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TRADE ISSUES IN TELECOMMUNICATIONS AND INFORMATION

UNITED STATES TRADE IN THE MERCHANDISE
OF INFORMATION INDUSTRIES
VOLUME I

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PREFACE

This paper is one of three on selected topics on trade in the goods and services of the telecommunications and information industries. Other papers in the series include:

Volume II "The Employment Effects of Trade in High Technology
Telecommunications and Information Products" by C.
Randall Jacobson.

Volume III "Promoting U.S. Trade in Telecommunications and
Information Products with Developing Countries" by
Kathleen M. White and C. Randall Jacobson;

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UNITED STATES TRADE
IN THE MERCHANDISE OF INFORMATION INDUSTRIES

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UNITED STATES TRADE IN THE MERCHANDISE
OF INFORMATION INDUSTRIES

EXECUTIVE SUMMARY

Fritz Machlup concluded that knowledge production in 1958 accounted for 29 per cent of GNP in the United States and that knowledge-producing occupations accounted for 32.4 per cent of total employee compensation. Marc Porat concluded that for the year 1967 some 46 per cent of GNP was accounted for by information activities and that nearly half the labor force held some sort of "informational" job.

While these studies of the relative significance of information industries have taken implicit account of international trade in their calculations, there has been comparatively little systematic effort devoted to analyzing the role of information goods and services in trade. This is the subject treated here, with emphasis on merchandise trade.

Information Merchandise and Services

Of the approximately \$200 billion of GNP generated by the primary information sector in 1967 (primary referring to output that is sold on established markets as opposed to being produced for internal consumption by governments and firms whose final outputs are not information products), only \$31.7 billion were generated by information merchandise or approximately 16 per cent of the sector.

Information services, therefore, by generating the remaining \$168.3 billion, accounted for the bulk of the sector's total contribution to GNP -- 84 per cent.

These results can be restated in relation to total GNP in 1967. Of total GNP of \$795.4 billion, only 4.0 per cent was generated by the merchandise component of the primary sector, while 21 per cent was generated by the services component of the primary information sector. These results indicate roughly that when we discuss trade in the merchandise component of information activities we are referring to a comparatively small segment of the total activity of the information sector and of the economy in general -- that is, to approximately 16 per cent of the primary information sector itself and to approximately four per cent of total GNP.

Information Merchandise in Trade

Trade in merchandise of 48 information industries combined was roughly in balance over the period 1972 to 1978. However, if exports and imports of just one of the 48 industries -- radio and television receiving sets -- is removed from the aggregate, the trade balance of the adjusted sector improves significantly, with exports exceeding imports by \$1.5 billion in 1972 and \$3.2 billion in 1978. By comparison, the balance for all merchandise trade of the United States was a negative \$31 billion in 1978.

Exports of information merchandise accounted for approximately 10 per cent of exports of all merchandise for the years 1972-1978; imports were a slightly smaller percentage of all merchandise imports, ranging from a high of 9.7 per cent in 1972 to a low of 8.1 per cent in 1977.

Conventional and Newer Technologies

Merchandise of the 14 industries comprising the information sector that are associated with newer technologies consistently registered positive balances and

accounted for a large and steadily growing majority of exports of all information merchandise, growing from \$3.4 billion or 65.4 per cent in 1972 to \$10.6 billion or 70.2 per cent by 1978. By contrast, products more closely associated with conventional technologies consistently registered trade deficits and accounted for a shrinking proportion of exports of information merchandise.

A rather striking observation is that 13 of the industries associated with newer technologies (radio and television receiving sets were removed) accounted for only 1.6 per cent of total GNP in 1967 and just 6.5 per cent of the primary information sector; yet in 1978 their trade surplus was over \$5 billion, a significant contribution, in relative terms, to the balance of trade position of the United States.

Exports as a Percentage of Industry Output

In 1972, exports as a percentage of industry output ranged for the 15 most export-oriented information industries from a high of 27.7 per cent for "calculating and accounting machines," to a low of 7.0 per cent for "radio and television transmitting apparatus." For all of these 15 industries combined, exports accounted for 13.7 per cent of industry output in 1972, a figure that grew to 18 per cent by 1977. Furthermore, the 15 industries which are comparatively active in export markets accounted for a growing proportion of domestic output of the merchandise component of the primary information sector; 43.1 per cent in 1972 and 44.6 per cent in 1977.

Regional Distribution of Trade -- Selected Industries

Asia, excluding Japan, was both the largest market for and largest supplier of semiconductors and related devices, though a significant portion of the "trade" activity with this region can be attributed to "exports" of parts of semiconductors

that are processed in overseas plants for subsequent "import" back to the United States. Western Europe was the second largest market, but dwindled in significance over the years, taking 36.0 per cent of U. S. exports in 1972 and 25.9 per cent in 1978. Imports into the United States from Western Europe also shrank as a percentage of the total, from 13.2 per cent in 1972 to only 4.2 per cent in 1978.

The Countries of Western Europe constituted the largest market for U. S. exports of electronic computing equipment, absorbing 56.2 per cent of total exports in 1972 and 58.5 per cent in 1978. (In dollar values, these percentages represent \$753 million and \$2.4 billion for the two years respectively.) Canada ranked second in both 1972 and 1978, even though the relative share of exports going to Canada declined, from 16.9 per cent (\$226 million) in 1972 to 12.7 per cent (\$525 million) by 1978.

In terms of total industry output, telephone and telegraph apparatus is moderately large when compared with other information industries -- about \$4.0 billion in 1972 and \$7.1 billion in 1978. Export markets for these products, however, have been relatively insignificant, with exports as a per cent of industry output amounting to only 1.9 per cent in 1972 and 3.6 per cent in 1977. The significance of individual foreign markets shifted rather dramatically between 1972 and 1978. For the earlier year Canada absorbed 35.8 per cent of exports from the United States, while Asia, excluding Japan accounted for only 6.8 per cent. By 1978, Canada's share fell to 15.6 per cent, while Asia, excluding Japan increased its relative share to 38.5 per cent. The relative share of Western Europe fell sharply also, from 27.8 per cent in 1972 to 14.9 per cent in 1978. For both years, 1972 and 1978, Japan supplied the largest share of U. S. imports of telephone and telegraph apparatus; \$36.8 million or 42.5 per cent in 1972 and \$93.0 million or 41.4 per cent in 1978.

Of the 48 information industries covered in this analysis of merchandise trade, radio and television receiving sets has the largest trade deficit, and one that grew from a negative \$1.7 billion in 1972 to negative \$3.6 billion by 1978. While exports from the United States accounted for only 6.0 per cent of domestic output in 1972 and 9.8 per cent in 1977, imports by the U. S. account for a significant and growing share of the domestic market: in 1972, imports of \$1.9 billion accounted for 36.5 per cent of the domestic market, while in 1978 imports of \$3.5 billion accounted for 45.1 per cent of the domestic market. Japan supplied 67.6 per cent of total U. S. imports in 1972 and 58.0 per cent in 1978. Asia, excluding Japan supplied 21 per cent and 30.8 per cent of imports by the United States in 1972 and 1978, respectively.

UNITED STATES TRADE
IN THE MERCHANDISE OF INFORMATION INDUSTRIES

As components of domestic economic activity, the "information industries" have received a good deal of attention in the United States. As early as 1962, Machlup brought to light the significance of information industries in the national economy by formulating estimates of the proportion of gross national product accounted for by "knowledge production."¹ He concluded that, "Total knowledge production in 1958 was almost 29 per cent of adjusted GNP,"² and that 32.4 per cent of total employee compensation was accounted for by knowledge-producing occupations.³

More recently, Porat, using a somewhat different technique of estimation with a slightly different list of activities assigned to the "information sector" concluded that for the year 1967, "...46 per cent of the Gross National Product is bound up with the information activity; and...nearly half the labor force holds some sort of 'informational' job, earning 53 per cent of labor income."⁴

These studies have demonstrated clearly that information goods and services are a significant part of total economic activity in the United States and give some indication as well that their relative importance has grown over the years.

