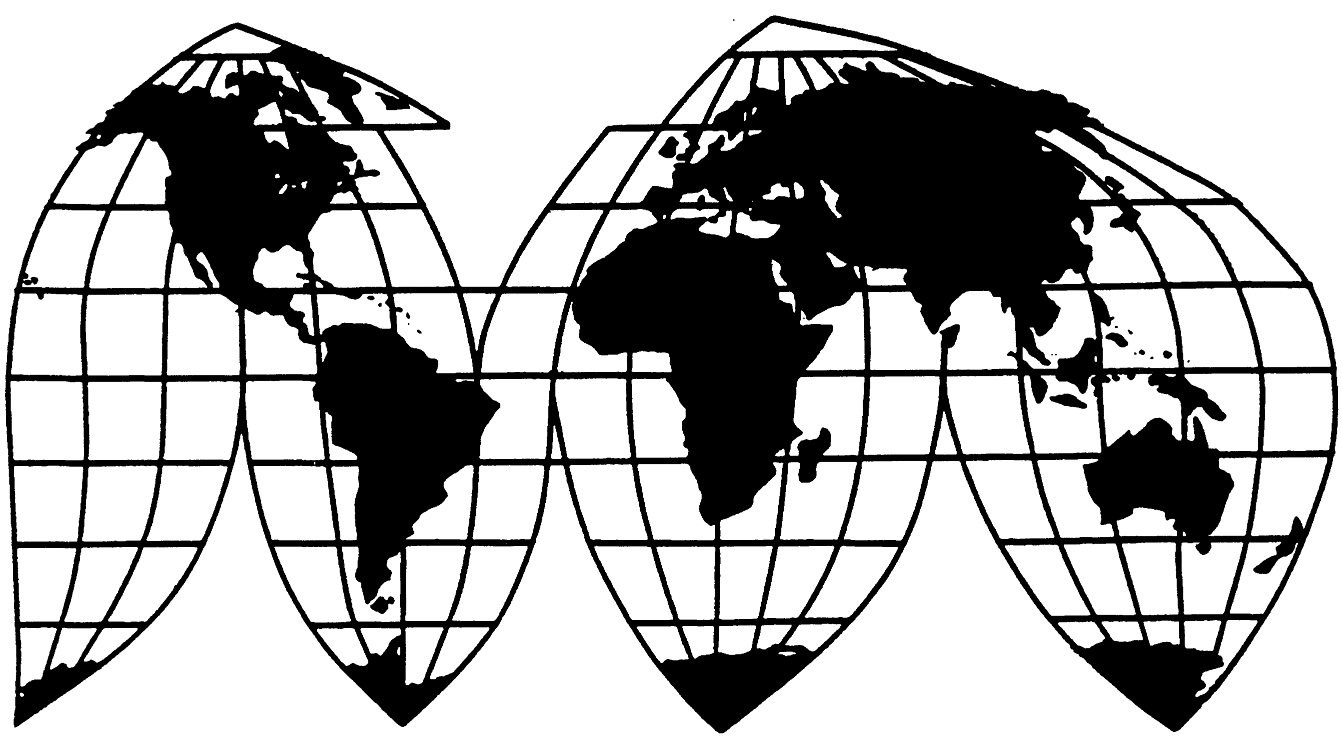
Advice Concerning the Proposed Modification of Duties on Certain Information Technology Products and Distilled Spirits

Report to the President on
Investigation No. 332-380

Publication 3031(Final) **April 1997**

U.S. International Trade Commission



Washington, DC 20436

www.usitc.gov

U.S. International Trade Commission

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

U.S. International Trade Commission

Washington, DC 20436
www.usitc.gov

Advice Concerning the Proposed Modification of Duties on Certain Information Technology Products and Distilled Spirits

Investigation No. 332-380

Publication 3031(Final)

April 1997

Advice Concerning the Proposed Modification of Duties on Certain Information Technology Products and Distilled Spirits

Investigation No. 332-380

Project Staff

Norman McLennan, Division Chief
Sylvia McDonough, Branch Chief

Staff Assigned

John Kitzmiller, Project Leader
kitzmiller@usitc.gov, 205-3387

Ronald Babula, Scott Baker, Robert Carr,
Roger Corey, John Davitt, Alfred Dennis,
Christopher Johnson, Scott Ki, Sharon Kosco,
Danielle Kriz, Susan Lusi

Support Staff

Phyllis Boone, Cindy Payne, Monica Reed, Wanda Tolson

PREFACE

Following receipt on February 27, 1997, of a request from the United States Trade Representative (appendix A), the U.S. International Trade Commission instituted the investigation *Advice Concerning the Proposed Modification of Duties on Certain Information Technology Products and Distilled Spirits* (investigation 332-380). The purpose of this report is to provide information and advice on the information technology products and distilled products under consideration for tariff modifications.

Copies of the notice of the investigation were posted in the Office of the Secretary, U.S. International Trade Commission, Washington, DC 20436, and the notice was published in the *Federal Register* (62 F.R. 11222) on March 11, 1997 (appendix C). Interested parties were invited to submit written statements concerning the investigation.

The information and analysis provided in this report are for the purpose of this report only. Nothing in this report should be considered to reflect possible future findings by the Commission in any investigation conducted under statutory authority covering the same or similar subject matter.

CONTENTS

CONTENTS--*Continued*

Page

CONTENTS--*Continued*

Page

Chapter 5: Electronic Components--*Continued*

CONTENTS--*Continued*

CONTENTS--*Continued*

Page

Figures

Page

Figures--*Continued*

Page

Tables

CONTENTS--*Continued*

Page

Tables--*Continued*

Appendices

Executive Summary

A major U.S. objective in the Uruguay Round (UR) negotiations of the General Agreement on Tariffs and Trade (GATT) was free trade in all electronic products. These products were one of the so-called "zero-for-zero" sectors for which U.S. trade negotiators hoped to achieve total elimination of tariffs by the major trading partners. Distilled spirits was also one of the sectors identified in the "zero-for-zero" initiative. Although complete duty elimination was achieved in a number of product sectors, the goals of the "zero-for-zero" initiative were not realized for the electronics sector, despite strong support by business interests in the United States, the European Union (EU), Japan, and Canada, nor were they realized for the distilled spirits sector.

In January 1995, the information technology (IT) industry associations of the United States, Europe, and Japan made a set of industry recommendations to the G-7[1] meeting in Brussels on the Global Information Infrastructure (GII). One of their key recommendations was to eliminate tariffs in the IT sector through the adoption of an information technology agreement (ITA).[2] U.S. trade negotiators indicated their desire to conclude such an ITA no later than the Singapore Ministerial conference of the World Trade Organization (WTO), so that tariff reductions could either be implemented at zero immediately, or be staged to reach zero by the year 2000.[3]

The ITA was signed by 28 countries and customs territories, including the United States, during the Singapore Ministerial in December 1996 and the number of participants later grew to 37.[4] The agreement requires participants to eliminate their tariffs by January 1, 2000, on a specific list of IT products attached to the Ministerial Declaration. At the same time, the United States and the EU entered into a reciprocal agreement on distilled spirits under which most duties would be eliminated by January 1, 2000.[5]

On February 27, 1997, the Commission received a letter from USTR requesting the Commission to provide information and advice in the form of industry profiles on the IT products and distilled spirits under consideration for tariff modification.[6] These profiles include a description of the industry and its relative strengths, trends in production, brief analyses of current tariffs, an assessment of patterns of imports and exports, and an indication of potential market access opportunities resulting from proposed tariff modifications.

Given the increased importance many countries have placed on having modern information infrastructures for the competitiveness of their economies, the current tariffs on IT products are viewed as impediments to growth. Elimination of tariffs on products of the IT industries will likely create significant

---

[1] The G-7, or Group of Seven, is a consortium of the EU and the seven largest economies in the world. The individual country members are Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

[2] Information Technology Industry Association, *Industry Recommendations for an Information Technology Agreement*, Apr. 16, 1996.

[3] U.S. Department of State telegram, "Demarche Request on ITA Tariff Initiative," message reference No. 139276, prepared by U.S. Department of State, Washington, DC, July 9, 1996.

[4] As of Mar. 26,1997, two more countries, the Czech Republic and Slovakia, had joined the ITA bringing the total to 39 participants.

[5] U.S. tariffs on high quality rum will not be eliminated until 2003.

[6] Under section 115 of the Uruguay Round Agreements Act (URAA), the President is required to seek advice from the USITC regarding the proposed action.

new economic opportunities in the rapidly expanding information products market. In addition to promoting these more general economic benefits, the ITA will directly help businesses by lowering costs, improving productivity, and expanding new services. Greater access to IT at lower prices is also likely to stimulate competitiveness and productivity in an increasing number in manufacturing and service industries that rely heavily on IT.

The elimination of tariffs on IT products is expected to increase market access opportunities in nearly all of the participants in the ITA. In the United States, the ITA would likely liberalize access in only a few sectors of the IT market. Increased market access opportunities are likely for electronic components, specifically capacitors and resistors, and certain telecommunications equipment. U.S. tariffs are relatively low in most other IT sectors and their elimination is not expected to dramatically increase market access. IT tariff elimination in the EU is likely to have a greater effect on market access because the EU has higher tariffs than the United States on a number of products. Suppliers of electronic components, silicon wafers, office machines, telecommunications equipment, and most unrecorded media to the EU market are all likely to benefit from the tariff eliminations of the ITA. The ITA should have a more significant effect on EU market access over time because of the addition of new members. While the EU presently consists of 15 members, 13 other countries have applied for membership.[7] As countries join the EU, they must adopt the common EU tariff schedule and agree to abide by trade agreements entered into by the EU, thus offering the same market access as the EU. There should be little or no change in market access in Japan as a result of ITA tariff elimination, since Japan's final UR tariffs on IT products, which are to be fully implemented by January 1, 1999, are zero.

Perhaps some of the greatest market access opportunities are in the developing nations of Asia. Although tariff elimination is a significant factor in increasing market opportunities in these countries, other factors such as rapidly expanding economies, large populations, expansion of communications infrastructures, and growing disposable income will also benefit trade in IT products. India and Indonesia, with most duties between 30 and 40 percent; Malaysia and Korea, with duties ranging as high as 30 percent; Taiwan, with most duties between 5 and 15 percent; and Singapore and Hong Kong, with duties as high as 10 percent, are the largest potential markets in Asia of all ITA participants.

The ITA made much progress in increasing market access opportunities; however, there are some areas where market access still needs improvement. The benefits of duty elimination as a result of the ITA may be tempered by non-tariff barriers. The lack of intellectual property rights protection, nontransparent government procurement, and customs' reclassification are some of the barriers that have impeded trade in IT products in the past and it is possible that these or other barriers could affect trade in the future. Two large markets, China and Brazil, are not signatories to the ITA and market access opportunities in these countries will not increase when the ITA is implemented. China's market access opportunities could be enhanced when China accedes to the WTO because ITA participants intend to seek duty reductions on the ITA product list from all countries acceding to the WTO.[8] Market access for ITA products in Brazil has improved recently as a result of improvements in intellectual property rights and reductions in export requirements; however, no improvements are expected as a result of the ITA.

---

[7] World Wide Web, retrieved Mar. 10, 1997, Europa, http://europa.eu.int/en/agenda/appmen.html. The 13 countries are Bulgaria, Poland, Cyprus, Romania, Czech Republic, Slovakia, Estonia, Slovenia, Hungary, Switzerland, Lithuania, Turkey, and Malta.

[8] U.S. Department of State telegram, "Information Technology Agreement Meets Deadline," message reference No. 000615, prepared by U.S. Mission, Geneva, Feb. 3, 1997.

The elimination of tariffs on distilled spirits should provide increased market access opportunities in both the United States and the EU. Although current import penetration in the EU is quite low--less than 5 percent--the elimination of these duties coupled with changing consumer preferences could lead to an increase in demand for imported products. The distilled spirits agreement should have a more significant effect on EU market access over time as new members join the EU. Market access opportunities in the United States are also likely to increase. Given the price pressure in the distilled spirits market, the elimination of these duties could increase the competitiveness of imported spirits in the U.S. market.

Comments from the public were received on several ITA sectors as well as distilled spirits. A number of U.S. capacitor producers expressed strong opposition to including capacitors in the agreement and one company opposed including resistors. The Institute for Interconnecting and Packaging Electronic Circuits and Leica, Inc. were in favor of the agreement but thought that the agreement was too narrow. One company stated that, in order for preferential programs to continue to benefit Caribbean exporters of rum to the United States, all rum should be excluded from the agreement. No opposition was cited in any other submission.

CHAPTER 1
Introduction

An Information Technology Agreement (ITA) was signed by 28 countries or customs territories, including the United States, during the World Trade Organization (WTO) Ministerial meeting in Singapore in December 1996. The agreement requires participants to eliminate their tariffs by January 1, 2000, on a specific list of Information Technology (IT) products listed in the Ministerial Declaration. These products include computers, telecommunications equipment, computer software, semiconductors, and other electronic components and equipment.

At the same time, the United States and the European Union (EU) entered into a reciprocal agreement on distilled spirits under which most duties would be eliminated by January 1, 2000. This agreement is on a most-favored-nation basis and will result in the elimination of duties on both brown and white distilled spirits. However, rum below a certain value is excluded from the agreement.[1]

On February 27, 1997, the Commission received a letter from the United States Trade Representative (USTR) requesting that the Commission institute an investigation under section 332(g) of the Tariff Act of 1930 (19 U.S.C. 332 (g)) to provide information and advice on the IT products and distilled spirits under consideration for tariff modification.[2] These products are enumerated in the annex to USTR's request letter (appendix A). USTR has requested industry profiles on a sectoral basis for the United States and major foreign producers. These profiles include a description of the industry and its relative strengths, trends in production, brief analyses of current tariffs, an assessment of patterns of imports and exports, and an indication of potential increased market access opportunities resulting from proposed tariff modifications. IT products have been divided into the following sectors for the purposes of this study:

- computer hardware
- software
- telecommunications equipment
- electronic components
- office machines
- unrecorded media
- semiconductor manufacturing and testing equipment
- measuring, testing, and analyzing instruments
- miscellaneous products

Structure of Report

Chapter 1 describes the request from USTR and provides background information on "zero-for-zero" negotiations relating to certain IT products and distilled spirits. Chapters 2 through 10 provide profiles of U.S. and major foreign producers and consumers of IT products. Chapter 11 provides information on the U.S. and the EU distilled spirits industries and markets. The advice requested for the products covered by these agreements consists of descriptions of the industries and their relative strengths, trends in production,

[1] Bulk rum valued at $.69 or less per proof liter and bottled rum valued at $3.00 or less per proof liter are excluded and will continue to face existing tariffs.

[2] Under section 115 of the Uruguay Round Agreements Act (URAA), the President is required to seek advice from the USITC regarding the proposed action.

brief analyses of current tariffs, and an assessment of patterns of imports and exports. Chapter 12 describes market access opportunities likely to result from proposed tariff modifications. The advice on the proposed tariff modifications concentrates on tariff elimination rather than non-tariff trade barriers.

The appendices attached to this study include the text of the Information Technology Agreement and a fact sheet on the U.S.-EU distilled spirits initiative. Also attached are the request letter from USTR and the Chairman's response, the *Federal Register* notice announcing the initiation of this study, and submissions received from the public in response to the *Federal Register* notice. The final appendix contains tables showing the final Uruguay Round (UR) General Agreement on Tariffs and Trade (GATT) duty rates for the products covered by the ITA.

Background

In 1996, world production of all electronic equipment and components amounted to just over $1 trillion.[3] Production in the United States, the global leader, amounted to $274 billion, or 27 percent of the world total.[4] However, the United States faces strong competition from Japanese, EU, and emerging Asian producers. Furthermore, despite its global leadership in production, the United States experiences an overall trade deficit in electronic products. In 1996, U.S. imports totaled $179 billion while U.S. exports amounted to just $136 billion, resulting in a trade deficit of $43 billion.[5]

A large portion of the U.S. trade deficit in electronic products is due to the global interdependence of the industry. In today's global IT market, U.S. manufacturers rely increasingly on internationally sourced components, foreign production and sales facilities, and strategic joint ventures to enhance their competitive positions. A typical personal computer designed and manufactured in the United States may contain a floppy disk drive from Japan, a display monitor produced in Korea, a motherboard from Taiwan, and a hard disk drive manufactured in Singapore. Suppliers of these components may be overseas subsidiaries of U.S.-based or foreign-headquartered firms. Final assembly and production of commodity electronic components and peripherals is largely done abroad, particularly in the rapidly emerging Asian countries where wage costs are lower. In general, the strengths of the U.S. IT industry are in high value-added sectors, such as software, microprocessors, and product design.

In recent years, the IT industry is increasingly characterized by intense competition, price sensitivity and falling prices, declining profit margins, and commoditization of critical parts and components. Accordingly, the ability of producers to reduce costs by securing high quality components and subassemblies at the lowest possible prices anywhere in the world has become a major factor of competitiveness in the global market. Trade barriers such as tariffs that increase IT suppliers' relative costs in major foreign markets play an important role in determining international competitiveness. Although tariffs on many electronic products, such as finished computers and systems, have been significantly reduced or eliminated among major IT-producing countries, some tariffs on semiconductors and other important electronic parts and components remain as impediments to trade. For example, both U.S. and EU computer manufacturers

---

[3] This figure includes almost all of the product coverage of the ITA (computer hardware, certain computer software, telecommunications equipment, semiconductors, other electronic components, and certain analyzing instruments). However, semiconductor manufacturing equipment and other products covered under the ITA are not included in these data. Further, certain other products such as consumer electronics and electromedical equipment are included in these totals, but are not included in the ITA. Elsevier Advanced Technology, *Yearbook of World Electronics Data 1996* (Oxford: Elsevier Science Ltd., 1996), vol. 3, table 2.3.4., p. 13.

[4] Elsevier Advanced Technology, *Yearbook of World Electronics Data*, 1996, vol. 3, table 2.3.4., p. 13.

[5] Compiled from official statistics of the U.S. Department of Commerce.

have voiced complaints against the relatively high EU tariffs on certain semiconductors and other electronic components.[6] Such tariffs either have been eliminated or reduced significantly by other major developed countries, including the United States and Japan.

ITA Initiative

Free trade in all electronic products was a major U.S. objective in the UR negotiations of the GATT. That sector was one of the so called "zero-for-zero" sectors for which U.S. trade negotiators hoped to achieve total elimination of tariffs by major trading partners. Although complete duty elimination was achieved in a number of product sectors, the electronics "zero-for-zero" initiative was not fully realized despite strong support by business interests in the United States, the EU, Japan, and Canada.

Section 111(b) of the Uruguay Round Agreements Act (URAA)(19 U.S.C. 3521(b)) authorizes the President to proclaim such duty modifications or changes in the staged reductions of duties as may be agreed to in future negotiations involving the sectors for which the United States sought duty elimination. The President's proclamation authority is subject to the consultation and layover procedures in section 115 of the URAA,[7] which include obtaining advice from the Commission.

In January 1995, the IT industry associations of the United States, Europe, and Japan[8] made a set of industry recommendations to the G-7[9] meeting in Brussels on the Global Information Infrastructure (GII). One of their key recommendations was to eliminate tariffs in the IT sector through the adoption of an information technology agreement.[10] U.S. trade negotiators indicated their desire to conclude such an ITA no later than the Singapore Ministerial conference, so that tariff reductions could either be implemented at zero immediately, or be staged to reach zero by the year 2000.[11]

Canada, Japan, the EU, and the United States (the Quad Members) agreed that an ITA should include as many participants as possible outside the Quad, particularly leading Asia-Pacific Economic Cooperation (APEC) economies, such as Korea, Taiwan, Malaysia, Indonesia, Thailand, the Philippines, Singapore, and China.[12] The ITA obtained an important endorsement from APEC economic leaders' meeting

---

[6] European industry and trade association officials, interviews by USITC staff, Frankfurt, Munich, Ivrea, Paris, and London, May 6-24, 1993; European Association of Manufacturers of Business Machines and Information Technology (EUROBIT), *European IT Competitiveness in a Distorted Market Environment: Consequences of EC - 14% - Tariff on Semiconductors for European Information Technology Manufacturers* (Frankfurt: EUROBIT, 1991); and *European Information Technology Observatory 1996* (Frankfurt: European Economic Interest Grouping, 1996), pp. 10-40.

[7] 19 U.S.C. 3524. Section 115 provides that the President may proclaim the action only if (1) he has obtained advice from the appropriate advisory committees (established under 19 U.S.C. 2155) and the United States International Trade Commission; (2) he has submitted a report to the House Committee on Ways and Means and the Senate Committee on Finance that sets forth the action to be taken, the reasons for the action, and the advice obtained; (3) a period of 60 calendar days has expired since he obtained such advice and submitted the required report; and (4) he has consulted with the two committees during the 60-day period.

[8] Information Technology Industry Council (ITI), EUROBIT, and Japan Electronic Industry Development Association.

[9] The G-7, or Group of Seven, is a consortium of the EU and the seven largest economies in the world. The individual country members are Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

[10] Information Technology Industry Association, *Industry Recommendations for an Information Technology Agreement*, Apr. 16, 1996.

[11] U.S. Department of State telegram, "Demarche Request on ITA Tariff Initiative," message reference No. 139276, prepared by U.S. Department of State, Washington, DC, July 9, 1996.

[12] Ibid.

in the Philippines in November 1996, which called for the conclusion of an "information technology agreement by the WTO Ministerial Conference that would substantially eliminate tariffs by the year 2000, recognizing the need for flexibility as negotiations in Geneva proceeded."[13]

Subsequently, an ITA was drafted during the Ministerial meeting in Singapore in December 1996 and a Ministerial Declaration on Trade in Information Technology Products was issued on behalf of representatives of countries accounting for well over 80 percent of world trade in these products. The countries or customs territories represented were Australia; Japan; Canada; Korea; the separate customs Territory of Taiwan, Penghu, Kinmen, and Matsu; Norway; the EU; Singapore; Hong Kong; Switzerland; Iceland; Turkey; Indonesia; and the United States.[14] Three more participants, New Zealand, Costa Rica and Macau, submitted their proposals in early February,[15] and Malaysia, Thailand, Romania, Estonia, India, and Israel also agreed to the ITA by the March 1, 1997 deadline.[16] The volume of IT products traded among the participants is estimated at 91.3 percent of the total world trade, 1.3 percent higher than the minimum requirement stated in the agreement.[17]

Signatories agreed that customs duties on all ITA products are to be eliminated by the year 2000. However, ministers also recognized that extended staging of reductions may be necessary in limited circumstances. Only economies that eliminate tariffs on all IT products enumerated in the agreement will be eligible to participate in the ongoing committees which determine customs nomenclature for ITA products and update the product coverage list. The Ministerial Declaration contained instructions from ministers to finalize plurilateral technical discussions by January 31, 1997, to allow time to prepare the documents needed for the WTO review process that began on March 1. Final schedules were to be approved at the end of March, and the agreement is to be implemented on July 1, 1997.

The agreement requires participants to eliminate their tariffs on a specific list of products attached to the Singapore Ministerial Declaration. Participants do not have the opportunity to selectively participate in the agreement; that is, there are no exceptions to product coverage. With this in mind, the key issue is resolving the staging of tariff elimination under the ITA, as noted in paragraph 2 of the Declaration's annex on modalities and product coverage. The annex specifies that, except as may be otherwise agreed by the participants, the elimination of customs duties must be completed no later than January 1, 2000, meaning that requests for longer staging will be considered on a product-by-product basis and must be approved by every participant.[18]

---

[13] Mark Felsenthal, "APEC Leaders Urge Conclusion of Information Technology Pact," *BNA International Trade Daily*, Nov. 26, 1996, pp. 1-3.

[14] U.S. Department of State telegram, "ITA: Urgent Action Request for Upcoming Talks in Geneva," message reference No. 009456, prepared by U.S. Department of State, Washington, DC, Jan. 17, 1997.

[15] Tani Freedman, "WTO information-technology pact wins crucial support," received by NewsEDGE/LAN, Mar. 3, 1997.

[16] "WTO chief hails information-technology pact progress," Geneva, March 3 (AFP), received by NewsEDGE/LAN, Mar. 3, 1997. Israel, Romania, and Estonia did not submit detailed schedules by Mar. 1, 1997 but have informed the WTO Secretariat of their intention to join the ITA within the parameters agreed to by the other participants. India has tabled the required schedule but it has not yet been accepted by ITA participants and negotiations are continuing with India. USTR officials, telephone interview by USITC staff, Mar. 4, 1997. As of Mar. 26, 1997, there were 39 participants in the ITA. The Czech Republic and Slovakia joined in late March. U.S. Department of State, "ITA Agreement Finalized in Geneva," message reference No. 057546, prepared by U.S. Department of State, Washington, DC, Mar. 28, 1997. However, due to time constraints, these two countries will not be included as ITA participants for the purposes of this study.

[17] "Thailand Agrees to Join Information Technology Accord," Bangkok (March 5) Xinhua, received by NewsEDGE/LAN, Mar. 3, 1997.

[18] U.S. Department of State telegram, "ITA: Urgent Action Request for Upcoming Talks in Geneva."

Thus far, delegations have come forward with very short lists of products for which they seek extended staging. Extended staging would not be available to declared developed countries. The Quad Members indicated that they would look at accelerated staging. While the Declaration provided that expanded product coverage may be necessary in limited circumstances, discussions in Singapore made clear that the coverage in the Declaration reflected the maximum flexibility from countries, and that there would be no exceptions, and few, if any, additions.[19]

By January 31, delegations had completed the discussions mandated by the Declaration, product coverage had been finalized (essentially the list that was produced in Singapore and some clarifications with respect to classifications), and all participants in the Declaration at Singapore had agreed on staging. Participants agreed to very few extended staging requests. Indonesia, Korea, Costa Rica, and Taiwan received extensions ranging from 2000 to 2005, none going beyond 2005. Taiwan took advantage of the provisions established to enable countries in the process of acceding to the WTO to join the ITA. It is expected that participants in the ITA will seek tariff reductions on the agreed ITA product list from all acceding countries.[20] Although staging requests vary by product and by participant, the key is that all rates will be bound immediately upon implementation and reductions will be staged to zero by 2000 in most instances and by 2005 at the latest. The United States and the EU may accelerate some aspects of staging, notably semiconductor tariffs.[21]

Work continues in Geneva on technical issues related to creating and formatting modalities for implementing the agreement. The most important modality agreed to by ITA participants will define the process for adding new products to the ITA. A review by ITA participants will begin in October 1997, with the aim of revising the ITA product coverage by January 1, 1999.[22]

Distilled Spirits Initiative

During the UR negotiations, the United States sought an agreement from its major trading partners to eliminate tariffs on all distilled spirits. However, the United States achieved only partial success in this distilled spirits "zero-for-zero" initiative. Agreement was reached to eliminate tariffs on whiskies and brandy by 2004 but white spirits were not part of the final agreement. Following the close of the UR the distilled spirits industries of the United States and the EU continued to support efforts to eliminate tariffs and increase market access opportunities in the two largest markets in the world.

At the WTO Ministerial Conference, the United States and the EU agreed to further liberalize market access for distilled spirits. The agreement includes the acceleration of the UR staged tariff cuts for brown spirits and the inclusion of white spirits in the "zero-for-zero" initiative. Under the distilled spirits initiative, tariffs on whiskies and brandy will be eliminated by the year 2000, rather than the UR committment of 2004. White spirits such as gin and vodka will also be duty free by January 1, 2000.

---

[19] Ibid.

[20] U.S. Department of State telegram, "Information Technology Agreement Meets Deadline," message reference No. 000615, prepared by U.S. Mission, Geneva, Feb. 5, 1997.

[21] Ibid.

[22] Ibid.

CHAPTER 2
Computer Hardware

Scott Ki

Products classified as computer hardware include the computers themselves as well as computer peripherals, sub-assemblies, and parts and accessories (table 2-1). Electronic components of computers such as semiconductors and printed circuit boards are discussed in chapter 5. Appendix A shows a complete list of products included in the Information Technology Agreement (ITA).

The United States, Japan, the EU, Singapore, Taiwan, and Korea accounted for an estimated 85 percent of global production of computer hardware in 1996 (figure 2-1).[1] During the same year, the United States and Japan each produced more than $70 billion worth of computer hardware, or roughly one-quarter each of the total, while the EU contributed more than $45 billion, or one-sixth (figure 2-2). Singapore, Taiwan, and Korea accounted for a combined total of slightly less than $45 billion in 1996. In terms of total sales revenue worldwide, U.S.-and Japanese-headquartered companies occupied the top ten positions in 1995 (table 2-2).

U.S. Industry Profile

The United States produced just slightly more computer hardware than Japan in 1996. U.S. firms manufacture all types of computers and computer-related equipment and encounter competition in nearly all product segments, especially with the major producers headquartered in Japan, Taiwan, and Korea. In an intensely competitive environment, the U.S. industry is strong in such critical areas as shifting the production of commoditized hardware to lower cost locations or contract manufacturers; managing production, inventory, and distribution to minimize costs; developing new and emerging technologies; quickly adapting to new innovations; and marketing and selling computer hardware. In comparison with some non-U.S. firms, U.S. producers of computer hardware have relatively higher costs of domestic labor and capital investment. However, as stated above, U.S. firms have been successful in reducing costs by moving labor-intensive production outside of the United States and/or sourcing from non-affiliated companies.

The U.S. computer hardware industry produced equipment worth approximately $71 billion in 1996.[2] Production of computer hardware has grown by an average annual rate of more than 10 percent since 1992. At least one-half of all production in the sector involves computers, while sub-assemblies and parts and accessories contribute slightly more than one-quarter to the sector. Computer peripherals make up the remainder of all production in the U.S. industry.

Exports of U.S. computer hardware increased from nearly $25 billion in 1992 to more than $38 billion in 1996.[3] This increase represents an average annual growth rate of roughly 11 percent. Approximately 25 percent of exports in 1996 were computers and computer systems (computers

---

[1] Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996), 1996 ed.; official statistics of the U.S. Department of Commerce (USDOC); and USDOC, *Computer Industry Trends and Trade Data*, Jan. 21, 1997, pp. 1-5.

[2] Ibid.

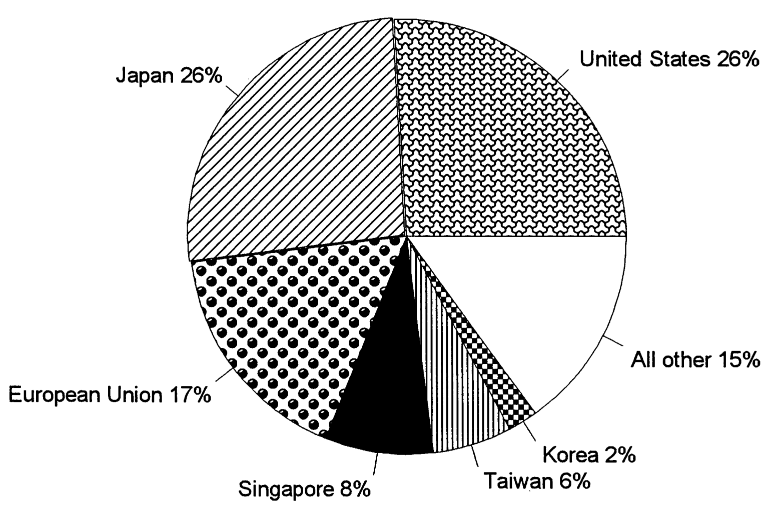
[3] Ibid.

Table 2-1
Examples of computer hardware

Computers	Peripherals
Supercomputers Mainframe computers Minicomputers Workstations Network servers (enterprise, local area, print, file) Desktop personal computers (PCs) Network computers (NCs) Portable PCs (notebooks, laptops, palmtops) Personal digital assistants (PDAs)	Displays/monitors Mice Keyboards Touch screens Scanners Printers Storage devices (disk drives, CD-ROM drives, DAT) Local area network (LAN) adapters
Sub-assemblies	**Parts and Accessories**
Motherboards Multimedia cards (video and sound cards) Memory boards	Housings Computer cables Other parts and accessories

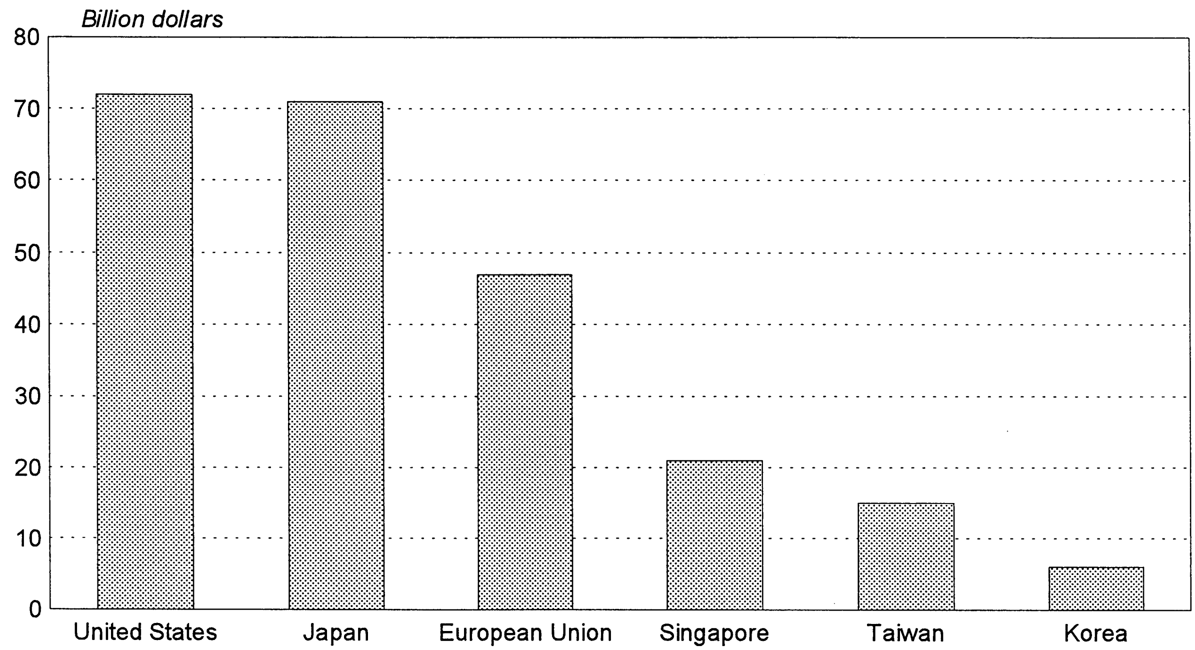
Source: Compiled by the staff of the USITC.

