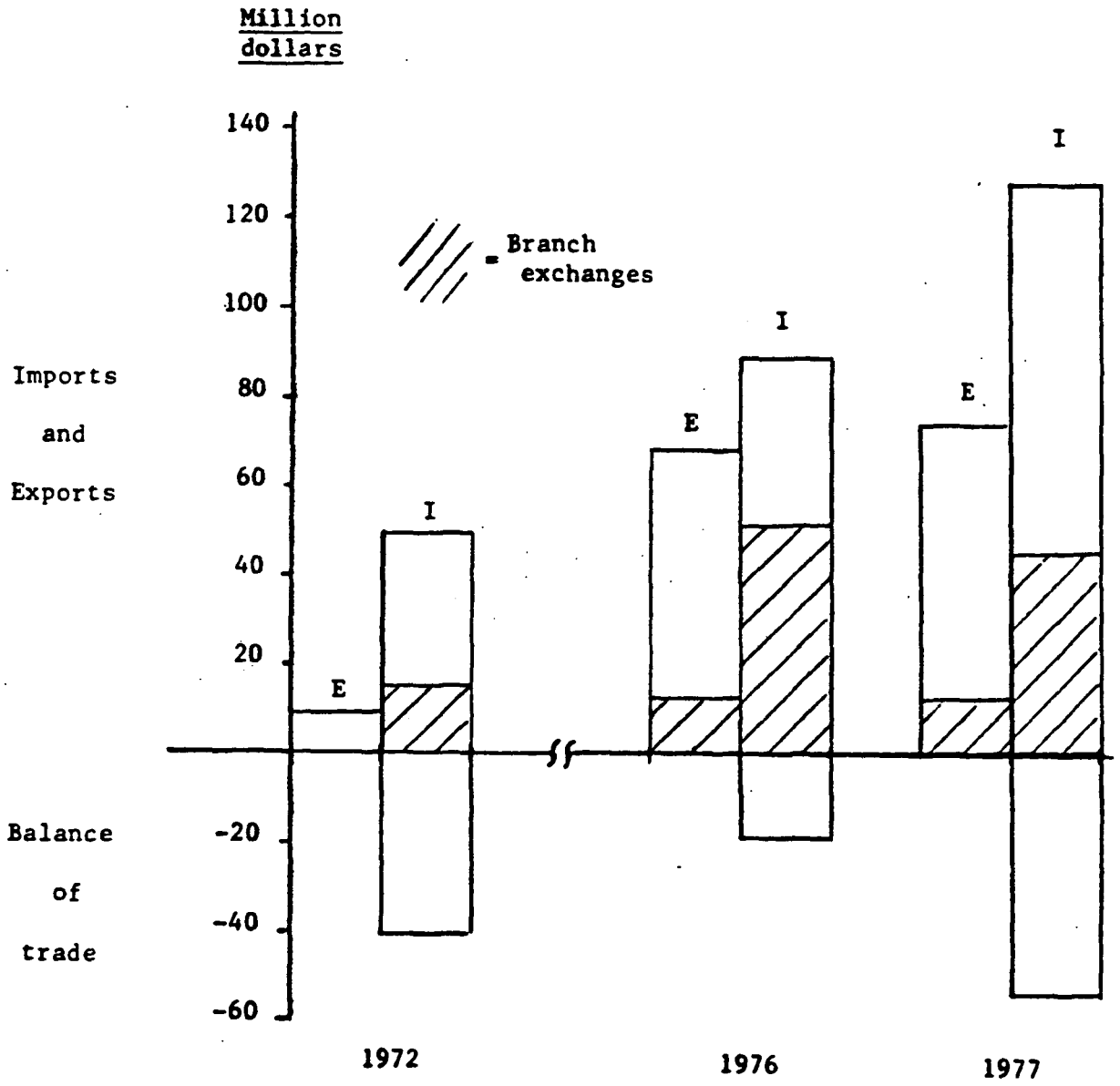
According to the responses to the Commission's questionnaire, in 1977, the value of U.S. shipments of telephone terminal and switching equipment reached * * * or * * * percent less than that reported in official statistics. In addition to variances in data collection between Commerce and the Commission, this difference in shipment level may be attributed to the inclusion of undefined equipment in Commerce figures. The value of shipments of telephone sets and branch exchanges reported to the Commission is much higher, and the value of shipments of central office switches and subassemblies and other equipment is much lower than that reported in official statistics.

Official statistics on branch exchanges shipped to common and private carriers (table B-4) show a lower value of shipments for private carriers. Commission data on shipments to regulated companies do not distinguish between private and common carriers.

Data on shipments collected by the Department of Commerce are subject to significant revisions after publication. Recent revisions of 1976 data by Commerce show large inaccuracies in the initial figures published for private branch exchanges and telephone sets. Revised shipments of telephone sets in 1976 increased 38 percent and branch exchange shipments increased 21 percent. Corrected 1975 shipment figures for branch exchanges were revised downwards by 20 percent from initially released statistics. Corrections to 1977 data will not be available until 1979. Because Commerce Department's 1977 figures for telephone equipment are likely to be substantially changed, no trends are shown for this data.

Data collected by the ITC showing total U.S. output (domestic shipments plus exports) are presented in table A-14. These figures are more comparable with official statistics since Commerce data reflect exports in shipment value.

Figure 9.--Total imports and exports of telephone terminal and switching equipment, imports and exports of branch exchanges, and balance of trade, 1972, 1976, and 1977



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Exports

Exports of telephone equipment covered by the ITC survey increased 9.6 percent in value from 1976 to 1977, from $68.3 million to $74.9 million (table A-15). Telephone sets accounted for almost $2.3 million of this increase in export value, and exports of branch exchanges showed a near $4 million increase during the same period, from $12.5 million to $16.5 million.

Exports of central office switching equipment declined slightly in value from 1976 to 1977. * * *

From 1972 to 1977, telephone equipment exports showed a sizeable growth in value, increasing from $8.9 million to $74.9 million. However, no detailed comparisons may be drawn during this period because the statistics for 1972 are incomplete. Several firms were not able to furnish sufficient export data from their 1972 records.

Foreign-owned firms in the U.S. are insignificant in export trade of telephone equipment. In 1977, exports of foreign firms located in the U.S. represented * * * percent of total exports. Data on exports of foreign and U.S.-owned firms are presented in table A-16.

The balance of trade in telephone equipment was negative in 1972, 1976, and 1977, with a deficit of $53 million in 1977. See figure 9 for a graphic comparison of import and export data.

Comparison between questionnaire and Commerce data

Official statistics from the Department of Commerce reveal a four-fold value increase in total telephone equipment exports between 1970-77, from $30.7 million to $156.4 million. These data are shown in table B-3. Commerce statistics on telephone equipment exceed by over 2 times the value disclosed in questionnaire returns in 1972, 1976, and 1977. In part, this is because the official figures embrace telephone products, such as intercoms and modems, which were specifically excluded in the ITC survey. Differences also may be attributed to valuation procedures. Questionnaire data on exports reflect the value of hardware or equipment only. Official statistics on exports tend to inflate dollar amounts because little control is placed on valuation determination. Training support, manuals, and service contracts are often counted in export valuation.

Export statistics from Commerce on telephone sets and switching equipment are considerably lower than the data compiled from questionnaire returns. Looking at branch exchanges alone, questionnaire responses show exports of $16.5 million in 1977, compared with Commerce figures of $9.2 million for all switching equipment exports. When central office switches are included, exports of switching equipment from survey returns total $48.4 million.

Discrepancies between Commerce and questionnaire data indicate misclassification in switching equipment exports. A large part of switching equipment exports appear to be classified in a general category called "other telephone equipment." Other telephone equipment exports totaled $140.9 million in 1977. The high valuation of this category suggests it contains a significant share of switching equipment.

Official statistics show a low export-to-shipment ratio in telephone equipment (table B-5). This ratio amounted to less than 4 percent in both switching equipment and telephone instruments during the period 1972-76.

Exports by principal markets

Questionnaire data detailing U.S. exports to selected geographic areas are shown in table A-17. Telephone equipment exports to Europe were negligible, amounting to less than * * * percent for the three years listed. Canada purchased about one-third of U.S. exports * * * 1977. The bulk of U.S. exports were directed to developing countries and were classified in the "all other" category.

Exports by type of equipment are based on Commerce Department statistics and are shown in tables B-6 through B-9. For all equipment except telephone instruments, Canada is the largest single recipient of U.S. exports. For telephone instruments, however, Mexico is the major purchaser of U.S. equipment, accounting for 24.9 percent of U.S. exports in 1977.

Imports

Imports of telephone equipment covered by the ITC survey increased 46.7 percent in value from 1976 to 1977, from $87.0 million to $127.6 million (table A-18). Comparison of survey import data between 1972-77 is not valid since the 1972 survey data are incomplete. A number of firms were unable to report 1972 data.

During 1976 and 1977, telephone key sets accounted for a large majority of imported telephone sets. Imports of all types of telephone sets increased 69.6 percent between 1976 and 1977. Imports of branch exchange and central office switching equipment increased 43.7 and 25.7 percent, respectively, during the same period. Key system switching equipment imports doubled between 1976 and 1977.

Foreign-owned firms in the U.S. account for a substantial share of imports of telephone equipment into the U.S. In 1977, foreign firms with manufacturing facilities in the U.S. represented 75 percent of total imports. By product line, foreign firms in the U.S. imported 66 percent and * * * percent, respectively, of all telephone set and branch exchange imports. Import data by types of ownership are shown in table A-19.

Direct sales of telephone equipment imported with no value added in the U.S. are made primarily to other than regulated companies. More than 80 percent of imports of key sets, branch exchanges, and parts and subassemblies were sold to noncarrier companies in 1972, 1976, and 1977. Imports of key system switching equipment and central offices were purchased principally by regulated companies. (see table A-20).

Official statistics

Official statistics of the U.S. Department of Commerce indicate that the value of imports increased 42.4 percent between 1972-77 (table B-10). The increase between 1976 and 1977 was $18.9 million, or 21.5 percent. Commerce Department statistics for 1972 considerably exceed the value reported in the survey. As noted, this is because of incomplete 1972 survey data. Imports reported by Commerce are essentially equal in value to the survey data for 1976. However, in 1977 the value of imports, as obtained by the ITC survey, exceeded Commerce Department value by $20.8 million, or 19.5 percent. There are several reasons for this disparity.

The survey of imported equipment was not limited to parts, subassemblies, and equipment as defined in the Tariff Schedules of the United States Annotated (TSUSA) item number 684.62. Firms were asked to report all imported material used in the assembly and manufacture of telephone terminal and switching equipment. Many of the firms reporting imports indicated TSUS numbers other than item 684.62 for articles used in telephone equipment. In official statistics, errors in imported product classifications may have occurred.

Imports by country of origin

According to official statistics, imports from Canada and Japan have ranged from 62 to 82 percent of all imports by value from 1972-77. No other country or group of countries exceeded 20 percent. Data compiled from the ITC questionnaires indicate that Japan and Canada claimed a * * * percent share of the import market in 1972, 1976 and 1977. Imports from Europe were less than 7 percent in 1976 and 1977 (table A-21).

Since 1975, import statistics for several categories of telephone equipment have been available. Tables B-10 through B-13 show imports by countries and geographic areas for telephone instruments, switching equipment, and other telephonic apparatus, including parts, from 1975-77. For telephone instruments, Japan has been the principal source of imports, accounting for more than 50 percent each year. Other telephone apparatus and parts are also principally sourced from Canada and Japan.

Imports under items 806.30 and 807.00

As shown in table B-14, the total value of telephone equipment imports of U.S. articles of metal exported from the United States for processing and returned to the United States for further finishing under item 806.30 has not exceeded $14,000 in any year during the period 1972-77.

Tariff Schedules of the United States (TSUS) item 807.00 concerns imports of products containing parts of U.S. origin which were previously exported. Duty is paid on the full value of the imported article less the value of U.S. parts returned. Certain conditions must be met in order to qualify under item 807.00. These conditions are shown in footnote 1 to table B-15. This table shows that telephone equipment entries under item 807.00 did not exceed $13 million in any year from 1972-77. Official statistics indicate that imports involving item 807.00 have risen from $1.7 million in 1972 to $11.9 million in 1977, but at no time during this period did these imports exceed 12 percent of total imports or 1 percent of U.S. consumption in any year.

Data from survey returns in the following table show a total value of * * * in 1977 for instrument and switching equipment articles imported under tariff provisions 806.30 and 807.00. Duty-free treatment on these articles amounted to 40 percent of total value. Questionnaire data on 806.30 and 807.00 items are incomplete in 1976 because several companies did not have information for this year.

Telephone terminal and switching equipment: Imports under TSUS items 806.30 and 807.00, 1976 and 1977

(In thousands of dollars)

Item	1976	1977
Total value	* * *	* * *
Value U.S. products	* * *	* * *

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

U.S. Consumption

Apparent consumption of telephone terminal and switching equipment increased almost 50 percent between 1972-77, from * * * to * * * Between 1976 and 1977 consumption increased by 25 percent (table A-22). As shown in tables A-23 through A-27, consumption increased in value in each of the years under study for all product lines except central offices, where it dipped slightly in 1976 compared with 1972.

Overall import penetration in the telephone instrument and switching equipment market is low (tables A-22 through A-27). Data submitted to the Commission reveal an import to consumption ratio of * * * percent for total telephone equipment in 1977, and less than * * * percent for total telephone sets and central offices.

Branch exchange equipment evinces the highest import pentration by product line, with an import to consumption ratio of * * * percent in 1977. For telephone key sets and subassemblies and parts, the import penetration ratio was * * * percent and * * * percent, respectively, in 1977. Foreign-owned firms in the United States which import materials for domestic assembly account for a large percentage of imports of subassemblies.

Import competition is concentrated in the market supplied by non-captive manufacturing companies. This market primarily includes firms with no subsidiary telephone operating companies. Using shipments to unrelated parties as an index of this market, the import penetration ratio of telephone equipment in this market was 17.1 percent in 1977, as shown in the following table. This market, represents a small, although growing, part of the total market in telephone equipment.

Telephone terminal and switching equipment:
U.S. shipments to parties unrelated to the manufacturer, imports for consumption, and apparent consumption, 1972, 1976, and 1977.

Year	U.S. shipments to unrelated parties	Imports	Apparent consumption	Ratio of imports to consumption
	(1,000 dollars)	1,000 dollars	(1,000 dollars)	(Percent)
1972-----	293,359	49,659	343,018	14.5
1976-----	468,953	87,025	555,978	15.7
1977-----	618,127	127,629	745,756	17.1

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Imports of central office equipment consist primarily of class 5 switches, as do shipments of central office equipment between unrelated parties. Total domestic shipments, however, contain a large percentage of high-valued class 1-3 switches, manufactured predominately by AT&T. Although the data is not broken out by class, imports and shipments of central offices in unrelated party transactions reflect principally class 5 switches and have similar valuation bases. Sales of such equipment are directed principally to

independent telephone companies. As shown in the table below, the import penetration ratio for central office equipment sold in unrelated party transactions reached a high of 15.1 percent in 1972 and declined to 12.3 percent in 1977. 1/

Central office switching equipment:
U.S. shipments to parties unrelated to the manufacturer, imports for consumption, and apparent consumption, 1972, 1976, and 1977

Year	U.S. shipments to unrelated parties	Imports	Apparent consumption	Ratio of imports to consumption
	(1,000 dollars)	1,000 dollars	(1,000 dollars)	(Percent)
1972-----	122,092	21,664	143,756	15.1
1976-----	168,010	20,119	188,129	10.7
1977-----	179,968	25,284	205,252	12.3

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Statistics from the Department of Commerce confirm a small penetration of imports into the U.S. telephone equipment market, as shown in tables B-16 through B-18. For telephone sets and all switching equipment, Commerce statistics show an import to consumption ratio in 1977 of 1.2 percent and 1.4 percent, respectively.

Official data for branch exchanges, however, indicate a high import penetration ratio, measuring 13.9 percent in 1977. These data are estimated since imports are not separately reported for PBX equipment. It is assumed that most of the switching equipment imports are branch exchanges. Commission survey data show a lower import to consumption ratio, and the higher percentage of Commerce data may be attributed to an apparently large understatement of branch exchange shipments by Commerce.

According to official statistics for all telephone equipment, exports exceeded imports in 1976 and 1977. When telephone terminal and switching equipment is considered separately, data submitted to the Commission show imports to be larger than exports. As derived from tables A-15 and A-18, the ratio of exports to imports was .71 and .53 in 1976 and 1977, respectively.

1/ A request was made in the hearing before the Commission on Sept. 26 to breakout class 5 shipments from all central office shipments to compare imports with shipments more adequately. (See Transcript 332-92, p. 28-29). Although this could not be done directly because some switches are made in combination classes, the aforementioned method offers an approximate comparison of imported and domestic class 5 switches.

Employment

Producing firms

Overall employment in terminal and switching equipment manufacturing firms was down by 5 percent in 1977 compared with 1972. Employment of all persons increased moderately from 1976 to 1977, from 72,434 to 82,276 persons (table A-28).