The views and conclusions contained in this paper reflect those of the author, and should not be interpreted as necessarily representing the official policies or recommendations of the National Telecommunications and Information Administration, the U.S. Department of Commerce, or the U.S. Government.

¹ Fritz Machlup, The Production and Distribution of Knowledge in the United States (Princeton: Princeton University Press, 1962). Machlup considers the terms "knowledge" and "information" to be essentially synonymous.

² Machlup, p. 362.

³ Machlup, p. 394.

⁴ Marc U. Porat, The Information Economy: Definition and Measurement (Washington, D.C.: U.S. Department of Commerce, May 1977) p. 1.

With the rapid development of the technologies of information processing that has occurred since the late 1960's, particularly in electronic computing and communications devices, it is likely that the "information sector" has continued to expand in both absolute and relative terms by claiming a larger proportion of an expanding economy.⁵ Moreover, there is growing recognition that the significance of information activities extends well beyond domestic concerns.

INTERNATIONAL ISSUES

Though the study of information, or knowledge, as a component of economic and social activity is by no means a new field, there has been comparatively little systematic effort devoted to analyzing the role of information goods and information services in international trade and, in a broader context, in international relations in general. We turn our attention to these issues here.

The Trade Component of Gross Output

Studies of the relative significance of information industries in gross national product have taken implicit account of foreign trade in their calculations. By definition, one of the components of GNP is the net trade balance, the arithmetic difference between exports and imports. Thus, when the value of exports exceeds the value of imports for a given industry, the gross product of the industry is increased by the net difference, and when the value of exports falls short of the value of imports the gross product is decreased by the net difference. In the studies cited above that have focused on domestic activity in the information industries, however, neither the value of exports nor the value of imports, nor

⁵ Statistical findings that may well support such a claim will become available over the next few years as Machlup periodically releases the installments of his eight-volume update and expansion of the 1962 work.

even their net contributions to output, positive or negative, have been emphasized. It is these buried values that we shall pull from the gross product figures and examine more carefully.

Separating the Components of Trade: Merchandise and Services

Because statistical data on trade in information merchandise are plentiful, while those available on trade in information services are scarce and of questionable reliability, these two components will have to be given separate treatment. This is unfortunate because, as we shall see shortly, the majority of activities that constitute the information sector fall under the heading "services," and not "merchandise." Nevertheless, merchandise is far from inconsequential. It is the hardware with which information services are provided. The analyses presented in this paper will deal almost exclusively with merchandise trade. An analysis of services would face a number of unresolved conceptual problems, and would have to settle for partial or inconsistent statistical data, when they are available at all.

DEFINING THE RELEVANT SECTOR:

THE INFORMATION INDUSTRIES

The phrase "information sector" has gained wide currency as a convenient means of referring to a number of industries that are in some way involved in the production, processing, or dissemination of information. Its precise composition, however, can be specified in a variety of ways and can be expected to vary according to the needs or interests of particular researchers or policy analysts. Thus, in order to interpret statements about the economic significance of the

"information sector," whether measured in terms of total output, the value of exports, size of labor force, or any other criterion, it is helpful to first specify the particular industries that comprise the sector.

Primary and Secondary Sectors

For discussions presented in this paper that pertain to the information sector as an aggregation of several industries and components of several others, we have, for the sake of expediency and with the hope of providing some analytical continuity, adopted the definitions developed by Porat.⁶ In his attempt to measure the economic significance of information activities in the United States, Porat defined both a primary information sector and a secondary information sector. The former contains industries that produce information machines or sell information services on established markets (a sector which he calculated accounted for 25.1 percent of GNP in the United States in 1967), while the latter includes all information services produced for internal consumption by governments and firms whose final outputs are not information products or services per se (a sector which he calculated accounted for an additional 21.1 percent of GNP in 1967). Taken together, the primary and secondary sectors accounted for 46.2 percent of total GNP in 1967. In this analysis, we shall confine our attention to exports and imports of the primary sector, largely because of the difficulties associated with trying to

⁶ Porat, 1977. We chose Porat's definitions rather than Machlup's because the former analyst adhered more closely to standard government accounting practices and definitions. While a technique that relies on the existing classification schemes is not necessarily well suited for separating information activities from non-information activities (they were not designed with such a purpose in mind), it makes the job of measuring merchandise exports and imports for the sector far less complicated.

measure the value in trade of the non-market activities of the secondary information sector.⁷ Industries belonging to Porat's primary sector span quite a wide range of information activities, including commercial research and development laboratories, engineering and architectural services, book publishing, blue printing and photocopying services, calculating and accounting machines, motion picture theaters, to name just a few. A complete list is provided in Table 1.

As noted earlier, the sharp distinction between the quality of data available on trade in information merchandise and those available on trade in information services forces us to discuss these two areas separately.⁸ As the point of departure, therefore, it would be useful to first determine the relative significance of each in overall gross national product (at least for the year 1967), a task accomplished by rearranging a few of Porat's categories and some of his data.

Merchandise and Services: Their Relative Significance in the Primary Sector

Porat divides the primary information sector into the following eight broad industrial categories, then lists the industries (at the 4-digit level of the Standard Industrial Classification scheme) belonging to each:⁹

⁷ A second reason for choosing to ignore the secondary information sector in this analysis is some misgivings about the criteria used for designating its composition and the techniques used to measure its relative contribution to total GNP. A discussion of these points, however, would take us far beyond the scope of the subject at hand.

⁸ Data on exports and imports of information merchandise are abundant, available in fine detail by product, and by geographic origin or destination, and are, for most analytical purposes, sufficiently reliable. Data on exports and imports of information services are, by contrast, particularly scarce for many of the industries of interest to us and those that are available are of dubious quality.

⁹ Standard Industrial Classification Manual, 1972, Executive Office of the President, Office of Management and Budget (Washington, D.C.: Government Printing Office, 1972).

1. Knowledge Production and Inventive Industries
2. Information Distribution and Communication Industries
3. Search and Coordination Industries
4. Risk Management Industries
5. Information Processing and Transmission Services
6. Information Goods Manufacturing Industries
7. Wholesale and Retail Trade in Information Goods
8. Support Facilities for Information Activities

Table 1 lists these eight categories and their sub-parts and shows the individual industries belonging to each. In addition, the table lists separately in the center column those industries whose final products are primarily physical goods (merchandise) and, in the right-hand column, those whose final products are primarily non-physical (services). As mentioned earlier, these 120 or so 4-digit "SIC" industries in combination (or, more correctly, the information component of these industries) accounted for 25.1 per cent of GNP in the United States in 1967. Because this figure, as originally derived, combined both merchandise and services, the relative significance of each was not made apparent.

The results of our own attempt at separating the merchandise components of the primary information sector from the services components are summarized in Table 2. Of the approximately \$200 billion of gross national product generated by the total primary information sector (including merchandise and services), only \$31.7 billion were generated by information merchandise; this was approximately 15.9 per cent of the sector. Information services, therefore, by generating the remaining \$168.3 billion accounted for the bulk of the sector's total contribution to GNP--84.1 per cent.