Figure 2-1
Share of world computer hardware production, by major producing countries, 1996



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996), 1996 ed.; official statistics of the U.S. Department of Commerce (USDOC); and USDOC, *Computer Industry Trends and Trade Data*, Jan. 21, 1997, pp. 1-5.

Figure 2-2
Production of computer hardware, by major producing countries, 1996



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996); official statistics of the U.S. Department of Commerce (USDOC); and USDOC, *Computer Industry Trends and Trade Data*, Jan. 21, 1997, pp. 1-5.

integrated with peripherals). Peripherals accounted for over 30 percent of exports, while computer parts equaled almost 45 percent of total exports. The EU, Canada, and Japan are the largest export markets for U.S. computer hardware.

Although production of computer hardware increased steadily during 1992-96, total U.S. industry employment declined from 220,000 employees in 1992 to an estimated 215,000 employees in 1996.[4] However, total employment in the industry may be stabilizing as employment has fluctuated between 211,000 and 215,000 workers since 1993. A similar trend has occurred in the number of production workers which has not fallen below 73,900 since 1992 and reached an estimated 77,000 workers in 1996.

These workers are employed at over 1,000 companies in the United States.[5] These firms vary in terms of size, product focus, and level of technology. U.S. computer companies include large operations such as International Business Machines (IBM) and small-to-medium sized businesses with less well known names. While companies like IBM and Hewlett-Packard Company (HP) produce the entire range of computers and related equipment, many computer companies specialize in one particular market segment or one specific type of computer or computer related hardware. Companies such as Dell Computer Corporation (Dell) and Gateway 2000, Inc. (Gateway 2000), for instance, are large companies that focus on PCs. In terms of level of technology, large companies like Silicon Graphics, Inc. (SGI) and even small start-up firms

---

[4] Ibid.; U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Wages Annual Averages, 1991, 1992, 1993, 1994*; and USDOC, *Current Industrial Report MA-35R, Computer and Office and Accounting Machines*, 1995.

[5] USDOC, *MA-35R,* 1995.

Table 2-2
Computer hardware: Leading world producers, 1995[1]

Products	Corporate headquarters location		
	United States	Japan	Europe
Large scale systems (Supercomputers, mainframes, high performance servers)[2]	IBM Unisys Amdahl[3] Cray Research (CRI) Silicon Graphics (SGI)	Fujitsu Hitachi NEC Mitsubishi	Groupe Bull Siemens-Nixdorf Comparex Olivetti
Low-to-midrange multiuser systems (minicomputers, low-to-midrange servers)	IBM Hewlett-Packard (HP) AT&T Compaq Tandem	NEC Toshiba Fujitsu Mitsubishi Hitachi	Siemens-Nixdorf Groupe Bull Olivetti
Desktops (PCs and workstations)	IBM Compaq Apple HP Dell	Fujitsu Toshiba NEC Matsushita Hitachi	Olivetti[4] Siemens-Nixdorf Groupe Bull
Peripherals	IBM HP Seagate Quantum Xerox	Canon Hitachi Fujitsu Matsushita Toshiba	Siemens-Nixdorf

[1] In order of worldwide revenues.
[2] IBM S/390 class computers and above.
[3] U.S. corporation with approximately 43 percent of common stock owned by Fujitsu of Japan.
[4] Olivetti recently sold its PC operations to a new company, Piedmont International, a consortium of Italian and other foreign investors.

Source: Compiled by USITC staff based on *Datamation,* June 15, 1996.

develop leading edge technologies, while other companies, large or small, devote a minimal amount to research and development (R&D).

The computer industry has shifted markedly away from vertically organized companies and toward reliance on global linkages and outsourcing both from the United States and from foreign sources, especially in the manufacturing process. Even monolithic companies such as IBM have adjusted to a competitive environment in which smaller, more cost effective, and flexible companies delivered quality products to end users at a low price. Essentially, globalization and outsourcing enhanced competitiveness in the sector by allowing companies to seek lower cost alternatives to vertically integrated operations. Specifically, globalization and outsourcing offered producers lower labor costs, lower risk, lower costs of capital investment, flexibility to adapt to rapid technological changes, ability to become new entrants or start-up firms, and lower R&D costs.

Until the 1980s, the computer industry in the United States and worldwide had been dominated by vertically organized corporations such as IBM, which produced all the various components of a computer system from the integrated circuits to the finished product, including all of the peripheral units.[6] With the introduction of PCs in the 1970s and the advent of IBM PC clone companies in the early 1980s, this model began to change as the acceptance of PCs and their relatively low costs increased price pressure throughout the computer industry. The price and performance demands of the PC industry spread to other computer market segments leading to shortened product life cycles and the increased use of standardized parts and components for all computers.[7] As a result, U.S. computer companies, including IBM, are increasingly establishing operations in foreign countries, and outsourcing the manufacture of computer hardware to outside contractors.

Today, the computer industry is truly global with relatively high levels of international investment in production, global sourcing of computer hardware, and international collaboration.[8] In fact, every producer in the industry relies on linkages with other producers in other countries to deliver finished products. Major U.S. computer companies such as Apple Computer, Inc. (Apple), Compaq Computer Corporation (Compaq), and HP have manufacturing operations located overseas in areas such as Asia, Latin America, and Europe.[9] Compaq, for instance, establishes manufacturing operations in different regions of the world to satisfy variations in global market demand and to decrease costs.

Along with overseas operations, outsourcing or contracting with domestic and foreign manufacturers is common among U.S. computer companies. Microprocessors for both IBM-compatible and Apple PCs are sourced from outside suppliers based in the United States -- predominantly Intel Corporation (Intel) for IBM-compatible PCs, and Motorola, Inc. and IBM for Apple PCs. Also, major U.S. computer manufacturers such as Apple, Compaq, Dell, and IBM will source computer peripherals, such as mice and keyboards, as well as computer motherboards and notebook computers from Taiwan[10] or other Asian suppliers. The benefits of outsourcing are similar to those derived from owning overseas operations in terms of cutting costs. Another distinct benefit of outsourcing arises from shifting the expense and risk of building and maintaining manufacturing facilities to companies that specialize in such areas. With the market uncertainty and shortened product life-cycles in the computer industry, major U.S. computer firms are willing to allow outsource contractors to handle the responsibilities and risks of maintaining production plants and developing supplier relationships.[11] This type of relationship also allows the U.S. company to remain flexible and quickly adapt to a new technological innovation. In return, outsource contractors are allowed to produce similar types of computer hardware for other, sometimes competing, firms.

Although IBM is still a leading U.S. computer company, other firms such as Compaq and Dell have established operations by quickly adapting to changes in the industry via global production and outsourcing and by focusing on the PC segment. For instance, in the United States, Dell and Compaq experienced unit shipment growth rates during 1995-96 of approximately 70 percent and 25 percent, respectively, while IBM

---

[6] Charles H. Ferguson and Charles R. Morris, *Computer Wars: How the West Can Win in a Post-IBM World* (New York: Times Books, 1993), pp. 7-10.

[7] Ferguson and Morris, *Computer Wars,* pp. 182-188 and Graham Vickery, "Globalisation in the Computer Industry," ch. 3 in *Globalisation of Industry: Overview and Sector Reports* (Paris: Organization for Economic Co-operation and Development (OECD), 1996), pp. 112-113.

[8] Vickery, "Globalisation in the Computer Industry," pp. 111-112.

[9] Apple, *10-K Report, 1995;* Compaq, *10-K Report, 1995;* and HP, *10-K Report, 1995.*

[10] World Wide Web, retrieved Jan. 15, 1997, The Profile of Taiwan Information Technology Industry, http://mic.iii.org.tw/english, Market Intelligence Center/Institute for the Information Industry (MIC/III), *Taiwan's IT Industry*, 1996.

[11] Tim Sturgeon and Stephen Cohen,"Background Discussion," *Working Meeting on Globalization, Berkeley Roundtable on the International Economy (BRIE)*, Mar. 8, 1996.

experienced a PC growth rate of 20 percent during the same period.[12] Compaq was the U.S. and worldwide PC market leader in unit shipments for 1995 and 1996.

Globalization and outsourcing also increased the ability of start-up firms and foreign operations to enter the U.S. industry. Start-up firms, especially in the PC and workstation sectors, are able to enter into agreements with contractors to manufacture products according to their specifications. All computer components, parts, and the finished computer system can be manufactured by outside companies, allowing the start-up company to focus resources and attention on finance, R&D, design, marketing, and sales. Sun Microsystems is an example of a workstation vendor that has followed this strategy.[13]

Globalization and outsourcing stimulated the number of computer hardware start-up firms established in the United States since 1990. Roughly 12 percent of all high technology companies formed during 1990-94 were computer hardware firms.[14] Computer software companies were the only other type of technology firm with a greater percentage of start-ups during the period. This number also includes foreign PC manufacturers that have established U.S. operations, many of which gained expertise by manufacturing outsourced products for major computer companies. The Acer Group of Taiwan, for instance, has established U.S. operations (Acer America Corporation), introduced its own brand name PCs while producing computer hardware for other firms, and recently entered into an agreement to acquire the portable computer unit of Texas Instruments.[15]

By taking advantage of globalization and outsourcing, PC companies developed lean operations without the extensive R&D costs or large administrative expenses incurred by firms like IBM or other high-end computer producers like SGI.[16] For instance, Dell is a PC-focused company which contracts with the Sony Corporation (Sony) of Japan and Quanta Computer of Taiwan for the production of basic notebook computers. These computers are then customized to end user specifications such as memory capacity and storage options at a local or regional final assembly center. Because of extensive outsourcing relationships such as these, Dell kept its R&D expenses to less than 2 percent of total revenues in fiscal year 1996.[17] In comparison, SGI, a maker of high-end servers, workstations, and supercomputers, devoted 12 percent of total revenues to R&D.[18]

The United States is a particularly attractive market for foreign-owned companies because it is a pacesetter in the use of computer technology at both the corporate and consumer levels.[19] Foreign-owned computer hardware companies operating in the United States in 1995 comprised slightly more than 14 percent of all computer hardware establishments in the United States (figure 2-3).[20] Japanese firms

[12] World Wide Web, retrieved Jan. 28, 1997, In the News, http://www.dataquest.com/irc/press, Tom McCall, "Dataquest Reports Worldwide PC Market Thrived in 1996 with 18 Percent Growth," Jan. 27, 1997.

[13] Sturgeon and Cohen,"Background Discussion."

[14] National Science Foundation (NSF), *Science and Engineering Indicators 1996* (Washington, DC: GPO, 1995), ch. 6, pp. 28-29.

[15] Kenneth L. Kraemer, Jason Dedrick, Chin-Yeong Hwang, Tze-Chen Tu, and Chee-Sing Yap, "Entrepreneurship, Flexibility, and Policy Coordination: Taiwan's Computer Industry," *The Information Society,* No. 12, 1996, pp. 238-241 and "Taiwan's Acer to Buy Texas Instruments Mobile Computing Branch," *Bridge News*, Jan. 24, 1997.

[16] Ferguson and Morris, *Computer Wars,* pp. 51-65 and *Standard and Poor's Industry Surveys: Computers: Hardware*, Sept. 19, 1996, pp. 13-14.

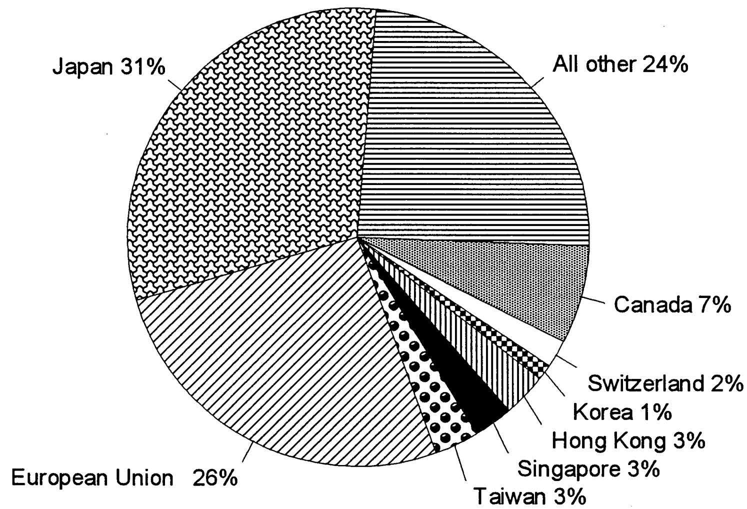
[17] Dell, *10-K Report 1996.*

[18] SGI acquired Cray Research, Inc. (CRI) in fiscal year 1996. Industry representative, interview by USITC staff, Mountain View, CA, Dec. 6, 1996.

[19] *Standard & Poor's: Computers,* pp. 3-4.

[20] Corporate Technology Information Services, Inc., CorpTech database Rev. 10.1 as cited in NSF, *Science and Engineering*, app. table 6-17.

Figure 2-3
Share of foreign-owned computer hardware establishments in the United States, by principal countries, 1995



Source: Corporate Technology Information Services, Inc., as cited in National Science Foundation, *Science and Engineering Indicators*, 1996.

accounted for the leading share with roughly 31 percent of these computer hardware establishments. Several countries of the EU -- the United Kingdom, Germany, France, Sweden, and the Netherlands -- together comprised an estimated 26 percent of all such establishments. Canadian firms accounted for 7 percent. Firms from Taiwan, Singapore, Korea, and Hong Kong represented approximately 10 percent.

The entire computer hardware industry is affected by price pressure and technological advances emanating from the lower end of the market which has caused reverberations in all segments of the sector. Price competition in the PC segment has intensified due to dramatic reductions in price coupled with the acceleration of performance levels. In general, microprocessor performance has doubled every 18 months since Intel's introduction of the 4004 chip in 1971 and prices have decreased even more rapidly than the increased performance.[21] For example, a Pentium processor that was released in 1994 processes more than 100 million instructions per second at a cost of $950. In comparison, a leading technology processor released in 1982 processed only 1 million instructions per second (or 1 percent of the Pentium's capabilities) and cost $320,000 (or 337 times more than the Pentium).[22] Since 1995, Intel has introduced incrementally faster Pentium chips nearly every quarter at prices similar to the market entry price of the previous version.[23]

---

[21] Nick Tredennick, "Microprocessor-Based Computers," *Computer,* Oct. 1996, p. 33 and Linley Gwennap, "Birth of a Chip," *Byte*, Dec. 1996, p. 82.

[22] *Standard & Poor's: Computers*, p. 10.

[23] Jeffrey Henning, "Intel in Your Face," *Datamation,* June 15, 1996, p. 44.

With advances in PC technology occurring at such a rapid pace, U.S. PC companies must introduce new product lines at least every 2 years, if not more quickly, to maintain a competitive edge and to benefit from the higher profit margins that are associated with the newest technologies.[24] Also, as new technologies and higher performance PCs are introduced at prices comparable to earlier market entry prices, the market for products using previous generations of chips or components declines rapidly. The speed of product introductions forces companies to cut prices on PCs that may only have been introduced 3 months earlier. In other words, although profit margins are large enough to entice companies to innovate and develop new products near the beginning of a product generation, these margins decrease substantially within 2 years. As a result, product delays or failures can quickly bring about reductions in market share and even the demise of companies. For example, an industry analyst stated that the introduction of Microsoft's Windows 95 PC operating system (OS) eroded any technological advantage Apple's Macintosh OS had in the marketplace and led to declines in sales of Apple computer hardware.[25]

Price pressure starting in the PC sector has affected higher performance segments of the computer industry for two primary reasons -- the continued adoption by end users of a distributed model of computing based on PC client/server networks and the cheaper price of client/server systems compared with mainframe systems.[26] PC client/server networks have been rapidly adopted by corporations because these networks allow them to process information quickly, responsively, and efficiently -- factors that are extremely important in a competitive marketplace.[27] In addition, PC client/server systems can increasingly perform the tasks of mainframe systems at a lower purchase price, although it is debatable whether the long term costs of ownership are lower. As a result, PC client/server networks have gained market share at the expense of mainframe computers, and mainframe prices have dropped.[28] Mainframe manufacturers have either stopped producing mainframes or have responded with cost-cutting strategies that are common to PC companies and have switched to cheaper processor technologies to compete with PC client/server networks.

This trend also extends to the highest performance computers, often referred to as supercomputers, because as the performance of PC network servers increases and mainframe prices decrease, lower cost servers and mainframes are encroaching upon a market segment traditionally associated with very high cost supercomputers. In fact, computers that use thousands of linked PC microprocessors, such as Intel's Pentium Pro, have equaled or surpassed performance benchmarks more commonly associated with supercomputers.[29] These factors, along with a decline in resources available to traditionally strong customers like government agencies,[30] contributed to a consolidation in the supercomputer segment. For instance, two of the last independent companies that specialized in supercomputers, Convex Computers Corporation and Cray Research, Inc., have been acquired by HP and SGI, respectively.

---

[24] Computer Systems Policy Project, *Freedom to Grow: Public Policy and the U.S. Computer Industry,* Jan. 1995.

[25] Henning, "Intel in Your Face," p. 45.

[26] A distributed model of computing is composed of at least two elements, a client and a server, with both elements being computers. The client is a computer that processes information, for instance, when an end user writes a document using a word processing application or calculates numbers using a spreadsheet application. The server provides a specific function or service requested by the client such as storing changes to a word processing document, accessing data files, or sharing printers. Client/server networks are any number of clients that are connected to a server creating what is known as a local area network (LAN). Servers range in price and performance from low-end PC servers that distribute file and print access to high-end servers that assume the tasks of mainframe computers.

[27] *Standard & Poor's: Computers*, pp. 7-11.

[28] Angie Pantages, "Big Iron is Back," *Datamation,* June 15, 1996, p. 67.

[29] Tom Thompson, "The World's Fastest Computers," *Byte,* Jan. 1996, p. 62.

[30] Industry representatives, interviews by USITC staff, Pittsburgh, PA, Nov. 19-21, 1996, and Dallas, TX, Dec. 2, 1996.

This type of consolidation is actually more common to PC companies. Although enduring falling margins, the U.S. PC industry continues to attract new entrants because of the potential for profits at the early stage of product introductions, growth rates that are in the double digits, and the relative ease of market entry.[31] But with intense price competition coupled with the need to innovate, success in the PC industry is difficult to attain and even more difficult to retain. Consequently, the PC industry continues to experience cost-cutting and consolidation. For instance, NEC's investment in the U.S. company Packard Bell consolidates the PC operations of three companies (Groupe Bull is the third) in the United States.[32] Other recent examples of consolidation include Samsung Electronics Company's (Samsung) equity stake of 49 percent in the U.S. PC maker AST Computer in 1995 (Samsung's stake will reportedly increase to full ownership) and the Acer Group's purchase of Texas Instrument's portable computer division in 1997.

The United States also leads in the variety of methods to deliver computer hardware to end users. Based on the level of product technology, the customer's knowledge and experience with computers, and whether the customer is a business or a consumer, different distribution channels are used by computer companies to deliver the product efficiently and cheaply. In general, the lower the level of technology and customer knowledge, or if the customer is buying the product for home use, the greater the reliance on retail outlets such as Office Depot, Wal-Mart, and CompUSA.[33] For corporate customers, and the sale of products such as workstations, mainframes, and supercomputers, U.S. computer companies rely either on their own sales and service force or work with resellers, systems integrators, and other companies who are the primary point of contact for end-user service and support. Because reliability is so important to business customers, manufacturers that offer service contracts, systems integrators, and resellers will install, maintain, and remain on call to fix any problems that may arise at any time.

The use of resellers and systems integrators can reduce the company's direct customer support and service overhead while increasing costs associated with maintaining a satisfactory relationship with resellers and systems integrators, and increasing the potential for excess inventory because of the longer sales cycle associated with indirect channel sales. Use of the retail channel, in comparison, means that high sales volume will be pushed by the use of narrow margins and cash incentives. Additionally, sales via retailers means that customer service will be handled directly by the computer company and those costs need to be factored into the decision to pursue a retail strategy. Many computer companies such as HP and IBM operate in all of the different channels of distribution in order to target the entire population of end-user markets while companies like Dell focus on one primary channel to minimize costs.

Overall, U.S. computer companies pursue market share and the resulting profits by continuing to develop innovative technology. Companies that bring a new product to market obtain the highest profit margins for the longest possible time. Also, as a general rule, higher performance products such as supercomputers and mainframes require more R&D investment than PCs or PC peripherals. U.S. computer companies, on average, spend 8 percent of their revenues on R&D.[34] Tandem Computers, for instance, devotes over 14 percent of its revenues to R&D because it is a manufacturer of fault-tolerant computer

---

[31] *Standard & Poor's: Computers*, p. 9.

[32] World Wide Web, retrieved Jan. 16, 1997, Upside.com: Search, http://www.upside.com/texis/archive/search/article.html?UID=9612011003, Geoffrey James, "U.S. Computer Market: Where East Meets West," *Upside*, Dec. 1996; World Wide Web, retrieved Feb. 4, 1997, Packard Bell-News, http://www.packardbell.com/news, Packard Bell, "Packard Bell and Zenith Data Systems to Combine Their Operations in Packard Bell," Feb. 7, 1996; and World Wide Web, retrieved Feb. 4, 1997, Packard Bell-News, http://www.packardbell.com/news, Packard Bell, "Agreement Concluded Between Packard Bell and NEC on Merger of Worldwide PC Operations," July 15, 1996.

[33] Industry representative, telephone interview by USITC staff, Jan. 30, 1997.

[34] Computer Systems Policy Project, *Freedom to Grow: Public Policy and the U.S. Computer Industry,* Jan. 1995.

systems for highly sensitive database processing such as on-line commercial transactions.[35] In another example, IBM leads the world in receiving U.S. patents. In 1996, as in the 3 preceding years, IBM received more U.S. patents than any other company in the world.[36] Holding patents is lucrative, as IBM's patent and technology licensing agreements contributed nearly $640 million to IBM's revenues in 1994.[37] In terms of share of total industrial R&D, the sector which includes computers and office machines accounted for 9.4 percent in 1992 and is ranked only below the communications and aircraft industries.[38] This translates to a total investment of $11.5 billion for R&D in the computers and office machines sector in 1992. Other estimates for R&D expenditures in 1995 are as high as $19 billion for the computer and office machine industry.[39]

In terms of U.S. government R&D funds, the High Performance Computing and Communications (HPCC) Program was initiated in 1991 to support research in advanced computer technologies such as supercomputers. Currently, 12 Federal agencies participate in this program which is divided into 5 components:

- High Performance Computing Systems
- National Research and Education Network
- Advanced Software Technology and Algorithms
- Information Infrastructure Technology and Applications
- Basic Research and Human Resources

For fiscal year (FY) 1997, the HPCC Program received funds estimated at slightly over $1 billion.[40] In addition, President Clinton requested over $1 billion for federal spending related to computing and communications research for the FY 1998 budget.[41] While some people may debate the direct effects of such programs, especially in the context of commercial applications, many analysts believe that the results of long-term government investment in computers and communications are visible today with the United States in the lead in these sectors.[42]

Several trends will continue to reshape the global operations of the U.S. industry. As discussed above, the commoditization of computer parts, components, and peripherals will continue to create price pressure that will affect all types of computer hardware companies, leading to greater international production and sourcing. Also, the high research intensity and the increasing convergence of computing, telecommunications, and consumer electronics will continue to lead to international alliances and consortia.[43] For example, IBM has technology agreements with companies like Hitachi, Toshiba, Canon, and Cyrix. IBM

---

[35] Lucien Virgile, "Tandem Computers," *The Value Line Investment Survey* (New York: Value Line Publishing), Oct. 25, 1996, p. 1109.

[36] "IBM Awarded Most U.S. Patents for Fourth Consecutive Year," *Business Wire*, Jan. 13, 1997.

[37] World Wide Web, retrieved Jan. 31, 1997, IBM Annual Report 1994, http://www.ibm.com, IBM, *Annual Report 1994.*

[38] NSF, *Science and Engineering*, ch. 6, p. 16.

[39] Information Technology Industry Council (ITI), Industry Statistics Program, *Information Technology Industry Data Book 1960-2006*, 1996, p. 15.

[40] World Wide Web, retrieved Jan. 31, 1997, HPCC Publications, http://www.hpcc.gov/reports/index.html, National Coordination Office for HPCC, *High Performance Computing and Communications: Advancing the Frontiers of Information Technology (FY 1997 Blue Book).*

[41] World Wide Web, retrieved Feb. 7, 1997, Tech Wire, http://www.techweb.com/wire/news/feb/0206clinton.html, Rex Nutting, "Clinton Asks 9% Boost in Computing R&D," *Tech Wire*, Feb. 7, 1997.

[42] Computer Science and Telecommunications Board, *Keeping the U.S. Computer and Communications Industry Competitive* (Washington, DC: National Research Council, 1995), pp. 83-85.

[43] Vickery, "Globalisation in the Computer Industry," p. 112.

sells such products as storage units and semiconductors to other manufacturers, including Apple, Cyrix, Hitachi, and Toshiba.[44]

Foreign Industry Profiles

The U.S. industry's foreign competitors are principally based in Japan, the EU, Singapore, Taiwan, and Korea. Production in the EU and Singapore is large and U.S.-owned manufacturing facilities account for a substantial share of such production. Also, U.S. and Japanese companies buy many computer products from Taiwan and Korea for labeling with their own brand names. Malaysia, China, Thailand, and Brazil are increasing their share of global manufacturing of computer hardware and are second-tier producers.[45]

Japan

Japanese firms manufacture all types of computer hardware. In the large computer sector, such as mainframes, Japanese companies have been successful in matching or even exceeding the performance of comparable products manufactured in the United States because of the Japanese industry's vertically integrated structure.[46] However, in sectors that require the rapid development of new technologies, flexibility, and low-cost structures, such as the PC and workstation segments, Japan has trailed the United States. In general, the Japanese industry is strong in areas such as the operation of high quality production facilities and the marketing and selling of computers as consumer products. However, the Japanese industry lags the United States in shifting the production of commoditized hardware to lower cost locations or contractors, developing new and emerging technologies, and quickly adapting to innovations.

The value of production of the Japanese computer industry in 1996 was slightly under $71 billion, nearly as much as that of the U.S. industry.[47] Production of computer hardware has steadily increased since 1992 when production equaled approximately $57 billion. Average annual growth rates in the Japanese computer industry have equaled 6 percent during 1992-96.

Japanese computer hardware exports increased slightly from more than $21 billion in 1992 to an estimated $28 billion in 1996, an average annual growth rate of 7 percent.[48] Approximately 10 percent of computer hardware exports in 1996 were computers and computer systems. Peripherals accounted for 45 percent of exports as did computer sub-assemblies and parts.[49] The United States and EU are the largest export markets for Japanese computer hardware with markets in Asia, such as China, Taiwan, Korea, Singapore, and Malaysia, accounting for the next highest share.[50]

---

[44] IBM, *Annual Report, 1994.*

[45] These are emerging producers, with 1996 production of at least $5 billion. Production in these countries is growing rapidly and is expected to continue to do so for the foreseeable future.

[46] Kenneth L. Kraemer and Jason Dedrick, draft copy of *Competing in Computers: Business and Government Strategy in East Asia* (Irvine: Center for Research on Information Technology and Organizations, University of California, Irvine, 1996), pp. 65-68.

[47] Estimated by USITC staff based on Elsevier, *Yearbooks of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; and USDOC, *Computer Industry*, pp. 1-5.

[48] Ibid.

[49] Estimated by USITC staff based on ASM Computer Group Research, "Computer Segment a Catalyst for Growth in Electronics," *Asian Sources Computer Products*, Jan. 1996, pp. 180-183.

[50] "Production Trends in Japan's Electronics Industry," *Japan Electronics Almanac '95/'96* (New York: Dempa Publications, 1995), pp. 35-36.

The Japanese computer industry is dominated by large, predominately vertically organized computer firms that manufacture the complete range of computer hardware. NEC, Fujitsu, and Hitachi, for instance, sell a wide range of technology products such as telecommunications equipment and electronic components, as well as computers. In terms of computer equipment, these three companies manufacture the complete range of products from supercomputers to portable notebook computers. Toshiba and Sony also sell PCs and laptops, but these companies are better known for consumer electronics products such as televisions and videocassette recorders (VCRs) than their computer hardware. There are very few counterparts to U.S. companies like Apple and Dell that began by focusing primarily on PCs, or Sun and SGI that began with workstations.

Although start-up firms are rare, there have been recent examples in the Japanese industry. For instance, the Akia Corporation, which was founded by a former executive of Tandy and Dell, is considered the ninth largest notebook computer supplier in Japan.[51] In addition, Japanese companies have been investing in U.S. venture capital firms or directly with U.S. start-up firms to gain access to new technologies.[52]

While U.S. companies have adopted global linkages and outsourcing in the computer industry, Japanese companies have been slower to adjust to a competitive environment that requires lower cost alternatives.[53] The Japanese PC industry, dominated by NEC, was relatively isolated from global trends because of its focus on mainframe production, the use of NEC's proprietary PC OS software unique to Japan, incompatibilities in PC applications software because of the proprietary OS, and lack of processor performance that could handle Japanese characters.[54] It was not until the introduction of the IBM-compatible DOS/V in 1991 and Apple's Japanese version of its OS that the PC industry in Japan first became exposed to competition from U.S. firms.[55] Also, PC competition in Japan became particularly intense when Compaq introduced its IBM-compatible PCs at one-half the price of equivalent NEC PCs in 1992. Other non-Japanese PC firms, such as IBM, Dell, and Acer, followed Compaq's lead and began to increase market share. Thus, an industry that was dominated by one manufacturer, NEC, became more competitive as viable alternatives to NEC's proprietary PC OS, NEC 9800, were introduced. In 1995, U.S. companies with operations in Japan appeared among the top five companies ranked by units shipped for such computer hardware as PCs, workstations, and peripherals (figure 2-4). Japan also continues to lag behind the United States in terms of the shift from mainframes to client server hardware as indicated by PC production. For instance, an estimated 85 percent of the value of U.S. computer production in 1995 was in PCs and workstations whereas nearly 70 percent of Japanese production during the same period was of the same type of products.[56]

---

[51] World Wide Web, retrieved Feb. 6, 1997, Tech Search, http://www.techweb.com/search, John Boyd, "Shakin' Shinjuku," *OEM Magazine*, Jan. 10, 1997.

[52] World Wide Web, retrieved Feb. 5, 1997, News Briefs, http://www.cjmag.com.jp/magazine/issues/1996/feb96/news.html, International News, "Hitachi Seeks Out New Technologies," *Computing Japan*, Feb/Mar. 1996 and World Wide Web, retrieved Feb. 5, 1997, News Briefs, http://www.cjmag.com.jp/magazine/issues/1996/aug96/08newsbrfs.html, International News, "NEC Makes Foreign Venture Capital Investment," *Computing Japan*, Aug. 1996.