Employment of production and related workers followed the pattern shown for all persons, with lower employment in both 1976 and 1977 than in 1972 and an increase from 1976 to 1977. The number of production and related workers declined 20 percent from 1972 to 1976, and increased 12 percent in 1977.

Of production and related workers, technicians and craftspeople were most affected by the downturn in employment. From 1972 to 1977, employment decreased by approximately 25 percent in each of these sectors. The level of employment in the telephone manufacturing industry in 1976 reflects the lingering effects of the general slowdown in the economy in preceding years, while the 1977 level depicts a healthy rebound.

Employment in foreign-owned firms in the U.S. increased from 298 persons in 1972 to 2,358 persons in 1977, or about a seven-fold increase. Compared with total employment, the number of workers in U.S. foreign firms represented less than 0.5 percent of total domestic employment in 1972 and almost 3 percent in 1977. Employment figures in U.S. and foreign-owned firms are detailed in table A-29.

Published employment statistics for the telephone and telegraph industry as a whole parallel the trends shown for telephone equipment firms. The number of production workers decreased by 22 percent in the industry, while the number of man-hours per production worker decreased by 2 percent between 1972-76. Employment of production workers rose moderately, from 74,000 in 1976 to 86,000 in 1977 (table B-19).

Common-carrier companies

Employment in common-carrier companies, the service end of the telephone industry, declined slightly in 1976, compared with employment in 1972. As shown in table B-20, telephone operators, the job sector most seriously impacted by employment reduction, declined in number by 24.4 percent; the number of installation and exchange craftspeople decreased by 3.5 percent between 1972-76.

For the independent common carriers, the number of employees increased mildly from 1972 to 1977 (table B-21). The only major decline in employment during this period occurred in the telephone operators sector.

Employment figures for the Bell System show an overall decline of 6.5 percent during the 1972-77 period (table B-22). The number of skilled craftspeople (including installation and exchange repair personnel) decreased by 7.1 percent, while semi-skilled operatives (including telephone operators) decreased by 14.7 percent during these years.

The ratio of telephones to common carrier employees serves as a measure of productivity in the telephone industry overall. As shown in table B-23, this ratio has risen steadily during the period 1970-77, increasing from 127.8 telephones in 1970 to 170.2 telephones in 1977.

Technology

Information is customarily conveyed by speech in the telephone network. The basic method of speech transmission between parties is the direct sending of voice-frequency (approximately 300 to 3,000 Hz) electric waves from the telephone instrument along a pair of wires and through sets of contacts at switches to the final telephone instrument.

However, this basic, reliable, and technically simple system is not the most efficient method of transmitting phone messages. Because of improvements in technology, a pair of wires is capable of handling more than one conversation simultaneously. The high cost of installing and servicing wire connections demand that wires be used efficiently; therefore, single pairs of wire, single coaxial cables, or single radio channels have carried for years many conversations simultaneously on trunks between central offices. The interoffice or intercity multichannel trunks no longer have the technical simplicity of the familiar one pair, one conversation phone system.

The ability to make more efficient use of the installed transmission and switching equipment was brought about with the invention of the transistor (at Bell Telephone Laboratories in 1948) and the subsequent development of integrated solid state electronic circuits and digital computers. This technology was incorporated into the telephone system. Telephone sets now can convert voice frequency signals into digital code signals before sending them along the wires. More and more central offices and private branch exchanges have been converted to switching systems which handle these digital bit streams rather than the traditional voice-frequency signals.

The most complex item of equipment in the phone system is the switch which routes calls from one party to another. Until the early 1960's, the switch was a complicated electromechanical device in which the path of a single circuit was completed by direct contract between literally hundreds of moving metallic junctions. The switch contained hundreds of thousands of these movable metallic junctions. The manufacturing processes were well known, the standards well developed, and the tooling basic. These switches, mostly the crossbar type, are still made today but are being replaced gradually by new semiconductor designs.

Makers of modern switching equipment use solid state semiconductor electronic technology almost exclusively. Within the newest switches, which resemble computers, telephone circuits are connected through semiconductors and integrated circuits; there are no moving parts.

Technology in the semiconductor industry is in a rapid state of flux. In past years, the industry, using crossbar technology, was well advanced along the learning curve. Today electronic technology has put the telephone equipment industry into an early stage of the learning curve. New devices are introduced frequently and standardization and design freeze are now more difficult to achieve.

Effects of technology change on labor

Production workers require efficient skills and more training to perform higher technology manufacturing processes. Training hours per production worker increased from * * * to 23.9 hours, or by * * * percent, between 1972-77 (table A-28). Between 1976 and 1977 alone, the increase was 32.0 percent. While technology change is not the only reason for increased training requirements, it is likely the major reason.

Effects of technology change on equipment in service

Changing technology may be demonstrated in the use of electronic central offices and the telephone lines connected through these offices as shown in the following table and tables B-24 and B-25.

Central offices by types of exchanges, and connections by types of exchanges, 1972 and 1977

Item	Number of central offices and percent of change		Telephones connected to central offices by type 1/ and percent of change	
	1972	1977	1972	1977
Electronic central offices	819	3,688	6,283,185	31,332,889
Percent of total	4.5	18.1	5.5	22.1
Percent of increase	-	350.3	-	398.7
Other than electronic central offices	17,503	16,673	108,478,054	110,524,537
Percent of total	95.5	84.9	94.5	77.9
Percent of increase or (decrease)	-	(4.7)	-	1.9
Total	18,322	20,361	114,761,241	141,854,446
Percent increase	-	11.1	-	23.6

1/ The sum of lines 185-190 of source document.

Source: FCC, Statistics of Communications Common Carriers.

Between 1972-77 the number of nonelectronic central office exchanges decreased because of consolidations and replacement, while the number of electronic exchanges in service increased 350 percent. Telephones connected through nonelectronic exchanges increased by only 2 million. Telephones connected through electronic exchanges, however, increased by 25 million. Thus, during the period 1972-77, it appears that 92.5 percent of all new connections were made through electronic exchanges. Since not all phone companies report to the FCC 1/ and since phones connected through privately owned branch exchanges are not reported, the increased use of solid-state electronic switching shown above may be understated.

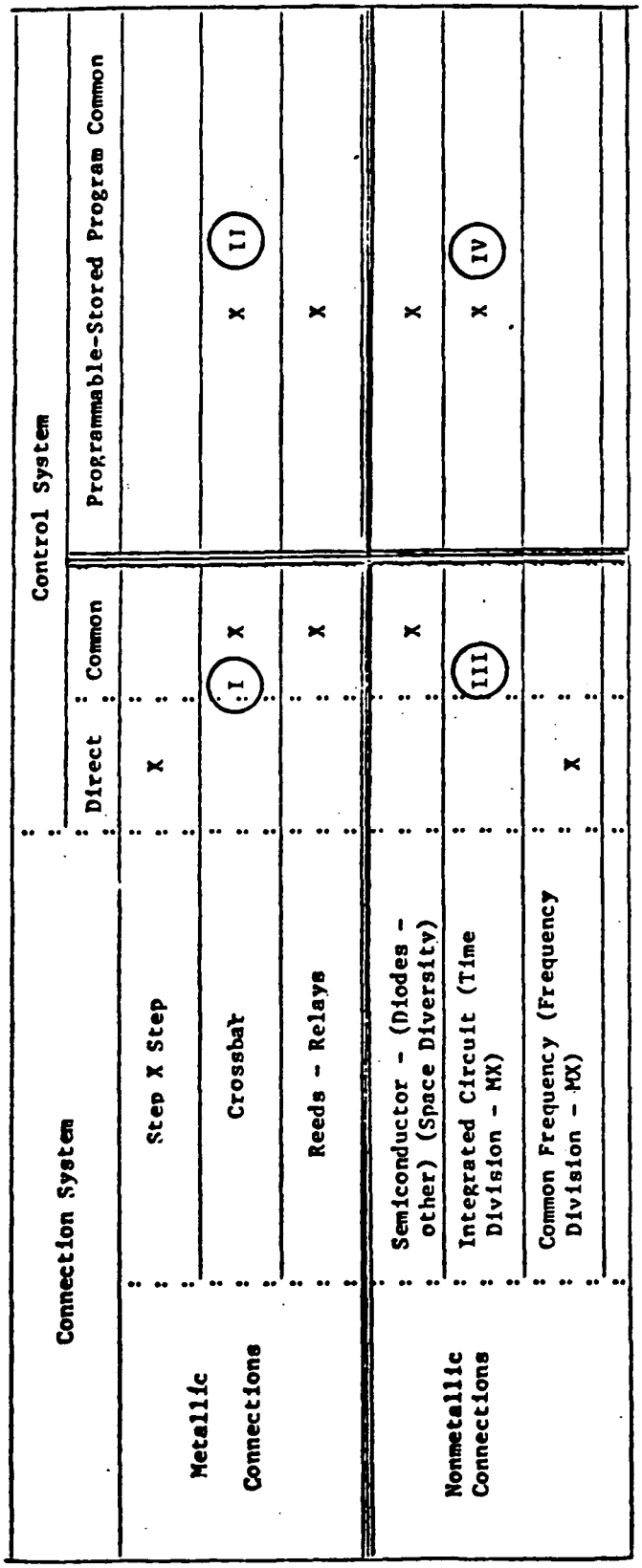
Effects of technology change on shipments

In order to obtain accurate data on technology changes, the U.S. International Trade Commission questionnaire was designed to collect information on several technologies used in the construction of branch exchanges and central offices. Two important parameters which vary with technology are the physical method by which circuit connections are made through the switch and the method of controlling the internal operations of the switch. The matrix in figure 10 shows the possible combinations of connection and control using these two parameters. The combinations were grouped to simplify reporting and to yield a measurement of the transition from older to newer technology.

The matrix is divided into four groups. Group I represents the oldest technology. Groups II, III, and IV represent increasing advances in technology. Group IV, a computer control system which operates a computer-like switch, is the most sophisticated system currently in use. The future may see a merging of the control and switching units into a single physical unit so that the parts are indistinct. Such construction may now be in use in the most advanced private branch exchanges.

1/ Only companies engaged in interstate commerce with operating revenues in excess of $1 million are required to file with the FCC.

Figure 10.--Switching equipment matrix



The four groupings of various combinations of switch connection and control system are:

Group	Switch Type/Control System	Comment
I	Metallic connections/direct and common control	Electromechanical exchanges; hard-wired control logic.
II	Metallic connections/stored program common control	Electromechanical connections but with improved electronic computer control, often achieved by upgrading Group I installations
III	Non-metallic connections/ direct and common control	Connections made through semi-conductors or common frequency selection, hard-wired or permanent (fixed) control logic
IV	Non-metallic connections/ stored program common control	Semiconductor technology throughout, control logic stored in a computer which can be reprogramed with new logic when necessary.

The graphs in figures 11 and 12 show the transition from Group I equipment to the later type equipment.

Branch exchanges have undergone the most radical shift from 1972 to 1977. In 1972 the ratio of shipments of the old technology exchanges (Groups I and II) to shipments of the newer types (Groups III and IV) was 13 to 1. In 1977, shipments of the latest, most sophisticated exchanges were 3 times shipments of the older designs. Technology change is more easily accomplished in the branch exchange market because of the equipment's generally smaller size (compared with the size of central offices) and the fact that it is sold to independent customers. Design and logistic support controls for the privately owned branch exchange are not as rigid as those controls required for equipment used in the national direct-dialing telephone network.

Central office equipment has undergone a more gradual change to the newest technology. Circuit connections are still made by metal-to-metal contact, but inflexible control system logic is rapidly being converted to the latest computer-like programmable systems. In 1972 the ratio of shipments of the old technology central office exchange (Group I) to the newer type (Group II) was 2.5 to 1. In 1977, shipments of the newer technology central office exchanges (Group II) were 5.6 times the shipments of the older technology (Group I). Shipments of the most advanced (Group IV) exchanges increased from * * * in 1972 to * * * in 1977, or by 700 percent.

Figure 11.--Domestic shipments of branch exchanges, by types, 1972, 1976, and 1977

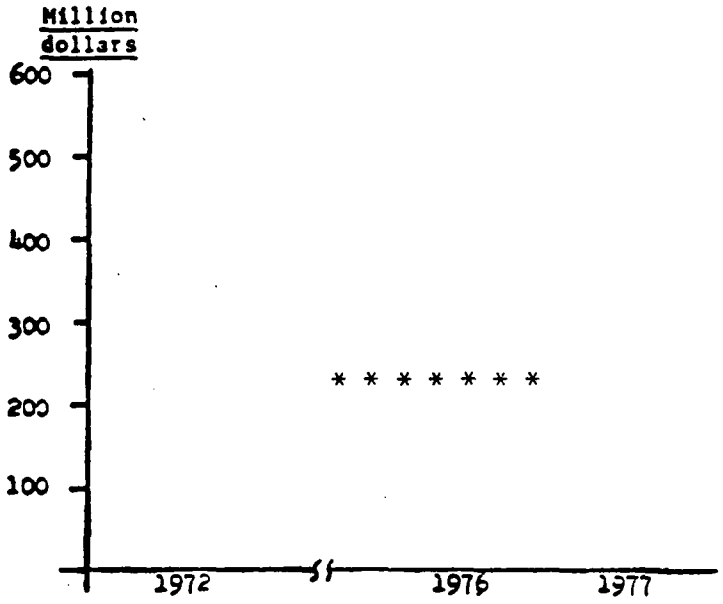
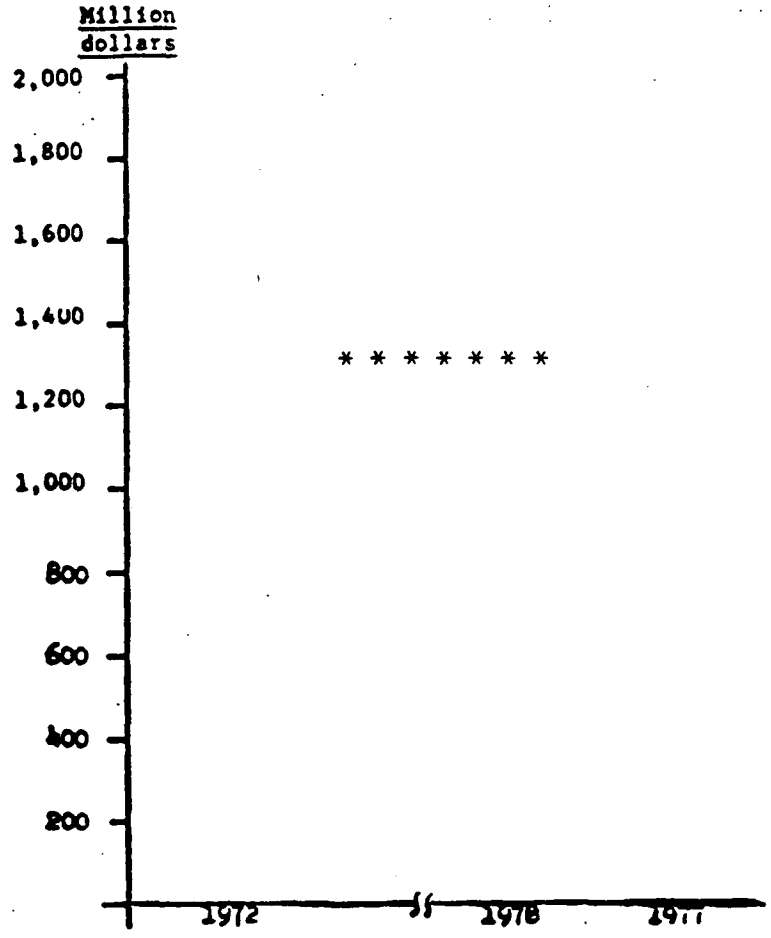


Figure 12.--Domestic shipments of central office switching equipment, by types, 1972, 1976, and 1977



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

While it might appear that the newest technology is somewhat slow to infuse the central office of the telephone system, two factors must be considered. First, the central office plant investment is $44.8 billion. In order to hold down the cost of service to the consumer, State public utility commissions require long-term depreciation of equipment. Thus, although much of the central office equipment may be technologically obsolete, it is still serviceable. Second, as noted in the previous discussion of branch exchanges, new central office equipment must be compatible with the existing transmission systems. The transmission system (wires, poles, trunks, microwave relay stations, and so forth) and station equipment (telephones, and so forth) represent a plant investment of approximately $74.2 billion. The newer equipment must be produced on a large scale when introduced, with uniform design and common logistic support. Doing otherwise could turn the national telephone network into a costly hodgepodge. Application of the latest technology is thus constrained by financial and technical factors.

Royalty Payments

U.S. firms are in the forefront of telecommunications technology. Data on royalty payments show a substantial net inflow to U.S. companies. In 1977, royalty payments made by U.S. companies amounted to * * * percent of royalty fees received. These figures, however, shown in the following tabulation, are incomplete, for several firms did not answer this section of the questionnaire.