These results can be restated in relation to total GNP in 1967. Of total GNP of \$795.4 billion in 1967, only 4.0 per cent was generated by the merchandise

Table 1. Industries of the Primary Information Sector as Enumerated by Porat, With an Additional Separation Showing Industries Reported in the Merchandise Component of U.S. Trade Statistics and Industries That Provide Services for Which Few Reliable Trade Data Exist
(Numbers in Parentheses Are Standard Industrial Classification--SIC--Codes)

	Information Industries Reported in the Merchandise Component of Exports and Imports	Information Industries That Provide Services for Which Few Reliable Data on Imports and Exports Are Available
<u>1. Knowledge Production and Inventive Industries</u>		
R&D Inventive Industries	-none-	(7391) Commercial Research and Development Laboratories (7397) Commercial Testing Laboratories (8921) Nonprofit Education and Scientific Research Agencies
Private Information Services	-none-	(6281) Services Allied with the Exchange of Securities or Commodities (6611) Combinations of Real Estate, Insurance, Loans, Law Offices (7392) Business, Management, Administrative, and Consulting Services (8111) Legal Services (8911) Engineering and Architectural Services (8931) Accounting, Auditing, and Bookkeeping Services (8999) Services, Not Elsewhere Classified
<u>2. Information Distribution and Communication Industries</u>		
Education	-none-	(8211) Elementary and Secondary Schools (8221) Colleges, Universities, and Professional Schools (8222) Junior Colleges and Technical Institutes (8241) Correspondence Schools (8242) Vocational Schools, Except Vocational High Schools (8299) Schools and Educational Services, Not Elsewhere Classified
Public Information Services	-none-	(8231) Libraries and Information Centers
Regulated Communication Media	-none-	(4832) Radio Broadcasting (4833) Television Broadcasting
Unregulated Communication Media	(2711) Newspapers:Publishing, Publishing and Printing (2721) Periodicals:Publishing, Publishing and Printing (2731) Books:Publishing, Publishing and Printing (2741) Miscellaneous Publishing	(7351) News Syndicates (7813) Motion Picture Production, Except for Television (7814) Motion Picture and Tape Production for Television (7815) Production of Still and Slide Films (7816) Motion Picture Film Exchange (7817) Film or Tape Distribution for Television (7821) Motion Picture Service Industries (7922) Theatrical Producers (Except Motion Picture) and Miscellaneous Theatrical Services

Table 1. Industries of the Primary Information Sector (Continued)

	Information Industries Reported in the Merchandise Component of Exports and Imports	Information Industries That Provide Services for Which Few Reliable Data on Imports and Exports Are Available
3. Search and Coordination Industries		
Search and Non-Speculative Brokerage Industries	-none-	(6052) Foreign Exchange Establishments (6053) Check Cashing Agencies and Currency Exchanges (6055) Clearing House Associations (6161) Loan Correspondents and Brokers (6231) Security and Commodity Exchanges (6411) Insurance Agents, Brokers, and Service (6531) Agents, Brokers, and Managers (6541) Title Abstract Companies (7313) Radio, Television, and Publishers' Advertising Representatives (7321) Consumer Credit Reporting Agencies, Mercantile Reporting Agencies, and Collection Agencies (7361) Private Employment Agencies (7398) Temporary Help Supply Agencies (7818) Services Allied to Motion Picture Distribution
Advertising Industries	(3993) Signs and Advertising Displays	(7311) Advertising Agencies (7312) Outdoor Advertising Services (7319) Miscellaneous Advertising (7331) Direct Mail Advertising Services
Non-Market Coordinating Institutions	-none-	(8611) Business Associations (8621) Professional Membership Organizations (8631) Labor Unions and Similar Organizations (8651) Political Organizations
4. Risk Management Industries		
Insurance Industries (Components Only)	-none-	(63) Life, Accident, Fire, and Casualty (636) Title Insurance
Finance Industries (Components Only)	-none-	(60) Commercial, Savings Banks, and Related Industries (61) Credit Institutions
Speculative Brokers (Components Only)	-none-	(62) Security Brokers, Commodity Contractors (63) Patent Owners and Lessors
5. Information Processing and Transmission Services		
Non-Electronic Based Processing	(2732) Book Printing (2751) Commercial Printing, Except Lithograph (2752) Commercial Printing, Lithograph (2753) Engraving and Plate Printing (2789) Bookbinding and Related Work (2791) Typesetting (2793) Photoengraving (2794) Electrotyping and Stereotyping	(7221) Photographic Studios, Including Commercial Photography (7332) Blueprinting and Photocopying Services (7339) Stenographic Services; and Duplicating Services, Not Elsewhere Classified (7395) Photofinishing Laboratories

Table 1. Industries of the Primary Information Sector (Continued)

	Information Industries Reported in the Merchandise Component of Exports and Imports	Information Industries That Provide Services for Which Few Reliable Data on Imports and Exports Are Available
5. Information Processing and Transmission Services		
(Continued)		
Electronic Based Processing	-none-	(7392) Pure Data Processing Services
Telecommunication Infrastructure	-none-	(4811) Telephone Communication (Wire or Radio) (4821) Telegraph Communication (Wire or Radio) (4899) Communication Services, Not Elsewhere Classified
6. Information Goods Manufacturing Industries		
Non-Electronic Consumption or Intermediate Goods		
	(2621) Paper Mills, Except Building Paper Mills	-none-
	(2642) Envelopes	
	(2761) Manifold Business Forms	
	(2782) Blankbooks, Loose Leaf Binders and Devices	
	(2893) Printing Ink	
	(2895) Carbon Black	
	(3861) Photographic Equipment and Supplies	
	(3873) Watches, Clocks, and Watchcases*	
	(3951) Pens, Pen Points, Fountain Pens, Ball Point Pens, Mechanical Pencils and Parts	
	(3952) Lead Pencils, Crayons, and Artists' Material	
	(3953) Marking Devices	
	(3955) Carbon Paper and Ink Ribbons	
Non-Electronic Investment Goods	(3554) Paper Industries Machinery (3555) Printing Trades Machinery and Equipment (3572) Typewriters* (3574) Calculating and Accounting Machines, Except Electronic Computing Equipment (3576) Scales, and Balances, Except Laboratory (3579) Office Machines, Not Elsewhere Classified (3821) Mechanical Measuring and Controlling Instruments, Except Automatic Temperature Controls (3822) Automatic Temperature Controls (3832) Optical Instruments and Lenses	-none-
Electronic Consumption or Intermediate Goods	(3652) Phonograph Records (3671) Radio and Television Receiving Type Electron Tubes, Except Cathode Ray (3672) Cathode Ray Picture Tubes (3673) Transmitting, Industrial and Special Purpose Electron Tubes (3674) Semiconductors and Related Devices	-none-

Table 1. Industries of the Primary Information Sector (Continued)

	Information Industries Reported in the Merchandise Component of Exports and Imports	Information Industries That Provide Services for Which Few Reliable Data on Imports and Exports Are Available
6. Information Goods Manufacturing Industries (Continued)		
Electronic Consumption or Intermediate Goods (Continued)	(3679) Electronic Components and Accessories, Not Elsewhere Classified (5065) Electronic Parts and Equipment	-none-
Electronic Investment Goods	(3573) Electronic Computing Equipment (3611) Electric Measuring Instruments and Test Equipment (3651) Radio and Television Receiving Sets, Except Communication Types (3661) Telephone and Telegraph Apparatus (3662) Radio and Television Transmitting, Signalling, and Detection Equip- ment and Apparatus (3693) Radiographic, Fluoroscopic, and Therapeutic X-Rays, and other X-Ray apparatus and Tubes; Electromedical and Electrotherapeutic Apparatus (3811) Engineering, Laboratory, and Scientific and Research Instruments and Associated Equipment	-none-
7. Wholesale and Retail Trade in Information Goods		
	-none-	(5732) Radio and Television Stores (5942) Book Stores (5994) Newsdealers and News Stands (5996) Camera and Photographic Supply Stores, Hand Calculators (7832) Motion Picture Theaters, Except Drive-Ins (7833) Drive-In Motion Picture Theaters
8. Support Facilities for Information Activities		
	-none-	(15) Contract Construction Office, School, Communications Building (65) Rentals of Information Structures (25) Furnishings for Office Buildings

- 0 1 -

* These industries were not listed in Porat's original Table 3.2 "Detailed Typology of the Primary Information Sector," *The Information Economy*, Volume I, though they did appear in the detailed discussions of each industry given in Volume II, and were apparently counted as part of the output of the primary information sector.