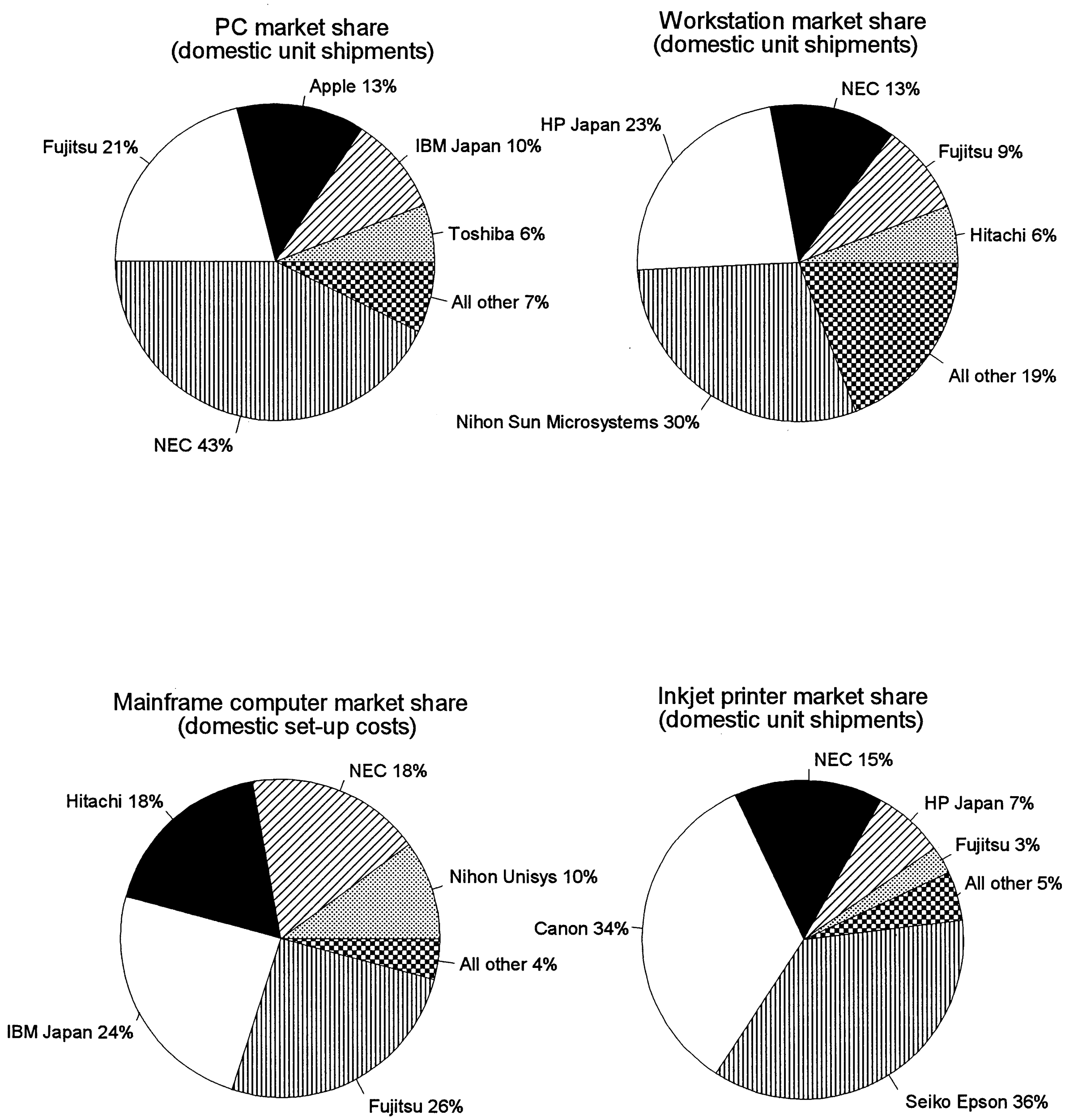
[53] Kraemer and Dedrick, *Competing in Computers,* pp. 71-72.

[54] Jason Dedrick and Kenneth L. Kraemer, "Behind the Curve: Japan's PC Industry," *Global Business*, No. 4, 1995, pp. 67-76.

[55] Virginia Kouyoumdjian, "Catch a Rising Star: Japanese PC Market Takes Off," *The Journal,* American Chamber of Commerce in Japan, Jan. 1996, pp. 22-29.

[56] Estimated by USITC staff based on Electronics Industry Association of Japan (EIAJ), *Facts and Figures on the Japanese Electronics Industry*, 1996 and USDOC, *MA-35R*, 1995.

Figure 2-4
Certain computer hardware: Share of the Japanese market for selected products, 1995



Source: *Nikkei Weekly*.

Japanese firms, albeit on a more limited scale than U.S. companies, have moved manufacturing operations overseas to take advantage of lower labor costs and have developed relationships with contractors in response to increased competition and price pressure. For example, in 1995, NEC sourced products from companies in Taiwan such as First International Computer, Inc., for notebook PCs and Elitegroup Computer Systems for PC motherboards.[57] Although overseas production by wholly owned subsidiaries is fairly common for Japanese companies like NEC, outsourcing relationships may be limited. For instance, Fujitsu and Hitachi discontinued contracts with Acer of Taiwan and are moving production of all Japanese computer models back to Japan.[58]

Also like the U.S. industry, Japanese companies are pursuing market share and the resulting profit margins of leading edge technologies by investing in R&D. While the share of total industrial R&D in the United States for computers and office machines was 9.4 percent in 1992, the share in Japan for the same sector was 8.6 percent, trailing the communications equipment, motor vehicle, electrical equipment, and chemicals industries.[59] In 1996, Fujitsu invested 9.2 percent of its total net sales in R&D while NEC invested nearly 7 percent during the same period.[60] These companies also operate other divisions, like telecommunications and electronics components operations, which share in the costs and benefits of R&D investment. As a result, the amount of R&D that Japanese companies dedicate to computers is not generally known. However, as technological developments in telecommunications and electronics components operations have an effect on computer hardware, shared resources may be an advantage that Japanese companies have over most U.S. companies. Nonetheless, because of the high cost of developing new computer technologies, Japanese companies have entered into international alliances and consortia to share these costs. As discussed in the U.S. industry profile, Hitachi and Toshiba, for instance, have entered into technology agreements with IBM.

Along with industry, the Japanese Government is involved in R&D funding for computer companies despite disappointing results in the past.[61] The Government of Japan currently sponsors the Real World Computing Program and the Micro Machine Project on a consortia basis, open to Japanese and non-Japanese enterprises and institutions. The first program was launched in 1992 to conduct R&D on massively parallel processing.[62] The second project is for the development of microscopic-level computer technologies. Japan's Ministry of International Trade and Industry (MITI) also established a small business R&D fund of approximately $10 billion. The fund is not targeted specifically on the computer industry and is intended to foster start-up firms in any sector that has the potential to create jobs and commercially viable technologies.

---

[57] World Wide Web, retrieved Feb. 6, 1997, Tech Search, http://www.techweb.com/search, Mark LaPedus, "Asia-Pacific Gets More Important in PC Assembly," *Electronic Buyers' News*, Jan. 29, 1996.

[58] World Wide Web, retrieved Feb. 6, 1997, Tech Search, http://www.techweb.com/search, Tom McHale, "Shock Therapy," *Electronic Buyers' News*, June 10, 1996 and World Wide Web, retrieved Feb. 6, 1997, Tech Search, http://www.techweb.com/search, Jack Robertson, "Japan Goes In-House With PCs," *Electronic Buyers' News*, July 8, 1996.

[59] NSF, *Science and Engineering*, ch. 6, pp. 16-17.

[60] World Wide Web, retrieved Feb. 6, 1997, Financial Review, http://www.nec.co.jp/english/profile/annual96/section/fin-2.html, NEC, *Annual Report 1996* and World Wide Web, retrieved Feb. 6, 1997, Fujitsu, http://www.fujitsu.co.jp/hypertext/About_fujitsu/annual96/r&d.htm, Fujitsu Limited, *Annual Report*, Mar. 1996.

[61] For further discussion on this topic, see USITC, *Global Competitiveness of U.S. Advanced-Technology Industries: Computers* (investigation No. 332-339), USITC publication 2705, Dec. 1993.

[62] Ibid. and Kraemer and Dedrick, *Competing in Computers*, pp. 82-83.

European Union

The EU is ranked third in world production of computer hardware. However, the EU computer industry is primarily dependent on the presence of U.S. and, to a lesser extent, Japanese subsidiaries. Relative to the United States and Japan, the EU industry is not particularly strong in minimizing cost, developing new technologies, adapting to innovations, or marketing and selling computer hardware. Rather, the EU is important as a hub for computer firms that want access to the EU market as well as the developing economies of Central and Eastern Europe.

The EU produced approximately $47 billion of computer hardware in 1996, behind only the United States and Japan.[63] Such production was up only slightly from the 1992 level of approximately $43 billion. Annual growth rates in the sector averaged slightly more than 2 percent during 1992-96. France, Germany, Ireland, Italy, and the United Kingdom, combined, accounted for nearly 80 percent of total EU production of computer hardware. EU computer hardware exports increased from about $12 billion in 1992 to an estimated $19 billion in 1996 at an estimated average annual growth rate of 12 percent.[64] The United States and Japan are the largest export markets for EU computer hardware.[65]

The EU computer industry is dominated by U.S. multinational corporations that invested in the region to gain access to European markets.[66] Investment by U.S.-owned companies in Scotland and Ireland is particularly fast growing. Both Scotland and Ireland offered U.S. firms the benefits of an educated labor force, relatively low wage rates, developed electronics infrastructure, financial incentives, and access to a large market for computer hardware.[67] Companies in Scotland, for example, produced more than 35 percent of Europe's PCs and more than 57 percent of its workstations in 1995. IBM, Digital, Compaq, and Motorola all have production operations in an area of Scotland nicknamed Silicon Glen. Ireland, in comparison, is the home of manufacturing facilities owned by Dell, Gateway 2000, HP, Apple, and AST.[68]

Because U.S.-owned computer firms have a strong presence in Europe -- for instance, the leading suppliers of PCs in Europe are Compaq, IBM, and HP[69] -- domestic firms, such as Siemens-Nixdorf Informationssysteme (SNI), Groupe Bull, and Olivetti, have had to reduce costs to be competitive. For example, SNI has moved away from mainframe and minicomputer production and is focusing on the manufacture of client/server systems using PC and workstation microprocessors.[70] Groupe Bull, in comparison, has merged its PC operations with Packard Bell NEC and is responsible for the distribution of computers to the business market in Europe.[71] Unable to make a profit in a competitive climate, Olivetti divested itself of its PC division in order to focus on telecommunications. A newly formed company,

---

[63] Estimated by USITC staff based on Elsevier, *Yearbooks of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; USDOC, *Computer Industry*, pp. 1-5; and Eurobit, "Computer and Office Equipment: NACE 33," ch. 10 in *Panorama of EU Industry '95/'96* (Luxembourg: Office for Official Publications of the European Communities, 1995).

[64] Ibid.

[65] Ibid.

[66] Eurobit, "Computer and Office Equipment."

[67] World Wide Web, retrieved Jan. 16, 1997, Upside.com: Search, http://www.upside.com/texis/search, Karen Southwick, "Clash of the Clans," *Upside*, Mar. 1995 and Lewis H. Young, "Scotland's New Draw: Research Consortiums," *Electronic Business Buyer*, Feb. 1995, pp. 77-78.

[68] Southwick, "Clash of the Clans" and "Ireland Offers Brainpower to Lure High-tech," *Electronic Business Buyer*, Apr. 1995, pp. 32-33.

[69] Silvia Ascarelli, "Dell Finds U.S. Strategy Works in Europe," *Wall Street Journal*, Feb. 3, 1997.

[70] Lewis H. Young, "European-style Restructuring," *Electronic Business Today*, Feb. 1997, p. 42.

[71] World Wide Web, retrieved Feb. 13, 1997, Finance Communication Press Releases First Half 1996, http://www.bull.com/finance/comm22_a.htm, "Group Bull's 1st Half 1996 Results," July, 29, 1996.

Piedmont International, owned by a group of Italian and international financial and industrial investors led by the Centenary Corporation, acquired Olivetti's PC division in February 1997.[72] In general, these European companies are reducing their share of computer hardware manufacturing operations and increasing such services revenue as systems integration and software development.

Because the European industry is relatively weak in developing new computer technologies compared with the U.S. industry, EU initiatives for R&D have been promoted in an attempt to close the gap. The EU Microelectronics Development for European Applications (MEDEA) fund, for example, is intended to aid in electronic design automation, multiprocessor development, and electronics manufacturing technology for chip applications in multimedia, telecommunications, and other industries.[73] This program is slated to last 4 years and is essentially an extension of the $700-million Joint European Submicron Silicon Initiative (JESSI) program to research new computer chips. Funding for MEDEA is to be provided equally by industry, the EU, and national governments. Another program, the European Strategic Program for Research in Information Technology (ESPRIT), is in its fourth phase (1994-1998) and is intended to create new technologies to benefit European IT industries.[74] Over $1.5 billion has been invested in this fund despite the lack of success in developing technologies that have been brought to market by European companies.[75]

Besides government-sponsored R&D programs, venture capital support and start-up financing for technology firms have recently been established in Europe. Modeled after the success of start-up companies in Silicon Valley, a European venture capital industry is developing. For instance, California firms such as Robertson, Stephens & Co. and Hambrecht & Quist have helped attract venture capital to European start-up computer companies. In addition, new European stock markets have been established in London (Alternative Investment Market) and Brussels (Easdaq) to assist new firms in raising capital by selling equity stakes.[76] These initiatives may increase the number of European computer firms that develop in the next few years, which is crucial for the development of new technology products.

Singapore

Singapore's role in the computer industry is shifting from a low-cost producer of computer peripherals and components for U.S. and Japanese multinational corporations to a producer of high value-added computers and peripherals, to a regional center for R&D, and to a regional management hub for multinationals doing business in Asia. This changing role was necessary to foster continued growth in the sector as the costs of doing business in Singapore increased and the industry trailed the United States and Japan in the development of new and emerging technologies.

---

[72] World Wide Web, retrieved Feb. 13, 1997, Olivetti Information Point, http://www.olivetti.it/info/pressuk/97012102.shtml, "Olivetti Signs Agreement for Sale of Personal Computers Business," Olivetti, Jan. 20, 1997.

[73] World Wide Web, retrieved Feb. 7, 1997, Tech Search, http://www.techweb.com/search, Jack Robertson, "R&D Initiative Launched in Europe," *Electronic Buyers' News*, July 8, 1996.

[74] World Wide Web, retrieved Jan. 16, 1997, Upside.com: Search, http://www.upside.com/texis/search, Joshua Greenbaum and Marsha Johnston, "Euro-Entrepreneurs in a Bind," *Upside*, Oct. 1993 and World Wide Web, retrieved Feb. 7, 1997, CORDIS, http://www.apollo.cordis.lu, "Specific Research and Technological Development Programme in the Field of Information Technologies, 1994-1998," Community R&D Information Service (CORDIS), Nov. 18, 1996.

[75] USITC, *Industry and Trade Summary: Computers, Peripherals, and Computer Components*, USITC publication 2821, Oct. 1994, pp. 18-19.

[76] Nicholas Denton, "IT: Europe May Be Catching Up," *Financial Times*, Feb. 3, 1997.

Singapore is ranked fourth in world production of computer hardware, producing approximately $21 billion in 1996.[77] Production of computer hardware has increased each year since 1992, when product shipments equaled $10 billion. Average annual growth in the sector was about 20 percent during 1992-96. Computer hardware exports from Singapore increased from $12 billion in 1992 to an estimated $28 billion in 1996, or an average annual growth rate of 23 percent. The value of exports exceeded production because export data includes re-exports or transshipments of goods and the export of finished or nearly finished goods assembled from imported parts and components. Over one-half of all computer hardware exports in 1996 were peripherals, especially storage products such as disk drives. Sub-assemblies and parts accounted for more than 30 percent of exports. Computers and computer systems made up the remainder of all computer hardware exports (15 percent).[78] Roughly two-thirds of Singapore's computer hardware exports are shipped to the United States.[79]

Singapore's computer industry is dominated by multinational corporations that invested in Singapore for the production of PCs, data storage devices (hard disk drives, removable cartridge disk drives, tape drives, CD-ROM drives), printers, and monitors (table 2-3). Singapore is a leading producer of hard disk drives, accounting for roughly 45 percent of worldwide unit shipments in 1995.[80] 1996 estimates show that unit shipments of hard disk drives will increase by at least 10 percent. Singapore also leads the world in multimedia video and sound cards with two domestic companies, Creative Technology Ltd. and Aztech Systems Ltd., responsible for nearly all shipments of such products worldwide.[81] The production of high-end computer systems such as mainframes and supercomputers is negligible in Singapore.

The development of Singapore's computer industry was aided by government policies which promoted the sector as a strategic priority. During the 1980s, Singapore's Economic Development Board (EDB) actively sought investment from computer-related companies by promoting Singapore's educated workforce, low wages, infrastructure geared towards exports, and financial incentives.[82] Seagate Technologies and Apple were two of the first computer companies to invest in manufacturing facilities in Singapore. Eventually other computer hardware producers followed, lured by similar incentives as well as Singapore's increasing importance as a springboard for other Asian markets. As Singapore successfully developed into a leading producer of computer and other electronics equipment, labor shortages developed and wages began to increase.

The focus of current government policies is to attract foreign investment in higher value-added production operations, R&D facilities, and regional management operations in order to foster the

---

[77] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; and USDOC, *Computer Industry*, pp. 1-5.

[78] Estimated by USITC staff based on ASM Computer Group Research, "Well-Rounded IT Industry Thrives on High-Tech Focus," *Asian Sources Computer Products*, Jan. 1996, pp. 282-294.

[79] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; and USDOC, *Computer Industry*, pp. 1-5.

[80] World Wide Web, retrieved Feb. 4, 1997, Industry Information, http://www.sedb.com.sg/biz/industry, Singapore Economic Development Board (EDB), "Electronics Industry Output Surpasses S$50 Billion for First Time," *Singapore's Business Climate*, Dec. 13, 1995.

[81] World Wide Web, retrieved Feb. 7, 1997, Synergy: June/July 1996 - S&T News, http://www.nstb.gov.sg/whatsnew/synergy/aug96/5.html, Singapore National Science and Technology Board, "Creative Sets Record," *Synergy for Science and Technology*, Aug./Sept. 1996; World Wide Web, retrieved Feb. 4, 1997, Aztech Substantially Increased Market Share in Sound Boards, http://www.dataquest.com/register/abstracts, Dataquest Interactive, "Aztech Substantially Increased Market Share in Sound Boards," Feb. 23, 1996; and "Driving Force: Multimedia Product Manufacturers Upgrade and Add Product Lines," *Singapore Trade News*, May/June 1995, pp. 8-11.

[82] USITC, *Industry and Trade Summary: Computers,* pp. 16-17.

Table 2-3
Computer hardware: Selected products, leading computer producers in Singapore, 1995-96[1]

Computers	Data storage peripherals
Apple	IBM
Compaq	Quantum[2]
HP	Seagate Technologies
IBM	Western Digital

[1] In alphabetical order.
[2] Via a manufacturing agreement with the Japanese company Matsushita-Kotobuki Electronics Industries Ltd.

Sources: Kenneth L. Kraemer and Jason Dedrick, draft copy of *Competing in Computers: Business and Government Strategy in East Asia* (Irvine: Center for Research on Information Technology and Organizations, University of California, Irvine, 1996), p. 129; ASM Computer Group Research, "Well-Rounded IT Industry Thrives on High-Tech Focus," *Asian Sources Computer Products*, Jan. 1996, pp. 282-306; Quantum Corporation, "Corporate Background," Feb. 12, 1997, http://www.quantum.com; and Western Digital, *Summary Annual Report, 1996.*

development of domestic information technology companies and continued sectoral growth.[83] In response, companies such as HP, Apple, and Compaq have increased their investment in Singapore by establishing advanced manufacturing and R&D operations focused on developing products for the Asian market.[84] The promotion of higher value activities is intended to reduce competition from lower wage countries in Southeast Asia. The Government of Singapore is actively involved in locating labor-intensive production operations in lower wage nations for technology companies as well as investing in the education and recruitment of skilled professionals and production workers.[85] Total government investment for the augmentation of Singapore's technology industries during the years 1996 to 2001 equals approximately $4 billion, as detailed in the National Science and Technology Plan announced by the Singapore Ministry of Trade and Industry in September 1996.[86]

Taiwan

Taiwan is a major source of PCs, peripherals, and sub-assemblies for U.S. and Japanese computer companies. As the computer industry shifted from vertically organized firms to global linkages, especially outsourcing relationships, Taiwan's industry became a dominant contractor for U.S. and Japanese companies because of its relatively low-cost manufacturing operations and ability to rapidly adapt to new technologies. However, the industry is relatively weak in terms of developing new technologies so it remains dependent on

[83] World Wide Web, retrieved Feb. 4, 1997, Industry Information, http://www.sedb.com.sg/biz/industry, EDB, "Towards a Developed Economy: EDB Sets Bold Targets for the Year 2000," *Singapore's Business Climate*, Jan. 30, 1996 and ASM Computer Group Research, "IT Industry," pp. 283-286.

[84] World Wide Web, retrieved Feb. 4, 1997, Singapore Investment News, http://www.sedb.com.sg/sinews, EDB, "Singapore: A Global R&D Hub of Hewlett-Packard," *Singapore Investment News*, July 1995; World Wide Web, retrieved Feb. 4, 1997, Singapore Investment News, http://www.sedb.com.sg/sinews, EDB, "Apple to Invest $40 Million in R&D Activities Here," *Singapore Investment News*, Oct. 1995; and World Wide Web, retrieved Feb. 4, 1997, Singapore Investment News, http://www.sedb.com.sg/sinews, EDB, "Compaq Asia's US$100 Million Facility II Opens," *Singapore Investment News*, Sept. 1996.

[85] World Wide Web, retrieved Feb. 4, 1997, Industry Information, http://www.sedb.com.sg/biz/industry, EDB, "Impressive Growth of 90% in Total Business Spending For Regional Headquarters," *Singapore's Business Climate*, Dec. 29, 1995 and USITC, *Industry Summary: Computers*, p. 17.

[86] USDOC, "Singapore -- National Science and Technology Plan 2000," Sept. 20, 1996.

imported components from the United States and Japan. Also, as the costs of doing business in Taiwan have risen, Taiwan is losing its status as a low-cost producer and computer companies are moving labor-intensive manufacturing facilities to lower cost areas in Southeast Asia and China.

Taiwan's computer industry, the world's fifth largest, produced an estimated $15 billion worth of hardware in 1996.[87] Production of computer hardware has steadily increased since 1992 when product shipments equaled $8 billion. The average annual growth rate was approximately 18 percent during 1992-96. Computer hardware exports from Taiwan increased from $7 billion in 1992 to an estimated $14 billion in 1996, or an average annual growth rate of 18 percent.[88] More than one-half of all computer hardware exports in 1996 were motherboards, sub-assemblies, and parts. Peripherals accounted for 20 percent of exports as did computers and computer systems.[89] The United States is Taiwan's largest export market with over one-half of all computer product exports.[90] Outside of North America, the EU is Taiwan's largest export market.[91]

Taiwan was ranked first in the world for the production of PC motherboards, monitors, keyboards, and graphics cards in 1995 (figure 2-5). However, Taiwan's industry does not produce high-end products such as mainframes or supercomputers, unlike U.S. and Japanese companies. Compared with the Japanese industry, Taiwan's sector has a significant number of small-to-medium sized businesses that focus on specific products, usually motherboards and such peripherals as scanners, keyboards, and mice. The number of computer hardware companies is estimated to be in the thousands. Many of the smaller companies established subcontracting and supply relationships with the larger producers of computer hardware which included the Acer Group, Mitac International Corp., First International Corp., Tatung, and Digital Equipment (DEC).[92]

Taiwan's industry developed as a low-cost base for multinational corporations that located production facilities in Taiwan. Companies such as Texas Instruments, Sanyo, Matsushita, IBM, and Philips invested in Taiwan in the 1960s and 1970s for the production of consumer electronics and computer components. Domestic companies responded by setting up supply and subcontracting operations for the developing industry.[93] These operations began to create increasingly sophisticated products, moving from basic electronic components to PC assembly operations. Eventually, U.S. and Japanese companies began to source such items as complete desktop and portable PCs from Taiwan because of the industry's relatively lower cost structure. For instance, Apple, Compaq, Dell, and IBM source extensively from Taiwanese companies (table 2-4). One Taiwanese company, Acer, even used its experience as a contractor to create its own branded line of computers.

However, Taiwan's advantage in low labor costs has lessened in recent years because of rising wages. In response, Taiwan has moved production operations overseas, either closer to the major markets to

---

[87] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data,* 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; and USDOC, *Computer Industry*, pp. 1-5.

[88] Ibid.

[89] Estimated by USITC staff based on ASM Computer Group Research, "New Competition Fails to Spoil Industry's Progress," *Asian Sources Computer Products*, Jan. 1996, pp. 124-128.

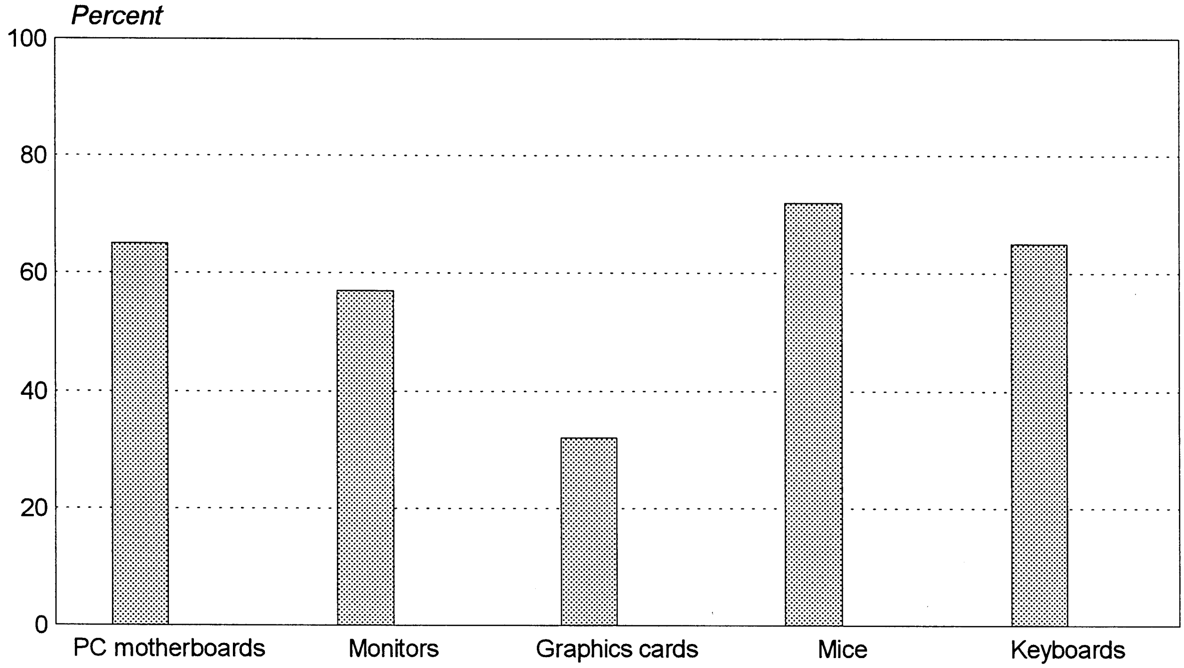
[90] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data,* 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; and USDOC, *Computer Industry*, pp. 1-5.

[91] MIC/III, *Conference on Taiwan/Asia IT Industry*, Mar. 10, 1995.

[92] Kraemer and Dedrick, *Competing in Computers*, pp. 107-108; MIC/III, *Taiwan's IT Industry*; and World Wide Web, retrieved Feb. 7, 1997, Tech Search, http://www.techweb.com/search, "Taiwan Computer Makers Find a Niche in Notebooks," *Electronic Buyers' News*, Mar. 11, 1996.

[93] Kraemer and Dedrick, *Competing in Computers*, pp. 101-102.

Figure 2-5
Computer hardware: Taiwan's share of world market, by selected products, 1995



Source: Market Intelligence Center/Institute for the Information Industry, *Taiwan's IT Industry*, 1996.

Table 2-4
Computer hardware: Taiwan production of selected products for leading computer companies, 1995

Buyer	Products	Taiwan maker	Estimated purchases ($US millions)
Apple	Monitors Notebook PCs PDAs	Tatung Acer Inventa	300-400
Compaq	Monitors Mice Notebook PCs	ADI, Philips, TECO Logitec, Primax Inventa	500
Dell	Monitors Notebook PCs Motherboards	Lite-on, Royal Quanta Lung Hwa, FIC	450
IBM	Monitors Motherboards Notebook PCs	Sampo, Capertronic GVC, Lung Hwa Sun-Moon-Star	450
Packard Bell	Desktop PCs Motherboards Keyboards	Tatung Tatung, GVC BTC	500

Sources: Market Intelligence Center/Institute for the Information Industry, "Upgrading Taiwan's IT Industry: New Challenges and the Role of International Cooperation," (overhead presentation by T.C. Tu), 1995 as cited in Kenneth L. Kraemer, Jason Dedrick, Chin-Yeong Hwang, Tze-Chen Tu, and Chee-Sing Yap, "Entrepreneurship, Flexibility, and Policy Coordination: Taiwan's Computer Industry," *The Information Society*, No. 12, 1996, p. 238 and Dell, *10-K Report*, 1996.

which they sell or to low labor cost areas such as China or Southeast Asia. Besides low cost structures, Taiwan is a leading source of the world's PC peripherals and sub-assemblies because of the industry's flexibility. In most instances, Taiwan's computer industry is not the first to develop a computer technology but can quickly emulate or produce a new product because the domestic supply network responds quickly. For instance, production of new PCs that incorporate a newly introduced microprocessor can take only 2 months compared to more than 3 months elsewhere.[94]

R&D expenditures for Taiwan's computer companies are lower than those of Fujitsu or IBM because Taiwanese firms do not develop new technologies. Taiwan's computer companies are dependent on U.S. or Japanese companies for new technologies and high value-added components. In an attempt to correct this weakness, Taiwan's resources for R&D are increasing, especially for higher value-added goods such as high-end workstations and servers.[95] In addition, innovative companies, such as Acer, have formed alliances with chip makers, computer hardware manufacturers, and software developers to gain access to new technologies and to spread the costs of product development. Acer has joint venture agreements with Texas Instruments for the production of memory chips and with Hitachi for the production of network PCs, and has entered into strategic alliances with Microsoft, Novell, and the Santa Cruz Operation.[96] Along with private sector initiatives, the Taiwan government supports and nurtures the domestic computer industry.[97] However, no leading edge technologies have yet developed as a result of government-sponsored programs.

Korea

Korea is the sixth largest producer of computer hardware. Korea's industry is important primarily as a source of PCs and peripherals such as computer monitors and storage units for companies in other countries. Korea's strength in the industry is derived from its high volume manufacturing operations which are well suited for monitors, which do not change as rapidly as other computer hardware. In products such as desktop and portable PCs, Korea is dependent on new technologies from the United States and Japan. Because the high volume manufacturing structure of Korean computer companies does not allow them to respond as rapidly to new developments, they trail other producers, such as the United States and Taiwan.

Korea produced approximately $6 billion worth of computer hardware in 1996, having increased every year since 1992, when product shipments were $3 billion.[98] This amounted to an average annual growth rate of nearly 14 percent during 1992-96. Exports of computer hardware from Korea increased from nearly $3 billion in 1992 to an estimated $5 billion in 1996, or an average annual growth rate of 13 percent.[99] Peripherals, predominately monitors, accounted for about three-quarters of all exports in 1996. Approximately 20 percent of exports were sub-assemblies and parts while computers and computer systems

---

[94] Kraemer and Dedrick, *Competing in Computers*, p. 109.

[95] ASM Computer Group Research, "New Competition," pp. 126-128 and ASM Computer Group Research, "PCs Solidify Occupation of Workstation Territory," *Asian Sources Computer Products,* Oct. 1995, CD-ROM.

[96] World Wide Web, retrieved Feb. 11, 1997, Acer America Corporate Profile, http://www.acer.com/aac/about/profile.htm, Acer, *About Acer* and World Wide Web, retrieved Feb. 4, 1997, Tech Search, http://www.techweb.com/search, "Hitachi and Acer Form Alliance," *Electronic Buyers' News*, Nov. 11, 1996.

[97] ASM Computer Group Research, "Survival Instinct Breeds Better Suppliers," *Asian Sources Computer Products*, Jan. 1995, p. 144.

[98] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; and USDOC, *Computer Industry*, pp. 1-5.

[99] Ibid. and Korea Customs Service, Korea Customs Research Institute, *Monthly Foreign Trade Statistics*, Nov. 1996, Dec. 1995.

equaled about 5 percent of exports.[100] The United States, the EU, and Canada are the largest export markets for Korean computer hardware.[101]

The Korean computer industry is most similar to Japan's because large, vertically organized computer firms dominate the industry. However, unlike Japan's industry, it produces virtually no high-end computer hardware such as mainframes and supercomputers. Production of computer hardware in Korea is focused on peripherals (especially monitors), components, and PCs. Six Korean firms -- Samsung, TriGem Computer, Sejin Computer, LG Electronics (LG), Hyundai Electronics (Hyundai), and Daewoo Telecom (Daewoo) -- accounted for nearly 80 percent of all PC units shipped in 1996.[102] Although not a large presence compared to the top five Korean firms, non-Korean owned companies such as Acer and IBM Korea also are involved in local assembly operations as are thousands of smaller Korean companies.[103]

In comparison to Taiwan and Singapore, Korea's computer hardware industry did not develop as a low-cost base for multinational corporations as these electronics producers left Korea for lower cost locations in the late 1970s.[104] These corporations transferred their electronics production expertise to Korean-owned firms via supply and subcontracting relationships before leaving, but most major domestic conglomerates began computer production when the Korean government heavily promoted the industry as a strategic sector in 1982. Korean firms imported foreign technologies for design and concentrated on efficient mass production techniques much as Japanese firms did during the development of their electronics industry.