Telephone terminal and switching equipment: Royalty payments paid to, and received by, U.S. manufacturers from companies located in foreign countries, 1972, 1976, and 1977

(In thousands of dollars)

Year	Payments received	Payments paid
1972	* * *	* * *
1976	* * *	* * *
1977	* * *	* * *

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

It should be pointed out that a low volume of physical exports coupled with a high degree of technology flow from the United States appears to be characteristic of the telephone equipment industry and also of the U.S. electronics industry in general. As mentioned, exports refer to equipment or hardware only and do not include management and contract services which the United States sends abroad in the telephone equipment field. The specific trade barriers discussed in this study apply primarily to physical exports. Because of numerous nontariff barriers in the world, low export volume and large technology outlow is not an atypical situation for U.S. firms. Given this, the ITC findings in regard to a favorable royalty payments flow and negative balance of trade are not unexpected.

The restrictive telecommunications policies of Europe are highlighted by the State Department in a comment on Britain's new domestic exchange system (System X) planned for service in 1982. The U.S. consulate office in London reports "it is unlikely that U.S. manufacturers will be able to gain any large part of the orders for construction of System X other than as suppliers of electronic components for the British manufacturers." 1/ The State Department cautiously indicates that permission granted recently to IBM in Europe to connect PBX equipment to British Post Office lines might possibly ease British communications restrictions for other U.S. manufacturers.

Like Europe, Japan's telecommunication policies encourage domestic suppliers and severely restrict the purchase of imported telephone equipment. Survey responses show that the Japanese market is very difficult for U.S. exporters of telephone terminal and switching equipment to penetrate. Questionnaire responses from several firms produced statements to the effect that "Japan is closed." Technical specifications and standards are based on design rather than performance and are written to favor specific products of national producers of communications equipment. As a general rule, only equipment designed by Nippon Telegraph and Telephone Public Corp. (NTT), Japan's domestic telecommunications carrier, qualifies for approval for sale in Japan.

Several export marketing managers related unproductive efforts to obtain information regarding NTT specifications in interviews. 2/ NTT considers standards to be proprietary information, and although foreign firms are required to meet certain specifications for approval, it is NTT's policy not to divulge what the standards are.

Discussions between State Department and NTT officials indicated that while NTT's stated procurement policy is open tender, in practice all procurement is exceptional. 3/ NTT negotiates most contracts on a noncompetitive basis. In some cases a selective tender arrangement is followed in which procurement officers qualify firms for bidding from a list of registered companies. Through private contracts and selective tender, NTT restricts its purchases to designated suppliers. * * *

As derived from table B-29, imports of communication equipment from all countries represented 1.5 percent of the Japanese market in 1974. Although the U.S. accounted for 44 percent of Japanese imports of private branch exchanges in 1974, total PBX imports amounted to only 0.7 percent of the Japanese market for PBX's in 1974 (derived from tables B-29 and B-39).

Rigid technical specification standards set by PTT'S may present substantial problems in exporting. Equipment specifications are so stringent in some countries, such as Colombia, that no manufacturer can meet the requirements, and the purchaser is allowed to choose the firm closest to specifications. This permits considerable leeway in selecting suppliers on factors other than price and technology.

1/ Department of State, AIRGRAM-184.
2/ See also Electronic News, Oct. 30, 1978, p. 38.
3/ Department of State, Telegram MTN.

Value-added requirements.--Developing countries often attempt to limit imports of telephone terminal and switching equipment by promoting local manufacture or value-added requirements. Import licenses offer one way of enforcing local manufacture demands. In Mexico, Argentina, and India, among other countries, import permits are denied for goods which are adequately supplied in the home market.

In Mexico imports of telephone terminal and switching equipment from the U.S. are small because of the Mexican Government's procedure of not issuing import licenses for goods if there is an adequate substitute available in the Mexican market. Several small-to medium-size telephone equipment manufacturers in the United States stated in questionnaire returns that they abandoned attempts to trade with Mexico because it was not economically feasible to establish a plant in the country.

Argentina follows the same policy as Mexico in issuing approval for importation only in cases where domestic supply is absent or inadequate. Telephone equipment imports are classified as goods which require a sworn declaration of need to be imported.

The amount of value added to imported equipment can be a decisive factor in obtaining an import permit in Venezuela. Import licenses in Venezuela are issued on the condition that the importer purchase domestic products equal to a prescribed percentage of the quantity imported.

In several developing countries local manufacturing or value-added requirements are not officially stipulated in trade regulations but are common practice. Local content percentages vary and are arrived at through negotiation. Governments in developing countries are prominently involved in the purchase of telecommunications equipment, and the amount of local content added is often a determining consideration in awarding contracts. Questionnaire responses showed that several countries tacitly require local content specification in excess of 50 percent of merchandise value. These countries include India, Republic of China, South Africa, the Republic of Korea, and Spain. France also practices in the telecommunication sector local content stipulations greater than 50 percent of value. Local-content requirements in amounts greater than 50 percent are sometimes referred to as coproduction, since firms must have or make arrangements for local production of equipment. In recent years, as developing countries have expanded their telecommunications network, local content clauses have become more predominant in international trade. In Iran modernization plans for the telecommunications system call for maximization of locally produced components. In 1979 the Government of Iran plans to issue tender for advanced stored program control switching exchanges, which may allow initial imports but will require a definite timetable for progressive local manufacture.

World Markets

International trade in telecommunications is dominated by multinational firms. European firms, in particular, are major exporters of telephone equipment. L.M. Ericsson of Sweden, Siemens AG of West Germany, CIT-Alcatel of France, Plessey of Great Britain, and ITT-Europe of Belgium are the principal European exporters. As shown in table B-26, exports from 5 European countries accounted for more than 60 percent of world exports of telephone and telegraph equipment in 1976. Japanese firms claimed approximately a 10 percent share of world exports, and U.S. companies accounted for almost 8 percent of the world export market in 1976.

Many foreign telecommunications firms are giant corporations with diversified operations, engaged in a wide range of production. Siemens, for example, with electrical equipment sales of $10.6 billion in 1977, ranked 20th in a Fortune 500 ranking of the largest non-U.S. industrial corporations in 1977. 1/ Hitachi of Japan ranked 22nd in this Fortune listing. The predominance of large corporations in telecommunications trade puts many medium size U.S. exporters at a disadvantage in securing markets and financing overseas.

Individual corporations have sizeable market shares in certain countries.

* * * * * * *

International Trade Barriers

Questionnaires were returned to the Commission by 37 firms which were involved with either telephone imports or exports. Of these respondents, 28 companies substantially completed the survey sections which requested information on tariff and nontariff barriers. The nonrespondents in the foreign trade section included four small companies which stated no knowledge of export barriers and five import firms which had no comments on problems in importation. None of the firms quantified the effect of barriers on their exports or imports and no attempt has been made herein to assign a value to the barriers alleged.

1/ Fortune, Aug. 14, 1978, p. 172.

Nontariff barriers

More than 80 percent of export firms listed foreign regulations, local buying practices, and/or varying transmission and signaling standards as factors which limited their sales of telephone terminal and switching equipment in foreign markets. Technological know-how was not cited as a barrier to trade. Most respondents commented that the United States is highly advanced in technological design and expertise, particularly in the areas of stored program control and digital switching. Foremost among the nontariff barriers identified by survey respondents is the preferential treatment given to domestic or in-country suppliers in both industrialized and developing countries. Although some of these advantages may be sanctioned under GATT, their use has the effect of restricting imports.

The advantage given to national suppliers is facilitated by government operation of telephone service in most countries of the world. Of telephones in service in the world, 49.2 percent are government (nonprivately) operated. The percentage of privately operated telephones to telephones in service by continental area is reported in table B-27. The United States accounts for the largest number of telephones in private operation in the world. If figures for the United States are removed from the world telephone statistics, government or state operation of telephones in the remainder of the world increases to 80.1 percent (table B-28).

Post, telephone, and telegraph authority approval.--Government operation of telephone services entails state involvement in the approval and purchase of telephone equipment. In most countries, market access of imported telephone and switching equipment is dependent upon post, telephone, and telegraph authority (PTT) approval. PTT approval procedures, particularly in developed countries, are designed to favor local suppliers and limit entry of imported goods. Telephone equipment standards in industrialized countries are generally modeled on a national supplier's product, and meeting various PTT specifications for an importer can be a difficult and costly expenditure. National PTT's in European countries, for example, have standardized on different design lines for the telephone instrument, and restrictive regulations on technology, design, and sizes for other types of telephone equipment vary from country to country.

Telecommunications policies in the EEC, reinforced by PTT approval procedures, generally require local sourcing of equipment. U.S. exporters report that their shipments of telephone terminal and switching equipment to Europe are limited to second sourcing. Documentation of approved technical characteristics and standards in European countries is often undefined or unavailable, and type approval procedures are time consuming.

In addition to favoring local suppliers, PTT policies, which are based on local technology, hinder access of high-technology imported telephone equipment. In questionnaire responses, U.S. exporters reported sales of advanced switching equipment to Europe limited by local PTT's lack of specification standards in technological areas where national companies have not yet progressed. Questionnaire answers showed that the European market is effectively closed to sales of U.S. telephone terminal and switching equipment, unless a U.S. company operates a manufacturing facility in Europe.

Prior deposits and guarantees.--Advance import deposits and guarantees are other nontariff barriers which restrain telecommunications exports to certain developing countries. To obtain an import permit in Brazil, a prior deposit of an amount equal to 100 percent of the f.o.b. value of importation is required. This deposit is held for 360 days without interest or monetary correction. In importations involving letter-of-credit financing, Brazil imposes a guaranty deposit equal to 100 percent of the f.o.b. value of the letter of credit. This amount is held for 180 days without interest. These arrangements are designed to encourage foreign firms to establish production facilities in Brazil rather than to export to the country. Nigeria imposes an insurance guaranty on imported merchandise, stipulating that all goods be insured with an institution in Nigeria. In effect, this rule requires an exporter to have double insurance protection in order to obtain international financing.

Government procurement.--Government procurement programs, in addition to PTT national preference policies, favor in-country firms and make it difficult for U.S. firms to obtain equipment contracts in telecommunications unless they establish manufacturing facilities in the country. This is particularly relevant in the terminal and switching equipment product area since the government in most countries is the predominant purchaser of this type of equipment.

In Argentina the "Buy Argentine" law directs Government purchases to local industries and gives preference to companies which have made the lowest volume of remittances abroad. Government procurement rules in Australia state that overseas purchases are to be guided by Australian industrial participation, which requires that local firms be significantly involved in research and supply. State agencies in Brazil must purchase certain telecommunications equipment from Brazilian manufacturers only. In the telecommunications sector, a Brazilian company is defined as one with * * * percent of voting capital and 51 percent of registered capital under Brazilian control. This definition of national ownership in the telecommunications industry is more stringent than the definition in general use in Brazil. The more liberal definition refers only to registered, not voting, capital, and holds that a Brazilian firm is one with 51 percent of registered capital under Brazilian control.

Safety standards.--The administration of multiple product-safety standards in the telecommunications area can present a real barrier to trade. In Europe the establishment and enforcement of electrical safety standards rests with national agencies in 16 countries. Although there are two international agencies, the International Electrotechnical Commission (IEC), and the International Commission on Rules for the Approval of Electrical Equipment (CEE), which formulate and publish electrical standards, each national product-safety agency writes its own set of standards, which normally deviate somewhat from international (EEC) standards. To market in Europe, telephone equipment manufacturers must be aware of the safety requirements in all 16 countries if they intend to sell in every country. Exporters report that the time required for IEC and CEE approval is extremely lengthy.

As an alternative to nation-by-nation approval, the Certification Body (CB) program can be used to gain entrance in member countries. Under this program, two European testing agencies are selected for product testing. Upon approval by these agencies, a CB certificate is awarded which should meet approval standards in the remaining countries. Authority for final approval, however, remains vested with the National Safety agencies.

Other.--In addition to the trade barriers discussed above, preferential import treatment accorded to member countries in regional trade markets, such as the Andean Group, was listed as a trade obstacle in questionnaire returns. Restrictions imposed by some countries, such as Nicaragua, on the amount of monies permitted for remittal abroad also was identified as a barrier to trade.

Multilateral Trade Negotiations

U.S. Government efforts to reduce trade barriers are ongoing, and at the time the report was drafted, discussions on nontariff concessions were in process. The government procurement code of the multilateral trade negotiations (MTN) is in negotiation and is not in final form. Although it is rather early to assess the impact of the proposed changes, it appears that enactment of meaningful liberalization and cessation of discriminatory government practices in the government procurement code should lead to increased U.S. exports. Japan, however, indicates an intention to exclude its domestic telephone service (NTT) from the provisions of the code. This action would not improve U.S. export opportunity in Japan.

Tariff barriers

Tariff rates applied to telephone equipment are often high in developing countries, exceeding 30 percent in several countries. Tariff rates on telephone equipment for 27 regions are shown in table B-31. High tariffs can serve as an effective trade limiting device designed to promote the development of local industry.

Survey returns emphasized the high duty rates applied to telephone equipment in Nigeria and Brazil (50 and 55 percent, respectively) which seriously disadvantage foreign goods in the local market. The Venezuelan duty rate of 60 percent applied to PBX's was mentioned several times by U.S. exporters as a major handicap to trade in switching equipment.

In questionnaire responses, U.S. exporters criticized the inequitable tariff rate treatment in telephone equipment trade between the U.S. and Canada. The Canadian telephone equipment duty of 17.5 percent is twice the rate applied to telephone apparatus in the United States. When the Canadian duty is coupled with the Dominion sales tax of 12 percent levied on the duty paid value of imported goods, the price of imported telephone equipment in the Canadian market increases 35 percent above landed price, compared with a 12-percent increase in the market price of Canadian telephone merchandise.

U.S. Export Barriers

The following paragraphs are a listing of barriers to exports which have been named by persons responding to Commission questionnaires. These allegations have not been analyzed or verified.

Prominent among these policies is the U.S. tax code as it relates to taxation of U.S. residents abroad. According to questionnaire responses, in contrast to several other countries' tax systems, U.S. tax laws make it expensive for businesses to sustain U.S. personnel overseas. Respondents indicated that the U.S. applies an income tax with limited exclusions on the worldwide income of citizens, whereas many foreign countries do not tax expenses and/or income of nationals working abroad. U.S. firms which establish foreign operations to facilitate export trade are at a disadvantage because the system taxes both the income and cost-of-living allowances of U.S. employees abroad. This reduces the financial incentives offered to employees in foreign locations, forcing firms to offer higher inducements for overseas work. Interviews with firm officials indicated that because of differences in tax systems, the business cost (salary, expenses, and financial incentives) of supporting a mid-level engineer in the Middle East varied from approximately $30,000 for a Japanese firm, to $50,000 for a European company, to $70,000 for a U.S. firm.

With increased competition in world markets, financing plays a key role in securing overseas business. Several firms indicated that financing commitments from the Export-Import Bank are difficult to obtain. Questionnaire responses indicated that small exporters in particular find it difficult to secure financing comparable with what foreign firms supported by government aid are able to provide. A few firms reported that although they underbid competitors, they lost contracts in developing countries to foreign firms offering complete financing packages.

Although legislation has been proposed to increase authorization to the Export-Import Bank, it appears that flexible financing arrangements will continue to be a problem for small- to medium-size U.S. exporters. A U.S. international banking official commented: "Unfortunately most of our export assistance is aimed at the high volume 'Big Ticket' export industries in the capital goods sector. From the perspective of the moderately-sized company whose export sales constitute a relatively small percentage of its volume there are fewer financing options available." 1/

As an example of the financing problems U.S. companies encounter in selling abroad, a French electronics firm (C.I.T.) and the French Government in 1978 sold the telephone company in Mexico a subscriber electronic switching system with one-third of the cost absorbed by the French company and one-third by the Government of France. After 1 year, if the Mexican telephone company is satisfied with the equipment, it will pay a one-third share of the cost;

1/ American Import Export Bulletin, October 1978, p. 630.

otherwise, it will return the system to France at no charge. 1/ This sale is mentioned to highlight special financing arrangements provided by foreign governments and not offered by the U.S. Government. There are no known joint U.S. Government and industry subsidy actions of this type in the telephone equipment field.

Complicated procedures and delays on the part of the Customs Bureau and Export Control Office of the Department of Commerce were mentioned in the survey returns as a source of irritation to some exporters. The excessive time often acquired to obtain goods returned from abroad for repair, and time consuming paperwork involved in qualifying for duty exemption under the 806.30 and 807.00 tariff provisions were cited as a limitation on export trade. Also mentioned in questionnaire responses were the increased number of products which come under export control regulations as a result of advancements in electronic technology. Presently, any product with a microprocessor requires an export license. Licensing procedures may involve considerable delays.