Source: Mark U. Porat, *The Information Economy: Definition and Measurement*, U.S. Department of Commerce, 1977, Table 3.2, pp. 27-28. The separation of these industries into those that are reported in the merchandise component of exports and imports and those that belong to the services sector was done solely for the purposes of this analysis.

component of the primary information sector (\$31.7 billion), while 21.1 per cent (\$168.3 billion), was generated by the services component of the primary information sector.

Table 2. Separation of Porat's Primary Information Sector into Its Merchandise and Services Components, 1967 (In Billions of Current Dollars)

	<u>1967</u>	<u>Per Cent of Primary Sector</u>	<u>Per Cent of GNP</u>
<u>Primary Information Sector</u>			
Merchandise Industries	\$ 31.7	15.9%	4.0%
Services Industries	<u>\$168.3</u>	<u>84.1%</u>	<u>21.1%</u>
Total Primary Information Sector	\$200.0	100.0%	25.1%
<u>Gross National Product</u>	\$795.4	--	100.0%

Source: These figures represent rough approximations of the breakdown between merchandise and services in the primary information sector derived by reorganizing the typology presented in Table 3.2 of Volume I of Porat's Information Economy (1977).

We cannot claim with any confidence that the results of our reorganization of Porat's 1967 figures portray an accurate picture of the relative size and composition of the primary information sector in the U.S. economy for years other than 1967. (We have compiled data on exports and imports for a few benchmark years -- 1972, 1976, 1977, and 1978.) However, the results do provide a useful setting for the analysis. They indicate roughly that whenever we discuss trade in the merchandise component of information activities we are referring to a comparatively small segment of the total activity of the information sector and of

the economy in general--that is, to approximately 16 per cent of the primary information sector itself and to approximately four per cent of total GNP.

With these calculations as background, we can proceed with the analysis of exports and imports of merchandise of the primary information sector.

INTERPRETING THE STATISTICAL DATA ON MERCHANDISE

The data upon which the analysis of merchandise trade is based are of high quality, carefully collected by Customs officials and by the statistical branches of the U.S. Department of Commerce according to well-established procedures. Most numerical data, however, regardless of their source and of the care taken in gathering, verifying, and tabulating (or computerizing) them are, to some degree, infelicitous as reliable measures or indices of the "real-world" phenomena they are supposed to describe.

A brief review of the data used here will serve to point out a few of the pitfalls to watch out for in the course of drawing inferences about the value, growth, and geographic distribution of trade in information merchandise.

Problems Raised by Classification

Import data are gathered and classified according to one classification scheme, the "Tariff Schedules of the United States Annotated" (TSUSA), and then, as a means of bringing the data on trade in closer conformance with data on domestic activity, are reclassified according to a second scheme, the "Standard Industrial Classification" (SIC). Similarly, export data are compiled in accordance

with one scheme, "Schedule B, Statistical Classification of Domestic and Foreign Commodities Exported from the United States," and then re-classified according to the SIC scheme. Unfortunately, since imports and exports are originally compiled in terms of structurally different commodity classifications, "a complete and precise presentation of imports (exports) in terms of the output commodity classification based on the SIC is not possible."¹⁰

Futhermore, since the import and export data are gathered according to different classification schemes, values of imports and exports for particular product classes or industries are probably not strictly comparable.

Sources of Data

Both import and export statistics are compiled by the Bureau of the Census. Import figures are compiled from copies of the import entry forms which importers are required by law to file with Customs officials and export figures are taken from copies of Shipper's Export Declarations (also required to be filed with Customs officials). Data on industry output are compiled from reports received from individual manufacturing establishments in the United States.

Valuation

Imports and exports are both expressed in f.a.s. (free alongside ship) values. These values include the purchase price of the merchandise, cost of inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier at the port of exportation (U.S. ports in the case of exports from the

¹⁰ U.S. Imports, FT/210 Annual, 1978 and U.S. Exports, FT/610 Annual, 1978, U. S. Department of Commerce, Bureau of the Census (Washington, D.C.: U.S. Government Printing Office), p. v of both publications.

U.S., foreign ports in the case of imports by the U.S.). The value excludes the cost of loading the merchandise aboard the carrier and also excludes freight, insurance, and any other charges or transportation charges beyond the port of exportation.

Current and Constant Values

All values appearing in this report are expressed in "current" dollars, that is, in values that reflect prices prevailing in the year to which the data pertain. They have not been adjusted for changes in the general level of prices--inflation.

One can sometimes "deflate" values expressed in current dollars by using an index of prices to obtain constant dollar values--a measure that purports to show the real flows of goods expressed in values prevailing in a given base year. We have not attempted this in the current analysis. There are too many practical problems involved in selecting a single deflator that would be appropriate to derive useful "constant" dollar values from "current" values. (The prices of all commodities do not change at the same rate; some prices may even fall; different countries experience different rates of inflation; exchange rates fluctuate; the packaging, technological sophistication, or general quality of products change rendering even properly derived "constant" values deceptive, and so on.)

We will have to be content with noting that, in general, increases over the years in current dollar values of exports or imports that outpace increases in the general level of prices imply that increases have taken place in the flows of "real" commodities; conversely, increases in current dollar values that fall short of increases in the general level of prices imply a diminution of the flow of "real" commodities.

Data on domestic "industry output" referred to in this paper were obtained from a publication of the Bureau of the Census entitled Commodity Exports and

Imports as Related to Output (data for 1972 were obtained from an issue published in June 1979; data for subsequent years were obtained from computer printouts). The figures on industry output in this publication are derived from other Census publications-- Census of Manufactures, and Annual Survey of Manufactures.

Comparing Industry Output with Exports

Shipments (output) by domestic producers are usually valued at the point of production while exports, valued f.a.s. as described above, are valued at the point of export and include not only the selling price, but expenditures for freight, insurance, and other charges incurred up to the point of export. The augmentation of the value of exports by these factors should be kept in mind in the subsequent discussions that compare exports with industry output.

TRADE IN THE MERCHANDISE OF INFORMATION INDUSTRIES

We have selected a few of several broad categories of merchandise trade for which data are available and show in Table 3 their exports, imports, and resulting balances. From these we can obtain an idea of the comparative performance and relative significance of the merchandise of the information sector in United States trade.