The Korean PC industry responded slowly to changes in technology and trailed in computer hardware innovation because Korean facilities were geared toward high volume production and were shielded from competition during most of the 1980s.[105] Thus, Korean manufacturers could not innovate rapidly and could not introduce new products as quickly as the small-to-medium sized enterprises based in Taiwan could. However, firms making color monitors are fairly successful because they have configured their facilities to produce both color televisions and computer displays. Korea was second only to Taiwan in the production of computer monitors with cathode-ray tubes in 1995 and 1996 (figure 2-6).[106]

As the Korean economy developed, rising wages negated any cost advantages. In response, Korean firms began to locate production operations overseas, much like U.S., Taiwan, and Japanese firms. For instance, LG is investing $200 million in the Commonwealth of Independent States to produce computer monitors, color televisions, and such consumer items as refrigerators and VCRs. Daewoo plans similar operations in Mexico and Vietnam.[107] Besides low cost manufacturing operations, these facilities will act as regional centers to increase market presence and brand recognition.

To acquire access to new computing technologies, Korean firms have entered into joint ventures and collaborative relationships with U.S. and Japanese companies or have bought existing producers. For example, Samsung established technical cooperation agreements with HP to develop workstations and with

---

[100] ASM Computer Group Research, "R&D Activity Gives Hopes for More Robust Economy," *Asian Sources Computer Products*, Jan. 1996, pp. 254-258.

[101] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; USDOC, *Computer Industry*, pp. 1-5; and Korea Customs Service, *Monthly Foreign Trade Statistics*.

[102] USDOC, "Korea Projects 3.2 Billion PC Sales in 1996," Dec. 24, 1996.

[103] USDOC, "Korea, Notebook Computers," July 1, 1996.

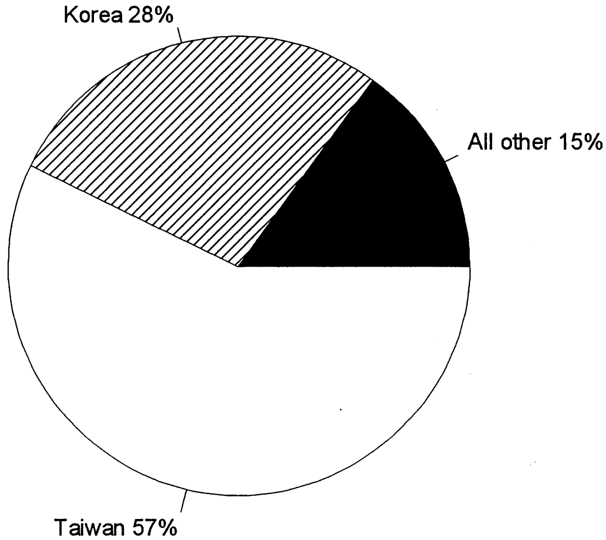
[104] Kraemer and Dedrick, *Competing in Computers*, pp. 90-92.

[105] Kraemer and Dedrick, *Competing in Computers*, p. 91.

[106] MIC/III, *Taiwan's IT Industry*.

[107] "After Windfall Year, Industry Cultivates Global Ambitions," *Journal of the Electronics Industry (JEI)*, Aug. 1995, p. 35 and "Daewoo Woos High-End Buyers, Prepares Global Push," *JEI*, Aug. 1995, p. 46.

Figure 2-6
Computer monitors:[1] Share of world unit production, 1995



[1] Cathode-ray tube monitors.

Source: Market Intelligence Center/Institute for the Information Industry, *Taiwan's IT Industry*, 1996.

IBM to develop desktop PCs. In addition, Samsung has a joint venture agreement with HP to produce and market computers in Korea[108] and it also intends to fully acquire AST. Hyundai owns a major stake in the U.S. disk drive manufacturer Maxtor.[109] Other collaborations include LG and DEC in Pentium notebook computers.[110]

As noted above, the Korean government treated the computer industry as one of several strategic sectors for investment since the 1980s. Recently, the Ministry of Trade, Industry, and Energy (MOTIE) invested between $150 and $200 million in R&D projects for core and advanced technologies.[111] Another example of recent government investment in the industry is the allocation of approximately $10 million to establish a multimedia city, with plans for a comprehensive technology complex that will include software, electronics, and computer manufacturing plants and R&D centers. In total, planned investment by MOTIE and the Ministry of Information and Communication (MOIC) for all IT industries, primarily for R&D, will be roughly $1 billion by the end of the 1990s.[112] However, despite these expenditures, the successful, indigenous development of leading edge technology has not yet materialized.

[108] World Wide Web, retrieved Nov. 5, 1996, Joint Ventures, http://www.samsung.com/about/alliance/corporate.html, Samsung, *Major Strategic Alliances*.

[109] World Wide Web, retrieved Nov. 5, 1996, Overseas Activities, http://www.hei.co.kr/english/intro/overseas.htm, Hyundai, *Production and Independent Subsidiaries*.

[110] USDOC, "Korea, Notebook Computers."

[111] USDOC, "Korean Information Infrastructure," Aug. 9, 1996.

[112] ASM Computer Group Research, "R&D Activity," pp. 254-256.

Other Producers

Malaysia, China, Thailand, and Brazil emerged as second-tier producers of computer hardware because they have lower costs than the producers discussed above and/or they provide access to rapidly developing markets.[113] These countries manufacture labor-intensive or low value-added products and rely on other countries for higher level computer technologies and for expertise in marketing and selling computer hardware. Each of these four countries produced at least $5 billion of computer hardware in 1996.[114] They accounted for almost 10 percent of total global production in 1996, or slightly more than $24 billion. In comparison, their total production in 1992 was slightly more than $10 billion, or about 6 percent of global production. During 1992-96, their combined average annual growth rate was 23 percent.

Exports of computer hardware from these four countries increased from over $5 billion in 1992 to an estimated $17 billion in 1996, at an average annual growth rate of 33 percent.[115] Sub-assemblies and parts accounted for three-quarters of computer hardware exports. The remaining one-quarter was peripherals, computers, and computer systems.[116] The United States, Japan, and Singapore were their main export markets.[117] Unlike the three emerging Asian countries, Brazil is not a major exporter of computer hardware because production is primarily consumed in the domestic market.

All four countries assemble PCs and peripherals for computer companies based in the United States, Japan, Taiwan, Singapore, and Korea. For instance, the U.S. companies Seagate Technologies and Dell have opened plants in Penang, Malaysia.[118] However, Malaysia is experiencing labor shortages which may hamper future investment so it has positioned itself as a centrally located host for high technology companies that want to do business in Asia with its promotion of a multimedia super corridor.[119] IBM, Compaq, Motorola, and AST have targeted China for joint venture manufacturing despite the difficulties of operating in the country.[120] In Brazil, Compaq has developed local manufacturing and assembly operations to service both the domestic market and other Latin American countries, especially since Brazil eased its informatics restrictions and improved intellectual property rights protection.

---

[113] ASM Computer Group Research, "Expansion Prevails Despite Economic Growing Pains," *Asian Sources Computer Products*, Jan. 1996, pp. 154-155 and World Wide Web, retrieved Feb. 7, 1997, IDC Market Research, http://www.idcresearch.com/HNR, International Data Corporation (IDC), "Brazil Largest PC Market in Latin America with 40 Percent of Shipments in Region," *IDC Market Research.*

[114] Estimated by USITC staff based on Elsevier, *Yearbooks of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; and USDOC, *Computer Industry*, pp. 1-5.

[115] Ibid.

[116] Estimated by USITC staff based on ASM Computer Group Research, "Problems Brake China's Progress," *Asian Sources Computer Products*, Jan. 1996, pp. 154-158; ASM Computer Group Research, "Malaysia Enjoys Booming Economy," *Asian Sources Computer Products*, Jan. 1996, pp. 336-338; and ASM Computer Group Research, "Thailand Exports Grew Almost 14 Percent," *Asian Sources Computer Products*, Jan. 1996, p. 350.

[117] World Wide Web, retrieved Jan. 23, 1997, White Paper on International Trade 1996 (Summary), http://www.jetro.go.jp/WHITEPAPER/Trade96/index.html, Japan External Trade Relations Organization (JETRO), *JETRO White Paper on International Trade 1996 (Summary).*

[118] ASM Computer Group Research, "High-Tech Sectors Drive Growth in Rising Economy," *Asian Sources Computer Products*, Jan. 1996, p. 352 and Dell, *10-K Report*, 1996.

[119] ASM Computer Group Research, "High-Tech Sectors," pp. 336-358 and World Wide Web, retrieved Jan. 20, 1997, Gambit in Malaysia, http://www.news.com/SpecialFeature, Tim Clark, "Gambit in Malaysia," *C/Net*, Jan. 20, 1997.

[120] World Wide Web, retrieved Feb. 7, 1996, Computer Firms Willing to Take a Chance on China (2/7), http://www.nytsyn.com/live/News3, Eric Lai, "Computer Firms Willing to Take a Chance on China," *South China Morning Post* and USDOC, *China Market Brief*, Apr. 5, 1996.

U.S. Market Profile

The U.S. market for computer hardware is the largest in the world, valued at an estimated $94 billion in 1996, up from nearly $55 billion in 1992 with an average annual growth rate of 14 percent.[121] U.S. import penetration for computer hardware is high as increased globalization and outsourcing in the industry means that many labor-intensive and low value-added products such as motherboards, monitors, keyboards, and other peripherals are imported from overseas. As a result, the import-to-consumption ratio steadily increased, from 58 percent in 1992 to an estimated 64 percent in 1996, a trend fostered by the low U.S. duties on computer hardware imports. In the absence of an ITA, U.S. tariff rates on imports of nearly all computer hardware are scheduled to be reduced to zero on January 1, 1999 (table 2-5).[122] The highest remaining tariff rate will be 2.4 percent for analog or hybrid computers. As most tariffs will be reduced to zero under Uruguay Round commitments, the agreement will have no effect on market access opportunities for nearly all computer hardware and will have little or no effect on market access for analog or hybrid computers.

As certain elements of a PC are easily and inexpensively sourced from overseas, competition in the U.S. market has been intense with declining prices and the easy entrance of domestic and foreign firms. The price of PCs in the United States has continued to drop with several manufacturers offering complete PC systems for less than $1,000.[123] Although the introduction of low-priced network computers (NCs) by Sun Microsystems and other partners of the Oracle Corporation has influenced this drop in price, the primary motivation for PC firms such as AST and Acer to reduce prices is to target households with incomes of less than $50,000 a year.[124] In addition, firms such as Sony that focus on the consumer market have entered the U.S. market hoping to translate their success in consumer products to desktop PCs. Other Japanese firms that plan to step up efforts in the U.S. computer market include Toshiba and Fujitsu.[125]

Other trends that affect the U.S. computer hardware market include the increasing convergence of computer equipment, communications products, and consumer devices and the growing use of the Internet by both corporations and households. In terms of convergence, products such as multimedia PCs that integrate computers with modems and CD -ROM players for video and audio have already been introduced into the U.S. market. Analysts expect this trend to intensify with greater miniaturization, lower cost, and increased use of computing devices in consumer electronics such as TVs and household appliances.[126] Moreover, both consumers and businesses increasingly use the Internet for applications such as e-mail and for browsing the

---

[121] Estimated by USITC staff based on Elsevier, *Yearbooks of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; and USDOC, *Computer Industry*, pp. 1-5.

[122] This reduction implements concessions made by the United States during the Uruguay Round of trade negotiations completed in late 1993. See appendix G for final Uruguay Round tariffs on specific Harmonized Tariff Schedule categories.

[123] World Wide Web, retrieved Feb. 4, 1997, Tech Search, http://www.techweb.com/search, Doug Olenick and Mark Harrington, "Low-Cost PCs Seen Flooding Stores This Fall," *Computer Retail Week*, Nov. 4, 1996.

[124] World Wide Web, retrieved Feb. 6, 1997, Research Highlights, http://www.dataquest.com/register/stories, Dataquest Interactive, "AST Moves into $1,000 PC Market," May 21, 1996 and World Wide Web, retrieved Feb. 6, 1997, Report Outline, http://www.dataquest.com/register/abstracts, Dataquest Interactive, "Acer Breaks PC Price Barrier with New AcerBasic Family: Includes First 'Network Computer' Models," July 2, 1996.

[125] *Standard & Poor's: Computers*, p. 3.

[126] Computer Science and Telecommunications Board, *Keeping the U.S. Computer and Communications Industry Competitive*, pp. 18-19.

Table 2-5
Final Uruguay Round tariffs on computer hardware for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	6-7.5
Canada	0
Costa Rica	([2])
Estonia	0
European Communities (15)	0-2.5
Hong Kong	0
Iceland	0
India	40
Indonesia	40
Israel	([2])
Japan	0
Korea	0-20
Macau	([2])
Malaysia	0
New Zealand	0
Norway	0-2
Romania	0-35
Singapore	0-10
Switzerland	0.2-0.7
Taiwan[3]	5-7.5
Thailand	20
Turkey	6-8
United States	0-2.4

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1995 unbound rates.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994, and U.S. Department of Commerce working documents.

interactive portion of the Internet known as the World Wide Web. Most analysts believe that the Internet has increased usage of PCs among both of these types of users.[127]

The rapid adoption of PC client/server networks made the PC segment the dominant market for computer hardware which reduced purchases of mainframe and minicomputers. However, the decline in mainframe demand appears to be reversing as shipments have increased recently. For instance, IBM reported that it shipped 60 percent more mainframes in 1995 than in 1994, and 40 percent more in 1994 than in 1993.[128] Ironically, mainframe demand appears to stem from the popularity of PC client/server networks for which mainframes are increasingly used to support such intensive applications as transaction processing and data warehousing that are accessed by hundreds, even thousands, of PC users on a network.

The United States imported an estimated $60 billion of computer hardware in 1996. Since 1992, when imports were slightly less than $32 billion, the average annual growth rate has been 18 percent. The composition of imports has changed slightly since 1992. Importation of computers and computer systems decreased from 16 percent of all computer hardware in 1992 to 10 percent in 1996. Similarly, the share of imports of peripherals fell slightly from 55 percent in 1992 to 52 percent in 1996. However, the share of imported computer parts increased from 30 percent in 1992 to 39 percent in 1996. The increasing import share of parts, which includes sub-assemblies, means that more U.S. firms conduct final assembly of computer hardware in the United States while partial assembly of computer hardware is done overseas. In addition, the greatest concentration of imports is in peripherals which, as mentioned, are labor-intensive and low value-added products suited for overseas manufacturing.

Japan, Singapore, Taiwan, and Korea contributed an estimated 64 percent of all U.S. computer hardware imports in 1996. Korea exports more sub-assemblies and parts to the United States than finished products while Taiwan exports about one-half of its products as finished products and the remainder as sub-assemblies and parts. Japan and Singapore export more finished products to the United States than parts or sub-assemblies.

In terms of average annual growth rates during 1992-96, U.S. imports from China and Malaysia increased more rapidly than those from other countries. In 1996, Malaysia was the fifth largest supplier of imports to the U.S. market and China was the eighth largest. Imports from China grew at an average annual rate of 66 percent while imports from Malaysia grew at a lower but still significant rate of 43 percent. Because of the relatively low costs of doing business, many U.S. firms have established production operations in these two countries.[129]

Foreign Market Profiles

As competitive pressures increased the trend toward greater globalization and outsourcing, differences in computer markets have narrowed. Purchasers are buying increasingly powerful computers at lower prices and are being offered equipment that incorporates communications and multimedia functions. In addition, the popularity of PC-based client/server networks has spread from the United States and these networks are increasingly being adopted in large markets such as the EU and Japan. Most importantly,

---

[127] World Wide Web, retrieved Feb. 4, 1997, Executive Insights, http://www.idcresearch.com/HNR/execin.htm, Frank Gens, "State of the 'Wired' Home: IDC/LINK's 1996 Home Media Consumer Survey," *IDC Executive Insights*, Dec. 1996 and *Standard & Poor's: Computers*, pp. 3-4.

[128] Angie Pantages, "Big Iron is Back," *Datamation,* June 15, 1996, p. 66.

[129] ASM Computer Group Research, "Malaysia," pp. 338-352.

competitive U.S.-owned firms typically lead the world in entering and establishing a presence in foreign countries, attracted by a large population of potential users or high economic growth rates.

European Union

The EU represented the second largest market in the world for computer hardware in 1996 after the United States. The United Kingdom, Germany, France, and Italy accounted for approximately 70 percent of the EU market for computer hardware.[130] Although the EU market was valued at an estimated $67 billion in 1996, it grew at a very low average annual rate of less than 1 percent since 1992, when the market was $66 billion. As in the United States, the import-to-consumption ratio has increased slightly, from 54 percent in 1992 to 58 percent in 1996, due to the importation of low value-added parts and peripherals from overseas. Imports are likely to continue to increase as duties decline. Under Uruguay Round commitments, EU tariff rates on imports of computer peripherals will be reduced to zero on January 1, 1999. The highest remaining tariff will be 2.5 percent on computers not used in civil aviation while certain parts will be dutiable at 2 percent.[131] As tariffs on computer peripherals will be reduced to zero in the absence of an ITA, the agreement will have no effect on market access for such computer hardware. The agreement will have only a slight effect on computers not used in civil aviation and such parts as printed circuit assemblies. In addition, EU classification of computer hardware as consumer electronics or telecommunications equipment has been a problem for market access. For instance, computers capable of receiving television signals have been classified as television receivers, which are not included in the ITA. Another example is the EU's classification of LAN adapter cards as telecommunications equipment which is assessed a higher duty than computer hardware.[132] However, over time, the ITA should have a greater effect on EU market access as the EU becomes larger. As countries join the EU, they adopt the common EU tariff and abide by trade agreements entered into by the EU. With EU enlargement, trade regimes in Europe will be simplified and it is likely that trade restrictions and tariffs currently imposed by countries awaiting EU admission will be lessened.

The EU emulated trends that occurred in the United States, albeit at a slower rate. As in the United States, global firms introduced intense price competition and spread the adoption of client/server networks as replacements for larger computer systems. For instance, Dell has successfully gained market share in the EU PC segment with a low-priced direct sales approach.[133] In fact, as mentioned above, the other leading PC companies are all based in the United States and are focused on gaining market share by pricing competitively.[134] As prices for PCs and PC servers declined and users adopted client/server networks, the market for large mainframes dropped sharply.[135]

---

[130] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; USDOC, *Computer Industry*, pp. 1-5; and Eurobit, "Computer and Office Equipment."

[131] *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994. The Marrakesh Protocol is part of the General Agreement on Tariffs and Trade 1994 (GATT 1994), which is a multilateral agreement that is an annex to the Agreement Establishing the World Trade Organization.

[132] World Wide Web, retrieved Apr. 2, 1997, United States Trade Representative (USTR), http://www.ustr.gov/reports, USTR, *1997 National Trade Estimate*.

[133] Silvia Ascarelli, "Dell Finds U.S. Strategy Works in Europe," *Wall Street Journal*, Feb. 3, 1997, p. A8.

[134] "Hewlett-Packard to Let Europeans Assemble PCs," *Bloomberg Business News* as published in the *San Jose Mercury News*, Feb. 18, 1997.

[135] Eurobit, "Computer and Office Equipment."

In addition, the declining prices of PCs will probably lead to increased purchases by consumers and small office/home office (SOHO) users.[136] Because PC penetration in these two market segments is at a relatively low level as compared to the United States, firms see an opportunity to take advantage of this growing demand, particularly for such PCs as multimedia computers which are geared for the home. Furthermore, the increased use of the Internet in Europe is expected to attract new users.[137]

Total imports of computer hardware increased only slightly, at an average annual growth rate of 2 percent, from $36 billion in 1992 to an estimated $39 billion in 1996.[138] The United States supplies the EU with the highest proportion of imports of computer hardware. EU imports of computer hardware from the United States were approximately $14 billion, or more than one-third of all such imports in 1996.[139] Japan was the second largest source of imports of computer hardware.[140]

Japan

Japan is the third largest world market for computer hardware, behind the United States and the EU. In 1996, the market was an estimated $52 billion, a notable increase from $39 billion in 1992.[141] Although the 8 percent average annual growth rate of Japan's market during 1992-96 was not as high as the U.S. growth rate of 14 percent, it is growing at a rate considerably higher than the EU's. Unlike the U.S. and EU markets, the import penetration level of computer hardware is low -- an estimated 18 percent in 1996, compared with 64 percent in the United States and 58 percent in the EU. However, this import share of the computer hardware market was double the 9 percent recorded in 1992. In addition, under Uruguay Round commitments all import duties on computer hardware are scheduled to be reduced to zero on January 1, 1999.[142] As such, the ITA will have no effect on market access opportunities. However, the United States is carefully monitoring the Japanese market for discriminatory practices in government procurement of all types of computers.[143]

The Japanese market, like the EU, is slowly following the trends in the U.S. market. Since 1992, for instance, U.S. companies have introduced price competition in Japan, increasing their share of PC sales and increasing the pace of switching to smaller computers. In addition, U.S. firms had a notable share of the PC, workstation, and mainframe markets (figure 2-4). The use of PCs in Japan has also increased with 17 percent of households owning a PC in 1996 compared to 12 percent in 1992.[144]

---

[136] Ibid.

[137] Bruno Lamborghini, "Information and Communications Technology in Europe: The Industry's View," *European Information Technology Observatory (EITO) 96* (Frankfurt: EITO, 1996), pp. 38 and 45.

[138] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; USDOC, *Computer Industry*, pp. 1-5; and Eurobit, "Computer and Office Equipment."

[139] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996, United Nations Trade Series D; official statistics of the USDOC; USDOC, *Computer Industry*, pp. 1-5; and Eurobit, "Computer and Office Equipment."

[140] *Japan Electronics Almanac '95/'96,* pp. 35-36.

[141] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; and USDOC, *Computer Industry*, pp. 1-5.

[142] *Most-Favoured-Nation Tariff Schedules.*

[143] USTR, *1997 National Trade Estimate.*

[144] EIAJ, *Facts and Figures on the Japanese Electronics Industry*, p. 87.

As in other markets, sales of PCs should grow in the next few years as the shift to client/server networks continues, use of the Internet increases, and communications/multimedia functions are incorporated into PCs.[145] Analysts expect the PC market to continue to grow at double digit rates while the mainframe segment will increase only slightly.[146] Competition in the area of multimedia PCs also should become even more intense as Japanese companies are strong in multimedia hardware such as CD-ROM drives and digital video disk players and are expert at selling products aimed at the consumer.[147]

Total Japanese imports of computer hardware increased at an average annual growth rate of 29 percent during 1992-96, from more than $3 billion to nearly $10 billion. Imports from the United States accounted for 55 percent of such imports into Japan in 1996.[148] Imports from Asian countries accounted for much of the remainder.

Other Markets

After the three major markets, the countries of Brazil, Canada, and China are the next leading markets for computer hardware. The computer hardware markets in these three countries combined was estimated at $19 billion in 1996.[149] Since 1992, when these three countries together represented a market of nearly $12 billion, the market has increased at an average annual growth rate of 12 percent.

The size of the computer hardware market in Brazil increased slightly from $5 billion in 1992 to an estimated $7 billion in 1996. This represented an average annual growth rate of 9 percent. Brazil is the largest computer hardware market in Latin America, and the fourth largest in the world. In Latin America, Brazil accounted for roughly a 40 percent share of all PCs sold in the region in 1996, with continued robust growth in the sector expected.[150] Brazil officially opened its computer hardware market to imports in October 1993 by implementing a new informatics law, and, as a result, imports have increased steadily. The import penetration rate has increased from 12 percent in 1992 to 22 percent in 1996.[151] In 1996, Brazil imported over $1 billion worth of computer hardware compared with less than $600 million in 1992, representing an average annual growth rate of 28 percent. The United States accounted for 86 percent of computer hardware imports in 1996. Duty rates on most computer hardware imports will remain relatively high at 35 percent while certain finished products and certain parts will be dutiable at lower rates of 20 percent and 15 percent as of January 1, 1999.[152] As Brazil is not a signatory to the ITA, the agreement will not affect market access opportunities for computer hardware.

---

[145] World Wide Web, retrieved Jan. 30, 1997, Announcement of Estimated Shipment, http://www.jeida.org.jp/yosuku/h9yosoku-e.html, Japan Electronics Industry Development Association, "Announcement of Estimated Shipment of Computers, Terminals, and Peripheral Equipment for FY 1997," Nov. 21, 1996 and World Wide Web, retrieved Jan. 30, 1997, Yahoo!- Dataquest sees Japan 1997 PC shipments up 27 pct, http://biz.yahoo.com/bin/jump?/finance/97/01/30, "Dataquest Sees Japan 1997 PC Shipments Up 27 Percent," *Reuters*, Jan. 30, 1997.

[146] Ibid.

[147] Dedrick and Kraemer, "Japan's PC Industry," pp. 67-76.

[148] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; and USDOC, *Computer Industry*, pp. 1-5.

[149] Ibid.

[150] World Wide Web, retrieved Feb. 25, 1997, IDC Market Research, http://www.idcresearch.com/HNR/latampcye.htm, IDC, "Compaq is Leading PC Vendor in Latin America for Second Straight Year," *IDC Market Research*.

[151] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994; United Nations Trade Series D; official statistics of the USDOC; and USDOC, *Computer Industry*, pp. 1-5.

[152] *Most-Favoured-Nation Tariff Schedules*.

In comparison to Brazil, the developed market of Canada had an average annual growth rate of 7 percent during 1992-96, moving from a market of $5 billion to more than $6 billion. Canada's market for computer hardware is closely related to that of the United States due to its proximity and U.S. company dominance. Market trends in Canada such as intense price competition, downsizing toward PCs, convergence, and Internet usage are nearly identical to the U.S. market.[153] However, Canada has a faster Internet adoption rate among consumers than in the United States. In addition, Canada imported approximately $8 billion worth of computer hardware in 1996.[154] Since 1992, when computer imports equaled $5 billion, the import growth rate has averaged about 11 percent per year. The value of imports exceeded market size because trade data includes re-exports or transshipments of goods. The United States accounted for over one-half of all imports into Canada. As all tariffs will be reduced to zero on January 1, 1999 under Uruguay Round commitments, the agreement will have no effect on market access opportunities.[155]

The market for computer hardware in China increased rapidly, at an average annual growth rate of nearly 27 percent during 1992-1996, from $2 billion to an estimated $5 billion. China is a fast growing market for computers due to its extremely low PC penetration rate of 1 PC per 245 people, healthy economic growth, and substantial investment in the country by computer companies throughout the world. The market for PCs, for example, increased by 39 percent during 1996.[156] Analysts expect the market for PCs to continue growing at a high rate in 1997. Chinese imports of computer hardware are estimated at more than $2 billion in 1996, with much of this value tied to the importation of components and parts for the assembly of computer hardware. For instance, many of the essential components used in the production of PCs, computer printers, mice, and monitors are imported from overseas, assembled into final or nearly finished products, and either absorbed domestically or exported.[157] During 1992-96, imports increased at an average annual growth rate of 24 percent from $970 million. China is not yet a member of the World Trade Organization and currently has unbound rates of duty, which means that these rates may change at any time. China's base tariff rates for computer hardware in 1992 ranged from a low of 9 percent to a high of 50 percent. As China is not a signatory to the ITA, the agreement will have no effect on market access opportunities.

---

[153] Industry representative, telephone interview by USITC staff, Feb. 28, 1997.

[154] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996; United Nations Trade Series D; official statistics of the USDOC; and USDOC, *Computer Industry*, pp. 1-5.

[155] *Most-Favoured-Nation Tariff Schedules*.

[156] World Wide Web, retrieved Feb. 28, 1997, IDC Market Research, http://www.idcresearch.com/HNR/idcapnr.htm, IDC, "Asia/Pacific PC Market Posts 32.1% Growth in 1996, Expanding to 16.98 Million Units," *IDC Market Research*.

[157] ASM Computer Group Research, "Expansion Prevails," pp. 154-168.

CHAPTER 3
Software
Danielle Kriz

The recorded media industry comprises audio, video, and data recorded on media including magnetic tape, magnetic disks, and optical disks. Of this industry, the Information Technology Agreement (ITA) includes recorded media that are used for "reproducing representations of instructions, data, sound, and image, recorded in a machine-readable binary form, and capable of being manipulated or providing interactivity to a user, by means of an automatic data processing machine."[1] This definition is designed to refer to computer software distributed on magnetic tape, magnetic disk, or optical disk, such as CD-ROM; it also includes software distributed electronically. The wording was chosen to cover future software technologies while excluding software intended for consumer electronics or for operating machinery.[2] Magnetic tape, magnetic disks, and optical disks "for reproducing phenomena other than sound or image"[3] also are included; such media might contain computer instructions in code. The ITA excludes all recorded media that are intended primarily for audio or video delivery, such as music recordings and movies, and that do not provide interactivity.[4] The ITA also excludes software pre-installed on a computer; such software is called firmware and is not classified separately for customs purposes.[5] Due to its wording, the ITA excludes cartridge-based interactive games and CD-based interactive software that is played on a video game console[6] rather than a computer. For a complete list of products included in the agreement, see appendix A.

The software covered by the ITA is commercially available packaged programs for sale or lease by systems vendors or independent software vendors (ISVs) and consists of two general categories, systems software and applications software. Systems software includes operating systems software, which runs the computer's hardware; utilities, which enhance a computer's capabilities; database management software; software development tools; and programming languages. Applications software performs specific functions such as word processing, graphic design, and financial analysis.[7] Recently, a new genre of applications software called interactive software, also known as entertainment, edutainment, or multimedia software, has emerged. Multimedia software combines video, animation, graphics, music, and text into a single system, and ranges from interactive encyclopedias such as Microsoft's Encarta to fast-paced sports games.[8]

Production numbers for the software industry are difficult to evaluate due to the nature of the industry. Software is not a traditional commodity industry. Software production, or the development of the intellectual property, is distinct from the replication or licensing of the software for sale. The value of software products lies almost completely in development, and revenues can be gained from a product even if a software firm does not replicate its own software. Thus, the industry is usually measured in terms of software producers' revenues. Measured this way, the largest producer of computer software covered by the ITA is the United States, which produced software valued at between $50 billion and $60 billion in 1996.

---

[1] *Ministerial Declaration on Trade in Information Technology Products*, Singapore, Dec. 13, 1996.
[2] National Import Specialist, U.S. Customs Service, telephone interview by USITC staff, Feb. 1997.
[3] *Ministerial Declaration on Trade in Information Technology Products*, Singapore, Dec. 13, 1996.
[4] The coverage of this sector of the ITA is based on USITC staff conversations with USTR ITA negotiator, Feb. 5, 1997.
[5] National Import Specialist, U.S. Customs Service, telephone interview by USITC staff, Feb. 1997.
[6] A video game machine that is connected to a television set.
[7] Peter Wood, CFA, *Standard & Poor's Industry Surveys: Computers: Software*, Oct. 10, 1996, p. 11.
[8] U.S. Department of Commerce (USDOC), "Computer Software and Networking," ch. 27 in *U.S. Industrial Outlook 1994* (Washington, DC: GPO, 1994), p. 27-3.

The European Union (EU) and Japan are distant followers; the EU's software production was valued at between $20 and $30 billion in 1996, and Japan's at approximately $10 billion.[9]

U.S. Industry Profile

The U.S. software industry is the largest in the world, and is one of the fastest growing high-technology sectors in the U.S. economy. In 1996, U.S. packaged software production was estimated to be between $50 billion and $60 billion.[10] U.S.-headquartered firms currently produce well over 90 percent of computer software consumed in the United States (table 3-1).[11] Virtually all of the remainder of U.S. production is performed by a few large German-based firms that produce applications software in the U.S. market.[12]

The U.S. software industry includes a number of large companies, but the vast majority of companies are small entrepreneurial firms employing less than 100 people and producing fewer than 5 revenue-generating products.[13] More than 7,000 establishments are reported to produce software in the United States.[14] However, this estimate must be treated with caution, as many small firms enter and exit the industry very quickly, and many software producers are individuals working out of their own homes.

ISVs such as Microsoft produce only software, while other firms such as IBM and Apple Computer produce software in addition to computer hardware. Large firms such as IBM, Novell, and Microsoft dominate the systems and applications software markets, and compete among themselves for market share. These firms are well established with entrenched distribution channels, sales, and marketing organizations, financial stability, and installed user bases. The small- and medium-sized firms have difficulty competing with the larger firms and instead do well in new and different niches such as software for homes and small businesses, including entertainment/edutainment and personal information and financial management software.[15] Smaller firms also have difficulty competing with large companies for shelf space in retail stores.[16] However, the growing use of on-line delivery systems has the potential to help smaller firms reach more customers.

Software is not traded internationally in the traditional sense. To sell software abroad, companies send master disks, or, increasingly, send software codes electronically,[17] to foreign markets for localization, replication, and distribution. Firms can also license their software for use by foreign firms. Because copies of software can be manufactured in high volumes at minimal cost and with no loss of quality, firms prefer to manufacture software in the region or country in which it is sold in order to save shipping and distribution costs, as well as time. In addition, software produced in the United States often is intended solely for the U.S. market, while software intended for foreign markets is produced in the region of sale so that it can be localized in terms of languages or cultures.[18]

---

[9] Estimated by USITC staff based on telephone interviews by USITC staff, Jan.-Feb. 1997.
[10] Ibid.
[11] Software Publishers Association (SPA), fax to USITC staff, Feb. 2, 1997.
[12] Ibid.
[13] USITC, *Global Competitiveness of the U.S. Computer Software and Services Industries,* USITC Staff Research Study 21, June 1995, p. 2-8 and Price Waterhouse LLP, *1996/97 Software Business Practices Survey*, p. 25.
[14] U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Wages Annual Averages, 1996.*
[15] Wood, *Computers: Software*, p. 16.
[16] "Software Reproduction Helps Smaller Publishers," *Software Developer and Publisher*, July/Aug. 1996, p. 38.
[17] Industry representative, telephone interview by USITC staff, Jan. 31, 1997.
[18] Industry representative, interview by USITC staff, COMDEX computer convention, Las Vegas, NV, Nov. 18, 1996.