Ambiguity associated with human rights legislation and difficulty in securing export licenses for countries with questionable human rights records was identified in survey returns as an export barrier. Some telecommunications firms were denied export licenses for Chile and South Africa. Antiboycott legislation as a deterrent to trade was mentioned in survey responses and interviews with company officials. These restrictions put U.S. firms at a disadvantage in exporting to the Middle East because few countries have followed the example of the U.S. in prohibiting trade with businesses which require discriminatory practices. Some respondents also referred to a negative posture of the U.S. Government toward exporters and commented on the lack of assistance from U.S. embassies abroad in negotiating large contracts with foreign governments.

Questionnaire answers indicated that U.S. antitrust laws present an uncertain environment for U.S. companies attempting to sell and expand markets abroad through joint ventures, collective bidding, or joint marketing arrangements. The Webb-Pomerene Act (1918) provides special antitrust exemption for acts of a collective export association of American producers, provided that the arrangement does not adversely affect U.S. domestic prices or restrain the export trade of any U.S. member of the association. 2/ The act at the present time, however, applies only to the export of products and does not explicitly extend to service and licensing transactions. Because of the Justice Department's suspicion of associations formed under the Webb Act, the provisions of the act have been little used by U.S. businesses. 3/ Exporters pointed out that antitrust limitations prevent U.S. companies from competing effectively against international consortiums, particularly in the telecommunications area, where joint bidding arrangements are common procedure.

1/ U.S. Department of State, Airgram, A-84.

2/ U.S. Department of Justice, Antitrust Guide for International Operations, January, 1977.

3/ "Webb-Pomerene: Washington sends business mixed signals", Forbes, July 24, 1978.

U.S. Import Barriers

Few importers cited any import barriers to trade in the U.S. Most of the trade problems mentioned dealt with customs procedures, particularly the lengthy process involved in duty liquidation and the discretion given to individual customs officers in administering customs regulations. Some importers found it difficult to obtain updated engineering data on existing telephone systems in the U.S. This may present a problem to foreign manufacturers because of the difference in standards between the U.S. and Europe and Japan. Many importers commented that the U.S. tariff rate of 8.5 percent on telephone equipment was reasonable compared with many countries.

Comparability of Statistics

In order to obtain data for shipments, imports and exports on the same valuation basis and for the same class of instrument and switching equipment products, the Commission obtained data from the industry by questionnaires. Definitions of the products and instructions for submission of data were designed to insure as consistent as possible classification and valuation of products. These definitions are presented in appendix C. Questionnaires were mailed to all known members of the industry, and responses were mandatory.

APPENDIX A

STATISTICAL TABLES BASED ON ITC DATA

Table A-1.--Telephone terminal and switching equipment: Labor value added to imported material, 1972, 1976, and 1977

Product	1972 (5 firms reporting)			1976 (16 firms reporting)			1977 (19 firms reporting)		
	Imported material	Labor value added	Ratio of labor to material	Imported material	Labor value added	Ratio of labor to material	Imported material	Labor value added	Ratio of labor to material
	1,000 dollars	1,000 dollars	Percent	1,000 dollars	1,000 dollars	Percent	1,000 dollars	1,000 dollars	Percent
Telephone sets	***	***	***	***	***	***	***	***	***
Telephone key sets	***	***	***	***	***	***	***	***	***
Key system switching equipment	***	***	***	***	***	***	***	***	***
Branch exchanges	***	***	***	***	***	***	***	***	***
Central office switching equipment	***	***	***	***	***	***	***	***	***
Subassemblies and parts	***	***	***	***	***	***	***	***	***
Total	35,476	2,252	6.3	66,344	3,916	5.9	85,719	6,312	7.4

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-2.--Telephone terminal and switching equipment: Imports to which labor was added as a percent of total imports, 1972, 1976, and 1977

Year	Total imports	Imported material for manufacture	Ratio
	1,000 dollars	1,000 dollars	Percent
1972	49,659	35,476	71.4
1976	87,025	66,344	76.2
1977	127,629	85,719	67.2

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-3.--Telephone terminal and switching equipment: Labor value added by foreign-owned firms to imported material, 1977

Product	Imported material	Labor value added	Ratio of labor to material	Total imports, all firms	Ratio of material imported by foreign-owned firms to all imported material
	1,000 dollars	1,000 dollars	Percent	1,000 dollars	Percent
Telephone sets	***	***	***	***	***
Telephone key sets	***	***	***	***	***
Key system-switching equipment	***	***	***	***	***
Branch exchanges	33,290	2,306	6.9	44,708	75.4
Central office switching equipment	***	***	***	***	***
Parts and subassemblies	6,805	517	7.6	24,234	28.1
Total	66,327	4,945	7.5	127,629	52.0

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-4.--Telephone terminal and switching equipment: U.S. shipments (excluding exports), by U.S. and foreign ownerships, 1972, 1976, and 1977

Product and ownership	1972		1976		1977	
	Value	Percent of total	Value	Percent of total	Value	Percent of total
	1,000 dollars		1,000 dollars		1,000 dollars	
Telephone sets:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	***	***	***	***	***	***
Telephone key sets:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	***	***	***	***	***	***
Total telephone sets:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	***	***	***	***	***	***
Key system-switching equipment:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	***	***	***	***	***	***
Branch exchanges:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	***	***	***	***	***	***
Central office switches:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	***	***	***	***	***	***
Subassemblies and parts of the above:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	***	***	***	***	***	***
Total, all equipment:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Grand total	***	***	***	***	***	***

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-5.--Telephone terminal and switching equipment: U.S. shipments (excluding exports), by products, 1972, 1976, and 1977

(In thousands of dollars)

Product	1972 1/	1976	1977
Telephone sets:			
Key sets	***	***	***
Other sets	***	***	***
Subtotal	***	***	***
Key system-switching equipment	***	***	***
Branch exchanges	***	***	***
Central office switches	***	***	***
Subassemblies and parts of the above	***	***	***
Total	***	***	***

1/ Data for 1972 are understated since many firms maintain records for 5 years only.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-6.--Telephone terminal and switching equipment: U.S. shipments (excluding exports), by products, in constant 1972 dollars 1/, 1972, 1976, and 1977

(In thousands of 1972 dollars)

Product	1972	1976	1977
Telephone sets:			
Key sets	***	***	***
Other sets	***	***	***
Subtotal	***	***	***
Key system-switching equipment	***	***	***
Branch exchanges	***	***	***
Central office switches	***	***	***
Subassemblies and parts of the above	***	***	***
Total	***	***	***

1/ Price deflator obtained from Survey of Current Business-statistics on manufacturing sales of electrical machinery in constant dollars.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission and Department of Commerce price statistics.

Table A-7.—Telephone terminal and switching equipment: U.S. shipments (excluding exports) to parties related to the manufacturer, by products, 1972, 1976, and 1977

(In thousands of dollars)

Product	1972 1/	1976	1977
Telephone sets:			
Key sets	***	***	***
Other sets	***	***	***
Subtotal	***	***	***
Key system-switching equipment	***	***	***
Branch exchanges	***	***	***
Central office switches	***	***	***
Subassemblies and parts of the above	***	***	***
Total	***	***	***

1/ Data for 1972 are understated since many firms maintain records for 5 years only.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-8.—Telephone terminal and switching equipment: U.S. shipments (excluding exports) to parties unrelated to the manufacturer, by products, 1972, 1976, and 1977

(In thousands of dollars)

Product	1972 1/	1976	1977
Telephone sets:			
Key sets	20,256	37,396	51,804
Other sets	40,673	55,966	82,836
Subtotal	60,929	93,362	134,640
Key system-switching equipment	9,052	17,944	25,243
Branch exchanges	55,843	122,821	183,340
Central office switches	122,092	168,010	179,968
Subassemblies and parts of the above	45,443	66,816	94,936
Total	293,359	468,953	618,127

1/ Data for 1972 are understated since many firms maintain records for 5 years only.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-9.--Telephone terminal and switching equipment: U.S. shipments (excluding exports) to regulated telecommunications common carriers, by products, 1972, 1976, and 1977

(In thousands of dollars)

Product	1972 1/	1976	1977
Telephone sets:			
Key sets	***	***	***
Other sets	***	***	***
Subtotal	***	***	***
Key system-switching equipment	***	***	***
Branch exchanges	***	***	***
Central office switches	***	***	***
Subassemblies and parts of the above	***	***	***
Total	***	***	***

1/ Data for 1972 are understated since many firms maintain records for 5 years only.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-10.--Telephone terminal and switching equipment: U.S. shipments (excluding exports) to customers other than regulated telecommunications common-carrier companies, by products, 1972, 1976, and 1977

(In thousands of dollars)

Product	1972 1/	1976	1977
Telephone sets:			
Key sets	***	31,957	43,381
Other sets	***	37,756	59,815
Subtotal	38,663	69,713	103,196
Key system-switching equipment	7,116	15,550	20,799
Branch exchanges	19,531	82,635	138,203
Central office switches	8,001	***	6,059
Subassemblies and parts of the above	24,136	***	54,754
Total	97,447	209,594	323,011

1/ Data for 1972 are understated since many firms maintain records for 5 years only.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-11.--Telephone terminal and switching equipment: U.S. shipments (excluding exports) to parties unrelated to the manufacturer, by U.S. and foreign ownerships, 1972, 1976, and 1977

Product and ownership	1972		1976		1977	
	Value	Percent of total	Value	Percent of total	Value	Percent of total
	1,000 dollars		1,000 dollars		1,000 dollars	
Telephone sets:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	40,673	100.0	55,966	100.0	82,836	100.0
Telephone key sets:						
Foreign-owned	***	***	***	***	9,685	18.7
U.S.-owned	***	***	***	***	42,119	81.3
Total	20,256	100.0	37,396	100.0	51,804	100.0
Total telephone sets:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	60,929	100.0	93,362	100.0	134,640	100.0
Key system switching equipment:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	9,052	100.0	17,944	100.0	25,243	100.0
Branch exchanges:						
Foreign-owned	***	***	56,869	46.3	67,709	36.9
U.S.-owned	***	***	65,952	53.7	115,631	63.1
Total	55,843	100.0	122,821	100.0	183,340	100.0
Central office switches:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	122,092	100.0	168,010	100.0	179,968	100.0
Subassemblies and parts of the above:						
Foreign-owned	***	***	6,544	9.8	***	***
U.S.-owned	***	***	60,272	90.2	***	***
Total	45,443	100.0	66,816	100.0	94,936	100.0
Total, all equipment:						
Foreign-owned	***	***	123,377	26.3	148,092	24.0
U.S.-owned	***	***	345,576	73.7	470,035	76.0
Grand total	293,359	100.0	468,953	100.0	618,127	100.0

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-12 .—Telephone terminal and switching equipment: U.S. shipments (excluding exports) to parties related to the manufacturer, by U.S. and foreign ownerships, 1972, 1976, and 1977

Ownership	1972		1976		1977	
	Value	Percent of total	Value	Percent of total	Value	Percent of total
	Million dollars		Million dollars		Million dollars	
Foreign-owned	-	-	1/	-	***	***
U.S.-owned	***	***	***	***	***	***
Total	***	***	***	***	***	***

1/ Less than $500,000.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-13.--Telephone terminal and switching equipment: U.S. shipments (excluding exports) to customers other than regulated telecommunications common-carrier companies, by U.S. and foreign ownerships, 1972, 1976, and 1977

Product and ownership	1972		1976		1977	
	Value	Percent of total	Value	Percent of total	Value	Percent of total
	1,000 dollars		1,000 dollars		1,000 dollars	
Telephone sets:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	***	***	37,756	100.0	59,815	100.0
Telephone key sets:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	***	***	31,957	100.0	43,381	100.0
Total telephone sets:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	38,663	100.0	69,713	100.0	103,196	100.0
Key system-switching equipment:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	7,116	100.0	15,550	100.0	20,799	100.0
Branch exchanges:						
Foreign-owned	***	***	34,427	41.7	51,258	37.1
U.S.-owned	***	***	48,208	58.3	86,945	62.9
Total	19,531	100.0	82,635	100.0	138,203	100.0
Central office switches:						
Foreign-owned	***	***	-	-	***	***
U.S.-owned	***	***	***	***	***	***
Total	8,001	100.0	***	***	6,059	100.0
Subassemblies and parts of the above:						
Foreign-owned	***	***	***	***	5,062	9.3
U.S.-owned	***	***	***	***	49,692	90.7
Total	24,136	100.0	***	***	54,754	100.0
Total, all equipment:						
Foreign-owned	***	***	51,767	24.7	77,888	24.1
U.S.-owned	***	***	157,827	75.3	245,123	95.9
Grand total	97,447	100.0	209,594	100.0	323,011	100.0

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-14.--Telephone terminal and switching equipment: Domestic shipments, exports, and total, 1972, 1976, and 1977

(In thousands of dollars)

Item	1972			1976			1977		
	Domestic shipments	Exports	Total	Domestic shipments	Exports	Total	Domestic shipments	Exports	Total
Telephone sets	***	***	***	***	5,907	***	***	7,598	***
Telephone key sets	***	***	***	***	435	***	***	1,001	***
Key system-switching equipment	***	***	***	***	200	***	***	1,104	***
Branch exchanges	***	***	***	***	12,508	***	***	16,466	***
Central office switches	***	***	***	***	***	***	***	***	***
Subassemblies and parts of the above	***	***	***	***	***	***	***	***	***
Total	***	8,934	***	***	68,273	***	***	74,864	***

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-15.—Telephone equipment: U.S. exports, by types of equipment, 1972, 1976, and 1977

(In thousands of dollars)

Type	1972 1/	1976	1977
Telephone sets:			
Key sets	***	435	1,001
Other sets	***	5,907	7,598
Subtotal	***	6,342	8,599
Key system-switching equipment	***	200	1,104
Branch exchanges	***	12,508	16,466
Central office switches	***	***	***
Subassemblies and parts of the above	***	***	***
Total	8,934	68,273	74,864

1/ Data for 1972 are understated since many firms maintain records for 5 years only.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-16.—Telephone terminal and switching equipment: U.S. exports, by U.S. and foreign ownerships, 1972, 1976, and 1977

Ownership	1972		1976		1977	
	Value	Percent of total	Value	Percent of total	Value	Percent of total
	1,000 dollars		1,000 dollars		1,000 dollars	
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Grand total	8,934	100.0	68,273	100.0	74,864	100.0

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-17.--Telephone terminal and switching equipment: U.S. exports, by principal markets, 1972, 1976, and 1977

Year	Canada	France, West Germany, Sweden, and Italy	Japan and Korea	Mexico	Iran	All other	Total
	Value (1,000 dollars)						
1972	***	***	***	***	-	***	***
1976	***	***	***	***	***	16,943	61,190
1977	21,818	***	***	246	***	29,435	65,421
	Percent of value						
1972	***	***	***	***	-	***	***
1976	***	***	***	***	***	27.7	100
1977	33.4	***	***	.4	***	44.9	100

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-18.—Telephone equipment: U.S. imports, by types of equipment, 1972, 1976, and 1977

(In thousands of dollars)

Type	1972 1/	1976	1977
Telephone sets:			
Key sets	3,257	***	15,643
Other sets	1,734	***	7,541
Subtotal	4,991	13,674	23,184
Key system-switching equipment	***	5,111	10,219
Branch exchanges	13,876	31,113	44,708
Central office switches	21,664	20,119	25,284
Subassemblies and parts of the above	***	17,008	24,234
Total	49,659	87,025	127,629

1/ Data for 1972 are incomplete since many firms maintain records for 5 years only.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-19.--Telephone terminal and switching equipment: U.S. imports, by U.S. and foreign ownerships, 1972, 1976, and 1977

Product and ownership	1972		1976		1977	
	Value	Percent of total	Value	Percent of total	Value	Percent of total
	1,000 dollars		1,000 dollars		1,000 dollars	
Telephone sets:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	1,734	100.0	***	***	7,541	100.0
Telephone key sets:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	3,257	100.0	***	***	15,643	100.0
Total telephone sets:						
Foreign-owned	***	***	***	***	15,216	65.6
U.S.-owned	***	***	***	***	7,968	34.4
Total	4,991	100.0	13,674	100.0	23,184	100.0
Key system-switching equipment:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	***	***	5,111	100.0	10,219	100.0
Branch exchanges:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	***	***	***	***	***
Total	13,876	100.0	31,113	100.0	44,708	100.0
Central office switches:						
Foreign-owned	***	***	***	***	***	***
U.S.-owned	***	53.8	***	***	***	***
Total	21,664	100.0	20,119	100.0	25,284	100.0
Subassemblies and parts of the above:						
Foreign-owned	***	***	***	***	15,932	65.7
U.S.-owned	***	***	***	***	8,302	34.3
Total	***	***	17,008	100.0	24,234	100.0
Total, all equipment:						
Foreign-owned	30,774	62.0	62,569	71.9	96,084	75.3
U.S.-owned	18,885	38.0	24,456	28.1	31,545	24.7
Grand total	49,659	100.0	87,025	100.0	127,629	100.0

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-20.--Imported telephone equipment: Percentage of U.S. sales to regulated and other than regulated companies, 1972, 1976, and 1977

(Percent of value)

Item	1972			1976			1977		
	Regulated companies	Other	Total	Regulated companies	Other	Total	Regulated companies	Other	Total
Telephone sets	-	100.0	100	-	100.0	100	-	100.0	100
Telephone key sets	-	100.0	100	-	100.0	100	6.6	93.4	100
Key system switching equipment	100.0	0	100	67.9	32.1	100	61.0	39.0	100
Branch exchanges	8.7	91.3	100	18.3	81.7	100	5.4	94.6	100
Central office switches	73.6	26.4	100	100.0	-	100	48.0	52.0	100
Subassemblies and parts of the above	8.7	91.3	100	5.5	94.5	100	12.4	87.6	100

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-21.--Telephone terminal and switching equipment: U.S. imports, by principal markets, 1972, 1976, and 1977

Year	Canada	France, West Germany, Sweden, and Italy	Japan and Korea	Mexico	Iran	All other	Total
	Value (1,000 dollars)						
1972	***	***	24,974	-	-	***	47,275
1976	***	4,839	35,138	***	-	***	78,130
1977	***	5,462	55,380	***	-	6,194	120,920
	Percent of total						
1972	***	***	52.8	-	-	***	100
1976	***	6.2	45.0	***	-	***	100
1977	***	4.5	45.8	***	-	5.1	100

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Note.--Because of rounding, figures may not add to the totals shown. The sum of imports is understated since some firms did not supply information on imports by principal sources.