The first four rows of Table 3 contain for the years 1972, 1976, 1977, and 1978 the dollar values (unadjusted for inflation) of exports, imports, and the resulting balances for five categories of trade: (1) All Merchandise, (2) Merchandise Excluding Agricultural Products, (3) Merchandise Excluding Agricultural and Petroleum Products, (4) Merchandise of Information Industries (the industries

Table 3 United States Trade in Merchandise — All Merchandise, Merchandise Excluding Agricultural Products, Merchandise Excluding Agricultural Products and Petroleum Products, Merchandise of Information Industries, and Merchandise of Information Industries Excluding Radio and Television Receiving Sets, for 1972, 1976, 1977, and 1978.
(In Billions of Current Dollars)

	1972			1976			1977			1978			Per Cent Change 1972-1978	
	Exports	Imports	Balance	Exports	Imports	Balance	Exports	Imports	Balance	Exports	Imports	Balance	Exports	Imports
(1) All Merchandise	\$49.4	\$55.8	(\$6.4)	\$114.7	\$124.0	(\$ 9.3)	\$120.5	\$151.7	(\$31.2)	\$141.0	\$172.0	(\$31.0)	+185.4%	+208.2%
(2) Merchandise Excluding Agricultural Products	\$39.9	\$49.3	(\$9.4)	\$ 91.3	\$112.8	(\$21.5)	\$ 96.1	\$138.1	(\$42.0)	\$111.7	\$157.0	(\$45.3)	+179.9%	+218.5%
(3) Merchandise Excluding Agricultural and Petroleum Products	\$39.4	\$44.6	(\$5.2)	\$ 90.2	\$ 78.2	\$12.0	\$ 94.8	\$ 93.4	\$ 1.4	\$110.1	\$117.9	(\$ 7.8)	+179.4%	+164.3%
(4) Merchandise of Information Industries*	\$ 5.2	\$ 5.4	(\$0.2)	\$ 11.2	\$ 10.8	\$ 0.4	\$ 12.4	\$ 12.3	\$ 0.1	\$ 15.1	\$ 15.6	(\$ 0.4)	+190.4%	+188.9%
(5) Merchandise of Information Industries, Excluding Radio and Television Receiving Sets	\$ 5.0	\$ 3.5	\$1.5	\$ 10.7	\$ 7.8	\$ 2.9	\$ 11.9	\$ 8.8	\$ 3.1	\$ 14.4	\$ 11.2	\$ 3.2	+188.0%	+220.0%
Information Industries as a Percentage of:														
(6) All Merchandise	10.5%	9.7%	-	9.8%	8.7%	-	10.3%	8.1%	-	10.7%	9.1%	-		
(7) Merchandise Excluding Agricultural Products	13.0%	11.0%	-	12.3%	9.6%	-	12.9%	8.9%	-	13.5%	9.9%	-		
(8) Merchandise Excluding Agricultural and Petroleum Products	13.2%	12.1%	-	12.4%	13.8%	-	13.1%	13.2%	-	13.7%	13.2%	-		

* The telecommunications and information industries are those listed in the first column of Table 1 under the "Merchandise" heading.

Source: Rows (1), (2), and (3) from U.S. Department of Commerce, Survey of Current Business; 1972 data: Vol. 57, No. 6, June 1977, p.42.
1976-77 data: Vol. 58, No. 3, March 1978, p. 51.
1978 data: Vol. 60, No. 5, May 1980, p. s-19.

Rows (4) and (5) from U.S. Department of Commerce, U.S. Exports: FT 610/Annual, 1972, 1976, 1977, and 1978.
U.S. Imports: FT 210/Annual, 1972, 1976, 1977, and 1978.

included are those listed in the center column of Table 1), and (5) Merchandise of Information Industries Excluding Radio and Television Receiving Sets. Rows (6), (7), and (8) show trade in information merchandise as percentages of trade in the first three categories.

Comparative Performance

In 1972, exports of All Merchandise fell short of imports by \$6.4 billion. This negative balance grew substantially larger over the period shown, reaching \$31.2 billion in 1977 and \$31.0 billion in 1978. The most severe deterioration, a trebling of the deficit, occurred between 1976 and 1977. This category, "All Merchandise," includes agriculture, a sector in which the United States registered a favorable balance of trade over the period shown. The figures are not displayed explicitly in the table, but for the four years shown the positive balances in agricultural products were \$3 billion, \$12.1 billion, \$11.1 billion, and \$14.4 billion. Thus, if exports and imports of agricultural merchandise are removed from the totals, an even less encouraging trend emerges: trade in "Merchandise Excluding Agricultural Products," row (2) of the table, registers a negative balance of \$9.4 billion in 1972, a deficit that more than doubles by 1976, then doubles again in a single year, reaching a negative balance of \$42.0 billion by 1977 and \$45.3 billion by 1978.

Next, removing trade in petroleum products, including oil, a product for which the United States has an increasingly unfavorable balance, leaves for the remaining kinds of merchandise (including merchandise of the information industries, chemicals, textiles, iron and steel, machinery and transportation equipment, and other goods) a mixed performance with a negative balance in 1972 of \$5.2 billion turning into positive balances of \$12.0 billion and \$1.4 billion in 1976 and 1977, respectively, and then reverting to a negative balance of \$7.8 billion in 1978.

The exports, imports, and resulting trade balances presented in the first three rows of Table 3 provide a basis of comparison of the trade performance of merchandise of the information sector displayed in rows (4) and (5). For the four years shown, merchandise trade of the 48 industries represented by the aggregate category "information industries," was roughly in balance, with a small negative balance of \$2 million in 1972 improving slightly in the subsequent years shown, becoming a positive balance of \$4 million by 1976 and then \$1 million by 1977, and then slipping slightly to a negative \$4 million in 1978.

Hence, industries belonging to the information sector maintained a comparatively stable balance of trade for the years shown, with exports and imports of the same order of magnitude. This, of course, is a general statement about the sector as a whole and does not necessarily apply to each of the component industries. One industry in particular, radio and television receiving sets (SIC 3651), exhibited extremely large deficits for these four years, with exports falling short of imports by \$1.7 billion in 1972 and by \$3.6 billion in 1978. If we remove this industry from the trade figures (only one of 48 industries included in the sector) we obtain the values displayed in row (5) of Table 3. There is now a positive balance for the adjusted sector, with the trade surplus growing gradually but steadily over the period, from \$1.5 billion in 1972 to \$3.2 billion in 1978.

The last two columns of the table show the percentage changes in the value of exports and imports between 1972 and 1978 for the five categories of trade. Though a comparison of end-point observations that are separated by a number of years ignores fluctuations that occur in intervening years, the comparison is still useful for our purposes, particularly since exports and imports of all categories have increased without interruption over the period. With regard to growth in

exports, the percentage change from 1972 to 1978 was largest for "Merchandise of Information Industries" at 190.4 per cent, though none of the other categories exhibits significantly smaller growth. The largest growth in imports occurred in the categories "Merchandise Excluding Agricultural Products" and "Merchandise of Information Industries Excluding Radio and Television Receiving Sets." Growth in imports was faster than growth in exports for the first, second, and fifth categories. Thus, with regard to growth in imports and exports over the period, there do not seem to be striking differences between the information sector and the other categories of trade shown.

Relative Significance

The final three rows of Table 3 show trade in the merchandise of information industries as percentages of the first three categories of trade. Exports of information merchandise accounted for approximately 10 per cent of exports of all merchandise for the years shown; imports were a slightly smaller percentage of all merchandise imports, ranging from a high of 9.7 per cent in 1972 to a low of 8.1 per cent in 1977.

When we compare, as in row (8), information merchandise with merchandise excluding the weighty categories "Agricultural Products" and "Petroleum Products," we find that information exports accounted for from 12.4 to 13.7 per cent of the adjusted figure and imports accounted for from 12.1 to 13.8 per cent.

We may also compare the significance of information merchandise in trade with the significance of information merchandise in economic activity in general. Calculations on Porat's figures that were presented earlier indicated that information merchandise accounted for roughly four per cent of total GNP in 1967. When we calculate exports of information merchandise as a percentage of total

exports from the United States for the four years under discussion here (including not only goods, but services as well), we obtain the results displayed in Table 4.

Exports of information merchandise accounted for from 6.5 to 6.8 per cent of total exports (of both merchandise and services) for the years shown, slightly above the four per cent figure observed for information merchandise as a percentage of output in general.

A tenuous conclusion would be that information merchandise is slightly more significant as a component of exports than as a component of economic activity in general in the United States. This, of course, is based on the unsubstantiated assumption that the relative mix of merchandise and services that applied for both trade and total activity in 1967 did not change appreciably over the subsequent decade.