Table 3-1
Selected major U.S. software producers, by category, 1996

Systems Software	Applications Software	
	Business	Entertainment/Edutainment
Computer Associates International	Lotus (IBM)	Broderbund
Digital Equipment Corporation	Microsoft	Electronic Arts
IBM	Novell	Lucas Arts
Microsoft	Oracle	Maxis
Sun Microsystems	Sybase	Microsoft

Source: Compiled by the staff of the USITC.

Because of these international distribution patterns, official statistics on software exports are not reliable. However, other figures indicate that U.S. firms sell much of their software abroad. For example, in 1996 the largest U.S. firms received nearly 50 percent of their personal computer (PC) applications software revenues from overseas sales.[19] Many of the larger firms such as Microsoft and Oracle have wholly owned subsidiaries that localize, advertise, and manage distribution networks in foreign markets.[20] However, an increasing number of small U.S. firms are using the rapidly globalizing Internet as a low-cost avenue to market and distribute software internationally.[21] This trend is expected to give even the smallest U.S. firms, which lack distribution networks, foreign sales offices, and large advertising budgets, access to customers around the world.[22]

Employment in the U.S. packaged software industry in 1996 was estimated at approximately 200,000 workers, showing an average annual increase of 11 percent since 1992, when employment was 131,000.[23] However, official employment figures probably understate actual employment. Many of the smaller firms that enter and exit the industry quickly may not be counted in official figures. Individuals writing software out of their own homes on a contract basis may also not be counted. Employment in the software industry is projected to continue to grow. However, the software industry requires highly skilled software engineers to develop and maintain software code, and a lack of skilled software engineers is becoming a problem for the U.S. industry. This skilled labor shortage reportedly could encourage U.S. firms to rely increasingly on overseas programmers.[24]

---

[19] SPA, fax to USITC staff, Feb. 2, 1997

[20] Industry representative, interview by USITC staff, COMDEX computer convention, Las Vegas, NV, Nov. 18, 1996, and industry representative, telephone interview by USITC staff, Feb. 6, 1997.

[21] Industry representative, interview by USITC staff, COMDEX computer convention, Las Vegas, NV, Nov. 19, 1996, and e-mail correspondence, Feb. 21, 1997.

[22] *The Value Line Investment Survey* (New York: Value Line Publishing, Dec. 6, 1996), p. 2205.

[23] U.S. Department of Labor, Bureau of Labor Statistics, *Current Employment Statistics*. The employment numbers for the packaged software industry include both production and supervisory employees. 1996 figures are estimates.

[24] Industry representative, telephone interview by USITC staff, Feb. 12, 1997.

First-mover advantages[25] have played a key role in U.S. producers' dominance of the U.S. software industry. Computer software was first commercially developed in the United States by computer hardware manufacturers to run their machines. Some of these firms, notably IBM, still maintain a strong market presence. In the beginning, all software was developed for proprietary systems. Later, the U.S. computer industry led the world in moving to non-proprietary systems, which lowered software development costs and brought new software producers into the market. Importantly, U.S. firms set the standards for these new systems, and other countries, which lagged the United States in computer development, adopted these standards, providing additional customers for U.S. software developers. The United States was the leader in adopting personal computers, or PCs, which increased computer penetration throughout the country and created a growing demand for software products, which thousands of new companies emerged to meet.[26]

The birth of the software industry in the United States resulted in English-language programming code becoming the industry standard, giving U.S. software companies, which have access to a large English-speaking workforce, an advantage over most foreign competition.[27] Other advantages of U.S. firms include a network of U.S. universities, colleges, and technical institutions offering courses and degrees in computer science, which provides U.S. students substantially more opportunities to obtain education in computer programming and engineering than students in other countries.[28] A number of strong advanced software engineering programs at universities throughout the country, such as Carnegie Mellon, MIT, and Stanford, also serve to keep the United States at the leading edge of software technology and innovation.

U.S. firms have retained their hold on the domestic market for various reasons. Microsoft, which holds about 80 percent of the U.S. PC operating systems market[29] and produces a wide range of business applications, has strong competitive advantages. Microsoft's dominant position provides it the ability to determine the direction of future operating systems, and to leverage its strength in certain product areas to achieve leadership in new markets.[30] In general, U.S. software firms have competitive advantages based on their product quality and reliability and after-sales support.[31] Firms also benefit from involvement in alliances, entering into cooperative efforts with each other to set industry standards and increase interoperability among products, reducing uncertainty about new product lines, as well as to share costs and risks and speed up development times.[32]

U.S. software firms retain first-mover advantages as they dominate the leading edge of the latest software trends, which usually begin in the United States and then are adopted in other countries. The United States was the first country to begin using the Internet on a large scale, and many U.S. companies are developing software for the Internet.[33] The U.S. firms Netscape and Microsoft together hold nearly 100 percent of the U.S. World Wide Web browser market,[34] and IBM/Lotus, Netscape, and Microsoft together hold more than one-half of the global e-mail software market.[35] The Java programming language, developed by the U.S. firm Sun Microsystems, has become the industry standard for Internet software

[25] First-mover advantages are those advantages realized by a firm that enters a market before its competitors. Examples are name recognition and standards-setting abilities.

[26] USITC, *Global Competitiveness*, p. 2-1.

[27] Ibid., p. 4-24.

[28] Ibid., p. 3-23.

[29] "IBM Launches Latest Version of OS/2 Warp," *Reuters NewMedia*, Sept. 19, 1996.

[30] Novell, *10-K Report*, Oct. 28, 1995.

[31] Sun Microsystems, *10-K Report,* June 30, 1995.

[32] USITC, *Global Competitiveness,* pp. 4-8 to 4-11.

[33] Wood, *Computers: Software*, p. 5.

[34] "Cyberspace Showdown," *Business Week*, Oct. 7, 1996, pp. 34-36.

[35] "Industry Research Confirms IBM/Lotus Lead Worldwide E-mail Market," press release, Lotus Development Corporation, Feb. 11, 1997.

development.[36] Finally, U.S. businesses have been moving toward using networked client/server PC systems,[37] and U.S. firms such as Computer Associates, Oracle, and Sun Microsystems are rapidly moving to produce client/server application software.[38]

The number of U.S. publishers of multimedia software is expanding rapidly each year, as the growing use of PCs in homes and schools is driving demand for such software.[39] Most of these new firms are small entrepreneurial companies, although large firms such as Microsoft also have begun producing a broad range of consumer software products such as CD-ROM multimedia reference titles, children's games, and other entertainment.[40] In addition, large U.S. entertainment firms such as Time Warner and Disney have entered into alliances with software firms, which complement these firms' programming skills and technical knowledge with the storytelling and character development skills of entertainment industry personnel.[41]

The software industry relies almost completely on intellectual property inputs. Physical inputs, mostly media such as floppy disks and CDs, are comparatively inexpensive, and are usually outsourced to software replicators who press copies of software from master disks. In a packaged software product, the cost of the physical medium is less than 1 percent of the final publishers' price.[42] By contrast, research and development (R&D) expenditures in the software industry are relatively high. A survey of large U.S. firms shows R&D reported at approximately 16 percent of sales,[43] more than four times the average for U.S. manufacturing industries.[44] R&D is critical to staying competitive, as product life cycles in the industry are short, estimated at approximately 3 years;[45] for interactive entertainment products, the typical life spans are only 3 to 12 months.[46] Continual technological advancements in data storage, data transfer speed from disk to computer, and graphics and sound capabilities push software companies to constantly innovate and upgrade their products in an attempt to beat their competitors to market. For example, Microsoft has its own research division of 170 scientists, and spent $700 million, or 10 percent of its revenues, on research in 1996. Microsoft plans to increase R&D spending to $2.1 billion in 1997.[47]

As software's value is based on its intellectual property rather than on the media on which it is published, the single most important factor affecting software development is protection of intellectual property rights, or IPR.[48] Without IPR protection, R&D resources and incentives to innovate would likely be reduced dramatically.[49] The United States has the strongest enforceable legal protection for software in the world.[50] U.S. firms can rely on copyright protection, embodied in the 1980 Computer Software Copyright Act, and, to a lesser degree, patent protection to safeguard their intellectual property. The software piracy rate in the United States in 1995 was 26 percent, the lowest in the world. However, domestic piracy is still an

---

[36] "IBM Launches Latest Version of OS/2 Warp," *Reuters NewMedia.*
[37] USITC, *Global Competitiveness*, p. 2-11. For more information on client/server networks, see chapter 2 of this report.
[38] Wood, *Computers: Software*, p. 1.
[39] Graphics Zone, *10-K Report*, June 30, 1996, and Peter Wood, CFA, "Computers Software," p. 5.
[40] Microsoft, *1996 Annual Report.*
[41] 7th Level, Inc., *10-K Report*, Dec. 31, 1994 and Graphics Zone, *10-K Report*, June 30, 1996.
[42] SPA, fax to USITC staff, Feb. 2, 1997.
[43] *The Value Line Investment Survey*, pp. 2105-2229.
[44] National Science Board, *Science & Engineering Indicators, 1995* (Washington, DC: GPO, 1996).
[45] "IT Outlook: Be Quick or Be Dead," *Software Magazine*, Mar. 1997, p. 96.
[46] Electronic Arts, *1996 Annual Report.*
[47] David Diamond, "The Brain Gain," *PCWeek*, http://www.PCWeek.com, Feb. 3, 1997.
[48] USITC, *Global Competitiveness*, p. 3-1.
[49] Anthony Lawrence Clapes, *Softwars: The Legal Battles for Control of the Global Software Industry* (Connecticut: Quorum Books, 1993), pp. 54-70.
[50] USITC, *Global Competitiveness*, p. 3-4.

expensive problem for U.S. firms, as losses from piracy in the United States in 1995 were estimated at $2.9 billion.[51]

Software program development is expensive; the average cost of developing a small software project is $500,000 and a large project over $2 million.[52] However, prices for software in the United States have fallen in recent years. The installed PC base in the U.S. market has grown continuously, particularly in the home computer market, boosting the demand for applications software, which has brought new suppliers and products into the market and driven prices down. Further, the growth in the number of compatible products has increased price competition, as consumers need not be loyal to any particular software supplier. Additionally, falling hardware prices have led consumers to expect similar declines in software prices, which has forced firms to reduce prices to increase their unit sales.[53] Thus, pricing has become a decisive factor in shaping software industry competition.[54]

U.S. firms have reacted to price pressures by streamlining their operations and reducing costs. Microsoft, Borland, and IBM all use object-oriented programming, in which programmers reuse groupings of base code to build new software programs, saving time and money.[55] CASE[56] tools automate parts of software development, such as code generation, while groupware applications support collaborative software engineering.[57] Mass-market software producers, such as Microsoft, because of their installed user base, can save money by beta-testing, or releasing projects in the final stages of completion free to users and asking them to discover and report defects.[58]

Intense price competition does not necessarily preclude smaller firms from competing in the industry. The smaller firms can enter the industry relatively easily due to low start up and overhead costs; often, all that is needed is a computer. Many small firms have kept costs low by operating out of home offices.[59] Further, small U.S. software firms benefit from the U.S. venture capital market, which has traditionally generated greater levels of venture capital funding than other countries, and which is particularly important for companies lacking start-up funds or collateral.[60] Additionally, the use of alternative distribution channels, such as mass merchandisers and on-line delivery, allows small firms to save costs.

As another cost-cutting measure, U.S. companies increasingly have been outsourcing their code programming to highly talented, lower cost programmers in countries such as India, Israel, the Philippines, Pakistan, China, and Russia.[61] These programmers had traditionally been flown to the United States for short periods of time to work on specific projects; however, due to tightening U.S. visa restrictions, the increased efficiency of the Internet, and firms' desire to save on travel costs, foreign programmers are increasingly

---

[51] This figure is only for piracy of business applications. Business Software Alliance (BSA) and Software Publishers Association (SPA), "More Than $13 Billion Lost Worldwide to Software Piracy Joint BSA/SPA Survey Reveals," press release, Dec. 18, 1996.

[52] "Software Survival," *Software Developer and Publisher*, July/Aug. 1996, pp. 24-25.

[53] USITC, *Global Competitiveness*, pp. 2-11 to 2-13.

[54] Ibid.

[55] "Object Oriented Programming: Reaching a Far Wider Audience," *Financial Times*, Apr. 23, 1991, p. 1 and "Sun and Next Operating from the Same Side," *Electronics Weekly*, Dec. 1, 1993, p. 2.

[56] Computer-Aided Software Engineering.

[57] C.V. Ramamoorthy and Wei-tek Tsai, "Advances in Software Engineering," *Computer: Innovative Technology for Professionals*, Oct. 1996, p. 50.

[58] Windows 95 was tested in this way by 200,000 volunteers. "Software's Chronic Crisis," *Scientific American*, Sept. 1994, pp. 86-95.

[59] USITC, *Global Competitiveness*, p. 2-8.

[60] Ibid., p. viii and p. 3-19.

[61] Ibid., p. 3-10 and Software Publishers Association.

working from their home countries, sending and receiving software code over the Internet.[62] For example, Novell has a large development center in Bangalore, India, where most of its maintenance engineering on established products is done.[63] IBM and Digital Equipment Corporation also have software programming subsidiaries in India.[64]

Foreign Industry Profiles

European Union

The EU is the second largest producer of software in the world. In 1996, EU production of software was estimated to be between $20 billion and $30 billion.[65] However, much of the EU-based software industry is dominated by local subsidiaries of U.S. firms, which produce over 60 percent of the EU's packaged software, including close to 90 percent of the PC applications software sold in the EU.[66] Large U.S.-headquartered firms producing in the EU include Microsoft, Lotus, Oracle, Novell, Borland, and Computer Associates. A few large EU software firms, based in the United Kingdom, France, and Germany, are major producers in the EU; the most successful are Germany's SAP and Software AG, producers of client/server application software.[67] As in the United States, the bulk of the EU software industry comprises thousands of small ISVs employing fewer than 20 people.[68] These smaller firms specialize in niche markets and sell most of their products locally.[69]

The EU does not sell much of its software abroad. Many software programs developed in the EU are custom programs developed for specific industry segments, particularly for banks and major retail systems. In addition, much software is being developed to facilitate the introduction of the single European currency.[70] Further, software developed for local consumption often is in a language other than English, which hinders its ability to compete in other countries.[71]

U.S.-based firms have been able to dominate production in the EU through the creation of software production facilities in the major EU countries, well-developed distribution channels, widespread advertising, and a reputation for high quality.[72] Importantly, U.S.-based firms have made efforts to localize software for

---

[62] USDOC, "Computer Software" in *U.S. Global Trade Outlook 1995-2000: Toward the 21st Century* (Washington, DC: USDOC, 1995), p. 133; industry representative, telephone interview by USITC staff, Nov. 5, 1996; and foreign industry representative, interview by USITC staff, COMDEX computer convention, Las Vegas, NV, Nov. 19, 1996.

[63] Novell representative, interview by USITC staff, COMDEX computer convention, Las Vegas, NV, Nov. 16, 1996.

[64] USITC, *Global Competitiveness*, p. 4-24.

[65] Estimated by USITC staff based on telephone interviews by USITC staff, Jan.-Feb. 1997.

[66] USITC, *Industry and Trade Summary: Computer Software and other Recorded Media*, USITC publication 2850, Jan. 1995, p. 9; USDOC, "Computer Software," p. 135; and Software Publishers Association.

[67] USITC, *Industry and Trade Summary: Computer Software*, p. 9.

[68] Industry representative, speech at COMDEX computer convention, Las Vegas, NV, Nov. 15, 1996, and Eurostat, *Panorama of EU Industry '95/'96* (Luxembourg: Office for Official Publications of the European Communities, 1995), p. 25-4.

[69] Foreign industry representative, telephone interview by USITC staff, Feb. 7, 1997.

[70] Ibid.

[71] World Wide Web, retrieved Feb. 7, 1997, National Trade Data Bank, http://www.stat-usa.gov/webdoc.cgi/public/market/, USDOC, "Germany: Packaged Software (Small/Home Office)," Feb. 1, 1996.

[72] USITC, *Industry and Trade Summary: Computer Software*, p. 9; industry representative, speech at COMDEX computer convention, Las Vegas, NV, Nov. 17, 1996; and USDOC, "Germany: Packaged Software (Small/Home Office)."

the various EU countries, a key to success within the EU, which comprises numerous different languages.[73] Many U.S. firms have operations in Ireland, which is becoming a center of software replication, distribution, localization, and translation for the EU markets in addition to assembly of computers and peripherals.[74] U.S.-based firms also have a competitive advantage in their ability to provide technical support for software, a service many EU firms lack.[75] Additionally, many PCs in the EU run on Microsoft's Windows operating systems, which provides an advantage for U.S.-based firms that have experience developing software for Windows.[76] Finally, U.S.-based firms' technological edge in producing increasingly sophisticated off-the-shelf products is allowing their software to replace more expensive and locally produced custom software.[77]

Various EU governments have been attempting to foster stronger indigenous software industries. Within France, the French Ministry of Research and Technology and the Ministry of Industry jointly run programs to collaborate with the private sector in developing new software technologies and products.[78] However, the relatively high software piracy rate in the EU, estimated at 49 percent in 1995, may deter the entry of new software firms.[79]

Japan

While Japan is the third-largest producer of software in the world, most software produced in Japan does not compete in global markets. The Japanese software market was started by, and remains dominated by, Japanese hardware firms, namely Fujitsu, NEC, and Hitachi, which produce proprietary operating systems for Japanese businesses.[80] The original software industry consisted of spin-offs of these hardware vendors and large users. These spin-offs organized into "software factories" to develop custom software for these operating systems and to meet particular businesses' needs, often using custom programming languages.[81] The software factories continue to exist, and proprietary and custom software is estimated to account for over 80 percent of all software produced in Japan.[82] However, the remaining 20 percent of the software produced in Japan was valued at approximately $10 billion in 1996.[83] Because most software in Japan is custom software in Japanese, little software is exported; most Japanese software exports are entertainment or game

---

[73] USITC, *Industry and Trade Summary: Computer Software*, p. 9; industry representative, speech at COMDEX computer convention, Las Vegas, NV, Nov. 17, 1996; and foreign industry representative, e-mail correspondence with USITC staff, Feb. 13, 1997.

[74] World Wide Web, retrieved Feb. 7, 1997, National Trade Data Bank, http://www.stat-usa.gov/webdoc.cgi/public/market/, USDOC, "Ireland: Info Tech Sector Overview," Mar. 27, 1996.

[75] World Wide Web, retrieved Feb. 7, 1997, National Trade Data Bank, http://www.stat-usa.gov/webdoc.cgi/public/market/, USDOC, "France: Packaged Software," Apr. 1, 1995.

[76] Ibid.

[77] Ibid.

[78] Ibid.

[79] This figure is only for piracy of business applications. BSA and SPA, "More Than $13 Billion Lost Worldwide to Software Piracy Joint BSA/SPA Survey Reveals."

[80] SPA, fax to USITC staff, Feb. 2, 1997.

[81] Ibid; Jason Dedrick and Kenneth L. Kraemer, "Behind the Curve: Japan's PC Industry," *Global Business*, vol. 4, 1996, pp. 67-76; and World Wide Web, retrieved Mar. 3, 1997, Computing Japan, http://www.cjmag.co.jp/magazine/issues/1996, "The Past, Present, and Future of Japanese Software," *Computing Japan*, June 1996.

[82] American Chamber of Commerce in Japan, *U.S.-Japan White Paper*, 1995.

[83] Estimated by USITC staff based on telephone interviews by USITC staff, Jan.-Feb. 1997.

software.[84] For example, firms such as Fujitsu and Nippon Columbia sell multimedia software in the United States.[85]

As Japan has been much slower than the United States in moving from proprietary to open systems, software firms have lacked a common set of technical standards to which they could direct their development efforts.[86] Further, the software factory approach and its top-down management has discouraged creativity.[87] This situation has hindered the growth of an independent software industry in Japan.[88] As a result, Japanese firms have fallen behind their U.S. counterparts in offering open systems software and competitive packaged applications. Subsidiaries of U.S. firms dominate the Japanese packaged software industry, producing over 90 percent of the PC applications software and the majority of the PC operating systems software sold in Japan.[89] Major U.S.-based producers in Japan include Microsoft, Lotus, Novel, Netscape, and Apple.[90]

The largest U.S.-based producer in Japan is Microsoft, whose operating systems, including the Japanese version of Windows 95, dominate the Japanese PC operating system market.[91] Microsoft also produces PC applications software, including the most popular Japanese word processing software in Japan.[92] Microsoft has been successful in Japan largely due to its ability to localize and develop software for the Japanese market, establish licensing agreements with Japanese hardware manufacturers, utilize Japanese distribution channels such as large retail outlets, and offer user support.[93] Microsoft used its knowledge gained from creating and controlling its Windows 95 operating system to bring its word processing software to market before its Japanese competitors.[94]

Japanese firms do produce some competitive applications software. The Japanese firm JustSystem produces the second most popular word-processing software in Japan.[95] However, Japanese software producers are more competitive in the market for CD-ROM games. Japanese game producers such as Sony, Sega, and Nintendo have been very strong in producing interactive games, which are very popular in Japan. While these firms traditionally have produced games for their proprietary TV-based cartridge or console machines, game software is gradually shifting to CD-ROM.[96] Some U.S. firms, such as Electronic Arts in a joint venture with Japan Victor Co., are moving into the Japanese PC game software market.[97]

The Japanese government has taken steps to help develop the Japanese software industry. One obstacle for Japanese software developers has been a lack of access to capital. Unlike the United States, Japan does not have a venture capital system; most financing is provided by financial establishments that do

---

[84] "Outlook 96: Japan," *Computer Products*, Jan. 1996, p. 204.
[85] "Computer, Software Firms Enter U.S. CD-ROM Market," *Nikkei Weekly*, Nov. 4, 1996, p. 9.
[86] USITC, *Global Competitiveness*, p. 2-4.
[87] Dedrick and Kraemer, "Behind the Curve: Japan's PC Industry," pp. 67-76.
[88] USITC, *Global Competitiveness,* p. 2-4.
[89] USITC, *Industry and Trade Summary: Computer Software*, p. 11; SPA, fax to USITC staff, Feb. 2, 1997; and Japan External Trade Organization (JETRO), "Personal Computer Software" (Tokyo: JETRO, 1996).
[90] JETRO, "Personal Computer Software."
[91] World Wide Web, retrieved Mar. 3, 1997, Computing Japan, http://www.cjmag.co.jp/magazine/issues/1996, "Japan's Top-Selling Software," *Computing Japan*, May 1996.
[92] "The Past, Present, and Future of Japanese Software," *Computing Japan.*
[93] JETRO, "Personal Computer Software."
[94] "The Past, Present, and Future of Japanese Software," *Computing Japan.*
[95] "Japan's Top-Selling Software," *Computing Japan.*
[96] World Wide Web, retrieved Feb. 10, 1997, Multimedia White Paper 1996, http://www.infoweb.or.jp/mma/english/summary/html, "Multimedia White Paper 1996," *Information-Technology Promotion Agency* (Tokyo: Information-Technology Promotion Agency, 1995-1996).
[97] "Virtual Businesses Turn Work into Play," *Nikkei Weekly*, Dec. 30, 1996/Jan. 6, 1997, p. 20.

not lend to smaller start-up firms with few or no assets. To address this problem, MITI set up funds in its fiscal 1995 budget to subsidize venture businesses to develop new software. To further assist software firms in securing funds, MITI also plans to set up a loan guarantee system.[98]

However, Japan still has obstacles to overcome to be competitive in software production. Unlike in the United States, Japanese universities do not have a large number of computer science programs, which is a disadvantage for Japanese software firms seeking to hire new talent.[99] Further, software is not valued as highly as hardware in Japan, either by users or producers, which may prevent talented people from being attracted to careers in software development.[100] Many of the best game software developers are still designing software for the proprietary game machine makers, rather than for PC CD-ROMs.[101] Further, the relatively high rate of software piracy in Japan, estimated at 55 percent in 1995, also may deter the entry of new software firms.[102]

Other Producers

While no countries have been able to compete successfully with the United States' dominance of the software industry, a number of smaller producers such as India, Israel, the Philippines, and Pakistan have been developing a strong base of low-cost, talented software programmers that often work on contract for U.S. and European software firms.[103] Programmers in these countries are able to compete for foreign contracts due to their English language ability.[104] The improvement of on-line communications between countries has facilitated the transfer of programming services, with many projects transmitted electronically.[105]

The Indian software industry is estimated to be growing at an average annual rate of approximately 40 to 45 percent.[106] Although much of the custom programming performed in India is done through subsidiaries of U.S. companies, such as Microsoft, Novell, IBM, and Texas Instruments, the number of Indian-owned firms that have used highly skilled, low-cost programmers to build successful export businesses is growing rapidly.[107]

Exports of Indian software reportedly are growing, particularly to the United States, the EU, Australia, and South Africa.[108] As the Indian software industry is a major foreign exchange earner, the Indian government provides incentives to promote the industry's growth, such as reduced import duties for hardware and software, incentives for export sales, and software technology parks for small- and medium-sized software ventures. In addition, with demand for software programmers outpacing supply, the Indian

[98] "Multimedia White Paper 1996," *Information-Technology Promotion Agency*.
[99] USITC, *Global Competitiveness,* p. 3-27.
[100] Dedrick and Kraemer, "Behind the Curve: Japan's PC Industry," pp. 67-76.
[101] "Game Business Plays Rough," *Nikkei Weekly*, Jan. 27, 1997, p. 1.
[102] This figure is only for piracy of business applications. BSA and SPA, "More Than $13 Billion Lost Worldwide to Software Piracy Joint BSA/SPA Survey Reveals."
[103] USITC, *Global Competitiveness of the U.S. Computer Software and Services Industries*, p. 4-24.
[104] Ibid.
[105] Ibid.
[106] World Wide Web, retrieved Feb. 11, 1997, National Trade Data Bank, http://www.stat-usa.gov/webdocs.cgi/public/market/, USDOC, "India: Computer Software Education and Training," Sept. 1, 1996.
[107] USITC, *Global Competitiveness,* p. 4-24.
[108] NASSCOM, "India's Software Industry Rises by 61 percent," *Comtex Scientific Corporation*, received by NewsEdge/LAN, Dec. 20, 1996.

government has developed several software engineering programs in conjunction with private computer education institutes. The Indian software industry currently employs about 9,000 software professionals with graduate degrees in software engineering, often from U.S. or U.K. schools.[109]

Like India, Israel has a rapidly growing software industry with a specialized and skilled workforce that is regarded highly in the global market. U.S. firms such as Microsoft, Novell, and Computer Associates have software development investments in Israel.[110] An estimated 200 Israeli software firms are involved in software production, exporting 70 percent of locally produced software. Due to the population's multiple language skills, Israeli software firms are able to export products in many languages to a large number of countries. The influx since 1991 of Soviet immigrants, many of whom are computer technicians, also has contributed to Israel's competitiveness in software programming.[111]

The number of software firms in the Philippines is near 100 and increasing steadily. Exports of software products comprise about 90 percent of local software firms' business. Locally developed software primarily caters to the U.S., European and Japanese markets. The expertise of these companies is broad and spans almost all types of platforms, operating environments, and languages. The Philippine software industry benefits from a large, highly educated and trainable work force, large number of training facilities, and programmers' proficiency in English. The Philippine government has promoted the software industry, encouraging overseas investors through various incentives to establish their computer software businesses, particularly for export, in the Philippines.[112]

Pakistan also has a small but growing software industry, consisting of close to 150 firms performing programming for offshore customers such as Time Warner in the United States and others in the United Kingdom and the Middle East. Many of Pakistan's software programmers are U.S.- or U.K.-educated, and most top management of software firms have foreign degrees. The Pakistani government has supported the development of Pakistan's software industry by creating a software export board to encourage exports as well as developing software technology parks.[113] As yet, the Pakistani industry is much smaller than that of India.

Large U.S. software firms such as Microsoft, IBM, and Lotus, which began to sell Chinese-language software in China in 1995, produce most of the software sold in China.[114] However, China has more than 1,000 local software development firms, most of which employ fewer than 50 people.[115] The Chinese government has taken steps to help the domestic software industry by investing in many Chinese software start-up firms and by building a number of software production facilities in China's technology parks. Much of the software developed by these firms is in Chinese for the growing domestic market.[116] While China has a large number of software programmers, it has not been as successful in competing overseas due to these programmers' poor English language skills.[117]

---

[109] USDOC, "India: Computer Software Education and Training."

[110] Israel Export Institute, *Israel's Electronics* (1996).

[111] World Wide Web, retrieved, Feb. 11, 1997, National Trade Data Bank, http://www.stat-usa.gov/webdocs.cgi/public/market/, USDOC, "Israel: Computer Software," May 1, 1996.

[112] World Wide Web, retrieved, Feb. 11, 1997, National Trade Data Bank, http://www.stat-usa.gov/webdocs.cgi/public/market/, USDOC, "Philippines: Application Software," Aug. 1, 1995.

[113] Foreign industry representative, interview by USITC staff, COMDEX computer convention, Las Vegas, NV, Nov. 19, 1996, and "Wanted: Cheap OOP Skills: Time Warner Taps Pakistan," *PCWeek*, Apr. 3, 1995, reprint.

[114] World Wide Web, retrieved, Feb. 11, 1997, National Trade Data Bank, http://www.stat-usa.gov/webdocs.cgi/public/markets/, USDOC, "China: Software Market," Jan. 1, 1996.

[115] "Foreign Firms Grip China's Software Sector," *United Press International*, NewsEdge/LAN, Jan. 6, 1997.

[116] USDOC, "China: Software Market."

[117] USITC, *Global Competitiveness*, p. 4-24.

U.S. Market Profile

The global market for packaged software products was estimated to be over $95 billion in 1996, growing at an average annual rate of over 11 percent from 1992 from 1996.[118] The United States accounted for approximately $45 billion, or almost half, reflecting an annual growth rate of over 13 percent from 1992-1996, due to the rapidly expanding number of PCs in the United States.[119] U.S. producers hold well over 90 percent of the U.S. market, although EU firms compete in the U.S. client/server applications markets and entertainment/edutainment field.[120]

Under Uruguay Round commitments U.S. tariffs on most software covered by the ITA would be zero on January 1, 1999, except for software recorded on magnetic tape and having no sound or image, which would be assessed a duty of 4.8¢/m^2 of recording surface.[121] The United States is one of few countries in the world to assess software import duties based on the software medium's surface area. Consequently, there would be little or no change in market access opportunities as a result of the ITA.

Foreign Market Profiles

The markets of the EU and Japan reached approximately $30 billion and $11 billion, respectively, in 1996.[122] These markets grew more slowly between 1992 and 1996 than that of the United States, at rates of approximately 8 and 7 percent, respectively.[123] Both the EU and Japan lag behind the United States in PC adoption,[124] causing software demand also to lag; in addition, the EU and Japan experienced recessions in the early 1990s which may have dampened their computer and software markets. However, these markets are projected to grow more quickly over the next three years, by 9 to 10 percent annually.[125] Other small but growing markets include China and other Asian countries, as well as Canada; these markets are expected to grow at approximately 10 percent annually.[126]

U.S. firms dominate the software markets of the EU and Japan, holding over 90 percent of their applications markets, although U.S. firms face some competition from local firms.[127] However, EU and Japanese software firms for the most part have little presence in other markets due to these firms' focus on custom software and also because they often develop software that is in a language other than English for local consumption.[128] As a result, most other software markets are dominated by U.S. firms.[129]

---

[118] Estimated by USITC staff based on USDOC, "Computers: Software."
[119] Ibid.
[120] SPA, fax to USITC staff, Feb. 2, 1997.
[121] *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994. The Marrakesh Protocol is part of the General Agreement on Tariffs and Trade 1994 (GATT 1994), which is a multilateral agreement that is an annex to the Agreement Establishing the World Trade Organization. See appendix G for final Uruguay Round tariffs on specific Harmonized Tariff Schedule categories.
[122] Estimated by USITC staff based on USDOC, "Computers: Software."
[123] Ibid.
[124] Jon Choy, "Computer Usage in Japan: Revolution or Fashion?" *Japan Economic Institute*, Jan. 26, 1996.
[125] Estimated by USITC staff based on USDOC, "Computers: Software."
[126] Ibid.
[127] Software Publishers Association (SPA), fax to USITC staff, Feb. 2, 1997.
[128] USDOC, "Germany: Packaged Software (Small/Home Office)."
[129] USDOC, "Computers: Software"and Software Publishers Association (SPA), telephone interviews with USITC staff, Jan.-Feb. 1997.