Table A-22.--Total telephone terminal and switching equipment: U.S. shipments, imports for consumption, exports, and apparent consumption, 1972, 1976, and 1977

Year	U.S. shipments	Imports	Exports	Apparent consumption	Ratio of imports to consumption
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	Percent
1972 1/	***	49,659	8,934	***	***
1976	***	87,025	68,273	***	***
1977	***	127,629	74,864	***	***

1/ Data for 1972 are understated since many firms maintain records for 5 years only.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Note.--Export data are shown for comparison purposes only. Exports are not included in shipment figures reported to the Commission.

Table A-23.—Branch exchanges: U.S. shipments, imports for consumption, exports, and apparent consumption, 1972, 1976, and 1977

Year	U.S. shipments	Imports	Exports	Apparent consumption	Ratio of imports to consumption
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	Percent
1972 1/	***	13,876	***	***	***
1976	***	31,113	12,508	***	***
1977	***	44,708	16,466	***	***

1/ Data for 1972 are understated since many firms maintain records for 5 years only.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Note.—Export data are shown for comparison purposes only. Exports are not included in shipment figures reported to the Commission.

Table A-24.—Central office switches: U.S. shipments, imports for consumption, exports, and apparent consumption, 1972, 1976, and 1977

Year	U.S. shipments	Imports	Exports	Apparent consumption	Ratio of imports to consumption
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	Percent
1972 1/	***	21,664	***	***	***
1976	***	20,119	***	***	***
1977	***	25,284	***	***	***

1/ Data for 1972 are understated since many firms maintain records for 5 years only.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Note.—Export data are shown for comparison purposes only. Exports are not included in shipment figures reported to the Commission.

Table A-25.—Telephone switching equipment 1/: U.S. shipments, imports for consumption, exports, and apparent consumption, 1972, 1976, and 1977

Year	U.S. shipments	Imports	Exports	Apparent consumption	Ratio of imports to consumption
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	Percent
1972 2/	***	***	***	***	***
1976	***	56,343	***	***	***
1977	***	80,211	***	***	***

1/ Branch exchange, central office, and key system switching equipment.
2/ Data for 1972 are understated since many firms maintain records for 5 years only.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Note.--Export data are shown for comparison purposes only. Exports are not included in shipment figures reported to the Commission.

Table A-26.—Subassemblies and parts: U.S. shipments, imports for consumption, exports, and apparent consumption, 1972, 1976, and 1977

Year	U.S. shipments	Imports	Exports	Apparent consumption	Ratio of imports to consumption
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	Percent
1972 1/	***	***	***	***	***
1976	***	17,008	***	***	***
1977	***	24,234	***	***	***

1/ Data for 1972 are understated since many firms maintain records for 5 years only.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Note.—Export data are shown for comparison purposes only. Exports are not included in shipment figures reported to the Commission.

Table A-27.--Telephone sets: U.S. shipments, imports for consumption, exports, and apparent consumption, by types, 1972, 1976, and 1977

(Quantity in thousands of units; value in thousands of dollars)

Type and year	U.S. shipments	Imports	Exports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
Other telephone sets:					
1972	11,970	***	***	***	***
1976	***	***	163	***	***
1977	17,263	282	184	17,545	1.6
Telephone key sets:					
1972	***	1/ 56	***	***	***
1976	***	1/ 134	5	***	***
1977	2,765	1/ 169	13	2,934	5.8
Total telephone sets:					
1972	***	153	***	***	***
1976	***	373	168	***	***
1977	20,028	451	197	20,479	2.2
	Value				
Other telephone sets:					
1972	***	1,734	***	***	***
1976	***	***	5,907	***	***
1977	***	7,541	7,598	***	***
Telephone key sets:					
1972	***	3,257	***	***	***
1976	***	***	435	***	***
1977	***	15,643	1,001	***	***
Total telephone sets:					
1972	***	4,991	***	***	***
1976	***	13,674	6,342	***	***
1977	***	23,184	8,599	***	***

1/ Quantity figures were adjusted because a few firms did not report units.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Note.--Export data are shown for comparison purposes only. Exports are not included in shipment figures reported to the Commission.

Table A-28.--Average number of employees, total and production and related workers engaged in producing telephone terminal and switching equipment, and training hours given to the latter, 1972, 1976, and 1977

Item	1972	1976	1977
All persons	86,232	72,434	82,276
Production and related workers:			
Technicians	4,095	3,001	3,012
Craftsmen	***	***	***
Operatives (semiskilled)	***	***	***
Service workers	1,382	1,025	1,141
Total	***	1/ 51,870	1/ 58,015
Training----------1,000 hours	1,030	938	1,386

1/ Total workers exceed classification breakouts because some companies supplied only total figures.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table A-29.--Telephone terminal and switching equipment: Employment of all persons and production and related workers, by U.S. and foreign ownerships, 1972, 1976, and 1977

Ownership	1972		1976		1977	
	All persons	Production and related workers	All persons	Production and related workers	All persons	Production and related workers
	Number of persons					
U.S.-owned firms	85,934	***	70,672	***	79,918	***
Foreign-owned firms	298	***	1,762	***	2,358	***
Total	86,232	***	72,434	51,870	82,276	58,015
	Percent of total					
U.S.-owned firms	99.7	***	97.6	***	97.1	***
Foreign-owned firms	.3	***	2.4	***	2.9	***
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

APPENDIX B

STATISTICAL TABLES BASED ON PUBLISHED SOURCE DATA

Table B-1.--Number of telephones in service and number of operating companies in the United States and the world, 1967-77

Year	Independents	Bell System 1/	Total, United States	Total, world
	Number of telephones (1,000 units)			
1967	16,953	86,776	103,729	222,400
1968	18,125	91,122	109,247	237,900
1969	19,254	95,942	115,196	255,200
1970	20,312	99,902	120,214	272,700
1971	21,444	103,698	125,142	291,300
1972	22,796	108,811	131,607	312,900
1973	24,351	113,960	138,311	335,600
1974	25,826	118,146	143,972	358,400
1975	26,823	121,800	148,623	379,500
1976	28,209	126,963	155,172	398,182
1977	29,675	132,397	162,072	2/
	Number of operating companies			
1967	2,100	24	2,124	2/
1968	1,970	25	1,995	2/
1969	1,892	25	1,917	2/
1970	1,841	25	1,866	2/
1971	1,805	25	1,830	2/
1972	1,758	25	1,783	2/
1973	1,695	25	1,720	2/
1974	1,641	25	1,666	2/
1975	1,618	25	1,643	2/
1976	1,590	25	1,615	2/
1977	1,556	25	1,581	2/

1/ AT&T and its subsidiaries.
2/ Not available.

Source: U.S. Independent Telephone Association, Independent Telephone Statistics, vol. I, 1977 and 1978 eds.; AT&T Long Lines, The World's Telephones.

Table B-2.—Plant investment by Bell System, independent telephone companies, and Rural Electrification Administration (REA) borrowers, 1976

Investor	Total plant investment	Station equipment	Central office equipment	Station and central office equipment	Ratio of station and central office equipment to total plant investment
	Million dollars	Million dollars	Million dollars	Million dollars	Percent
Bell System 1/	93,626.2	17,721.5	36,353.2	54,074.7	57.8
Independent companies 2/	21,323.0	1,983.8	7,269.8	9,253.6	43.4
REA borrowers 3/	4,053.1	598.5	1,176.7	1,775.2	43.8

1/ AT&T and its subsidiaries, except Cincinnati Bell and Southern New England.

2/ Independent companies represent 96 percent of the plant investment of the independent telephone industry.

3/ REA borrowers numbered 876 in 1976.

Source: Bell System Statistical Manual; U.S. Independent Telephone Association, Independent Telephone Statistics, vol. I, 1977 ed.; REA, Annual Statistics Report, 1976.

Table B-3.—Telephone and telegraph equipment: U.S. shipments, imports, and exports, by types, 1970-77

(In thousands of dollars)

Item	1970	1971	1972	1973	1974	1975	1976	1977
U.S. shipments:								
Telephone and telegraph equipment, total	1/	1/	3,851,309	4,273,445	4,840,767	4,803,159	5,204,985	6,790,306
Telephone switching equipment, total	1/	1/	1,515,005	1,725,531	2,040,363	1,798,124	2,028,154	2,723,664
Private branch exchange (PBX)	1/	1/	221,552	292,636	297,873	186,858	208,685	254,665
Central office switching equipment	1/	1/	1,293,453	1,432,895	1,699,760	1,611,266	1,819,469	2,468,999
Telephone sets	1/	1/	351,241	347,844	350,769	377,748	580,937	671,946
Other telephone and telegraph equipment (excluding telegraph, teleprinter, and carrier equipment)	1/	1/	1,329,123	2/	2/	1,695,289	1,761,249	2,181,934
Subtotal	1/	1/	3,195,369	2/	2/	3,871,161	4,370,340	5,577,544
U.S. imports:								
Telephone and telegraph equipment, total	54,803	79,468	85,963	125,045	162,309	93,099	99,987	128,756
Telephone switching equipment, total	3/ 23,770	3/ 36,111	3/ 36,746	3/ 56,967	3/ 72,321	32,777	33,369	39,665
Telephone sets	3/ 970	3/ 1,474	3/ 1,500	3/ 2,325	3/ 2,952	3,471	8,504	8,102
Other telephone equipment	3/ 23,770	3/ 36,111	3/ 36,746	3/ 56,967	3/ 72,321	36,952	46,022	59,024
Subtotal	3/ 48,510	3/ 73,696	3/ 74,992	3/116,259	3/147,594	73,200	87,895	106,791
U.S. exports:								
Telephone and telegraph equipment, total	73,900	60,275	76,238	111,259	158,794	196,771	225,614	256,176
Telephone switching equipment	2,566	1,466	3,549	1,847	2,170	5,854	7,182	9,187
Telephone sets	1,557	1,334	2,549	2,557	3,361	2,138	4,728	6,293
Other telephone equipment	26,619	23,718	28,294	45,102	68,610	107,429	128,946	140,892
Subtotal	30,742	26,518	34,392	49,506	74,141	115,421	140,856	156,372

1/ Not available; not collected by the U.S. Bureau of the Census.
2/ Withheld to avoid disclosing figures for individual companies.
3/ Estimated.

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

Table B-4.--Private branch exchanges: U.S. shipments, by users, 1972-77

(In thousands of dollars)

Year	Private branch exchanges		
	Common carrier	Private carrier	Total
1972	211,876	9,676	221,552
1973	258,158	34,478	292,636
1974	266,183	31,690	297,873
1975	154,992	31,866	186,858
1976	181,359	27,326	208,685
1977	220,599	34,066	254,665

Source: U.S. Department of Commerce, Current Industrial Reports.

Table B-5.--Telephone and telegraph equipment: Ratios of imports and exports to shipments, by types of equipment, 1972-77

(In percent)

Item	1972	1973	1974	1975	1976	1977
	Ratio of imports to shipments					
Telephone and telegraph equipment, total	2.2	2.9	3.4	1.9	1.9	1.9
Telephone switching equipment	2.4	3.3	3.5	1.6	1.6	1.5
Private branch exchange (PBX) 1/	16.6	19.5	24.3	17.5	16.0	15.6
Telephone sets	.4	.7	.8	.9	1.5	1.2
Other telephone and telegraph equipment (excluding telegraph, teleprinter, and carrier equipment)	2.8	2/	2/	2.2	2.6	2.7
	Ratio of exports to shipments					
Telephone and telegraph equipment, total	2.0	2.6	3.3	4.1	4.3	3.8
Telephone switching equipment	.2	.1	.1	.3	.4	.3
Private branch exchange (PBX) 1/	1.6	.6	.7	3.1	3.4	3.6
Telephone sets	.7	.7	1.0	.6	.8	.9
Other telephone and telegraph equipment (excluding telegraph, teleprinter, and carrier equipment)	2.1	2/	2/	6.3	7.3	6.5

1/ Imports and exports of telephone switching equipment are not broken down by product classification, but consist primarily of PBX's.

2/ Not available.

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

Table B-6.—Telephone terminal and switching equipment: U.S. exports, by principal markets, 1972-77

Year	Canada	France, West Germany, Sweden, and Italy	Japan and Korea	Mexico	Iran	All other	Total
	Value (1,000 dollars)						
1972	12,941	1,603	2,200	586	127	16,934	34,391
1973	22,764	1,818	3,388	2,067	-	19,469	49,506
1974	23,862	4,699	4,170	6,074	911	34,426	74,142
1975	27,888	9,459	4,805	11,443	11,626	50,200	115,421
1976	34,375	7,711	2,167	11,113	27,637	57,852	140,855
1977	46,898	9,290	2,343	6,250	20,626	70,965	156,372
	Percent of total						
1972	37.6	4.7	6.4	1.7	0.4	49.2	100.0
1973	46.0	3.7	6.8	4.2	0	39.3	100.0
1974	32.2	6.3	5.6	8.2	1.2	46.4	100.0
1975	24.2	8.2	4.2	9.9	10.1	43.5	100.0
1976	24.4	5.5	1.5	7.9	19.6	41.1	100.0
1977	30.0	5.9	1.5	4.0	13.2	45.4	100.0

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

Table B-7.--Telephone instruments: U.S. exports, by principal markets, 1972-77

Year	Canada	France, West Germany, Sweden, and Italy	Japan and Korea	Mexico	Iran	All other	Total
	Value (1,000 dollars)						
1972	665	33	25	20	-	1,778	2,548
1973	1,030	44	66	53	-	1,364	2,557
1974	1,677	79	158	127	85	1,235	3,361
1975	246	-	84	-	-	1,808	2,138
1976	761	180	-	1,023	-	2,764	4,728
1977	564	130	157	1,567	72	3,803	6,293
	Percent of total						
1972	26.1	1.3	2.0	0.8	-	69.8	100.0
1973	40.3	1.7	2.6	2.1	-	53.3	100.0
1974	49.9	2.4	4.7	3.8	2.5	36.8	100.0
1975	11.5	-	3.9	-	-	84.6	100.0
1976	16.1	3.8	-	21.6	-	58.5	100.0
1977	9.0	2.1	2.5	24.9	1.1	60.4	100.0

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

Table B-8.—Telephone switching equipment: U.S. exports, by principal markets, 1972-77

Year	Canada	France, West Germany, Sweden, and Italy	Japan and Korea	Mexico	Iran	All other	Total
	Value (1,000 dollars)						
1972	2,530	36	128	-	-	855	3,549
1973	732	47	81	13	-	974	1,847
1974	226	-	85	53	-	1,807	2,171
1975	939	225	416	168	185	3,921	5,854
1976	1,200	227	90	96	-	5,568	7,181
1977	2,203	601	-	157	575	5,651	9,187
	Percent of total						
1972	71.3	1.0	3.6	-	-	24.1	100.0
1973	39.6	2.5	4.4	.7	-	52.7	100.0
1974	10.4		3.9	2.4	-	83.2	100.0
1975	16.0	3.8	7.1	2.9	3.2	67.0	100.0
1976	16.7	3.2	1.3	1.3	-	77.5	100.0
1977	24.0	6.5	-	1.7	6.3	61.5	100.0

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

Table B-9.—Other telephone equipment and parts: 1/ U.S. exports, by principal markets, 1972-77

Year	Canada	France, West Germany, Sweden, and Italy	Japan and Korea	Mexico	Iran	All other	Total
	Value (1,000 dollars)						
1972	9,746	1,534	2,020	566	127	14,301	28,294
1973	21,002	1,727	3,241	2,001	-	17,131	45,102
1974	21,959	4,620	3,927	5,894	826	31,384	68,610
1975	26,703	9,234	4,305	11,275	11,441	44,471	107,429
1976	32,414	7,304	2,077	9,994	27,637	49,520	128,946
1977	44,131	8,559	2,186	4,526	19,979	61,511	140,892
	Percent of total						
1972	34.4	5.4	7.1	2.0	0.4	50.5	100.0
1973	46.6	3.8	7.2	4.4	-	38.0	100.0
1974	32.0	6.7	5.7	8.6	1.2	45.7	100.0
1975	24.9	8.6	4.0	10.5	10.6	41.4	100.0
1976	25.1	5.7	1.6	7.8	21.4	38.4	100.0
1977	31.3	6.1	1.6	3.2	14.2	43.7	100.0

1/ Schedule B, No. 724.9150.