Table 4. Exports of Information Merchandise as a Percentage of Total Exports, 1972, 1976, 1977, and 1978
(In Billions of Current Dollars)

	<u>1972</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>
Total Exports of Goods and Services ¹	\$ 77.5	\$171.6	\$184.7	\$221.0
Exports of Information Merchandise ²	\$ 5.2	\$ 11.2	\$ 12.4	\$ 15.1
Exports of Information Merchandise as a Percentage of Total Exports	6.7%	6.5%	6.7%	6.8%

Sources: ¹ U.S. Department of Commerce, Survey of Current Business, Vol. 60, No. 6, June 1980, Table 1, p. 33.

² Row (4) of Table 3, above.

Differences Between Conventional and Newer Technologies

When total exports and imports of information merchandise are divided into two broad categories--merchandise associated with conventional technologies such as books, newspapers, non-electronic office machines, etc., and merchandise associated with newer technologies such as electronic computers, semiconductors, telephone and telegraph apparatus, etc., a clear contrast in trade performance can be observed.¹¹

Table 5 shows exports, imports, and trade balances for the merchandise of two groups of industries separated according to their general technological characteristics as follows:

<u>Conventional Technologies</u>	<u>Number of 4-Digit SIC Industries*</u>	<u>Newer Technologies</u>	<u>Number of 4-Digit SIC Industries*</u>
Unregulated Communications Media	4	Electronic Consump- tion or Inter- mediate Goods	7
Advertising Industries	1		
Non-Electronic (Infor- mation) Processing	8	Electronic Invest- ment Goods	7
Non-Electronic Consump- tion or Intermediate Goods	12		
Non-Electronic Investment Goods	9		
	<hr/>		<hr/>
	34		14

* The names of the individual 4-digit industries can be found in the first column of Table 1.

¹¹ Admittedly, the classification of products into these two broadly defined groups is somewhat arbitrary for a few of the industries belonging to the information sector; a single 4-digit SIC industry classification may contain some products of conventional technologies and others of newer technologies. Even a given product may contain elements of both conventional and newer technologies. Furthermore, distinguishing between only two categories of technology--conventional and newer-- fails to take account of the whole spectrum of vintages of technologies in use at any given time. With these limitations in mind, we offer the material in this section as only a very rough analysis.

Table 5 Exports, Imports, and Trade Balances of Information Merchandise Separated into Two Groups: 34 Industries That Rely Primarily on Conventional (Non-Electronic) Technologies and 14 Industries That Rely Primarily on Newer (Electronic) Technologies (In Billions of Current Dollars)

	1 9 7 2				1 9 7 6			
	Exports	Per Cent of Total	Imports	Balance	Exports	Per Cent of Total	Imports	Balance
Information Merchandise That Relies Primarily on:								
<u>Conventional Technologies,</u> (34 industries, largely non-electronic)	\$1.8	34.6	\$2.5	(\$0.7)	\$3.6	32.1	\$4.5	(\$0.9)
<u>Newer Technologies,</u> (14 industries, depending heavily on electronics)	\$3.4	65.4	\$2.9	\$0.5	\$7.6	67.9	\$6.3	\$1.3
Total	\$5.2	100.0	\$5.4	(\$0.2)	\$11.2	100.0	\$10.8	\$0.4

	1 9 7 7				1 9 7 8			
	Exports	Per Cent of Total	Imports	Balance	Exports	Per Cent of Total	Imports	Balance
Information Merchandise That Relies Primarily on:								
<u>Conventional Technologies,</u> (34 industries, largely non-electronic)	\$3.9	31.5	\$5.3	(\$1.4)	\$4.5	29.8	\$6.5	(\$2.0)
<u>Newer Technologies,</u> (14 industries, depending heavily on electronics)	\$8.5	68.5	\$7.0	\$1.5	\$10.6	70.2	\$9.1	\$1.5
Total	\$12.4	100.0	\$12.3	\$0.1	\$15.1	100.0	\$15.6	(\$0.5)

Source: U.S. Department of Commerce, U.S. Exports, FT 610/Annual, 1972, 1976, 1977, and 1978.
U.S. Imports, FT 210/Annual, 1972, 1976, 1977, and 1978.

Of the 48 industries listed in the merchandise column of Table 1, 34 are identified as relying primarily on conventional technologies; 14 as relying primarily on newer technologies. Table 5 shows that merchandise of the 14 industries employing newer technologies accounted for a large and steadily growing majority of exports of information merchandise, from \$3.4 billion or 65.4 per cent in 1972 to \$10.6 billion or 70.2 per cent by 1978. Furthermore, while products more closely associated with conventional technologies registered a deficit in each of the years shown, growing from \$7 million in 1972 to \$2 billion by 1978, the products associated with more advanced technologies consistently registered positive balances. Incidentally, if we go a step further and remove as we did for a previous discussion, "Radio and Television Receiving Sets" (SIC 3651) from the group of 14 industries associated with newer technologies, the positive trade balances (not shown in the table) for the remaining 13 increase appreciably. The surplus is now \$2.2 billion in 1972 and rises to \$5.2 billion in 1978. Returning once again to Porat's findings, we note that in 1967 these 13 industries accounted for only 1.6 per cent of total GNP and just 6.5 per cent of the primary information sector; yet in 1978 their trade surplus was over \$5 billion, a rather significant contribution, in relative terms, to the balance of trade position of the United States.

Exports as a Percentage of Industry Output

As a means of assessing the extent to which information industries in the United States rely on foreign markets for revenues, we compare the value of exports with the value of total output of the industries. Table 6 lists individually the 15 merchandise industries (from among the total of 48 that constitute the primary information sector) that rely most heavily on foreign markets. It shows exports, trade balances, industry output, and exports as a percentage of output

Table 6 Exports as a Percentage of Industry Output for 15 Individual Information Industries That Rely Most Heavily on Foreign Markets and for the Remaining 33 Industries of the Primary Information Sector as a Group, 1972 and 1977 (In Millions of Current Dollars)

	SIC Code	1972					1977				
		Exports	Trade Balance	Industry Output	Exports as a Per Cent of Output	Rank	Exports	Trade Balance	Industry Output	Exports as a Per Cent of Output	Rank
1. Calculating and Accounting Machines	(3574)	\$ 192.2	\$ 42.2	\$ 694.2	27.7	1	\$ 212.0	(\$28.8)	\$ 836.2	25.4	3
2. * Electronic Computing Equipment	(3573)	1,339.6	1,338.7	6,108.0	21.9	2	3,256.9	3,256.9	13,398.4	24.3	5
3. * Radiographic X-ray, Electro-medical Equipment	(3693)	81.2	24.9	383.0	21.2	3	337.9	139.9	1,751.0	19.3	6
4. Paper Industries Machinery	(3554)	77.6	22.6	381.4	20.3	4	184.2	33.0	704.9	26.1	2
5. * Semiconductors and Related Devices	(3674)	469.6**	100.8	2,360.8	19.9	5	1,490.5**	147.6	4,482.7	33.2	1
6. Printing Trades Machinery	(3555)	142.4	73.4	736.6	19.3	6	318.6	171.3	1,278.2	24.9	4
7. * Transmitting Electron Tubes	(3673)	40.8	32.3	366.2	12.8	7	73.3	39.6	544.6	13.5	11
8. Optical Instruments and Lenses	(3832)	70.2	(54.0)	584.7	12.0	8	162.5	(137.7)	1,814.8	12.4	12
9. Photographic Equipment and Supplies	(3861)	614.2	266.1	5,211.4	11.8	9	1,436.4	466.9	9,477.9	15.2	8
10. * Engineering, Lab and Research Equipment	(3811)	128.0	108.8	1,106.0	11.6	10	224.6	188.5	1,829.4	12.3	13
11. Pens, Mechanical Pencils and Parts	(3951)	35.2	23.3	311.7	11.3	11	99.8	60.2	546.3	18.3	7
12. * Electronic Components	(3679)	358.7	245.8	3,209.8	11.2	12	740.7	347.4	5,314.2	13.9	9
13. Scales and Balances, Except Laboratory	(3576)	16.3	12.0	182.1	9.0	13	39.1	26.1	326.9	12.0	14
14. * Cathode Ray Picture Tubes	(3672)	45.9	40.4	633.6	7.2	14	83.7	63.5	603.5	13.9	9
15. * Radio and TV Transmitting Apparatus	(3662)	588.4	309.8	8,376.6	7.0	15	1,551.2	209.0	13,906.4	11.2	15
All of the Above 15 Industries Combined		\$4,200.3	\$2,636.1	\$30,646.1	13.7	-	\$10,211.4	\$4,983.4	\$56,815.4	18.0	-
Remaining 33 Merchandise Industries of the Primary Information Sector		1,019.8	(2,820.4)	40,507.1	2.5	-	2,162.4	(4,915.7)	70,450.7	3.1	-

* One of the 14 industries designated earlier as relying primarily on newer technologies.