Most countries other than the United States assess *ad valorem* duties, which can vary based on the value a country determines for the software products it imports. In some countries, such value may not be the price at which the software will be sold, but rather the perceived value of the software's intellectual property or future revenues. This value often is decided arbitrarily at a customs office and can be many times greater than the sale price, resulting in a higher tariff.[130] As a result of Uruguay Round commitments the EU's tariffs on January 1, 1999, would range from 0 to 3.5 percent.[131] Japan will have no tariffs on any software imports as of January 1, 1999.[132] For software tariffs of the other ITA signators, see table 3-2 and for tariffs on specific harmonized tariff schedule categories, see appendix G.

Software firms may realize slightly increased market access opportunities as a result of the ITA, and the expected expansion of the EU should provide access to emerging markets in Europe. However, as mentioned earlier, software is not traded internationally in the traditional sense; often a few master disks are sent abroad and replicated for sale, rather than multiple copies of software being sent across borders. Therefore, tariff savings may not be substantial. Additionally, software firms competing in foreign markets reportedly find the lack of IPR protection to be the single largest barrier to trade.[133] Further, recordings combining video and music with interactive games could prove problematic under the ITA.[134] Countries may choose to classify these recordings as video or music, rather than software, products; the former are not covered by the ITA, and resulting tariffs could impede market access opportunities by software firms.[135]

---

[130] Industry representative, telephone interview by USITC staff, Jan. 28, 1997.

[131] *Most-Favoured-Nation Tariff Schedules.*

[132] Ibid.

[133] World Wide Web, retrieved Apr. 2, 1997, United States Trade Representative (USTR), http://www.ustr.gov/reports/nte/1997/contents.html, USTR, *1997 National Trade Estimate.*

[134] According to industry sources, some movie companies are releasing CD-ROMs holding full-length movies followed by interactive games. Industry representative, telephone interview by USITC staff, Feb. 26, 1997.

[135] SPA, letter to USTR, Nov. 5, 1996.

Table 3-2
Final Uruguay Round tariffs on software for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	0-7
Canada	0-7.4
Costa Rica	([2])
Estonia	0
European Communities (15)	0-3.5
Hong Kong	0
Iceland	16-29
India	([2])
Indonesia	40
Israel	12
Japan	0
Korea	13
Macau	0
Malaysia	5-10
New Zealand	5-10
Norway	0
Romania	25
Singapore	0-10
Switzerland	0.2-0.6
Taiwan[3]	5
Thailand	30
Turkey	([2])
United States	0-4.8¢/sq.mtr.[4]

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.
[4] Based on surface area of medium.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994, and Department of Commerce working documents.

CHAPTER 4
Telecommunications Equipment
John Davitt

The Information Technology Agreement (ITA) includes most equipment typically associated with the telecommunications sector, such as telephone sets, fax machines, switching equipment, answering machines, pagers, cellular phones, and fiber optic transmission systems, as well as the vast majority of parts for these products. Uninsulated optical fiber cable and communications satellites are excluded from the agreement and, accordingly, from this discussion of the telecommunications industry. A complete list of products included in the agreement is set forth in appendix A. Table 4-1 shows the six sectors which comprise the telecommunications equipment industry as defined for purposes of this report and selected U.S. producers of the equipment within each sector.

World production of telecommunications equipment is dominated by the European Union (EU), the United States, and Japan (figure 4-1). In 1996, they collectively accounted for an estimated 82 percent of global production of telecommunications equipment. Production in the telecommunications equipment industry as a whole increased in the United States and Japan during the 1992-96 period, while production growth in the EU has been more erratic. Production in certain sectors of the telecommunications equipment industry such as cellular communications and data communications has steadily increased in all regions.

U.S. Industry Profile

The United States is the world's largest single-country producer of telecommunications equipment. The value of U.S. shipments of telecommunications equipment increased from approximately $24 billion in 1992 to an estimated $41.4 billion in 1996, an increase of 71 percent (figure 4-2).[1] This increase in production has required only a moderate expansion of the workforce. Employment in the telecommunications equipment industry as a whole increased from approximately 145,000 employees in 1992 to approximately 170,000 employees in 1996.[2] This represents a productivity increase per employee of 47 percent during 1992-96 and is largely the result of increased automation and other efforts to cut costs and improve efficiency in response to growing competition. This growth in productivity is expected to continue as production increases in all telecommunications equipment sectors while employment grows at a slower rate in sectors such as wireless and data communications or declines in other industry segments.[3] During this same period, hourly wages increased by an estimated 16 percent.[4]

U.S. production encompasses a vast range of telecommunications products although it is largely concentrated in high technology equipment such as digital switches, cellular telephone equipment, and various types of data communications equipment where U.S. companies lead the global industry (figure 4-3).

---

[1] Estimated by USITC staff based on U.S. Department of Commerce (USDOC), *Current Industrial Report MA36P, Communications Equipment and Other Electronic Systems and Equipment*, Oct. 15, 1996 and *Telecommunications: A Profile of the Worldwide Telecommunications Industry* (Oxford: Elsevier Science Ltd., 1997).
[2] Estimated by USITC staff based on U.S. Department of Labor (USDOL), Bureau of Labor Statistics (BLS) data.
[3] U.S. industry representatives and investment analysts, telephone interviews by USITC staff, Oct. 1996-Feb. 1997.
[4] Estimated by USITC staff based on USDOL, BLS data.

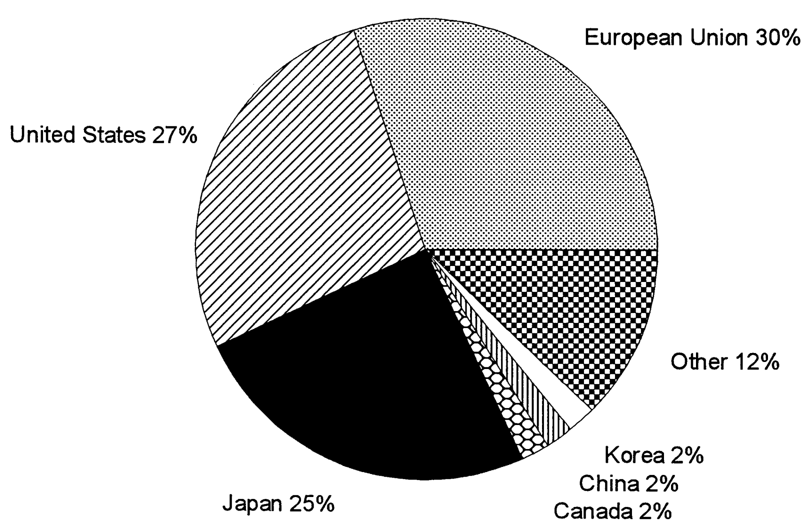
Table 4-1
Principal types of telecommunications equipment and selected U.S. producers[1]

Cellular equipment and pagers	Switching equipment
Americon Andrew Corporation Ericsson Radio Systems Lucent Technologies Motorola, Inc. Qualcomm	Bytex Coastcom DSC Communications Corp. Lucent Technologies Nortel (Northern Telecom) Tellabs Operations, Inc.
Carrier line equipment and modems	**Terminal equipment**
ADC Telecommunications, Inc. Alcatel Network Systems, Inc. Coastcom Digital Transmission Systems Micom Communications Corp. Multitech Systems	Centigram Cobra Electronics Corp. General Electric Harris Communications IBM Mitsubishi Consumer Electronics
Fiber optic equipment	**Other data communications equipment**
Alcatel Network Systems Codenoll Technology Corp. Lucent Technologies NEC America Nortel (Northern Telecom) Tellabs	Bay Networks Cisco CXR Telcom Racal Datacom Inc. U.S. Robotics 3Com

[1] For purposes of this study "U.S. producers" comprise all companies that manufacture telecommunications equipment in the United States regardless of ownership.

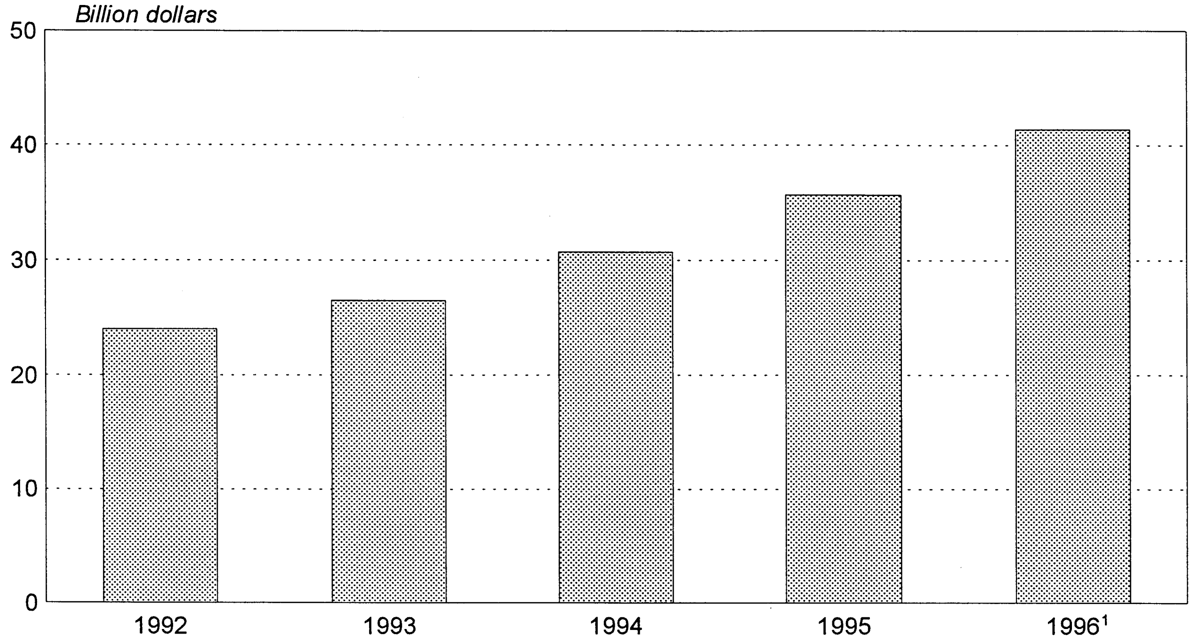
Source: Compiled by the staff of the USITC.

Figure 4-1
Telecommunications equipment: Share of world production, by principal producers, 1996



Source: Elsevier, *Telecommunications: A Profile of the Worldwide Telecommunications Industry*, 1997, and USITC staff estimates.

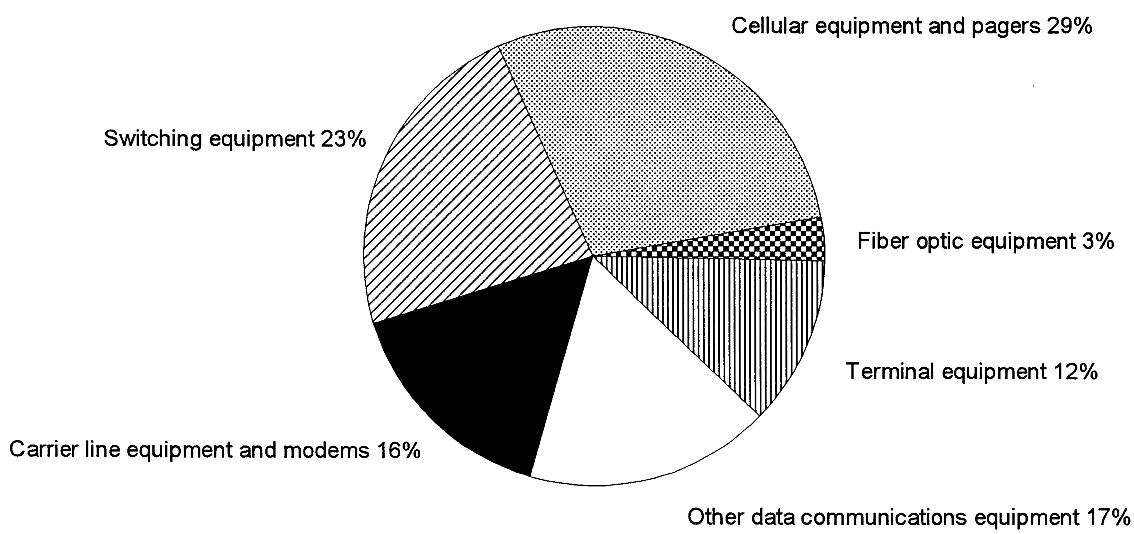
Figure 4-2
Telecommunications equipment: U.S. shipments, 1992-96



[1] Estimated.

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

Figure 4-3
Telecommunications equipment: Shares of U.S. shipments, by industry sector, 1996



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

The United States is also generally recognized as the global leader in high-end terminal equipment such as voice processing systems and advanced telecommunications transmission systems.[5] This is particularly true with respect to new products and technologies targeted at sophisticated business users, such as high-speed data transmission systems.[6] U.S. producers of both transmission and switching equipment also benefit from technological advances in related sectors which are increasingly utilized in advanced telecommunications transmission and switching devices. The United States leads in crucial technologies used as inputs for telecommunications equipment, such as microprocessors, software, and computers. Low-end commodity-type products for the U.S. market which are more labor-intensive, such as single-line phones and simple facsimile machines, are typically produced abroad.[7]

The industry has increased in size as well as diversity in recent years. Although a major portion of U.S. production is concentrated among a few large integrated, multiproduct, multinational firms, there were more than 500 producers of telecommunications equipment in the United States in 1996, an estimated 9 percent average annual increase since 1992.[8] Greater diversity has resulted from the technological convergence of industries such as computers and broadcasting with telecommunications, which has brought new entrants into the telecommunications equipment industry in recent years. Firms such as Cisco, 3Com, Bay Networks, and U.S. Robotics manufacture equipment for data communications that is used by both the computer and telecommunications industries. For example, growing Internet usage and the demand for improved graphics and video have created similar challenges for both industries and have prompted these industries to jointly seek solutions to meet these demands. Similarly, the challenge of providing teleconferencing and video on demand has linked the broadcasting equipment industry to the telecommunications industry.

A number of factors determine the location of telecommunications equipment production, including access to a workforce with the required training, market proximity, the existence of other high tech industries, tax incentives, and competitive wage rates.[9] Many U.S. and foreign-based equipment manufacturers have chosen the United States for the production of high technology telecommunications products because it is the world's largest market for these products, it provides a highly trained workforce, and it is home to a large number of high tech industries. This is reflected in the fact that an estimated 980,000 scientists and engineers were employed in R&D in the United States during 1995.[10] The comparable figures for Japan, West Germany, and France were 535,000, 255,000, and 145,000, respectively.[11]

Competition has been growing in recent years in the industry as a whole, although it varies somewhat by industry sector. Traditional suppliers continue to have competitive advantages over new entrants that allow them to monopolize certain markets. Many of these producers may have a sizable base of installed equipment which, despite industry trends toward standardization, still contains many proprietary products, thus increasing the likelihood that add-on and replacement equipment will come from these original suppliers. For example, Lucent, formerly AT&T, and Northern Telecom have long dominated the North American

---

[5] U.S., EU, and Japanese industry analysts, personal and telephone interviews by USITC staff, Oct. 1996-Feb. 1997.

[6] European Commission, *Panorama of EU Industry 95/96* (Luxembourg: Office for Official Publications of the European Communities, 1995), pp. 10-24 through 10-29.

[7] North American Telecommunication Association (NATA), *1995 Telecommunications Market Review and Forecast*, p. 10

[8] *The Information Technology Industry Data Book 1960-2006* (Washington, DC: Information Technology Industry Council, 1996), 2nd Edition 1996, p. 32.

[9] *North American Free Trade & Investment Report: Perspectives*, vol.7, No.1, Jan. 15, 1997, p. 13 and industry representatives, telephone interviews by USITC staff, Feb. 1997.

[10] *The Information Technology Industry Data Book 1960-2006*, p. 116.

[11] Ibid.

market for central office switches principally because of the large installed base of their equipment and the substantial startup costs associated with the requirement that these switches conform to customers' system and software specifications.[12] Both Lucent and Northern Telecom made this startup investment years ago and have maintained large market shares for decades. Large multiproduct producers such as Lucent or Northern Telecom offer a diversity of products and services allowing them to deliver complex turn-key projects and to provide one-stop-shopping for the major carriers. In addition, these producers also enjoy significant economies of scale and scope.

In most sectors of the industry, competition is fierce. For example, the cellular and personal communications services (PCS) equipment sectors are extremely competitive because a base of installed equipment and long-standing relationships have yet to be established. U.S. producers report that they compete not only with respect to price but also on the basis of many other factors such as company reputation, reliability, ontime delivery, and ability to provide customer support.[13] In general, the opening of telecommunications equipment markets to competition and the concomitant pressures to cut costs but maintain breadth of product line has caused a trend away from the vertically integrated model to a more horizontal industry structure characterized by strategic alliances and increased flexibility. This trend has been aided by the increased use of standard rather than proprietary interfaces which allow customized solutions to specific company needs.[14]

Spending on research and development (R&D) as a percent of sales for the telecommunications equipment industry rose between 1992 and 1996.[15] Telecommunications equipment producers have historically dedicated a slightly lower percentage of overall sales revenues to research than other information technology industries, such as software and computers.[16] However, by the early 1990s, R&D spending levels in the telecommunications equipment industries were converging with those of other information technology industries.

The fast pace of new product development combined with growing competition in the telecommunications equipment industry require that producers make substantial investment in R&D. Large R&D investments are necessary to fund the almost continuous innovation that consumers have come to expect from the leading producers of high technology telecommunications equipment. Producers that can make products that are faster, smaller, cheaper, easier to use, of better quality, or containing more features will be rewarded with increased market share and high returns. In many telecommunications product areas, firms compete on the basis of their ability to provide state-of-the-art solutions while maintaining competitive pricing. In a rapidly expanding market, such as that for PCS, the payoff can be enormous. Although the industry as a whole invested approximately 10 percent of total revenues in R&D during 1995,[17] R&D expenditures were significantly higher for many firms engaged in the production of products characterized by strong competition and rapid technological change such as cellular equipment. For example, in 1995, Ericsson and Northern Telecom, both major producers of wireless equipment, invested approximately 15 percent of net sales in R&D and Motorola reported that 13 percent of its U.S.-based workforce was

---

[12] NATA, *1995 Market Review and Forecast*, p. 66.

[13] Industry representatives, telephone interviews by USITC staff, Feb. 4, 1997.

[14] World Wide Web, retrieved Jan. 3, 1997, Multimedia Telecommunications Association, http://www.mmta.org/news/indoverview, MultiMedia Telecommunications Association, *Industry Overview*, Jan. 3, 1997, p. 8.

[15] National Science Board, *Science and Engineering Indicators, 1995* (Washington DC: GPO, 1996) and company annual reports.

[16] Ibid.

[17] *The Information Technology Industry Data Book 1960-2006*, pp. 10 and 15.

engaged in R&D.[18] Similarly, in recent years, Alcatel has invested approximately 13 percent of its revenues for R&D for telecommunications products as a whole and close to 20 percent of its revenues in areas such as network systems, radio communications, and business systems.[19]

Patents and patent protection are extremely important in this industry as a means of protecting R&D investment. The number of patents held by the major telecommunications firms provides ample evidence of the substantial innovation that has occurred in this industry. For example, Bell Labs, the research division of Lucent Technologies, has registered an average of one patent a day since 1925, and currently holds 8,100 active patents in the United States and 22,000 worldwide.[20] Motorola currently owns 6,604 patents in the United States and 5,177 in foreign countries.[21]

Foreign-owned firms are an integral part of the U.S. telecommunications equipment industry (table 4-2). The National Science Foundation estimates that 12 percent of telecommunications equipment production operations located in the United States are foreign-owned.[22] Japanese firms constitute the largest share of this group, with 26 percent of the total, followed by Canada and the United Kingdom with 17 percent and 15 percent, respectively. These firms include some of the world's largest telecommunications equipment producers and U.S. operations are often a substantial share of their total production. For example, Northern Telecom's U.S. operations employ more than 22,000 (35 percent of its total workforce) while Ericsson employs over 7,000 workers in the United States. Both companies conduct significant levels of R&D and produce a wide range of telecommunications products in the United States although their focus is on high technology products. Many major foreign producers of telecommunications equipment have chosen to base a portion of their research and development efforts in the United States. Northern Telecom has established five R&D centers in the United States,[23] Ericsson conducts R&D at Virginia and North Carolina facilities,[24] and Siemens has located major R&D facilities in New Jersey.[25]

The reputation of U.S. telecommunication products provides a competitive advantage in some export markets. Additionally, some analysts argue that U.S. telecommunications manufacturers have benefited from exposure to competition in the domestic market, which may provide an advantage over some firms that have only experienced preferred-supplier relationships with monopoly service providers.[26]

The value of U.S. telecommunications equipment exports has grown steadily since 1992, and in 1996 totaled approximately $14 billion. Export growth averaged 25 percent per year during 1992-95, although in 1996, the rate of growth slowed to 4 percent. A major factor in this declining rate of growth was the significant decrease in exports of cellular transmission apparatus which had been growing steadily in previous

---

[18] Motorola, *1995 10-K Report*; World Wide Web, retrieved Jan. 29, 1997, Ericsson, http://www.ericsson.nl/Organization.html, *Ericsson-An Introduction*; and William Mack, "Northern Telecom," *The Value Line Investment Survey* (New York: Value Line Publishing), Oct. 11, 1996, p. 794.

[19] Datapro, *Communications Equipment and Services: Alcatel, N.V.*, (Datapro Information Services Group, 1995), p. 2.

[20] Industry representatives, telephone interviews by USITC staff, Feb. 10, 1997.

[21] Motorola, *1995 10-K Report.*

[22] *Science and Engineering Indicators*, National Science Foundation, 1996, Appendix A, p. 43.

[23] *Northern Telecom at Work in the United States,* Northern Telecom, p. 2.

[24] Industry representatives, telephone interviews by USITC staff, Feb. 13, 1997, and *Financial Times Telecommunications Survey,* Sept. 19, 1996, p. XXI.

[25] *Siemens '97: A Review of Siemens Businesses in the USA*, Siemens Corporation, p. 4.

[26] U.S., EU, and Japanese industry analysts, telephone interviews by USITC staff, Oct. 1996-Feb. 1997.

Table 4-2
Selected U.S. telecommunications equipment producers with a foreign parent

Location of foreign parent	U.S. company
Japan	Fujitsu Network Transmission Systems Hitachi (U.S.) Inc. NEC America
Germany	Siemens Stromberg Carlson Siemens Rolm Communications, Inc.
Canada	Nortel (Northern Telecom) Gandalf Systems
United Kingdom	Summa Four Racal Datacom, Inc.
France	Alcatel Network Systems, Inc.
Sweden	Ericsson Network Systems

Source: Compiled by the staff of the USITC.

years.[27] The largest U.S. telecommunications equipment export categories are radio transceivers, switching equipment, and terminal apparatus. Each of these export groups increased in value between 1992 and 1996. Transmission equipment and pager exports have also steadily increased in value since 1992 while exports of radio receivers increased by 137 percent during the 1992-95 period and then decreased by an estimated 6 percent in 1996.

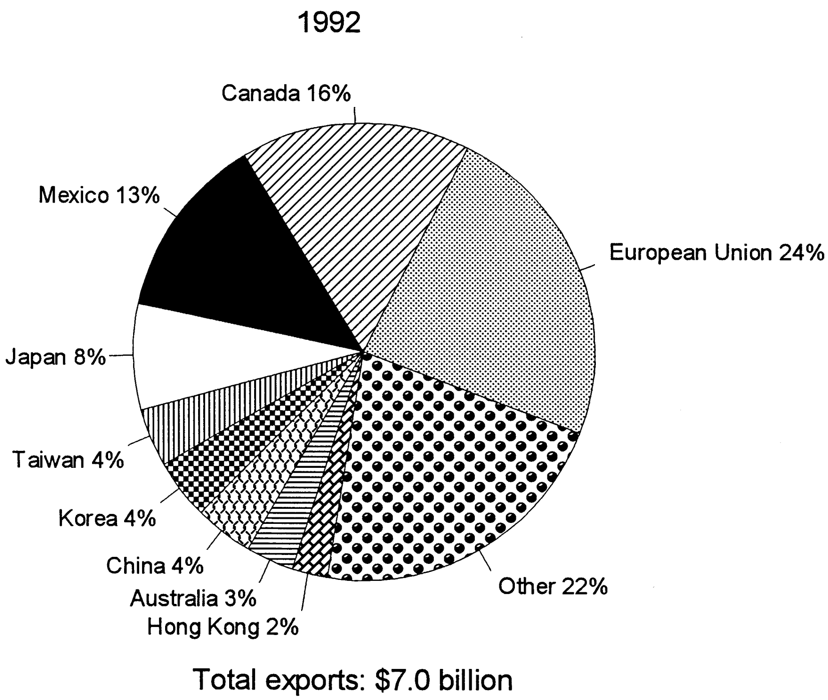
The EU, Canada, and Japan were the largest markets for U.S. telecommunications equipment exports in 1996 and accounted for approximately 18 percent, 15 percent, and 14 percent of total exports, respectively (figure 4-4).[28] The value of U.S. telecommunications equipment exports increased significantly in most major markets during 1992-96, with the most notable exception being Mexico. The decline in U.S. exports to Mexico during this period was most likely the result of the peso crisis and its aftermath which increased the price of U.S.-made equipment in the Mexican market. U.S. telecommunications equipment exports to the EU increased by 71 percent during 1992-95, then decreased by 11 percent to approximately $2.5 billion in 1996, which coincided with a general economic downturn in major European markets such as Italy and France.[29] Exports to Canada increased by 46 percent during 1992-95 and by an additional 29 percent during 1996. Telecommunications equipment exports to Japan, aided by a steadily appreciating yen, increased by an average annual rate of almost 47 percent during 1992-95. This rate of growth slowed to 12 percent in 1996 as the dollar regained value against the yen thereby increasing the cost of U.S.-produced equipment in the Japanese market.

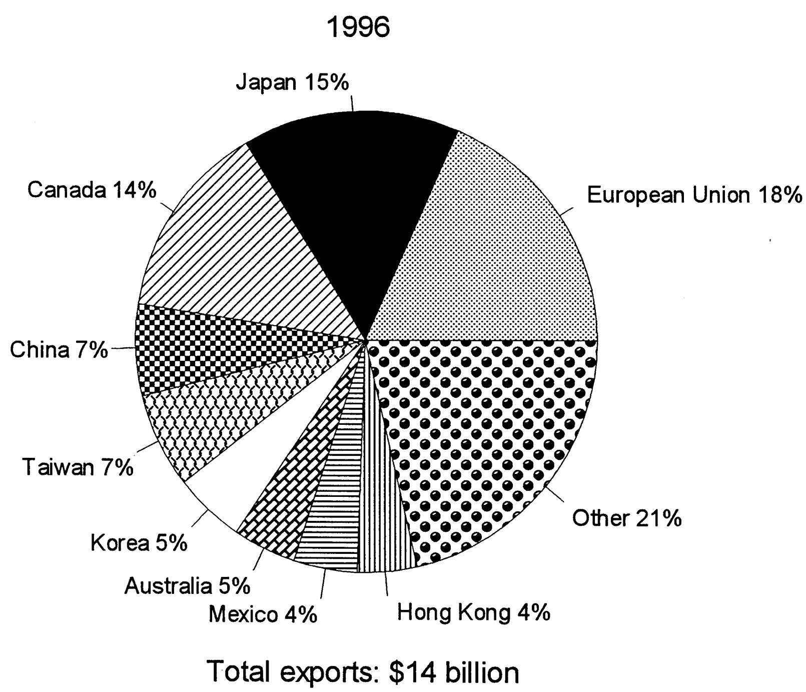
[27] Some U.S. industry representatives have attributed declining sales in U.S. transmission equipment to the efforts of European government officials who have strongly urged their foreign counterparts to accept the GSM standard, which has been adopted by the EU, rather than either of the two prevailing U.S. standards. In doing so, they have seriously hampered U.S. sales of transmission equipment. Industry representative, interviewed by USITC staff, Washington, DC, Feb. 12, 1997.

[28] Compiled from official statistics of the USDOC.

[29] *Telecommunications: A Profile of the Worldwide Telecommunications Industry*, p. 10.

Figure 4-4
Telecommunications equipment: Major U.S. export markets, 1992 and 1996





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

Foreign Industry Profiles

Most of the major non-U.S. producers of telecommunications equipment are located in Japan and the EU.[30] These producers collectively account for more than two-thirds of total telecommunications equipment production outside the United States. The global nature of the telecommunications equipment industry has resulted in many similarities between the U.S. and foreign industries. The major producers tend to be large, integrated, multiproduct, multinational firms that developed over many years in markets where little, if any, competition existed. Now that competition has entered these markets, telecommunications equipment producers in the EU, Japan, and elsewhere are facing the same competitive pressures as their U.S. counterparts and taking similar action. Most are increasingly locating production of commodity-type products in low-wage Asian countries. They are also establishing production operations for higher technology equipment and research and development facilities closer to their major markets. The need to rapidly establish presence in many markets at once has led to numerous agreements, acquisitions, and joint ventures among the various players. Greater competition in some markets and greater cooperation in others has, in turn, resulted in the rapid dissemination of technological advances to telecommunications equipment producers. Thus, outmoded production and marketing strategies that would have sufficed under the old monopoly structure are rapidly being replaced by those that have proven their value under the new market conditions.

Japan

Despite a serious recession and the appreciation of the yen, total Japanese telecommunications equipment production increased to nearly $38 billion in 1996, an average annual rate of approximately 18 percent during 1992-96 (table 4-3).[31] This growth surge is primarily the result of increased production of wireless telecommunications equipment, which has nearly tripled since 1992, and to a lesser extent, increased production of switching equipment. Facsimile machines and transmission equipment also constitute major shares of Japanese telecommunications equipment production, but production of both was flat during the 1992-96 period. Production of telephone sets and telephone systems decreased during this period, largely as a result of Japanese companies moving production of low-end consumer-oriented telecommunications products to lower wage economies.

Japanese telecommunications equipment producers have been less successful than U.S. and EU companies in the network and switching segments of the global telecommunications market. They produce these products primarily for their own markets and have had some success in developing markets in Asia and Latin America where price and service have been of greater importance than advanced technological features characteristic of U.S. and EU equipment.[32] Japan surpasses the United States and the EU in the production of certain terminal equipment such as facsimile machines and other consumer-oriented telecommunications equipment where competition is based primarily on price because of more advanced manufacturing processes that minimize production costs. In recent years, however, production of less sophisticated facsimile and terminal devices has been moving to lower wage Asian countries such as Malaysia, Indonesia, and China.[33]

---

[30] The notable exceptions are Northern Telecom in Canada and Samsung Electronics in Korea.

[31] World Wide Web, retrieved Jan. 14, 1997, Communications Industry Association of Japan, http://www.ciaj.or.jp/ciaj/ciaj-e/quart/ci000481.html, *Communications Industry Association of Japan*.

[32] U.S. and EU industry representatives and investment analysts, telephone interviews by USITC staff, Oct. 1995-Feb. 1996 and European Commission, *Panorama of EU Industry 95/96*, pp. 10-24 through 10-29.

[33] Japanese industry representatives and investment analysts, telephone interviews by USITC staff, Oct. 1996-Feb. 1997.

Table 4-3
Telecommunications equipment: International production trends by major producing countries, 1992-96

	1992	1993	1994	1995	1996	CAGR[1] 1992-1996
	Million dollars					*Percent*
European Union . .	41,605	36,890	39,687	45,248	45,245	2.1
United States	24,007	26,451	30,701	35,690	41,437	14.6
Japan	19,477	22,278	24,766	30,601	37,609	17.9
Korea	1,994	2,111	2,511	2,747	2,952	10.3
China	1,408	1,552	1,911	2,339	2,753	18.2
Canada	2,319	2,257	2,230	2,315	2,379	1.0
Taiwan	1,411	1,580	1,692	1,735	1,762	5.3

[1] Compound annual growth rate.

Source: *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996); Communications Industry Association of Japan; and USITC staff estimates.

Japanese telecommunications equipment suppliers such as Toshiba and Matsushita Electric Industrial, which also specialize in consumer electronics products, are likely to have an advantage over traditional Japanese network equipment providers in expanding their global market presence because of their greater exposure to competitive international markets. The value of this advantage is expected to increase as the markets for telecommunications, computers, and consumer electronics converge and the demand for multimedia products accelerates.[34]

Four of the 20 largest world suppliers of telecommunications equipment are headquartered in Japan: NEC, Fujitsu, Matsushita, and Oki Electric (figure 4-5). Three other large Japanese suppliers--Toshiba, Sumitomo Electric, and Japan Radio--fall within the top 25 global producers. Most of these firms manufacture a combination of transmission and switching equipment and terminal equipment.

NEC is a leading supplier of digital switching systems, radio transmission systems, terminal equipment, and mobile communications systems.[35] NEC also produces computers, optoelectronic devices,[36] and industrial electronic systems which have enabled NEC to attain a global leadership position in the integration of computer and communications technology. Fujitsu similarly benefits from being a computer manufacturer. It is also one of the world leaders in the production of asynchronous transfer mode (ATM)[37] switching systems and fiber optic transmission systems.[38] Matsushita has four divisions:

[34] U.S. and EU industry representatives and investment analysts, telephone interviews by USITC staff, Oct. 1996-Feb. 1997.

[35] The Nippon Electric Corporation (NEC) was formed as Japan's first joint venture in partnership with AT&T's Western Electric Company (now Lucent Technologies) in 1899.