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

Table B-10.--Telephone instruments, switching equipment, and parts: U.S. imports for consumption, by principal sources, 1972-77

Source	1972	1973	1974	1975	1976	1977
	Value (1,000 dollars)					
Canada	21,749	26,584	66,347	34,725	36,408	50,164
France	945	2,806	1,774	1,803	4,798	1,114
West Germany	2,632	2,430	1,803	2,984	3,039	1,342
Sweden	5,739	6,873	4,006	3,530	2,324	1,609
Italy	638	885	1,959	444	935	736
Subtotal	9,954	12,994	9,542	9,074	11,096	4,801
Japan	36,139	63,985	55,167	10,364	27,044	35,162
Republic of Korea	270	1,051	1,730	374	257	471
Subtotal	36,409	65,036	56,897	10,738	27,301	35,633
Mexico	280	3,058	5,453	4,530	5,959	6,294
Iran	-	-	-	-	1	-
All other	6,600	8,587	9,354	14,133	7,130	9,899
Total	74,992	116,259	147,593	73,200	87,895	106,791
	Percent of total					
Canada	29.0	22.9	45.0	47.4	41.4	47.0
France	1.3	2.4	1.2	2.5	5.5	1.0
West Germany	3.5	2.1	1.2	4.1	3.5	1.3
Sweden	7.7	5.9	2.7	4.8	2.6	1.5
Italy	.9	.8	1.3	.6	1.1	.7
Subtotal	13.3	11.2	6.5	12.4	12.6	4.5
Japan	48.2	55.0	37.4	14.2	30.8	32.9
Republic of Korea	.4	.9	1.2	.5	.3	.4
Subtotal	48.6	55.9	38.5	14.7	31.1	33.4
Mexico	.4	2.6	3.7	6.2	6.8	5.9
Iran	-	-	-	-	1/	-
All other	8.8	7.4	6.3	19.3	8.1	9.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

1/ Less than 0.05 percent.

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

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

Table B-11.--Telephone instruments: U.S. imports for consumption, by principal sources, 1975-77

Source	1975 1/	1976	1977
	Value (1,000 dollars)		
Canada	326	194	542
France	13	1	1
West Germany	5	21	2
Sweden	-	1	11
Italy	206	471	442
Subtotal	224	494	456
Japan	2,171	6,311	4,772
Republic of Korea	242	73	293
Subtotal	2,413	6,384	5,065
Mexico	3	2	21
Iran	-	-	-
All other	505	1,430	2,018
Total	3,471	8,504	8,102
	Percent of total		
Canada	9.4	2.3	6.7
France	.4	-	-
West Germany	.1	.2	-
Sweden	.0	-	.1
Italy	5.9	5.5	5.5
Subtotal	6.5	5.8	5.6
Japan	62.5	74.2	58.9
Republic of Korea	7.0	.9	3.6
Subtotal	69.5	75.1	62.5
Mexico	.1	-	.3
Iran	-	-	-
All other	14.5	16.8	24.9
Total	100.0	100.0	100.0

1/ Imports of telephone instruments not separately classified in tariff schedules prior to 1975.

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

Note.--Because of rounding, figures may not add to the subtotals shown.

Table B-12.—Telephone switching equipment: U.S. imports for consumption, by principal sources, 1975-77

Source	1975 1/	1976	1977
	Value (1,000 dollars)		
Canada	16,754	16,316	20,128
France	923	680	194
West Germany	619	927	678
Sweden	1,348	1,585	1,137
Italy	-	91	64
Subtotal	2,890	3,283	2,073
Japan	876	10,805	14,823
Republic of Korea	71	9	-
Subtotal	947	10,814	14,823
Mexico	200	289	-
Iran	-	1	-
All other	11,986	2,666	2,641
Total	32,777	33,369	39,665
	Percent of total		
Canada	51.1	48.9	50.7
France	2.8	2.0	.5
West Germany	1.9	2.8	1.7
Sweden	4.1	4.7	2.9
Italy	-	.3	.2
Subtotal	8.8	9.8	5.2
Japan	2.7	32.4	37.4
Republic of Korea	.2	-	-
Subtotal	2.9	32.4	37.4
Mexico	.6	.9	-
Iran	-	-	-
All other	36.6	8.0	6.7
Total	100.0	100.0	100.0

1/ Imports of switching equipment not separately classified in tariff schedules prior to 1975.

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

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

Table B-13.--Other telephonic equipment and parts: 1/ U.S. imports for consumption, by principal sources, 1975-77

Source	1975 2/	1976	1977
	Value (1,000 dollars)		
Canada	17,645	19,898	29,494
France	867	4,117	919
West Germany	2,673	2,091	662
Sweden	2,182	738	461
Italy	238	373	230
Subtotal	5,960	7,319	2,272
Japan	7,317	9,928	15,567
Republic of Korea	61	175	178
Subtotal	7,378	10,103	15,745
Mexico	4,327	5,668	6,273
Iran	-	-	-
All other	1,642	3,034	5,240
Total	36,952	46,022	59,024
	Percent of total		
Canada	47.8	43.2	50.0
France	2.3	8.9	1.6
West Germany	7.2	4.5	1.1
Sweden	5.9	1.6	.8
Italy	.6	.8	.4
Subtotal	16.1	15.9	3.8
Japan	19.8	21.6	26.4
Republic of Korea	.2	.4	.3
Subtotal	20.0	22.0	26.7
Mexico	11.7	12.3	10.6
Iran	-	-	-
All other	4.4	6.6	8.9
Total	100.0	100.0	100.0

1/ TSUSA item 684.6240.

2/ Imports of other telephonic equipment and parts not separately classified in tariff schedules prior to 1975.

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

Note.--Because of rounding, figures may not add to the subtotals shown.

Table B-14.—Telephone equipment and parts: Total value and value of U.S. products imported under TSUS item 806.30, 1/ by categories and by specified sources, specified years 2/ 1972-77

(In thousands of dollars)

Year and item	Telephone equipment 3/		Other telephone equipment 4/	
	Canada	Mexico	Canada	Mexico
1973:				
Total value	-	14	5/	5/
Value U.S. products	-	13	5/	5/
1974:				
Total value	3	-	5/	5/
Value U.S. products	6/	-	5/	5/
1976:				
Total value	7/	7/	-	12
Value U.S. products	7/	7/	-	2
1977:				
Total value	7/	7/	13	-
Value U.S. products	7/	7/	12	-

1/ TSUS item 806.30 provides that duty is levied only upon the value of processing outside the United States for metal articles which are manufactured in the United States, exported for processing, and returned to the United States for further processing.

2/ No telephone imports under TSUS item 806.30 in 1972 and 1975.

3/ TSUSA item 684.6200. Includes all telephone equipment imports.

4/ TSUSA item 684.6240. Excludes switching equipment, telephone instruments, and intercom systems.

5/ Classification not established until 1975.

6/ Less than $500.

7/ Classification discontinued in 1975.

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

...telephone equipment and parts: Total value and value of U.S. products imported under TSUS item 807.00, 1/ by categories and by specified sources, 1972-77

(In thousands of dollars)

Category	1972		1973		1974		1975		1976		1977	
	Total value	Value U.S. products	Total value	Value U.S. products	Total value	Value U.S. products	Total value	Value U.S. products	Total value	Value U.S. products	Total value	Value U.S. products
Telephone equipment: 2/												
Canada	1,510	251	1,258	162	438	90						
Mexico	204	185	2,918	2,461	5,132	3,901						
Haiti	32	17	48	20	30	25						
Singapore	1	1	-	-	-	-	Classification discontinued in 1975.					
Hong Kong	3/	3/	24	21	-	-						
Dominican Republic	-	-	2	3/	-	-						
Spain	-	-	-	-	1	3/						
Israel	-	-	-	-	11	1						
Republic of China	-	-	-	-	191	32						
Japan	-	-	-	-	6,612	556						
Total	1,747	454	4,250	2,664	12,355	4,606						
Switching equipment: 4/												
Canada							146	19	1	3/	1,897	254
Mexico	Classification not established until 1975.						200	161	108	91	3/	3/
Israel							49	6	23	3	-	-
Japan							426	56	467	43	38	13
Total							821	242	599	137	1,935	267
Telephone instruments: 5/												
Mexico							3	3	-	-	21	13
Republic of Korea	Classification not established until 1975.						181	45	-	-	-	-
Republic of China							155	38	-	-	-	-
Japan							385	74	351	56	-	-
Total							724	160	351	56	21	13
Other telephone equipment: 6/												
Canada							682	168	1,199	189	6,607	1,039
Mexico							4,223	2,902	5,350	2,547	5,066	2,149
Leeward & Windward Islands							30	24	-	-	-	-
Trinidad							16	12	-	-	-	-
United Kingdom							29	20	40	21	3	1
Israel	Classification not established until 1975.						38	4	37	4	-	-
Japan							490	116	1,261	211	4	1
Switzerland							-	-	3	1	-	-
Republic of China							-	-	22	20	184	114
Haiti							-	-	-	-	34	21
Total							5,507	3,246	7,911	2,994	11,899	3,325

1/ TSUS item 807.00 provides that duty is levied upon the full value of the imported article, less the value of U.S. products for articles assembled in a foreign country of U.S.-fabricated components provided the components (a) were exported in condition ready for assembly without further fabrication, (b) have not lost their physical identity in such articles by change in form, shape, or otherwise, and (c) have not been advanced in value or improved in condition abroad except by being assembled and except by operations incidental to the assembly process such as cleaning, lubricating and painting.

2/ TSUSA item 684.6200. Includes all telephone equipment imports.

3/ Less than $500.

4/ TSUSA item 684.6210.

5/ TSUSA item 684.6220.

6/ TSUSA item 684.6240. Excludes switching equipment, telephone instruments, and intercom systems.

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

Table B-16.--Telephone sets: U.S. shipments, imports for consumption, exports, and apparent consumption, 1972-77

Year	U.S. shipments	Imports	Exports	Apparent consumption	Ratio of imports to consumption
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	Percent
1972	351,241	1/ 1,500	2,549	350,192	0.4
1973	347,844	1/ 2,325	2,557	347,612	.7
1974	350,769	1/ 2,952	3,361	350,360	.8
1975	377,748	3,471	2,138	379,081	.9
1976	580,937	8,504	4,728	584,713	1.4
1977	671,946	8,102	6,293	673,755	1.2

1/ Estimated.

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

Note.--Compared with questionnaire responses, imports are significantly understated in 1972, 1976, and 1977. Shipments also are low in these years.

Table B-17.--Telephone switching equipment: U.S. shipments, imports for consumption, exports, and apparent consumption, 1972-77

Year	U.S. shipments	Imports	Exports	Apparent consumption	Ratio of imports to consumption
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	Percent
1972	1,515,005	1/ 36,746	3,549	1,548,202	2.4
1973	1,725,531	1/ 56,967	1,847	1,780,651	3.2
1974	2,040,363	1/ 72,321	2,170	2,110,514	3.4
1975	1,798,124	32,777	5,854	1,825,047	1.8
1976	2,028,154	33,369	7,182	2,054,341	1.6
1977	2,723,664	39,665	9,187	2,754,142	1.4

1/ Estimated.

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

Note.--Compared with questionnaire responses, import and export data are significantly understated in 1976 and 1977. Shipment figures appear to be high in 1976 and 1977.

Table B-18.—Private branch exchanges: U.S. shipments, imports for consumption, exports, and apparent consumption, 1972-77

Year	U.S. shipments	Imports 1/	Exports 1/	Apparent consumption	Ratio of imports to consumption
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	Percent
1972	221,552	2/ 36,746	3,549	254,749	14.4
1973	292,636	2/ 56,967	1,847	347,756	16.4
1974	297,873	2/ 72,321	2,170	368,024	19.6
1975	186,858	32,777	5,854	213,781	15.3
1976	208,685	33,369	7,182	234,872	14.2
1977	254,665	39,665	9,187	285,143	13.9

1/ While imports and exports of telephone switching equipment are not broken down by product types, this classification appears to consist primarily of PBX's.
2/ Estimated.

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

Note.—Compared with questionnaire responses, shipment and export data are significantly understated in 1976 and 1977.

Table B-19.--Average number of employees, and total production workers engaged in producing telephone and telegraph equipment, and number of man-hours of the latter, 1970-77

Year	All employees	Production workers	Man-hours
	Thousands	Thousands	Millions
1970	142	102	199
1971	140	98	186
1972	134	95	176
1973	140	100	191
1974	145	102	183
1975	119	81	148
1976	105	74	134
1977	125	86	1/

1/ Not available.

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

Table B-20.—Telephone common carriers: 1/ Number of employees, by occupational groups, 1972 and 1976

Occupational group	1972	1976	Percentage change, 1976 from 1972
All employees, except officials and managerial assistants, total	841,176	810,064	-3.7
Professional and semi-professional 2/	94,322	85,654	-9.2
Business office sales	68,347	72,255	5.8
Clerical	182,142	182,201	.1
Telephone operators	187,666	141,954	-24.4
Construction, installation, and maintenance, total	280,835	302,314	7.7
Foremen of telephone craftsmen	42,238	38,705	-8.4
Central office craftsmen, total	95,733	122,700	28.2
Test board and repeater men	20,736	20,775	.2
Central office repairmen	69,589	55,061	-20.9
Others 3/	5,408	46,864	766.7
Installation and exchange repair craftsmen, total	97,597	94,210	-3.5
PBX and station installers	43,902	46,172	5.2
Exchange repairmen	25,619	28,962	13.1
Others 3/	28,076	19,076	-32.1
Line, cable, and conduit craftsmen	45,244	46,659	3.2
Laborers	23	40	73.9
Building, supply, and motor vehicle employees	25,457	25,011	-1.8
Other 4/	2,407	675	-72.0

1/ Carriers engaged in interstate service which are required to report annually to the FCC. Data represents 62 carriers in 1976.

2/ Numbers in this category may show wide variation from year to year because of changes in classification procedures between professional and management groupings.

3/ Includes skilled and semiskilled workers in apprentice and training programs. Technicians are classified in this category.

4/ Consultants are classified in this category.

Source: FCC, Statistics of Communications Common Carriers, 1972-76.

Table B-21.—Independent telephone companies: Number of employees, 1/ by occupational groups, 1972, 1976, and 1977

Occupational group	1972	1976	1977	Percentage change— 1976 from 1972	Percentage change— 1977 from 1972
Officials and managerial assistants	6,185	6,872	6,701	11.1	8.3
Professional and semi-professional	11,736	13,284	14,358	13.2	22.3
Business office and sales	10,029	10,901	11,661	8.7	16.3
Clerical	24,745	27,617	29,575	11.6	19.5
Telephone operators	31,837	25,523	25,334	-19.9	-20.4
Construction, installation, and maintenance:					
Foremen of telephone craftsmen	6,998	7,507	7,996	7.3	14.3
Central office craftsmen	18,129	19,047	20,067	5.1	10.7
Installation and exchange repair craftsmen	22,722	23,789	24,285	4.7	6.9
Line cable and conduit craftsmen	11,579	11,420	11,426	-1.4	-1.3
Laborers	531	516	524	-2.9	-1.3
Subtotal	59,959	62,279	64,498	3.9	7.6
Service 2/	6,160	6,727	7,201	9.2	16.9
Other	991	1,290	1,312	30.2	32.4
Total	151,642	154,493	160,440	1.9	5.8

1/ Data represent 96 percent of independent telephone industry employment in 1976 and 1977.

2/ Includes building, supply, and motor vehicle employees.

Source: U.S. Independent Telephone Association, Independent Telephone Statistics, vol. I, 1978, 1977, and 1973 eds.

Table B-22.—Bell System: 1/ Number of employees, by occupational groups, 1972, 1976, and 1977

Occupational group	1972	1976	1977	Percentage change— 1976 from 1972	Percentage change— 1977 from 1972
Officials and managers	119,336	110,525	114,374	-7.4	-4.2
Professionals	94,261	109,954	117,017	16.6	24.1
Technicians	23,007	33,767	35,802	46.8	55.6
Sales workers	13,962	17,973	20,550	28.7	47.2
Office and clerical	393,660	330,951	325,014	-15.9	-17.4
Craftspersons (skilled)	260,221	243,893	241,759	-6.3	-7.1
Operatives (semi-skilled)	103,549	80,126	88,371	-22.6	-14.7
Service workers	11,966	11,125	10,358	-7.0	-13.4
Total	1,019,962	938,314	953,245	-8.0	-6.5

1/ AT&T and its subsidiaries.