** These export figures include parts of semiconductors exported for further processing in overseas plants that are subsequently returned to the United States. Hence the value of exports as a per cent of industry output is overstated. See text for further elaboration.

Source: U.S. Department of Commerce, Bureau of the Census, Commodity Exports and Imports as Related to Output, 1972 and 1977.

for each. The criterion for inclusion here is that for 1977, exports must have accounted for at least ten per cent of industry output; figures are shown, however, for both 1972 and 1977. The table also provides aggregate values for the remaining 33 merchandise industries of the primary information sector that rely less heavily on export markets.

In 1972, exports as a percentage of industry output ranged for the 15 most export-oriented industries from a high of 27.7 per cent for "Calculating and Accounting Machines," to a low of 7.0 per cent for "Radio and Television Transmitting Apparatus." For all 15 industries combined, exports accounted for 13.7 per cent of industry output in 1972, a figure that grew to 18.0 per cent by 1977.

Of the 15 industries shown in the table, 13 saw the relative importance of exports grow, while only two--"Calculating and Accounting Machines" and "Radiographic X-ray, Electro-medical Equipment"--saw exports as a percentage of output decline. Among the most notable increases in the significance of exports were "Semiconductors and Related Devices," jumping from fifth place in 1972 with exports accounting for 19.9 per cent of industry output, to first place in 1977 with exports accounting for a very substantial one-third of output.¹² Other notable gainers were "Pens, Mechanical Pencils, and Parts," going from eleventh to seventh place, and "Cathode Ray Picture Tubes" going from fourteenth to ninth, though these latter two industries had comparatively small values of output and exports.

¹²These figures overestimate the significance of exports as a percentage of industry output because they include semiconductor subassemblies and parts of semiconductors exported for assembly or further processing in overseas plants that are then returned to the United States. These components accounted for 27 per cent of total exports in 1972. Figures for 1977 are not available. If total exports are reduced by the amount returned to the U. S., then exports as a percentage of industry output would fall to 14.5 per cent in 1972, and would rank sixth instead of fifth. A similar adjustment would have to be made for the 1977 figures. For further elaboration see "A Report on the U. S. Semiconductor Industry," by Clifford, Pettingill, Marcus, and McLennar, U. S. Department of Commerce, September 1979.

It is not surprising (though, of course, not inevitable) that these 15 industries that rely so heavily on export markets have strong positive balances of trade. In 1972 only "Optical Instruments and Lenses" posted a trade deficit with imports exceeding exports by \$54.0 million, while the 14 remaining industries all had positive balances. Twelve of these 14 managed to improve their trade balances by 1977 while the balances of the remaining two deteriorated: "Calculating and Accounting Machines" went from a positive \$42.2 million in 1972 to a negative \$28.8 million in 1977, and "Optical Instruments and Lenses" saw its negative balance of \$54.0 million deteriorate further to negative \$137.7 million in 1977. The 15 taken as a whole, however, register a substantial improvement, going from positive \$2.6 billion in 1972 to positive \$5.0 billion by 1977, an increase of 92 per cent.

The export activities of the remaining 33 industries of the primary information sector, shown as a group in the bottom row of the table, are by contrast rather modest. For these, exports accounted for only 2.5 per cent of industry output in 1972, though this figure did grow to 3.1 per cent by 1977, an indication, just as in the case of the 15 more active industries, of the growing importance of export markets. The aggregate deficit for the group of 33 deteriorated over the period shown from negative \$2.8 billion to negative \$4.9 billion.

The figures in Table 6 can be used to derive a few additional findings on the comparative performances of these two groups of information industries. The 15 that were comparatively active in export markets accounted for a growing proportion of merchandise output of the primary information sector; 43.1 per cent in 1972 and 44.6 per cent in 1977. This was a necessary result of the fact that industry output grew at a much faster rate for the 15 than for the 33: from

\$30.6 billion to \$56.7 billion, or by 85.3 per cent in the case of the former and from \$40.5 billion to \$70.5 billion, or by 74.1 per cent in the case of the latter. Observations of this sort, however, do not reveal how significant a role can be attributed to exports per se as a factor accounting for differences in growth of output for the two groups.

REGIONAL DISTRIBUTION OF TRADE FOR SELECTED INDUSTRIES

Instead of presenting several additional pages of statistical tables showing for individual industries the geographic distribution of exports, imports, and trade balances over the years, we shall merely provide a paragraph or two of discussion based on tables in our work files on four selected industries.

In order to condense the discussions on regional distribution of trade, all countries of the world are classified under one of the following eight headings: United States, Canada, Other Countries of the Western Hemisphere (excluding the United States and Canada), Western Europe, Communist Europe, Japan, Other Asian Countries (excluding Japan), Australia and Oceania, and Africa.

Semiconductors and Related Devices

This category of merchandise (SIC code 3674) includes, "semiconductors and related solid state devices, such as semiconductor diodes and stacks, including rectifiers, integrated microcircuits (semiconductor networks), transistors, solar cells, and light sensing and emitting semiconductor (solid state) devices."¹³ The SIC manual lists no fewer than 39 individual products under this code.

¹³Standard Industrial Classification Manual, 1972.

From Table 6 of a previous section, we saw that this industry exports a high percentage of its total output: 19.5 per cent in 1972 and 33.2 per cent in 1977. It is noteworthy that while this industry relies heavily on export markets, it also competes in the domestic market with a large volume of imported merchandise. That is, both exports and imports are significant fractions of industry output. If we count total industry output in the United States minus exports, plus imports as the size of the domestic market, 15 per cent of domestic demand was met by imports in 1972 and 31 per cent was met by imports in 1977.¹⁴

Asia, excluding Japan, was both the largest market for and largest supplier of semiconductors and related devices. (Much of the "trade" activity in this region can be attributed to off-shore processing plants.) With regard to exports from the United States, this market absorbed 35.4 per cent of total exports of \$469.6 million in 1972 and 56.6 per cent of exports of \$1,510.7 million in 1978. This region supplied to the U.S. market 61.5 per cent of total imports of \$328.8 million in 1972 and 78.3 per cent of imports of \$1,735.8 million in 1978. (Incidentally, by 1978, the United States had a negative balance of trade in semiconductors, the first negative balance for the years covered in this study.)

Western Europe was the second largest market, but dwindled in significance over the years, taking 36.0 per cent of U.S. exports in 1972 and 25.9 per cent in 1978. Imports into the United States from Western Europe also shrank as a percentage of the total, from 13.2 per cent in 1972 to only 4.2 per cent in 1978.

Canada, Western Hemisphere excluding the U.S. and Canada, and Japan accounted for the bulk of the remaining export markets and sources of imports.

¹⁴Again, these statements must be qualified by noting that a significant portion of exports are not sold overseas, but merely processed in offshore plants and then returned. Similarly, the import figures include not only foreign-produced semiconductors, but the components that are processed off shore by U. S. firms and then returned.