[36] Optoelectronic devices generate and transmit light (bases and light-emitting devices), amplify light (optical amplifiers), detect light (photodiodes), and control light (electro-optic circuits). *Newton's Telecom Dictionary*, Harry Newton, Flatiron Publishing, Inc., 1996, p. 437.

[37] ATM switching systems are advanced digital packet-switching systems that facilitate the transfer and switching of voice, data, and video information.

[38] *Telecommunications: A Profile of the Worldwide Telecommunications Industry*, p. 185.

Figure 4-5
Telecommunications equipment: Top 20 producers and global telecommunications equipment revenue, 1995

	($ millions)	
(1)	Lucent Technologies *[U.S.]*	$18,389
(2)	Motorola *[U.S.]*	$16,222
(3)	Alcatel Alsthom *[France]*	$15,716
(4)	Ericsson *[Sweden]*	$13,178
(5)	NEC *[Japan]*	$13,045
(6)	Siemens *[Germany]*	$12,787
(7)	Northern Telecom *[Canada]*	$10,143
(8)	IBM *[U.S.]*	$7,750
(9)	Fujitsu *[Japan]*	$6,642
(10)	Nokia *[Finland]*	$6,491
(11)	Cisco Systems *[U.S.]*	$4,096
(12)	Bosch Group *[Germany]*	$3,574
(13)	Matsushita Electric Industrial *[Japan]*	$3,316
(14)	Samsung Electronics *[South Korea]*	$2,347
(15)	3Com *[U.S.]*	$2,327
(16)	General Electric Company *[U.K.]*	$2,300
(17)	GM Hughes *[U.S.]*	$2,195
(18)	Oki Electric *[Japan]*	$2,061
(19)	Bay Networks *[U.S.]*	$2,057
(20)	General Instruments *[U.S.]*	$2,018

Source: *Communications Week International*, Nov. 1996.

telecommunications, data processing and measurement, audio-video, and automotive electronics. Matsushita's main telecommunications products are cellular phones, pagers, telephone sets and systems, digital PBX systems, radio systems, and network equipment. Matsushita operates four telecommunications equipment plants in Japan and three overseas that are located in the United States, the United Kingdom, and China. Oki Electric manufactures telecommunications systems, information processing systems, and electronic devices.[39] Oki Electric divides its telecommunications products into three groups: switching systems, transmission systems, and telecommunications terminal equipment.

The research and development efforts of Japanese firms such as NEC, Fujitsu, and Hitachi benefit from the synergies created by their participation in a number of different communications and electronic product sectors. R&D expenditures as a share of net sales tend to be lower for the major Japanese telecommunications equipment producers than for their U.S. counterparts. R&D expenditures as a share of total net sales for NEC and Fujitsu were 6.8 percent and 9.9 percent, respectively.[40] Finally, these companies have benefitted from joint comparative R&D projects sponsored by Japan's major network service provider, Nippon Telephone and Telegraph (NTT).

Most of the telecommunications equipment produced in Japan continues to be consumed domestically and this trend has increased considerably in recent years. As indicated previously, Japanese network equipment has not been as competitive in foreign markets as that of the United States and European Union. During 1992, approximately 64 percent of Japanese telecommunications equipment production was consumed in the domestic market. By 1996, a higher level of production and decreasing exports had caused this share to increase to approximately 87 percent.

Japanese exports of telecommunications equipment have steadily decreased in recent years, due largely to the appreciation of the yen, to approximately $5 billion in 1996. The yen-denominated value of exports decreased by 39 percent during 1992-96.[41] The major components of Japanese telecommunications equipment exports are facsimile machines, electronic switching equipment, transmission equipment, cordless telephones, and accessories and parts.[42] In 1996, the largest markets for Japanese telecommunications equipment exports were the United States, the EU, and various Asian nations. The United States and Asia each received approximately one-third of Japanese telecommunications equipment exports while approximately 17 percent was shipped to the EU.

European Union

The EU as a whole is the world's largest telecommunications equipment producer. After expanding rapidly during the latter part of the 1980s, growth in EU telecommunications equipment revenues slowed markedly due to increased competition and lower prices resulting from the full introduction of microelectronics technology in every telecommunications segment.[43] Production in the EU decreased by 11 percent between 1992 and 1993, before stabilizing at $45 billion during 1995-96 (table 4-3). Within the EU, Germany and France are the major telecommunications equipment producers and, in 1996, jointly produced approximately 47 percent of total EU production. The EU includes many of the world's largest individual producers. In recent years, however, several of these producers have been overtaken by competing

---

[39] *Telecommunications: A Profile of the Worldwide Telecommunications Industry*, p. 191.

[40] These percentages are reflective of total sales rather than sales of telecommunications equipment alone.

[41] Japanese telecommunications equipment trade has been denominated in yen to remove the distortions caused by large fluctuations in the exchange rate during the analysis period. In this case, a yen-denominated trade value gives a more accurate picture of the actual trends in the volume of trade than would a dollar-denominated value.

[42] *Japan Electronics Almanac 95/96*, (Tokyo: Dempa Publications, Inc., 1995), p. 87.

[43] European Commission, *Panorama of EU Industry 95/96*, pp. 10-24 through 10-29.

firms outside the EU. During 1993, nine of the twenty top producers of telecommunications equipment were based in the EU. In 1995, only six EU-based companies remained in the top twenty.[44]

The six leading EU producers and their base countries are Alcatel (France), Ericsson (Sweden), Siemens (Germany), Nokia (Finland), Bosch (Germany), and General Electric Company (UK).[45] Similar to many major U.S. and Japanese telecommunications equipment producers, these companies are multiproduct, multinational firms that produce an array of telecommunications equipment, and each also manufactures products for use outside the telecommunications industry.

Production costs for telecommunications equipment companies in the EU countries are often higher than those in Japan or Asia, but similar to those in the United States. Compared to Japanese firms, EU firms tend to be slightly less automated, and the cost of labor generally is higher. Employment in the EU telecommunications industry, as in the United States, is falling due to higher productivity rates and industry consolidation, but at a slower rate than in the U.S. industry due to more rigorous labor regulation and workplace rules in the EU.[46] EU producers have an advantage in their home markets because of their reputation and installed base positions as well as in foreign markets where their countries formerly had colonial relationships. EU telecommunications network equipment suppliers are more competitive with U.S. companies in global markets than are Japanese firms. Although U.S. telecommunications equipment firms maintain an edge over EU producers in technological sophistication and innovation, EU producers typically surpass Japanese firms in these same areas due to greater international sales and investment in research and software development.

Similar to those in the United States, EU companies are very well positioned as global industry competitors in higher-end network transmission and switching equipment. Although not as technologically sophisticated as the leading U.S. companies, EU companies benefit from standards developments which originated in the EU and have been adopted as important market standards not only in Europe but in major overseas markets as well.[47] The European Telecommunications Standards Institute (ETSI) was formed in the 1980s to develop uniform standards for manufacturers of telecommunications equipment.

The Global System for Mobile Communications (GSM), ETSI's pan-European standard for cellular communications equipment, has proved beneficial for European manufacturers and is expected to increase economies of scale and reduce production costs for European equipment manufacturers.[48] Because ETSI's early development of standards resulted in a commercially viable system, several countries outside of Europe have also adopted the GSM standards. Other pan-European decisions that have benefitted the telecommunications equipment industry include the EU's terminal equipment directive, which simplifies the type-approval process necessary for bringing terminal equipment to market, and ETSI's advocacy of a standardized European Integrated Services Digital Network (ISDN) system.

Despite adoption of the GSM standard, larger traditional network telecommunications companies such as Siemens and Alcatel have been less adaptive to the rapidly growing EU mobile and cellular communications market than have Ericsson and Nokia, or even the major U.S. mobile communications giant, Motorola. In fact, Motorola has now overtaken both Siemens and Alcatel and is second only to Lucent Technologies in terms of telecommunications equipment production. EU analysts assert that Alcatel did not take an interest in mobile telecommunications until too late and was unable to effectively negotiate the sharp

---

[44] In addition, Ascom, a Swiss company, fell from the top 20 producer list. *Communications Week International*, Nov. 25, 1996.

[45] *Communications Week International*, Nov. 25, 1996.

[46] U.S. and European investment analysts, telephone interviews by USITC staff, Mar. 3-5, 1997.

[47] European Commission, *Panorama of EU Industry 95/96*, pp. 10-24 through 10-29.

[48] Ibid.

turn toward mobile communications.[49] The Scandinavian-based Ericsson and Nokia, which like Motorola also have many years of experience in mobile and cellular technology, have been able to take better advantage of the large increases in mobile sales during 1992-96 and emerging market opportunities than have the traditional EU network players.

The opening of EU telecommunications markets to competition is forcing domestic equipment suppliers to compete with foreign companies. To take advantage of these opportunities, non-EU firms, including U.S. firms, are locating manufacturing plants in the EU. In many cases, these production facilities are being located in southern Europe where labor and startup costs tend to be the lowest and sufficient skilled labor is available. In response to increased competition from non-EU companies, European manufacturers are expanding their export focus, with the United States and Japan viewed as the principal export markets.[50]

In 1996, the value of telecommunications equipment exports from the EU was approximately $19 billion.[51] Although exports increased sharply during 1992-94, growth slowed considerably during 1995-96.[52] Most EU exports are directed toward developing countries and are concentrated in large network systems, whereas most imports are from the industrially advanced countries such as Japan and the United States and largely consist of terminal equipment.[53]

Some EU industry analysts see this trend as a weakness in the external trade structure of the EU telecommunications equipment industry. Others see this trend as a possible source of future strength for EU producers, given that countries like China, India, and other Asian markets represent great future opportunities due to the double digit growth rates projected for these countries. According to industry analysts, newly industrialized countries will develop their fixed and mobile digital networks with the technological and financial help of large EU players such as Siemens, Alcatel, Ericsson, and Nokia.[54]

Canada

The Canadian telecommunications equipment industry consists of one large integrated multiproduct firm, Northern Telecom; a few subsidiaries of foreign-based firms such as Ericsson, Alcatel, Motorola, and Harris; and a number of manufacturers with more narrowly focused product lines including Eicon, Gandalf, Newbridge Networks, and Mitel. Approximately 31 companies account for over 90 percent of Canadian industry output.[55] Overall, the industry produces a wide variety of telecommunications products, including radio communications equipment, multiplex equipment, central office and subscriber switches, data network equipment, and other subscriber apparatus.

In 1992, Canada produced approximately $2.3 billion of telecommunications equipment (table 4-3). Between 1992 and 1996, production increased only slightly to approximately $2.4 billion.[56] The lack of growth was due largely to greater competition from foreign suppliers, most notably those in the United States.

---

[49] World Wide Web, retrieved Mar. 2, 1997, Telecom Observer, http://tellobs.com.gov./Telecom Observer/Industry 8/Analyse Mobile.html/, Anne Lapasset, "Mobile Communication Specialists Besiege Wire Network," *Telecom Observer*, 1996, pp. 1-2.

[50] European Commission, *Panorama of EU Industry 1995/96*, p. 10-26.

[51] Estimated by USITC staff based on *Telecommunications: A Profile of the Worldwide Telecommunications Industry* and *Panorama of EU Industry 1995/96*, p. 10-26.

[52] *Telecommunications: A Profile of the Worldwide Telecommunications Industry,* Elsevier, 1997, p. 10.

[53] European Commission, *Panorama of EU Industry 1995/96*, p. 10-26.

[54] US and EU investment analysts, telephone interviews by USITC staff, Mar. 3-5, 1997.

[55] World Wide Web, retrieved Feb. 10, 1997, Industry Canada, http://strategis.ic.gc.ca, Ron Walsh, *The Canadian Telecommunications Equipment Industry, Structure and Performance*, Industry Canada, May 27, 1996, p. 2.

[56] Elsevier, *Yearbook of World Electronics Data 1996*, vol. 2, p. 14.

This competition has forced a number of changes in the Canadian telecommunications equipment industry. For example, since 1989 Northern Telecom has closed or sold 10 manufacturing plants while Mitel and Gandalf have each consolidated their manufacturing activities.[57]

Canadian R&D is substantial, accounting for 19 percent of the value of shipments in 1994. Northern Telecom has steadily increased its R&D spending in recent years and during 1995 invested $1.75 billion in R&D, an amount equal to 14.8 percent of its total revenues.[58] A substantial portion of Northern Telecom's R&D is conducted in the United States, its most important market. On the other hand, Canada provides an attractive base for the R&D operations of foreign-based telecommunications firms. For example, Ericsson established an R&D center in Montreal that employs 450 persons while Motorola chose British Columbia for an R&D facility that will focus on radio communications research.[59]

In 1996, the value of Canadian exports of telecommunications equipment was approximately $1.8 billion.[60] Although the average growth rate for Canadian telecommunications exports was approximately 19 percent during 1992-94, it decreased to approximately 2 percent during 1994-96. Parts and accessories were the largest component of Canadian telecommunications equipment exports during 1992-96, followed by transmission equipment incorporating reception devices and telephone sets.

Other Producers

For many years, U.S., EU, and Japanese telecommunications equipment producers have chosen to locate subsidiaries in a number of Asian countries with low production costs and advanced manufacturing skills. Companies such as Ericsson and Siemens have entered into joint ventures to increase their presence in the growing Asian market. Production in China has increased substantially in recent years as multinationals have established joint manufacturing arrangements with Chinese firms to supply the rapidly expanding Chinese marketplace.[61] Asian governments have been willing to facilitate these relationships because they encourage local production and technology transfer.

More recently, liberalized Asian markets have fueled the development of local enterprises. Although industry officials suggest it is difficult for small start-up companies in Asia to compete with established subsidiaries of foreign firms, many are making inroads by establishing niche markets, building on OEM[62] relationships, and forming partnerships with Western companies. For example, to establish themselves, Asian telecommunications equipment firms frequently rely on partnerships with Western or Japanese companies. Asian firms supply the plant and labor, whereas Western companies generally provide the technology.

China's production of telecommunications equipment has increased at an average rate of over 18 percent a year since 1992, reaching approximately $2.8 billion in 1996, making China the third largest producer in Asia (table 4-3). This growth is expected to continue because China has also been the fastest growing economy in the world during this period and the Chinese government has identified telecommunications as a high national priority. The rapid expansion of this sector has been made possible by the numerous joint ventures with foreign telecommunications equipment providers. The price of entry into

---

[57] Walsh, *The Canadian Telecommunications Equipment Industry*, p. 3.

[58] Northern Telecom, *1995 Annual Report*, p. 33.

[59] Walsh, *The Canadian Telecommunications Equipment Industry*, p. 2.

[60] Elsevier, *Yearbook of World Electronics Data*, 1996 and USITC staff estimates.

[61] "Walking and Talking," *The China Business Review*, Mar.-Apr. 1996, p. 16.

[62] Original equipment manufacturers (OEMs) are producers of equipment that is marketed by another vendor, usually under the name of the reseller.

the potentially enormous Chinese market often has included the transfer of production technology. Telecommunications equipment vendors based outside of China have moved production within China's borders to reduce costs and better serve the market. Motorola, for example, recently began its seventh joint venture in China and other global producers such as Nokia, Siemens, Alcatel, Ericsson, and NEC also have formed joint ventures in recent years with Chinese partners.[63]

During 1992-96, China became a major producer of telecommunications equipment for foreign markets. In 1996, the value of Chinese exports of telecommunications equipment totaled an estimated $1.7 billion.[64] Most of the telecommunications equipment produced in China for the export market has consisted of low-end commodity-type products. For example, during 1995, China was the fourth largest source of telecommunications equipment imports to the United States. Seventy-four percent of these imports consisted of corded and cordless telephones.[65]

The total value of telecommunications equipment production in Korea was approximately $3 billion in 1996. The growth of Korea's telecommunications equipment industry, like that of many other telecommunications equipment producers worldwide, has been led by the production of mobile telephone equipment. Growth of mobile telephone equipment averaged 26 percent a year during 1993-96, making it the largest sector of the Korean telecommunications equipment industry. Other significant sectors of the Korean industry include switching equipment, facsimile machines, and cordless telephones. Korea's exports of telecommunications equipment increased by 79 percent during 1992-96, totaling $1.2 billion in 1996. Transmission apparatus, cellular telephone equipment, and telephone sets comprised major shares of these exports.

The Korean electronics industry's aggressive globalization campaign backed by the Korean government is the driving force behind Korea's rapid emergence in the telecommunications equipment sector.[66] The electronics industry's share of Korea's total exports has grown continuously from 16 percent in 1985 to over 30 percent in 1996. In particular, high-technology sectors such as telecommunications equipment, computers, and semiconductors are expected to make up one-half of Korea's exports by the early 2000s, according to "Strategies and Vision for Korean Industries in the 21st Century," a publication by Korea's Ministry of Trade, Industry, and Energy.[67]

During 1996, Taiwan produced an estimated $2.2 billion of telecommunications equipment. Approximately 70 percent of this equipment consisted of switching equipment, telephone sets, and facsimile machines. The production of switching equipment and facsimile machines has steadily increased in recent years while telephone set production has declined markedly. As wages in Taiwan have increased, production of lower technology products has moved to lower wage countries such as China, the Philippines, Singapore, and Thailand.

Taiwan's recent liberalization of its laws relating to its telecommunications market is expected to give its telecommunications equipment industry a needed boost. Prior to liberalization, the Directorate General of Telecommunications (DGT) was the only permitted purchaser of telephone equipment in Taiwan and, to simplify maintenance, DGT limited its procurement to three joint venture sources.[68] As part of this

---

[63] "Walking and Talking," p. 16.

[64] Estimated by USITC staff based on United Nations Trade Series D and *Telecommunications: A Profile of the Worldwide Telecommunications Industry*.

[65] USDOC, *U.S. Telecommunications Trade in 1995*, p. 2.

[66] World Wide Web, retrieved Mar. 5, 1997, Electronic Industry Association of Korea (EIAK), http://eiak.com/overview.htm, EIAK, "Moving Towards a Soft Landing in 1996," 1997, p. 7.

[67] Ibid.

[68] World Wide Web, retrieved Feb. 3, 1997, National Trade Data Bank, http://www.stat-usa.gov/webdocs.cgi/public/markets/, USDOC, "Taiwan-Foreign Investment Restrictions," Aug. 30, 1996.

liberalization, Taiwan reduced restrictions on the ownership of plants manufacturing digital office switching equipment to encourage foreign investment. The total value of Taiwan's exports of telecommunications equipment was $1.6 billion in 1996. This value has grown steadily since 1992 and is largely comprised of telecommunications parts and accessories, transmission equipment, and telephone sets.

Global Market Profile

The global market for telecommunications equipment as a whole steadily increased during 1992-96,[69] driven by a combination of forces in both developed and developing nations. The privatization of telecommunications carriers and the deregulation of telecommunications markets has spurred competition in many countries and increased the demand for the telecommunications equipment. Recent entrants in the telecommunications services market need equipment to build new telecommunications infrastructures, whereas established telecommunications providers now facing competition are having to update old infrastructure. Rapidly developing technology has also fueled demand by regularly introducing new products and services and lowering the cost of old products and services.[70]

The growth of the telecommunications equipment market has not been uniform in all geographic regions or in all sectors of the telecommunications industry. For example, although the overall market for telecommunications products has increased substantially in the United States, Japan, China, Korea, and many other countries since 1992, it has decreased during this period in the EU and Canada.[71] The market for products such as wireless and data communications equipment, digital switches, and fiber optic transmission equipment has increased in nearly all markets including Canada and the EU.

Tariff treatment of telecommunications equipment in the major international markets varies significantly. For example, while most telecommunications equipment imports enter Canada and Japan duty free, tariffs are as high as 30 percent for these same products entering Malaysia and Thailand and will continue at that level even after the full reductions of the Uruguay Round Agreements take effect on January 1, 1999.[72] Tariffs for most telecommunications equipment entering the EU range between 2 and 4 percent although telephone sets enter duty free and tariffs on insulated fiber optic cable are 5.2 percent.

U.S. Market Profile

The U.S. telecommunications equipment market increased at an average annual rate of over 11 percent during 1992-96, reaching approximately $38 billion in 1996.[73] Demand for switching equipment, mobile radio systems, and carrier line equipment, which comprise the largest segments of the U.S. telecommunications equipment market, has increased since 1992. Demand for mobile radio systems, which includes cellular equipment, has been especially strong. This growth in demand has been driven by increased competition brought about by additional allocation of bandwidth through the Federal Communications

---

[69] *Telecommunications: A Profile of the Worldwide Telecommunications Industry*, pp. 13-40.

[70] *World Telecommunications Development Report*, (Geneva: International Telecommunications Union, 1995), p. 132.

[71] *Telecommunications: A Profile of the Worldwide Telecommunications Industry*, p. 9.

[72] *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994. The Marrakesh Protocol is part of the General Agreement on Tariffs and Trade 1994 (GATT 1994), which is a multilateral agreement that is an annex to the Agreement Establishing the World Trade Organization. See appendix G for final Uruguay Round tariffs on specific Harmonized Tariff Schedule categories.

[73] Elsevier, *Yearbook of World Electronics Data*, 1996.

Commission's PCS auctions, improved transmission quality resulting from the development of digital technology and compression technologies, and wider coverage areas as wireless providers expand their service areas through agreements with other providers. In addition, cellular phones are becoming cheaper and more convenient as smaller phones with more features become available. These new wireless services will require new types of equipment which will benefit both U.S. and foreign producers.

U.S. imports of telecommunications equipment were $11 billion in 1996 and accounted for approximately 29 percent of U.S. apparent consumption. These imports consisted largely of commodity-type terminal equipment such as telephone sets, facsimile machines, and answering machines.[74] U.S. imports of both corded and cordless telephone sets were $2.5 billion in 1996.[75] Between 1992 and 1996, U.S. imports of cordless telephone sets increased steadily while imports of corded telephone sets remained flat. U.S. imports of modems also steadily increased during 1992-96, although U.S.-produced modems make up the largest share of domestic consumption.

Canada, Japan, China, and Mexico are the principal sources of telecommunications equipment imports to the United States, accounting for approximately 21 percent, 18 percent, 12 percent, and 10 percent of U.S. imports, respectively.[76] Imports of telecommunications equipment from Canada have steadily increased since 1992 and include a wide range of products from central office switches to antennas. Telecommunications equipment imports from Japan have decreased since 1994 with Japan's share of U.S. facsimile machine imports decreasing from 77 percent in 1994 to 48 percent in 1996. Most of the U.S. facsimile machine market lost by Japan since 1994 has been gained by Malaysia, Thailand, and China.

China's production of telecommunications equipment has rapidly increased in recent years and China is now one of the largest suppliers to the U.S. market. Imports of telecommunications equipment from China consist primarily of telephone sets as well as modems, antennas, answering machines, pagers, and parts. U.S. telecommunications equipment imports from Mexico have increased at an average annual rate of almost 40 percent since 1992 and reached approximately $1.1 billion in 1996.[77] This growth has been assisted by the implementation of the NAFTA which went into effect on January 1, 1994, and major devaluations of the peso during 1994 and 1995.[78] Under the NAFTA, tariffs on most telecommunications equipment trade among Canada, the United States, and Mexico have been eliminated. The largest categories of telecommunications equipment represented in these imports were line telephone sets, cellular telephones, antennas, modems, and pagers.

Under the Uruguay Round Agreement, the United States agreed to reduce tariffs on most telecommunication imports "conditional upon the provision by other major countries of adequate entity coverage under the Agreement on Government Procurement."[79] To date, the United States has not found that these conditions have been met and, consequently, has not reduced its tariffs on these products. Under Uruguay Round commitments, the MFN tariffs on telecommunications equipment entering the United States will range between 0 and 8.5 percent ad valorem as of January 1, 1999. Under the ITA, tariffs on these products would be removed without conditions and it is likely that there will be an increase in market access opportunities as a result of the ITA.

---

[74] Compiled from official statistics of the USDOC.
[75] Ibid.
[76] Ibid.
[77] Ibid.
[78] *International Financial Statistics*, International Monetary Fund, Feb. 1997.
[79] *Most-Favoured-Nation Tariff Schedules.*

Foreign Market Profiles

Japan

The Japanese market for telecommunications equipment has steadily expanded since 1992 despite a serious recession and, in 1996, was approximately $36 billion.[80] Although Japan still relies primarily on domestic production to meet the demand for telecommunications equipment in its own market, imports from both foreign subsidiaries of Japanese-based firms and unrelated producers have increased in recent years. Imports of telecommunications equipment increased dramatically from $722 million in 1992 to $4.2 billion in 1996.[81] This surge in imports increased import penetration of telecommunications equipment from only 5.4 percent of consumption in 1992 to 11.5 percent in 1996.

A large share of Japanese telecommunications imports are comprised of telephone sets which are increasingly being produced in other Asian nations. Imports also contained a large number of radio transmitters, reception apparatus and transceivers, PBX equipment, and parts. The United States was Japan's largest source of telecommunication equipment imports and accounts for approximately 50 percent of both its wired and radio telecommunications equipment.[82]

Under Uruguay Round commitments, all import duties on telecommunications equipment will be zero on January 1, 1999 with the exception of certain insulated wire which will be dutiable at 4.8 percent ad valorem (table 4-4).[83] This wire represents a negligible amount of trade in telecommunications products. Although the ITA will eliminate this duty, it is likely that there would be little or no increase in market access opportunities as a result. The Telecommunications Industry Association has stated that the greatest trade barrier to the Japanese telecommunications market is the procurement policies of the Japanese government and Japan's primary telecommunications service provider, NTT.[84] As such, the ITA will have no effect on market access.

European Union

The European market for telecommunications equipment has decreased in value since 1992, in part because of general economic conditions as well as by falling prices for telecommunications equipment as competition increases within each country. The value of the EU market was approximately $37 billion in 1996.[85] The United States, Japan, and South East Asia are the primary sources of imports for the European Union and account for approximately 25 percent, 21 percent, and 11 percent of EU imports, respectively.[86] Import penetration was approximately 33 percent of telecommunications equipment total consumption in 1996.

---

[80] Communications Industry Association of Japan, http://www.ciaj.or.jp/ciaj/ciaj-e/quart/ci000481.html, Jan. 14, 1997.

[81] Ibid.

[82] Ibid.

[83] *Most-Favoured-Nation Tariff Schedules.*

[84] Industry representative, telephone interview by USITC staff, Apr. 1, 1997, and World Wide Web, retrieved Apr. 2, 1997, United States Trade Representative, http://www.ustr.gov/reports/nte/1997/contents.html, USTR, *1997 National Trade Estimate.*

[85] Estimated by USITC staff based on *Telecommunications: A Profile of the Worldwide Telecommunications Industry* and European Commission, *Panorama of EU Industry 1995/96*, p. 10-26.

[86] European Commission, *Panorama of EU Industry 1995/96*, p. 10-26.

Under Uruguay Round commitments, duty rates on most telecommunications imports will range from 0-3.6 percent as of January 1, 1999.[87] Any future enlargement of the European Union will automatically increase the size of the market covered by the ITA since countries joining the European Union will adopt common EU tariffs and abide by all EU trade agreements. There may be a slight increase in market access opportunities as a result of the ITA.

Other Markets

Acceptance of the ITA would have a profound effect on several Asian countries that are presently importing large quantities of telecommunications equipment under a system of high tariffs. For example, high tariffs are particularly costly to countries such as Korea, Thailand, and Malaysia, the governments of which are committed to expanding and upgrading their telecommunications infrastructure. Under Uruguay Round commitments, Korea will maintain tariffs of 13 to 16 percent on imports of telecommunications equipment that, in 1996, totaled approximately $800 million.[88] Thailand's tariff rate for telecommunications equipment imports is 30 percent while the comparable rates for Malaysia range between 20 and 30 percent. The value of telecommunications imports for these countries in 1996 was approximately $900 million and $700 million, respectively.[89] The magnitude of existing tariff barriers in these markets makes it likely that the implementation of the ITA will increase market access opportunities.

---

[87] *Most-Favoured-Nation Tariff Schedules*

[88] Estimated by USITC staff based on *Telecommunications: A Profile of the Worldwide Telecommunications Industry*.

[89] Ibid.

Table 4-4
Final Uruguay Round tariffs on telecommunications equipment for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	0-15
Canada	0-8.7
Costa Rica	([2])
Estonia	0
European Communities (15)	0-8
Hong Kong	0
Iceland	18-35
India	([2])
Indonesia	40
Israel	6-16
Japan	0[3]
Korea	6-13
Macau	0
Malaysia	5-30
New Zealand	0-35
Norway	0-5
Romania	0-35
Singapore	0-10
Switzerland	0.2-2.1
Taiwan[4]	1.25-15.0
Thailand	5-30
Turkey	([2])
United States	0-8.5

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Tariffs of 4.8 percent remain on certain insulated wire but this represents a negligible amount of trade in telecommunications products.
[4] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations, (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994; and U.S. Department of Commerce working documents.

CHAPTER 5
Electronic Components
Robert Carr

Electronic components are the fundamental building blocks of the electronics industry and encompass a wide variety of products. The three main classes of electronic components include active, passive, and electro-mechanical/interconnective. Active components include semiconductors and electronic tubes. Passive components include capacitors and resistors. Electro-mechanical/interconnective components include printed circuits, connectors, relays, and switches. The three classes of components, usually working together, direct the operation of electronic products. In effect, electronic components are the functional "guts" of electronic end-products. The production of electronic components is a function of the demand for the electronic end-products and, in turn, innovations in component production are significant drivers of the markets for electronic end-products. Approximately three-quarters of electronic component production is incorporated into computers and office equipment, telecommunications equipment, and consumer electronics.[1] The remaining market for electronic components consists primarily of automotive electronics, medical equipment, avionics, measuring and analytical equipment, and military electronics.[2] The Information Technology Agreement (ITA) provides for the complete elimination of tariffs on certain electronic components, including semiconductors, capacitors and resistors, and printed circuits. The United States is a major producer of these components (figure 5-1), each of which is discussed in greater detail in the following sections.[3]

Semiconductors

Semiconductors are integral components in nearly all electronic products, including computers, communications equipment, consumer electronics, automobiles, and industrial equipment.[4] Semiconductors have often been referred to as the "crude oil of the information age," because innovation in semiconductor technology has historically powered the evolution and performance of electronic products.[5] Although semiconductors represent only about 17 percent of total electronics production, electronics products themselves are becoming increasingly semiconductor intensive as semiconductors are accounting for ever larger shares of the overall value of electronic products.[6] The development of semiconductors occurred in the United States during the 1940s-1960s, and since that time, the United States has been a world leader in both production and consumption. Other major producers include Japan, the EU, and various Asian economies (figure 5-2). For a complete list of semiconductor products included in the agreement see appendix A.

---

[1] Integrated Circuit Engineering (ICE), Bill McLean, ed., *Mid-Term 1996, A Report on the Integrated Circuit Industry* (Scottsdale, AZ: ICE, 1996), p. 1-9; European Commission, *Panorama of EU Industry* (Luxembourg: Office for Official Publications of the European Communities, 1995), pp. 10-8 to 10-15; and estimates by USITC staff.

[2] Ibid.

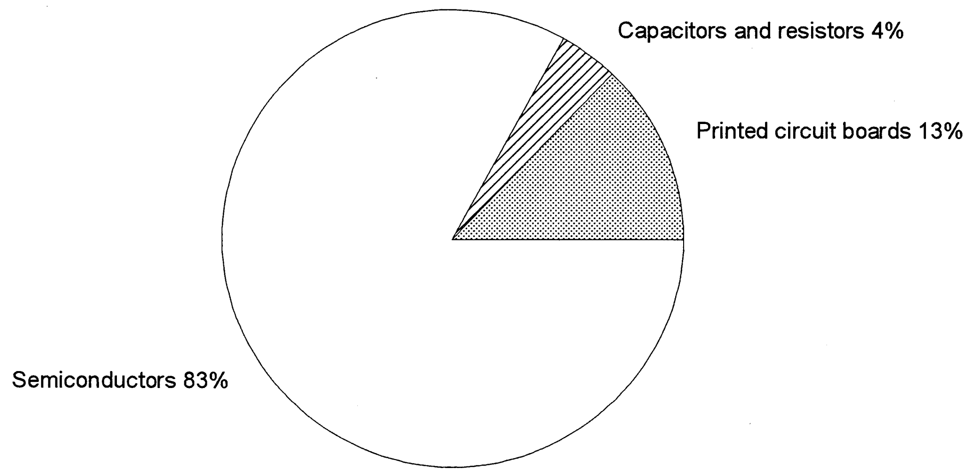
[3] The Information Technology Agreement also includes certain switching products, but as they are estimated to account for less than one-half of 1 percent of overall U.S. component production, they are not discussed here.

[4] B. McLean, ed., *Mid-Term 1996*, p. 1-9.

[5] Peter Van Zant, *Microchip Fabrication: A Practical Guide to Semiconductor Processing*, 2nd. edition (New York: McGraw-Hill, 1990), pp. 8-9 and World Wide Web, retrieved Aug. 12, 1996, Semiconductor Industry Association (SIA), http://www.semichips.org/whatis.htm, *What is a Semiconductor?*.

[6] McLean, ed., *Mid-Term 1996*, p. 1-5.