Source: AT&T, Statistical Report, 1976 and 1977.

Table B-23.—Number of telephones and employees in service in U.S. common-carrier companies, 1/ 1968-77

Year	Number of telephones	Number of employees	Number of telephones per employee
	1,000 units	Thousands	
1968	109,247	826	132.3
1969	115,196	893	129.0
1970	120,214	941	127.8
1971	125,142	948	132.0
1972	131,607	952	138.2
1973	138,311	979	141.3
1974	143,972	975	147.7
1975	148,623	946	157.1
1976	155,172	938	165.4
1977	162,072	952	170.2

1/ Data include Bell System and independent telephone companies.

Source: U.S. Independent Telephone Association, Independent Telephone Statistics, vol. 1, 1978 ed.

Table B-24.--Central offices, 1/ by types of telephone switching equipment, 1972, 1976, and 1977

Type of switch	1972		1976		1977	
	Number	Percent of total	Number	Percent of total	Number	Percent of total
Nonmetallic (electronic):						
Direct and common control	819	4.5	2,881	14.4	3,688	18.1
Stored program control						
Metallic: 2/						
Direct and common control	17,503	95.5	17,139	85.6	16,673	81.9
Stored program control						
Total	18,322	100.0	20,020	100.0	20,361	100.0

1/ Central offices of common-carrier companies which report annually to the FCC. Data represent about 90 percent of telephone industry.
2/ Includes a small percentage of manual and panel dial switchboards.

Source: Compiled from official statistics of the FCC.

Table B-25.--Company telephones, 1/ by types of telephone switching equipment, 1972, 1976, and 1977

Type of switches	1972		1976		1977	
	Number	Percent of total	Number	Percent of total	Number	Percent of total
	1,000 units		1,000 units		1,000 units	
Nonmetallic (electronic):						
Direct and common control	6,283	5.5	23,641	17.6	31,333	22.1
Stored program control						
Metallic: 2/						
Direct and common control	108,478	94.5	110,951	82.4	110,525	77.9
Stored program control						
	114,761	100.0	134,592	100.0	141,858	100.0

1/ Telephones of common carrier companies which report annually to the FCC. Data represent about 90 percent of telephone industry.
2/ Includes a small percentage of manual and panel dial switchboards.

Source: Compiled from official statistics of the FCC.

Table B-26.—Telephone and telegraph equipment: Exports and share of the world export market, by 7 principal exporting countries, 1970-76

Country	1970	1971	1972	1973	1974	1975	1976
	Value (millions of dollars)						
Sweden	178	219	275	363	422	578	583
West Germany	190	247	295	382	446	536	584
Japan	53	103	139	195	226	243	280
Belgium	50	74	120	146	153	209	299
United States	74	61	77	112	161	199	231
France	46	55	63	96	129	193	192
United Kingdom	91	126	122	131	133	155	210
Total	682	885	1,091	1,425	1,670	2,113	2,379
Total, 14 major producer nations	841	1,080	1,318	1,714	2,026	2,520	2,925
	Percent of World Export Market						
Sweden	21.2	20.3	20.8	21.2	20.8	22.9	19.9
West Germany	22.6	22.9	22.4	22.3	22.0	21.3	20.0
Japan	6.3	9.5	10.6	11.4	11.1	9.6	9.6
Belgium	5.9	6.8	9.1	8.5	7.6	8.3	10.2
United States	8.8	5.7	5.8	6.6	7.9	7.9	7.9
France	5.5	5.1	4.8	5.6	6.4	7.7	6.6
United Kingdom	10.8	11.7	9.3	7.6	6.6	6.1	7.2
Total	81.1	82.0	82.8	83.2	82.4	83.8	81.4
Total, 14 major producer nations	1/	1/	1/	1/	1/	1/	1/

1/ Approximately 100 percent.

Source: United Nations Trade Statistics.

Table B-27.—Number of telephones in service, total and those privately operated, by continental areas, 1976

(Quantity in thousands of units)

Continental area	Total	Privately operated telephones	Ratio (percent) of privately operated telephones to total
	Quantity		
North America	168,362	165,930	98.6
Middle America	4,880	3,559	72.9
South America	9,856	1,386	14.1
Europe	143,871	27,363	19.0
Africa	3,890	46	1.2
Asia	59,426	3,385	5.7
Oceania	7,897	601	7.6
Total	398,182	202,270	50.8
	Percent of total		
North America	42.3	82.0	-
Middle America	1.2	1.8	-
South America	2.5	.7	-
Europe	36.1	13.5	-
Africa	1.0	-	-
Asia	14.9	1.7	-
Oceania	2.0	.3	-
Total	100.0	100.0	-

Source: AT&T Long Lines, The World's Telephones.

Table B-28.—Number of telephones in service, total and those privately and government-operated, by areas, 1976

Area	Total	Privately operated telephones	Government-operated telephones	Ratio of government-operated telephones to total
	1,000 units	1,000 units	1,000 units	Percent
United States	155,172	154,997	175	0.1
World (except the United States)	243,010	47,273	195,737	80.1

Source: Compiled from AT&T Long Lines, The World's Telephones.

Table B-29.--Telephone terminal and switching equipment: Imports into 11 foreign countries and total sales in those countries, by types of equipment, 1974

Item	West Germany	Japan	Brazil	Italy	Spain	Australia	Mexico	South Africa	Thailand	Colombia	Republic of China
Central office exchanges:											
Imports----------1,000 U.S. dollars--	28,300	1/	2/	6,200	2/	6,300		20,750	1,626	11,300	1,429
Total sales----------do----	535,000	390,200	150,500	53,000	164,300	91,800		83,000	8,500	11,980	11,600
Ratio of imports to sales------percent--	5.3	1/	2/	11.7	2/	6.9		25.0	19.1	94.3	12.3
							45,400				
Private branch exchanges:							146,800				
Imports----------1,000 U.S. dollars--	23,400	497	2,961	2,400	290	12,400	30.9	4,290	812	1,540	801
Total sales----------do----	135,000	75,000	29,100	7,400	2,900	26,100		15,800	1,800	1,930	3,700
Ratio of imports to sales------percent--	17.3	0.7	10.2	32.4	10.0	47.5		27.2	45.1	79.8	21.6
Other: 3/											
Imports----------1,000 U.S. dollars--	24,000	4,449	6,431	25,500	26,470	12,300	13,179	5,290	1,973	5,580	4,362
Total sales----------do----	230,000	493,000	98,800	256,000	43,900	45,000	18,300	21,200	7,800	6,990	7,900
Ratio of imports to sales------percent--	10.4	.9	6.5	10.0	60.3	27.3	72.0	25.0	25.3	79.8	55.2

1/ Negligible.
2/ Data not available by types of equipment.
3/ Subscriber/user premises equipment, such as telephone sets, teleprinters, and telex equipment, and central office equipment including parts n.e.c.

Source: Compiled from the U.S. Department of Commerce, Global Market Survey, Communications Equipment and Systems.

Table B-30.--Telephone terminal and switching equipment: Imports into 11 foreign countries from the United States and from all countries, by types of equipment, 1974

Item	West Germany	Japan	Brazil	Italy	Spain	Australia	Mexico	South Africa	Thailand	Colombia	Republic of China
Central office exchanges:											
Imports from											
United States---1,000 U.S. dollars--	1/	2/	2/	200	2/			40	1/	450	119
Total imports----------do----	28,300	2/	2/	6,200	2/			20,750	1,626	11,300	1,429
Ratio of imports from United States to total----------percent--	1/	2/	2/	3.2	2/	1/	1,196	0.2	1/	3.98	8.0
Private branch exchanges:						63,000	45,441				
Imports from						1/	2.6				
United States---1,000 U.S. dollars--	200	220	3	300	50			100	32	310	96
Total imports----------do----	23,400	497	2,961	2,400	290			4,290	812	1,540	801
Ratio of imports from United States to total----------percent--	0.9	44.3	0.1	12.5	17.2			2.3	3.9	20.1	12.0
Other: 3/											
Imports from											
United States---1,000 U.S. dollars--	900	2,229	532	1,600	4,850	1,600	1,637	300	149	2,810	361
Total imports----------do----	24,000	4,449	6,431	25,500	26,470	12,300	13,179	5,290	1,973	5,580	4,362
Ratio of imports from United States to total----------percent--	3.8	50.1	8.3	6.3	18.3	13.0	12.4	5.7	7.6	50.4	8.3

1/ Negligible.
2/ Data not available by types of equipment.
3/ Subscriber/user premises equipment, such as telephone sets, teleprinters and telex equipment, and central office equipment including parts n.e.c.

Source: Compiled from the U.S. Department of Commerce, Global Market Survey, Communications Equipment and Systems.

Table B-31.--Telephone equipment: 1/ Tariff rates, prior deposit requirements, and import charges, by areas and countries, 1977-78

(In percent)

Geographic area and country	Description	Tariff rate	Prior deposit requirement	Additional surcharge
Africa:				
Ivory Coast	Telephone switchboards with more than 80 intermediary lines.	7	-	-
Do	Other telephonic apparatus and parts.	22	-	-
Kenya	Telephonic apparatus and parts	30	-	-
Nigeria	do	50	-	-
Senegal	do	10	-	5
Tanzania	do	30	-	-
Asia:				
Indonesia	Telephone sets in completely knocked-down condition.	10	-	10
Do	Other sets	30	-	10
Do	Other telephonic apparatus	20	-	10
Israel	Telephonic apparatus and parts, except dials.	35	-	-
Do	Dials	10	-	-
Japan	Electronic switchboards	2/ 12	-	-
Do	Other telephonic apparatus	6	-	-
Korea	Telephonic apparatus and parts	3/ 30	-	-
Singapore	do	0	-	-
Turkey	Telephonic apparatus	45	-	-
Do	Parts	18	-	-
Europe:				
EEC	Telephonic apparatus and parts	7.5	-	-
Finland	do	6.5	-	-
Spain	do	20	-	-
North America:				
Canada	do	17.5	-	-
Mexico	Telephones, exterior	50	-	-
Do	Other telephonic apparatus	20	-	-
Do	Parts	10	-	-
United States	Telephonic apparatus and parts	8.5	-	-
Oceania:				
New Zealand	do	35	-	-
South America:				
Argentina	Telephone sets, switchboards and exchanges, and parts.	80	40	-
Do	Other	40	40	-
Bolivia	Telephonic apparatus and parts	20	-	-
Brazil	do	55	100	-
Chile	Telephone sets	4/ 18	-	3
Do	Other	4/ 17	-	3
Colombia	Telephonic apparatus and parts	20	35	-
Ecuador	Telephone sets and automatic exchanges.	30	20	5
Do	Parts	20	20	5
Paraguay	Telephonic apparatus and parts	31.5	100	-
Uruguay	do	18	-	-
Venezuela	Automatic telephone exchanges	60	-	-
Do	Other telephonic apparatus	2	-	-

1/ BTN heading 85.13.
2/ Effective rate; statutory rate is 15 percent.
3/ Temporary rate; statutory rate is 40 percent.
4/ Will be reduced to 10 percent in June 1979.

Source: International Customs Tariffs Bureau, The International Customs Journal, and discussions with officials of the U.S. Department of Commerce.

APPENDIX C

PRODUCT DEFINITIONS

Products under Study

Meaningful comparisons of imports, exports, and U.S. shipments are possible only if all data are collected on precisely the same product and statistical basis. Following are definitions as used in the USITC questionnaire to manufacturers, importers, and exporters.

Telephone terminal equipment

Telephone terminal equipment is equipment designed principally for communication of two-way speech (audio frequency) intelligence by wire (including coaxial cable), regardless of modulation method, and for installation in houses, offices, or other permanent nonmobile structures. The modulation method for terminal equipment is not limited to voice frequencies but includes digital or radio frequency signals. Products included are telephone sets, key sets, and subassemblies thereof. 1/ Not included are installation hardware, modem terminals, data sets, auxiliary devices, transmission equipment, teletype, facsimile, telegraph, intercom (intercommunication) systems, and other such equipment.

Telephone sets.--A telephone set is the terminal instrument by which audible sounds are converted to electric signals for transmission by wire 2/ to and from a switch. The set may or may not contain a signaling device (dial, touch pad, and so forth) but does include a transmitter and receiver and an on-off mechanism. Telephone sets which include special features (such as loudspeakers, hold buttons, lighted dials, or pads, and so forth) are included. If modular telephone sets are shipped as components, the equivalent number of assembled modular sets with any remaining components are provided under subassemblies and parts.

Telephone key sets.--Telephone key sets (with or without special functions) are terminal instruments capable of terminating two or more lines and incorporating key switches for selection of a circuit. Attendant key sets or consoles are included. The term includes those sets having special functions.

Switching equipment

Switching equipment is equipment designed principally to permit the connection of any terminal or group of terminals to any other terminal or group as desired. Connections may be made by metallic contacts, semiconductors, or digital devices. Products included are branch exchanges,

---

1/ Private branch exchanges and key system switching equipment may be considered to be terminal equipment. They are treated separately in this study under switching equipment.

2/ The method of transmission includes voice frequency, digital code, or high-frequency signals.

central office (all classes) switches, and subassemblies thereof. Not included are certain auxiliary equipment, installation hardware, transmission equipment, switches designed exclusively for switching record communications (teletype, telex), intercom systems (intercommunications systems not capable of being connected to the switched telephone networks), and the like.

Key system switching equipment.--Key system switching equipment is switching equipment which controls the key telephone sets in a key telephone system. This equipment is the basic customer or premise equipment which is the interface between the key telephone sets and the incoming and outgoing trunks or access lines. This switching equipment is also used as an interface to CENTREX service. The printed wiring cards and plug-in modules associated with key systems are included in this definition.

Branch exchange.--The branch exchange is intended to provide local intercommunications between members of a business and access to the public switching network. Such switches are generally located on the customers' premises.

Central office switches.--Central office switches are those complete switches normally used by regulated common carriers in the public telephone network. They are commonly referred to as class 1 through class 5 offices. This definition does not include independent auxiliary systems sold separately.

Switching equipment by type of connection

Metallic contact connection.--Exchanges or switches which use step switches, relays, crossbars, reeds, or other direct physical metallic connection for completing a circuit.

Electronic (nonmetallic) connection.--Exchanges or central offices which use semiconductor, optoelectronic, or other nonmetallic connection schemes.

Switching equipment by type of control

Direct and common control.--Direct control covers switching systems in which the signaling message directly controls the switch closures. Common control refers to switching systems in which the signaling message is interpreted by switch-independent wired logic which generates the ultimate switch closure instructions.

Stored program common control.--Common control switching systems in which some or all of the logic circuits are implemented by other than hard wires. The most common technology in use is solid-state (semiconductor), although other technologies (magnetic domain, and so forth) may be used. Control systems with either alterable or permanent memory are included.

Subassemblies

Subassemblies and parts.--All parts, components, and subassemblies of telephone terminal and switching equipment which are shipped or imported separately from the finished product, and computer controllers, switch modules and matrices. These parts, components, and subassemblies are shipped to original-equipment manufacturers or are used for replacement, repair, or expansion of existing systems. Subassemblies include the following:

Switch modules or matrices.--Subassemblies of complete central office switches or branch exchanges which are used for expansion of the installed equipment to its fullest capability or repair and replacement of installed equipment.

Computer-type controllers.--Includes special-purpose controllers, general-purpose computers, or a combination of the two.

APPENDIX D

CONGRESSIONAL AND REGULATORY ACTIONS

Congressional Actions Relating to the Telephone Industry

Through legislation enacted in the early twentieth century, Congress promoted consolidation and regulation of the telephone industry. The legislation provided for operation of service in the public interest.

The Willis-Graham Act, 1921

Within 10 years after the first telephone patents filed by the inventor had expired (1894), some 6,000 phone companies had come into existence. In many areas several phone companies offered the same service. Often these companies had no direct connection with each other's equipment. A customer needing wide coverage (police, fire, and hospitals) required different telephones provided by several companies.

In the early 1900's individual States began to regulate telephone companies as utilities. A chief issue in such cases was the diseconomies brought about by uncoordinated, technically dissimilar, duplicate services. By 1920, many States had substituted public regulation for competition in the telephone industry.

In 1921 the Willis-Graham Act endorsed, on the national level, a policy of consolidation of telephone companies and the establishment of legally franchised monopolies within a given service area. The act provided exemption from antitrust laws for consolidations approved by the Interstate Commerce Commission (ICC). 1/ 2/ It provided the basis for a national telephone network using common engineering standards, system signaling, noise and transmission standards, numbering, and maintenance standards. 3/

The Communications Act of 1934

The U.S. House of Representatives directed an in-depth investigation of the electric power, natural gas, and the telephone industries in 1932. By this year, AT&T had emerged as the largest of the franchised telephone utilities. For the telephone industry the outcome of the investigation was the Communications Act of 1934. This law created the FCC to establish and regulate "in the public interest" all forms of telephone, telegraph, and

---

1/ In 1910 the Mann-Elkin Act had made the ICC responsible for regulation of the telephone and telegraph industry.