The first two of these three regions lost ground, in relative terms, both as markets for U.S. exports and as suppliers of U.S. imports. Japan managed to increase slightly its share of the U.S. market. Exports to Canada fell as percentage of total U.S. exports, from 5.2 in 1972 to 3.7 in 1978; imports fell also, from 2.3 per cent to 1.2 per cent of total U.S. imports. Markets of "Other Western Hemisphere" followed a pattern analogous to that of Canada, absorbing 11.3 per cent of U.S. exports in 1972 and only 6.4 per cent in 1978; imports to the U.S. from this region fell from 18.5 to 8.7 per cent; Japan took 11.3 per cent of U.S. exports in 1972 but only 6.7 per cent 1978. As was mentioned, imports from Japan as a percentage of total imports to the U.S. rose slightly, from 4.5 per cent in 1972 to 7.6 per cent in 1978.

What these shifting patterns of export and import shares entailed in terms of trade balances between each of these regions and the United States is summarized below. Negative balances are in parentheses; values are in millions of current dollars.

Balances of Trade in Semiconductors with:	<u>1972</u>	<u>1978</u>
Asia, excluding Japan	\$ (36.2)	\$ (503.0)
Other Western Hemisphere	(7.8)	(54.2)
Japan	38.3	(31.8)
Western Europe	126.0	317.9
Canada	17.0	35.7
All Other Regions	<u>3.7</u>	<u>10.3</u>
All Regions	\$ 141.0	\$ (225.1)

Hence, over all, the trade balance in semiconductors and related devices deteriorated from a positive \$141.0 million to a negative \$225.1 million. The deterioration was confined to the first three regions; the United States actually improved its trade balance with the others.

Electronic Computing Equipment

Electronic Computing Equipment (SIC code 3573) includes computers and peripheral equipment and major logical components intended for use in electronic computer systems. A few of the individual products that fall in this category include accounting machines that use machine readable programs, analog and digital computers, central processing units for electronic computing systems, computer storage units, magnetic ink readers, paper-tape punches and readers, printers, and others. As is the case with semiconductors, this industry exports a large percentage of its output; 21.9 per cent in 1972 and 24.3 per cent in 1977.¹⁵

The countries of Western Europe constituted the largest market for U.S. exports of electronic computing equipment, absorbing 56.2 per cent of total exports in 1972 and 58.5 per cent in 1978. (In dollar values, these percentages represent \$753 million and \$2.4 billion for the two years, respectively.)

Canada ranked second in both 1972 and 1978, even though the relative share of exports going to Canada declined, from 16.9 per cent (\$226 million) in 1972 to 12.7 per cent (\$525 million) by 1978.

The relative share of U.S. exports going to Japan, the third-ranking customer in both 1972 and 1978, also declined over the period, from 10.7 per cent (\$144 million) in the earlier year to 7.6 per cent (\$325 million) in the later year.

¹⁵ Because of a classification problem, reliable data on the regional distribution of imports of electronic computing equipment were not presented in U.S. Imports, FT/210 Annual, and will therefore not be treated in this paper.

Of the remaining regions, Asia, excluding Japan, purchased 6.9 per cent of U.S. exports in 1972 and 6.8 per cent in 1978; countries in the Western Hemisphere, excluding the United States and Canada accounted for 5.2 per cent and 6.7 per cent in the two years; and Australia and Oceania, for 2.7 and 4.6 per cent in 1972 and 1978, respectively. Africa's share rose from 0.9 per cent to 1.7 per cent, and Communist Europe from a half a per cent (\$6.5 million) in 1972 to one per cent (\$41.3 million) by 1978.

Telephone and Telegraph Apparatus

Telephone and telegraph apparatus (SIC code 3661) includes such products as carrier equipment for telephone and telegraph, telephone sets, dialing devices, station equipment, teletypewriters, telegraph office switching equipment, and other products.

In terms of total industry output, the industrial classification "Telephone and Telegraph Apparatus" was moderately large when compared with other information industries: about \$4.0 billion in 1972 and \$7.1 billion in 1978. Export markets for these products, however, have been relatively insignificant, with exports as a per cent of industry output amounting to only 1.9 per cent in 1972 and 3.6 per cent in 1977.

The balance of trade for this industry improved steadily from negative \$10 million in 1972 to positive values of \$131.3 million in 1976, \$139.1 million in 1977, and \$163.5 million in 1978.

The significance of individual foreign markets shifted rather dramatically between 1972 and 1978. For the earlier year, Canada absorbed 35.8 per cent of total exports from the United States. of only \$76.6 million. Asia, excluding Japan, on the other hand, accounted for only 6.8 per cent of exports in 1972. By 1978

Canada's share fell to 15.6 per cent of U.S. exports, while Asia, excluding Japan increased its relative share to 38.5 per cent. As was the case with Canada, the relative share of Western Europe fell from 27.8 per cent in 1972 to 14.9 per cent in 1978.

For both years, 1972 and 1978, Japan supplied the largest share of U.S. imports of telephone and telegraph apparatus; \$36.8 million or 42.5 per cent in 1972 and \$93.0 million or 41.4 per cent in 1978. The two other regions that supplied a significant share of total imports to the U.S. were Canada with 26.8 per cent in 1972 and 31.1 per cent in 1978, and Western Europe with 28.6 per cent in 1972 and 13.8 per cent for these two years respectively.

Radio and Television Receiving Sets

This industry (SIC 3651) includes establishments primarily engaged in manufacturing electronic equipment for home entertainment. In addition to radio and television receiving sets, it includes such products as AM and FM tuners, juke boxes, microphones, musical instrument amplifiers, public address systems, and turntables for phonographs.

Of all 48 information industries covered in this analysis of merchandise trade, this has the largest trade deficit, and one that grew from a negative \$1.7 billion in 1972 to negative \$3.6 billion by 1978. While exports from the United States accounted for only 6.0 per cent of domestic industry output in 1972 and 9.8 per cent in 1977 (industry output figures were not available for 1978), imports by the U.S. account for a significant and growing share of the domestic market: in 1972 imports of \$1.9 billion accounted for 36.5 per cent of the domestic market, while in 1977 imports of \$3.5 billion accounted for 45.1 per cent of the domestic market.¹⁶

¹⁶ Again, the size of the domestic market is approximated by subtracting exports from industry output and adding imports.

By far, Japan and the region called "Asia, excluding Japan" have accounted for the largest share of imports by the United States. Imports from Japan were \$1.3 billion in 1972 or 67.6 per cent of total U.S. imports and \$2.6 billion in 1978, or 58.0 per cent of imports. Asia, excluding Japan, supplied the U.S. market with \$0.4 billion in 1972 (21 per cent of imports by the U.S.) and \$1.4 billion in 1978 (30.8 per cent of imports).¹⁷

Western Europe, the next most significant source of imports, accounted for only 6.3 per cent of imports of radio and television receiving sets in 1972 and 5.3 per cent in 1978.

Exports from the United States of the products of this industry were \$215.3 million in 1972 and \$755.4 million in 1978. The markets for these exports were quite different from the sources of imports. Canada, "Other Western Hemisphere, excluding Canada and the United States," and Western Europe jointly absorbed 88.5 percent of U.S. exports in 1972 and 70.8 per cent in 1978. Japan and Asia, excluding Japan accounted for 9.8 per cent of the U.S. export market in 1972 and for 15.4 per cent in 1978.

¹⁷In May 1977 the United States and Japan concluded an "Orderly Market Agreement" that restricted the number of color television receivers that could be exported by Japan to the U. S. Market. This agreement undoubtedly affected the shift in relative shares of imports noted here for Japan and "Asia, excluding Japan."

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