2/ During World War I, the Postmaster General took over operation of the telephone industry. This experience also contributed to the enactment of the Willis-Graham Act.

3/ Not all service areas were consolidated rapidly. It is reported that as late as 1939 there were communities served by two telephone companies.

wireless communications. 1/ There is little other guidance provided to the FCC in the law. The recommendation of the chief congressional investigator during the hearings was that the structure of the industry be maintained. A prime reason given was the requirement for universal interconnection between all telephones.

The Communications Act of 1978 2/

When the Communications Act was enacted in 1934, the wireless communications industry was in its infancy, and the telephone industry far from mature. Although the basic nature of broadcast and radio point-to-point communications was well known, many of the inventions such as television had not occurred. The same is true of the telephone industry; the transistor was born 14 years later. Technical sophistication and the demands of the market place have created a wide range of products and services since 1934.

In 1978, a new communications act was proposed in Congress in an attempt to reassess telecommunication and broadcasting regulation in light of rapid changes in technology. The opening "findings" of the proposed act are quoted.

> "SEC. 101. The congress hereby finds that the regulation of interstate and foreign telecommunications is necessary in order to--
>
> (1) make available to the people of the United States nationwide and worldwide telecommunications services which are diverse, reliable, and efficient, and which are available at affordable rates; and
>
> (2) advance United States foreign policy, the national defense, and the safety of life and property."

Title II of the bill would establish a new Commission, the Communications Regulatory Commission (CRC). The CRC would have the power to issue subpoenas. The Commission would be organized such that the Chairman is the principal executive officer. The budget submission for the Commission is to be made through the Office of Manpower and Budget, with a concurrent copy forwarded to Congress.

1/ The ICC's authority over telephone and telegraph commerce was transferred to the FCC. The Federal Radio Commission had been established in 1927. It was folded into the new FCC.

2/ This legislation, H.R. 13015, 95th Congress, was not enacted.

The provisions of the proposed legislation which most directly affect the telephone terminal and switching equipment industry are contained in Title III of the bill. Following is a summary of the sections as they affect the instant baseline study.

Section	Provides that--
Accounts and records	The CRC shall prescribe the forms and records to be provided.
Valuation of Property	The CRC will make a valuation of property held by the common carriers.
Depreciation	The CRC will set the depreciation rate allowed for the various classes of common carrier property.
Common carrier holdings	Common carriers may hold or own shares in other telecommunications companies.
Restriction on manufacture	No persons providing non-competitive telecommunications service may engage in the manufacture of equipment used to supply such service.

The aforementioned provisions are significant in light of recent criticism of the common carriers' accounting system as it pertains to changes in technology. It is alleged that the system of accounts maintained by the common carriers is archaic and that the various costs of operations cannot be determined. A major issue that will affect the telephone equipment manufacturing industry is the depreciation rate allowed on items such as central office equipment. Current equipment is, or will be, depreciated over a 20-year period. However, with the revolution in solid-state electronics, products, such as computers, are depreciated in 7 years. The modern telephone switching equipment uses and may closely resemble computers.

Finally, in the sections of Title III (part B) dealing directly with domestic common carriers, the bill appears to substitute competition under regulation for the pervasive comprehensive regulation of the Communications Act of 1934. Of particular importance to the industry producing telephone terminal and switching equipment industries are sections 332 and 333 of the bill. Section 332 appears to relax some of the constraints on common carriers in that they may hold or acquire shares in any other companies engaged in the common-carrier business. The consent decree entered into by AT&T and the Department of Justice in 1956 prohibited AT&T from such holdings. However, section 333, known in the industry as the divestiture provision, prohibits companies which provide "noncompetitive telecommunications service" to be "engaged in the manufacture of equipment used in furnishing any domestic common carrier service." This could cause the divestiture of such companies as Western Electric (AT&T) and Automatic Electric (GTE).

FCC Actions--Regulation and Competition

The rulings and decisions of the FCC which directly affect the industry producing telephone terminal and switching equipment are discussed as follows.

FCC competitive policies to date have affected customer-premises equipment, such as telephone sets, key system switching equipment, and PBX's. It is too early to determine the impact of FCC decisions and court appeals affecting specialized common carriers. These actions may eventually impact the central office equipment manufacturing industry.

1956 consent decree: AT&T and Department of Justice

As the result of an antitrust suit filed by the Department of Justice in 1949, AT&T entered into a consent decree in 1956. Sections IV and X of the consent decree most directly affected the telephone terminal and switching equipment industry.

Section IV essentially prohibits AT&T and Western Electric from manufacturing any products not used by the Bell Telephone System in furnishing common-carrier communications services. Section X requires AT&T to grant licenses for all patents including prior and future patents. Prior patents were to be licensed royalty free, and later patents at reasonable rates. However, the terms of the consent decree do permit AT&T to require cross-licensing of an applicant's patents.

As an example of the effects of the consent decree, the transistor, upon which the entire semiconductor industry is based, was invented in, and patented by, the Bell Telephone Laboratories in 1948. U.S. shipments by semiconductor firms in 1977 exceeded $4 billion.

1956 Hush-A-Phone decision

Prior to 1956, complete end-to-end service was supplied by operating telephone companies, i.e., all equipment was owned by the telephone companies. Alien attachments to telephone instruments were prohibited. The Hush-A-Phone was simply a cup-like device which, when placed on the mouthpiece of a telephone set, funneled the speaker's voice into the transmitter. The device was designed for use in noisy environments to decrease the amount of outside noise entering the mouthpiece.

The FCC ruled against Hush-A-Phone but was overruled in the Federal courts. The Hush-A-Phone case is mentioned since it is considered to be the first decision which permitted the attachment of an alien device to telephone equipment. It is considered a precursor to the Carterfone decision.

1968 Carterfone decision

The Carterfone Co. filed an antitrust suit against AT&T in 1966. At issue was the connection of the Carterfone device to the telephone instrument. The device was an acoustic coupler for connecting radio transceivers to the telephone instrument. The radio transceivers were part of a mobile radio system. The antitrust suit was dismissed, with the court ruling that the FCC had primary jurisdiction to decide if the Carterfone equipment could be connected to the telephone system. The FCC at this time was investigating the same issue in several different proceedings. In 1968 the FCC ruled in favor of Carterfone. However, the finding covered the connection of a broader range of equipment than Carterfone devices to the telephone system.

The telephone companies have defended their prohibition on the connection of customer-provided equipment on the basis of harm to the network and potential harm to the customer. The FCC decided that the connection of harmless devices and potentially harmful devices must be treated separately. Sound coupling devices, such as Carterfone's, were ruled essentially harmless. The issue of direct electrical connection to the telephone lines was not completely resolved.

After 1968 the telephone companies allowed direct connection with telephone lines through equipment called "protective couplers." These couplers were rented to the customer by the telephone company.

1974 FCC Docket 19528 - First Order and Report

In 1972 the FCC issued a Notice of Inquiry and Proposed Rulemaking which became Docket 19528. This proceeding began a broad investigation into the technical impact of direct connection of customer-provided equipment into the public-switched network. In 1974 the FCC issued the First Order and Report in Docket 19528.

The First Order established a registration program for terminal equipment. If a manufacturer submits equipment to the FCC which meets standards necessary to protect the telephone system and the user from harm, a registration number is issued. Registered equipment may then be connected directly to the telephone system. However, this First Order did not cover telephone sets, key sets, and PBX equipment. This equipment required further investigation.

1977 FCC Docket 19528 - Second Order and Report

In 1976 the FCC issued a Second Order which included telephone sets, key sets, and PBX's in the registration program. This Order was stayed in the courts until October 1977 when it was upheld. Even then PBX's were not accepted for registration because of technical problems in designing a standard interface and other specifications. These problems were solved in early 1978, and PBX's are now accepted for registration.

APPENDIX E

ACCURACY AND COMPARABILITY OF STATISTICS

Accuracy and Comparability of Statistics

The basis for the collection of shipment, import, and export statistics in the Government and difficulties with the use of Government data are examined below.

U.S. shipments

The output of the U.S. production base is reported yearly for the telephone industry in the "Current Industrial Report, MA 36N." This report is based on data taken by Census surveys and contains data on total shipments from U.S. manufacturing establishments. Both material exported, as well that consumed in the U.S., is reported in the totals.

Data are collected from every distinct manufacturing entity that is part of the subject industry. Under this procedure, in a vertically integrated company, the same product may be counted a number of times as it passes from plant to plant and is transformed into an end product. As will be noted later, imports and exports are counted only once as they cross the borders of the United States, although they may be counted as a U.S. shipment if value is added in the United States.

Commercial language.--Commercial language is used to describe the products in the current industrial reports. The Standard Industrial Classification (SIC) code is the basic product code for commodity descriptions. These descriptions are generally not mutually exclusive. Reporting procedures of Census, although mandatory, leave considerable discretion to businesses. The selection of products to be reported under a given SIC heading is determined essentially by individual firms. There can be considerable variation in the classification of products as reported from company to company.

Aggregation.--To protect the business operations of a single company which may dominate an industry or even a single product line, Government rules on confidentiality require that several product lines be aggregated and only the totals shown. Although the current industrial reports begin as a detailed statistical report on various important commodities within a large industry, the final report may show only an aggregation of many products into large totals and subtotals. For example, the Current Industrial Report for 1976 lists eight specific line items of telephone central office switching equipment manufactured by 14 companies. There is a ninth catch-all line item described as "other telephone switching and switchboard equipment." All nine line items were aggregated to a single total of $1.8 billion shipments in 1976. Thus, the distinction between the eight line items is obliterated.

Baskets.--All reporting systems contain large so called "basket" line items. These catch-alls are the last reporting line item for a given commodity. Products which may not fit other descriptions are classified in baskets. The value of basket categories is often as large as the total of all previous line items. Because product categories are not properly distinguished, a great deal of material is reported under the basket heading "telephone apparatus" without any further breakdown in the current industrial reports. The basket category "other telephone and telegraph apparatus" was $1.8 billion, or 35.3 percent of the total value of shipments in 1976.

Accuracy.--The yearly issue of the Current Industrial Report is published from 6 to 10 months after the end of the calendar year. This report contains both the current year data and revisions of the previous year's data. Accurate data is therefore available 18 to 22 months after the year in question. As noted in this report, Commerce data revisions can be sizeable. Current year uncorrected data must be considered preliminary.

U.S. imports for consumption

All U.S. imports are classified in the Tariff Schedules of the United States (TSUS) by rate-line item. Total U.S. imports are published yearly by the Commerce Department on the basis of data collected by the U.S. Customs Service as imports are entered.

The tariff schedules are a commodity code. Mutually exclusive descriptions for each line item (commodity) are attempted, and end-use designations avoided. The requirement for mutually exclusive, legally constructed tariff language leads to technical, physical descriptions.

Consumer/commercial distinction.--Tariff language descriptions cannot readily separate the consumer from the commercial product since end-use provisions are seldom employed. A commercial commodity may be exported and the consumer product imported, and both may be reported under the same description.

With respect to telephone apparatus, such separation between consumer and commercial product has not occurred. Although the consumer may own a telephone instrument, the specification which this instrument must meet in accordance with FCC's rules and regulations and the specification which the instrument must meet in order to interface properly with the telephone system make the telephone instrument a distinct commodity not given to market segregation.

Annotations.--Prior to 1975 all telephone apparatus import statistics were collected under a single tariff line item, "Telephonic apparatus and instruments, and parts thereof. . . . ." (TSUS number 684.62). On January 1, 1975, four statistical subcategories or "annotations" were added to the basic line item 684.62:

684.6210 Telephone switching and switchboard equipment and parts and components thereof . . .
684.6220 Telephone instruments . . .
684.6230 Intercom Systems . . .
684.6240 Other, including parts not specifically provided for...

The annotations were added in order to collect data on major product categories of telephone apparatus. The rate of duty applied to all categories was not affected by this change. The four categories appear to be reasonably well alined with current industrial report categories. However, TSUS number 684.62 is not the only line under which parts or components which are used in the manufacture of telephone apparatus may enter. The TSUS provides that eo nomine (actual name) descriptions will prevail over less specific descriptions. Thus, for example, a resistor, regardless of its ultimate use, would enter under TSUS number 686.10 or 686.11. In recent year, telephone technology has shifted from specially designed telephone parts to general electronic components, particularly semiconductor products. Import statistics collected under TSUS 684.62 do not, therefore, represent the full amount of imported material which is ultimately manufactured or assembled into telephone terminal and switching equipment.

Unfinished, unassembled articles and parts.--In order to simplify classification of commodities, the tariff schedule requires that unassembled or unfinished products be classified with the finished product. Some of the more complex types of machines have an individual tariff line item for parts. That is, where there is no specific or eo nomine provision for a part, and where the part is of specialized design, specific rate lines or annotations may exist. Subassemblies may be included in the parts provision lines. However, if the subassembly has been sufficiently advanced so that the final finished product can be readily identified, the subassembly is classified as an unfinished product.

Baskets.--At the end of each tariff schedule, a basket provision item is listed for commodities which cannot be, or have not been, identified in previous line items. Import baskets tend to be quite large. There are several reasons for this. The rapid advancement of technology and continuous introduction of new products into the commerce of the United States make it difficult to update tariff language definitions. Until such time as it is known that new products are imported in significant amounts, such products are referred to the basket provision. For instance, telephone instruments containing a calculator are relegated at the present time to line item 688.40 "Electrical articles, and electrical parts of articles, not specifically provided for....."

Accuracy of data.--The U.S. Customs Service furnishes the Census Bureau with copies of import consumption entry documents, form number 7501. These documents are sent to Census by individual customs houses before final liquidation of the entries. The accuracy of statistical annotations numbers may not have been verified, which can lead to inaccuracies in the published

data. Forty-eight complete and liquidated consumption entry forms (from 1-percent sample files) for fiscal year 1977 were examined carefully. The total value of imports represented by this sample was $479,969. Although the sample size is small compared with total imports reported, it is a random sample.

Of the 48 entries, 18 were judged to be in error as to statistical annotation. Either the invoice description did not fit the reported tariff description or there was insufficient description on which to base accurate classification. The value of material represented by these apparently inaccurate classifications was $195,667. The error rate in this sample was 41 percent. Although all of the apparatus was telephonic in nature, the exact type of telephonic apparatus was not discernible.

Valuation.--Differences in the valuation base reported for imports, exports, and U.S. production can cause distortions in the economic picture. Data on imports are collected on the commodity, i.e., only the hardware or individually defined product is considered for duty and statistical purposes. Since the duty is paid on the assessed value of the product, the product is, for all practical purposes, stripped bare of any nondutiable item. For instance, even if an imported commodity is part of a program to provide a completely engineered and installed system, only the equipment itself is reported. Blue prints, engineering support services and the like, which may ultimately come into the United States under separate contract, are not considered to be imports for consumption. The same treatment may or may not be afforded U.S. products exported into other countries.

U.S. exports

Data on merchandise, products, and commodities exported from the United States are collected by the Bureau of Census. Statistical information is collected from export declarations submitted to Customs and tabulated by Census.

With the exception of exports of war materials and high-technology equipment, there is little or no scrutiny of export declarations. Export licenses for advanced technology and strategic materials are examined by the Department of Commerce and Department of Defense. This examination represents a small percentage of all materials exported. Verification of the accuracy of export declaration prior to 1977 was essentially nonexistent. Primarily because no duty is collected on exports, verification of statistics is neglected. It is preferable to measure U.S. exports by measuring the imports of other countries.

Export commodity codes.--The export commodity code in use is called "Schedule B." The Schedule B prior to 1978 was based on the Standard International Classification (SITC) Code. This is a very loose grouping of commodities somewhat akin to the Brussels Tariff Nomenclature (BTN). The language of this commodity code is highly imprecise, with many overlapping commodity descriptions. Under the old Schedule B, line item descriptions were followed by a listing of trade names, and the same product may have been listed under different headings according to end use.

Export value.--Since there is no duty transaction involved in exporting, the reported value of exports can vary widely for the same product. Total contract prices, which may provide for personnel services and documentation in addition to hardware, often are reported. In such cases exports show grossly inflated unit values. This is particularly true in the years prior to 1978. In 1978 the classification system for exported products and the rules for declaring exports were put on essentially the same basis as imports. Computer verification techniques are now used to verify the accuracy of exports. Comparison of imports and exports should be greatly facilitated in years to come.

Library Cataloging Data

U.S. International Trade Commission.
A baseline study of the telephone terminal and switching equipment industry. Report to the Subcommittee on Trade of the Committee on Ways and Means of the U.S. House of Representatives on investigation no.332-92 under section 332 of the Tariff act of 1930, as amended. Washington, 1979.

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INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C. 20436

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ADDRESS CORRECTION REQUESTED

Postage And Fees Paid
U.S. International Trade Commission

ADDRESS CHANGE
- ☐ Remove from List
- ☐ Change as Shown

Please detach address label and mail to address shown above.