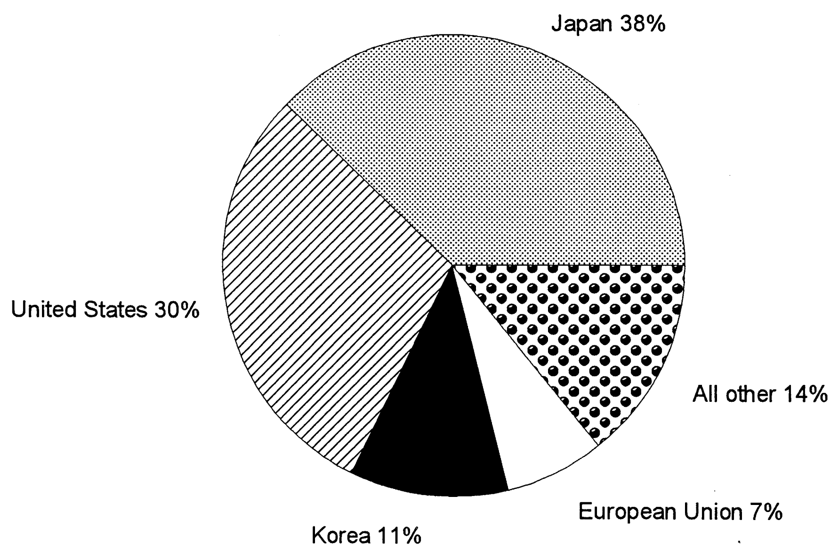
Figure 5-1
U.S. production of electronic components included in the Information Technology Agreement, 1996



Total: $47.2 billion

Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

Figure 5-2
Semiconductors: Share of world production, by major producing countries, 1996



Total: $132 billion

Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

The manufacture of semiconductors is a highly capital-intensive and automated process and can be divided into three stages: design, fabrication, and test and assembly.[7] The design of a semiconductor often requires highly skilled technical employees, computer hardware, and computer-aided design (CAD) software. The fabrication process is very automated and extremely capital intensive, with the cost of a new fabrication facility, or "fab," currently estimated at $1.2 billion. After the fabrication stage, chips are tested and assembled. Assembly includes the separation of the wafer into separate chips, packaging the chips in either plastic or ceramic, and wire bonding metal leads to the chips. Although test and assembly is quite automated, it is relatively labor intensive compared to fabrication and usually is conducted in low labor-cost countries in Asia.[8] Depending on the diameter of the wafer and the type of semiconductor being produced, as many as 800 identical semiconductor chips may be produced simultaneously. Great effort is required to maximize wafer yield (number of working chips per wafer), especially in commodity products, because yield determines, to some extent, the price that a company must charge for its product. The higher the wafer yield, the lower the price that a producer can charge and still make a profit.

U.S. Industry Profile

The U.S. semiconductor industry, which produces a wide range of semiconductor products, faces intense international competition in nearly every product sector. The strengths of the U.S. industry are closely tied to research and development (R&D), flexibility, and a shift toward the production of noncommodity products. Although U.S. manufacturers produce a broad line of semiconductors, it is in noncommodity semiconductors that U.S. firms have become global leaders.[9] Primarily as a result of intense Japanese competition, the bulk of the U.S. industry has shifted away from the production of commodity semiconductors and toward the production of more specialized, high value digital products. These products often require developing new technologies and the flexibility to bring a product with a short life-cycle to market quickly. U.S. firms are in the forefront of this process and are currently global leaders in the production of various specialized digital semiconductor products including high-end microprocessors, digital signal processors (DSP), programmable logic devices, and flash memory.[10] Production of these devices is often lucrative due to the limited number of competitors and unit prices much higher than those of commodity semiconductors. For example, although microcomponents, a product in which U.S. firms lead in production, accounted for only 10 percent of world unit shipments in 1995, they accounted for 31 percent of the value of world shipments. In 1996, chips constructed from an 8-inch wafer devoted to 16 megabyte dynamic random access memory (DRAMs) were valued at roughly $2,500 while the same 8-inch wafers devoted to the production of Pentium microprocessors were worth about $26,000.[11] This shift in U.S. semiconductor production has coincided with the rapid growth in U.S. and world production of computer equipment and other applications which require high-end digital semiconductors. Partially as a result of this shift and reduced market volatility for high value products, the U.S. industry recovered significantly in the 1990s.

---

[7] This description of semiconductor manufacturing draws upon a letter from Motorola Corp., "The Making of a Semiconductor," delivered to USITC staff, July 29, 1996, and World Wide Web, retrieved Jan. 6, 1997, Harris Semiconductor, http:www.semi.harris.com/docs/lexicon/manufacture.html, *How Semiconductors are Made*.

[8] This delineation of the manufacturing process is referred to as production sharing. For a more detailed explanation of production sharing in semiconductors, see USITC, *Production Sharing: Use of U.S. Components and Materials in Foreign Assembly Operations, 1991-1994* (investigation No. 332-237), USITC publication 2966, May 1996, p. 4-9.

[9] Arthur Gottschalk, "Asian Makers Storm Semiconductor Market," *Journal of Commerce*, Aug. 27, 1996, p. 1.

[10] Michael Marks, "Industrial Policy at Work or True Grit?," *Technology Transfer Business* (Los Angeles, CA: Technology Transfer Society, Summer 1993), pp. 29-33.

[11] McLean, ed., *Mid-Term 1996*, p. 3-16.

According to some analysts, the U.S. industry does have certain disadvantages. Because many U.S. chip manufacturers do not produce in large volumes, they do not often achieve the production efficiencies of foreign commodity producing competitors. In addition, because most U.S. firms are not diversified out of semiconductor production, they do not have guaranteed captive consumption or the necessary financial resources to absorb a prolonged downturn in semiconductor demand.[12] However, certain U.S. producers have maintained production of commodity chips and have used it as a "process driver" to assist in improving the production efficiencies of other products. Another disadvantage for the U.S. industry is capital equipment depreciation schedules. U.S. manufacturers can fully depreciate their capital equipment in 5 years, while many of their competitors can depreciate a majority of the value of their capital equipment in 1 year. As semiconductor manufacturing equipment reportedly has an average life cycle of 3 years, U.S. manufacturers are put to a significant disadvantage.[13]

U.S. semiconductor production grew from approximately $24 billion to $39 billion during 1992-96 (figure 5-3).[14] The downturn in U.S. production that occurred in 1996 was concurrent with the downturn in the global semiconductor market, which dropped by nearly 8 percent. Although the value of domestic shipments of semiconductors had increased by more than 60 percent during 1992-96, employment for that period only expanded by roughly 9 percent to an estimated 190,000 workers.[15] This trend is reportedly due to the U.S. industry adopting increasingly capital-intensive manufacturing processes and to increases in labor productivity.[16]

The largest U.S. producers in 1996 were Intel, Texas Instruments (TI), Motorola, IBM, and Micron Technology, which together accounted for over one-half of the total U.S. output.[17] Though there are some notable exceptions, such as TI, Motorola, and IBM, most U.S. semiconductor manufacturers specialize in the production of semiconductors and are not diversified into other industrial sectors. Most U.S. firms further specialize in the production of specific types of semiconductors, while only a few U.S. firms (IBM, Motorola, TI) offer a wide product line (table 5-1).

Semiconductor producers can be divided into captive and merchant. Merchant producers primarily sell their output on the open market, while captive firms primarily produce semiconductors for consumption in their own end-products.[18] Certain U.S. producers, such as Motorola, TI, and IBM, manufacture semiconductors for both internal consumption and sale on the open market, but are generally considered to be merchants. The trend in the United States has been toward greater merchant production, which rose from 88 percent to 95 percent of total U.S. semiconductor production during 1986-1996.[19]

U.S. producers dominated global semiconductor production until the 1980s, when domestic production was eclipsed by that of Japan. The decline in the U.S. share of world production was also connected to the movement offshore of production facilities by many larger U.S. firms. Since the early

---

[12] USITC, *Industry and Trade Summary: Semiconductors*, USITC publication 2708, Dec. 1993, pp. 12-13.

[13] World Wide Web, retrieved Feb. 19, 1997, SIA, http://www.semichips.org/rd/taxdep.htm, *Research and Technology*.

[14] Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford, UK: Elsevier Science Ltd., 1993), 1993 ed., p. 223 and Elsevier, *Yearbook of World Electronics Data*, 1996, p. 229.

[15] U.S. Department of Commerce (USDOC), *Statistical Abstract of the United States: 1996* (Washington, DC: U.S. Bureau of the Census, 1996), p. 893.

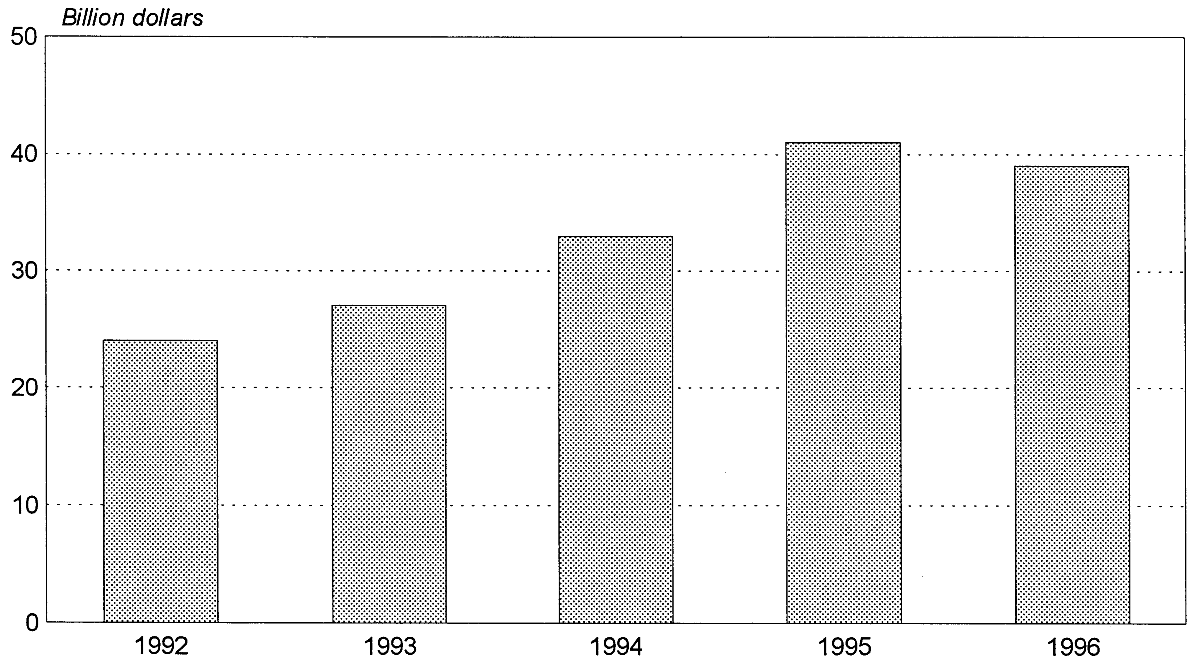
[16] USITC, *Industry and Trade Summary: Semiconductors*, p. 5.

[17] Estimated by USITC staff based on McLean, ed., *Mid-Term 1996.*

[18] Examples of U.S. merchant firms are Intel Corp., Cirrus Logic, Advanced Micro Devices, and Harris Semiconductor. Examples of U.S. captive firms are Westinghouse, Lockheed Martin, and Delco Electronics.

[19] Estimated by USITC staff based on McLean, ed., *Mid-Term 1996.*

Figure 5-3
Semiconductor: U.S. production, 1992-96



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

Table 5-1
Major U.S. merchant[1] semiconductor manufacturers, major product types, and primary end uses

Company name	Major product types	Primary end uses
AMD	Microprocessors, flash memory, logic devices	Computers, communications equipment
Analog Devices	Analog, DSPs	Consumer electronics, industrial equipment, communication equipment
Cirrus Logic	Microprocessors, DSPs	Computers, communications equipment, consumer electronics
IBM	Microprocessors, DRAMs, ASICs,[2] DSPs	Computers
Intel	Microprocessors, flash memory, microcontrollers	Computers
LSI Logic	ASICs[2]	Consumer electronics, computers, communications equipment
Lucent	ASICs,[2] microcontrollers, logic devices	Communications equipment, consumer electronics
Micron Technology	DRAMs, SRAMs	Computers
Motorola	Microcontrollers, microprocessors, ASICs,[2] SRAMs	Computers, communications equipment, automobiles
National Semiconductor	Analog, DSPs	Communications equipment, computers
Texas Instruments	DRAMs, microprocessors, DSPs, logic devices, ASICs[2]	Computers, communications equipment, consumer electronics
VLSI	ASICs[2]	Computers

[1] Producers who primarily sell their output on the open market.
[2] Application specific integrated circuits.

Source: Compiled by the staff of the USITC.

1990s, the U.S. share of world production has largely stabilized as the world demand for noncommodity semiconductors, in which U.S. firms lead in production, has risen.[20]

Globalization has become a significant feature in the domestic and international semiconductor industry. As mentioned, U.S. firms have expanded production outside of the United States while foreign firms have opened production facilities in the United States. Most major U.S. firms have become reliant upon sales and production outside of the United States. U.S. firms locate production facilities abroad for a variety of reasons, including gaining access to foreign markets by circumventing tariff and non-tariff measures, better serving markets by locating in regions where semiconductors are being consumed, and gaining access to financing and investment incentives.[21] For example, Intel Corp. has fabrication facilities (fabs) in the United States, Ireland, and Israel, assembly facilities in Malaysia, the Philippines, and China, and design facilities in the United States, Japan, Malaysia, and Israel.[22] In addition, a number of Japanese and EU firms have located fabrication facilities in the United States, with Korean firms also expected to open fabs in the United States in the next 2 years.[23] The Japanese and Korean firms locating in the United States are largely concentrating in the production of commodity memory devices, primarily DRAMs.

Globalization in the semiconductor industry has also taken the form of strategic joint ventures and technology licensing. Semiconductor production requires significant R&D and facility investment, and a number of U.S. firms license proprietary technology to other firms or enter into joint ventures with other firms as a means of increasing revenues and spreading costs and risks. Strategic alliances also allow firms to gain access to expertise that they may be lacking such as distribution networks, design technology, and manufacturing process technology.[24] According to a recent DRI/McGraw-Hill study, U.S. semiconductor firms have led the way in the formation of alliances with firms headquartered in other regions, most notably with Japanese firms.[25] For example, IBM and Toshiba of Japan are currently engaged in a cooperative development program to produce future generations of DRAMs and are jointly funding the construction of a new fab in Virginia.[26] U.S. firms which are strong in specialized, noncommodity products, such as microcomponents, are also active in the licensing of these technologies to foreign producers. For example, Silicon Graphics has licensed parts of its microprocessor technology to NEC of Japan and to Philips of the Netherlands.[27]

Globalization of the semiconductor industry has also resulted in the expansion of the value of U.S. exports. U.S. exports have more than doubled since 1992, from $11.5 billion to an estimated $23.5 billion in 1996.[28] Growth in exports during this time has been at a faster rate than the increase in U.S. production, and reflects the 120-percent increase in global semiconductor demand.[29] The largest U.S. export markets are Malaysia (15 percent), the EU (13 percent), Canada (12 percent), Singapore (10 percent), and Japan

---

[20] Marks, "Industrial Policy at Work or True Grit?," *Technology Transfer Business* (Los Angeles, CA: Technology Transfer Society, Summer 1993), pp. 29-33.

[21] U.S. industry officials, interviews by USITC staff, fall/winter 1996; OECD, *Information Technology Outlook, 1995* (Paris: OECD, 1995), p. 46; and USITC, *Industry and Trade Summary: Semiconductors*, p. 7.

[22] World Wide Web, retrieved Oct. 24, 1996, Intel, http://www.intel.com/intel/intelis/sites.htm, Worldwide Locations.

[23] McLean, ed., *Mid-Term 1996*, pp. 2-46 to 2-48.

[24] World Wide Web, retrieved Feb. 2, 1997, Electronic Industries Association of Japan (EIAJ), http://eiaj.org/study/executive.html#3, EIAJ, DRI/McGraw-Hill Study, *The Globalization of the Semiconductor Industry, Executive Summary*.

[25] Ibid.

[26] McLean, ed., *Mid-Term 1996*, pp. 2-14 to 2-16.

[27] McLean, ed., *Mid-Term 1996*, p. 2-42.

[28] Estimated by USITC staff based on official statistics of the USDOC.

[29] World Wide Web, retrieved Feb. 19, 1997, SIA, http://www.semichips.org/indstats/shares.htm, *Chip Industry Stats* and official statistics of the USDOC.

(9 percent). Approximately one-half of U.S. exports are in the form of unfinished semiconductors. These are semiconductors that have been fabricated, but not yet assembled and packaged. After assembly, the finished semiconductors are often shipped back to the United States or other markets for final sale. Nearly 90 percent of exports to Malaysia in 1995, and substantial shares of U.S. exports to Canada, Singapore, and Japan, were in the form of unfinished products.[30] The primary finished products in which the United States has experienced export growth are microcomponents and flash memory.[31]

It is essential that semiconductor firms have access to the most recent technology and equipment in order to remain competitive in a business with ever shortening product cycles. As a result, the semiconductor industry is among the most technology intensive.[32] New generations of DRAMs are developed about every 3 years, and each new generation requires 5 times the development costs of the previous generation.[33] Semiconductor R&D investments help to reduce product costs, accelerate product development, and shorten the time-to-market.[34] According to ICE, R&D expenditures accounted for nearly 12 percent of the sales of semiconductor producers in 1995, double that of the overall electronics industry.[35] The U.S. and Japanese industries were the two largest capital spenders in 1992, both at about $4 billion. U.S. capital expenditures are expected to be about $15 billion in 1996, and since 1993 the U.S. industry has outspent the Japanese industry by an estimated total of $9 billion.

To assist U.S. producers with the great expense of R&D, two major consortia, the Semiconductor Research Corporation (SRC) and SEMATECH, have been created. SRC was formed in 1982 by the Semiconductor Industry Association (SIA), which represents the U.S. semiconductor industry. The SRC is a university research consortium which supports collegiate semiconductor research and students specializing in semiconductor technologies. SRC's current annual budget is approximately $28 million.[36] SEMATECH, also a proposal of the SIA, was created in 1987. SEMATECH was initially a collaboration between 14 major U.S. semiconductor manufacturers and the U.S. Government. Its initial membership was restricted to U.S.-based firms and its goal was to improve the competitiveness of the U.S. industry. SEMATECH was funded equally by industry membership and the Federal government. Since 1987, the consortium has spent over $2.1 billion in industry and government funds for semiconductor R&D. SEMATECH is currently in a state of change as Federal government contributions ceased in 1996, and its funding is now completely from the private sector. Also, SEMATECH has begun to relax its membership requirements. Participation in a new SEMATECH initiative to increase wafer size by 50 percent is open to any semiconductor manufacturer that has production facilities in the United States.

Although the extent of the contribution is disputed, SEMATECH and the SRC are often credited with increasing the competitiveness of U.S. producers by improving U.S. manufacturing processes and advancing the technology level of the U.S. equipment industry which supplies U.S. semiconductor producers.[37] Tangible improvements have been made in equipment reliability, process technology, and design

---

[30] USITC, *Shifts in U.S. Merchandise Trade in 1995* (investigation No. 332-345), USITC publication 2992, 1996, p. 11-5.

[31] Estimated by USITC staff based on official statistics of the USDOC.

[32] USITC, *Identification of U.S. Advanced-Technology Manufacturing Industries for Monitoring and Possible Comprehensive Study* (investigation No. 332-294), USITC publication 2319, 1990, p. 6.

[33] McLean, ed., *Mid-Term 1996,* pp. 3-1 to 3-6.

[34] USITC, *Industry and Trade Summary: Semiconductors*, p. 8.

[35] McLean, ed., *Mid-Term 1996*, p. 3-34.

[36] McLean, ed., *Mid-Term 1996*, p. 2-71.

[37] Marks, "Industrial Policy at Work or True Grit?," pp. 29-33.

software.[38] In addition, SEMATECH and the SRC have contributed to standards development and facilitated a greater willingness on the part of U.S. manufacturers to cooperate in pre-competitive technologies.

Given the great expense involved in semiconductor research, the U.S. industry is very interested in the protection of intellectual property rights. In 1984, the industry was successful in gaining the passage of the U.S. Semiconductor Chip Protection Act, which protects semiconductor layout designs, or maskworks.[39] In 1994, these protections were made international under the Trade Related Aspects of Intellectual Property Rights (TRIPS) code, which was agreed to under the Uruguay Round of the GATT.

The demand for and marketing of semiconductors is closely related to the demand for the products in which they are incorporated (figure 5-4).[40] Chief among these are data processing equipment (computers), communications equipment, and consumer electronics. Customized, or application specific chips, are often "designed-in" to electronics products. The design-in process often requires close collaboration between a semiconductor manufacturer and an electronics OEM (original equipment manufacturer), and can result in the direct sale of chips to the OEM. However, according to *Electronic Business Today*, well over half of all chip sales to OEMs are conducted through distributors, a trend that appears to be increasing.

Foreign Industry Profiles

Japan

Japanese producers surfaced as major competitors to U.S. firms during the late 1970s, and in the mid-1980s Japanese production overtook that of the United States.[41] The Japanese industry concentrated initially on the production of commodity semiconductors, for which the manufacturing technology was fairly accessible. Japanese firms developed competitive production equipment and techniques and manufactured these products on an extremely large scale.[42] By the late 1980s, Japanese producers were able to leverage their advantages in manufacturing efficiencies to dominate world production of volatile memory devices, DRAMs, and static random access memories (SRAMs) which in 1995 represented nearly 32 percent of global semiconductor sales.[43] The total value of Japanese production has increased from roughly $35 billion to $50 billion during 1992-96 (figure 5-5).[44] During that period, Japanese exports increased from nearly $13 billion in 1992 to an estimated $25 billion in 1996.[45] Japan has maintained a global lead in the production of memory devices, but has lost substantial world market share during the 1990s to Korea and Taiwan. Due in part to competition from other Asian producers as well as a shift toward greater world

[38] McLean, ed., *Mid-Term 1996*, p. 2-70.

[39] World Wide Web, retrieved Feb. 19, 1997, SIA, http://www.semichips.org/trade/intprop.htm, SIA, "Trade Issues."

[40] McLean, ed., *Mid-Term 1996*, p. 1-4.

[41] The United States and Japan entered into a Semiconductor Arrangement on September 2, 1986 that resulted in the suspension of EPROM and 256k and above DRAM antidumping investigations and a related section 301 investigation. This arrangement, in some form, has been extended twice, most recently in August 1996.

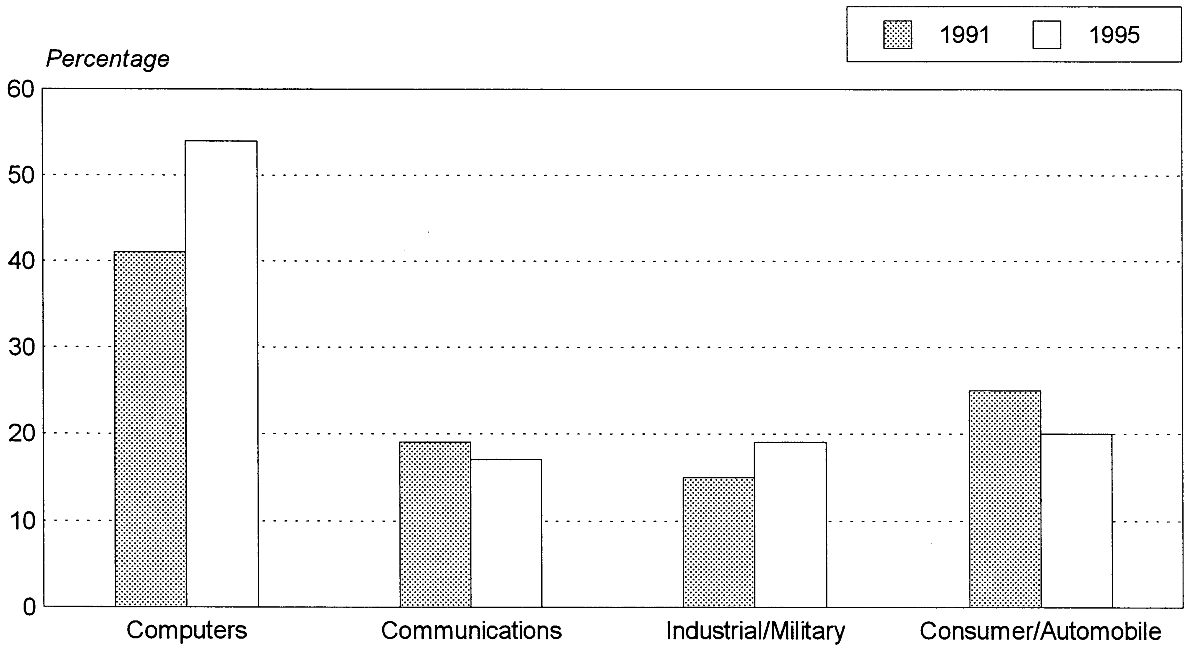
[42] USITC, *Industry and Trade Summary: Semiconductors*, p. 10.

[43] USDOC, *U.S. Industrial Outlook, 1994* (Washington, DC: USDOC, 1994), p. 15-7 and estimated by USITC staff based on In-Stat Inc. This number is estimated to have dropped substantially during the global semiconductor recession of 1996, but memories still represent a sizeable portion of the entire market.

[44] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996.

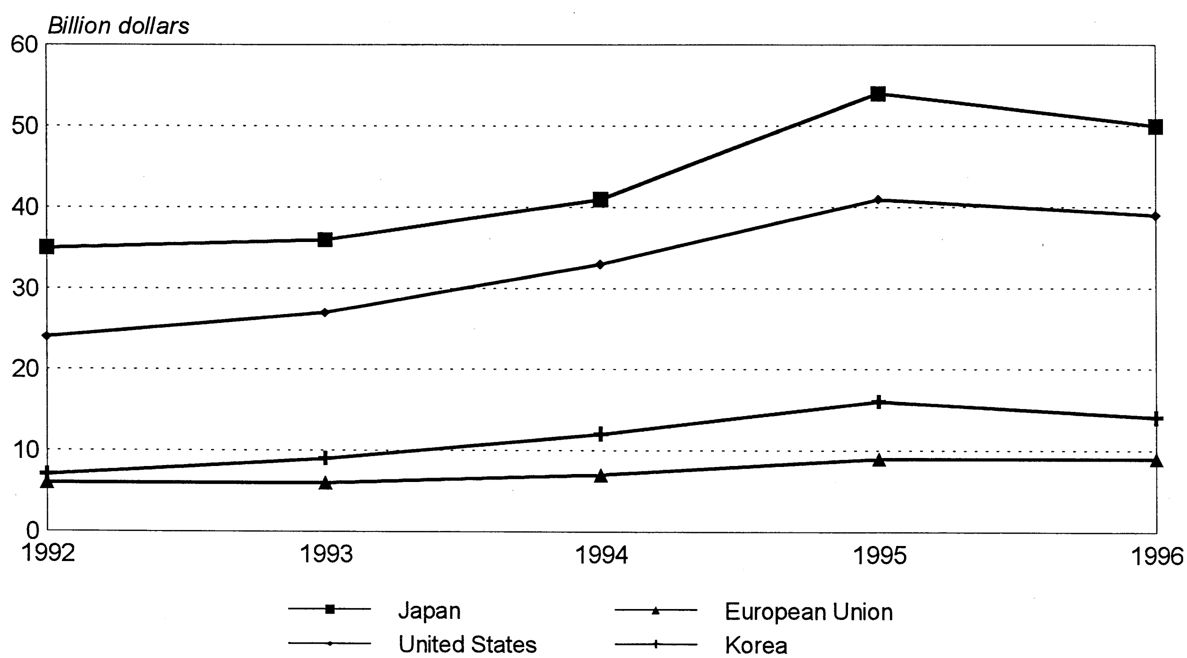
[45] Estimated by USITC staff based on United Nations Trade Series D.

Figure 5-4
Semiconductors: World usage, 1991 and 1995



Source: Integrated Circuit Engineering, *Mid-Term 1996, A Report on the Integrated Circuit Industry* (Scottsdale, AZ: ICE, 1996).

Figure 5-5
Semiconductors: Trends in production of selected producers, 1992-96



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

consumption of noncommodity products, Japan is seeking to broaden its semiconductor production into product areas that U.S. manufacturers dominate, including microcomponents, logic devices, and ASICs.[46]

The structure of the Japanese industry is markedly different from that of the U.S. industry. Japanese producers of semiconductors are often large, vertically integrated firms that are members of tightly affiliated industrial groups, sometimes referred to as keiretsu. There is a large concentration among these firms, as the top ten integrated circuit manufacturers are estimated to account for nearly 82 percent of Japanese production. These firms include NEC, Hitachi, Toshiba, Mitsubishi Electric, Fujitsu, Matsushita Electronics, Sanyo Electric, Oki, Sharp, and Sony.[47] These companies all mass produce commodity devices such as DRAMs, and benefit from increased production efficiencies and process improvements associated with large economies of scale. Japanese firms are typically diversified, and produce semiconductors and other electronic components as well as the end products in which they are incorporated, such as computers and consumer electronics. The structure of the Japanese producers may offer significant advantages. Due to the high degree of captive consumption, these firms are guaranteed a certain level of demand. In addition, because of their product diversification, Japanese producers may have a greater ability than U.S. firms to weather market downturns, and greater resources to devote to R&D and capital expenses.

As is the case with U.S. producers, Japanese manufacturers depend heavily on semiconductor R&D and capital equipment spending in order to remain competitive. Like U.S. producers, Japanese producers have also organized a number of research consortia to pool resources for the development of semiconductor technology. Among these are the Association of Super-Advanced Electronics Technology (ASET) and Semiconductor Leading Edge Technologies Inc. (Selete).[48] ASET is largely dedicated to the advancement of basic process technologies, especially improvements in lithography. Selete is dedicated to the development of advanced manufacturing equipment and the enlargement of wafer sizes to 12 inches (300 mm). ASET has been opened to certain foreign-owned manufacturers located in Japan, while participation in Selete has been restricted solely to Japanese-owned firms.[49]

In addition to exporting, Japanese firms, like their U.S. counterparts, are increasingly involved in other forms of international transactions. Japanese firms are entering into joint ventures and technology licensing arrangements with U.S., European, and, more recently, Korean producers, in order to gain access to new technologies and spread financial risks. Japanese firms have also become active in establishing off-shore production and assembly facilities. Japanese producers have located a number of fabrication facilities in the United States and Europe, and have established numerous production-sharing assembly facilities in Southeast Asia.

Korea

Korea has rapidly grown into a major semiconductor producer. From 1992-96, Korean semiconductor production grew from $7 billion to an estimated $14 billion, and Korea currently ranks third in world production.[50] Like Japan, Korea entered the semiconductor market through the production of volatile memories, DRAMs and SRAMs. Korean manufacturers have invested tremendous amounts of capital toward

---

[46] U.S. Department of State telegram, message reference No. 001049, prepared by U.S. Embassy, Tokyo, Feb. 5, 1997 and USDOC, *U.S. Industrial Outlook, 1994*, p. 15-7.

[47] Yano Research Institute, *Market Share in Japan 1995* (Tokyo, Japan: Yano Research Institute Ltd., 1996), p. 238.

[48] McLean, ed., *Mid-Term 1996*, p. 2-72.

[49] Ibid.

[50] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996.

the production of commodity devices and have taken advantage of large economies of scale and competitive manufacturing technologies.[51]

The composition of the Korean industry is unique, while the structure of the Korean companies somewhat resembles the Japanese model. There are only three major Korean semiconductor manufacturers, Samsung, Hyundai, and LG Semicon, a division of Lucky Goldstar. These three firms account for nearly 98 percent of total Korean production.[52] They are vertically integrated conglomerates that produce a wide variety of electronic products from components to finished electronic systems such as televisions and other consumer electronics. As such, they have the financial resources to sustain downturns in the market and to make significant investments in R&D and capital equipment and other product lines to offset the down cycles in semiconductors. For example, Korean capital spending has increased from about $1 billion in 1992 to roughly $7 billion in 1996.[53] Korean firms have concentrated almost exclusively in the production of DRAMs and SRAMs, and in 1995, Samsung was the global leader in both DRAM and SRAM production. DRAMs alone are estimated to account for more than 80 percent of Korean production. Korean firms were quick to jump into commercial production of 4 megabyte and 16 megabyte DRAMs, and are currently leaders in the development of next generation 64 megabyte and 265 megabyte DRAMs.[54] During the strong memory market of 1995, Korean firms experienced over 80-percent growth in sales.[55] However, during the global downturn in the 1996 market, particularly in DRAMs, Korean firms were among the hardest hit. As a result, Korean firms are currently striving to diversify their product lines.[56]

Like their foreign competitors, Korean firms are becoming increasingly active in international trade, foreign production, joint ventures, and technology licensing. Korean production is export oriented, and during 1992-96, exports grew from about $6 billion to an estimated $13 billion.[57] Korean producers have not established any foreign production facilities, but all three firms are in the process of doing so. Samsung and Hyundai are currently building fabrication facilities in the United States, while LG Semicon is constructing a site in the United Kingdom. In addition to establishing off-shore production facilities, Korean firms are also entering into numerous alliances with foreign producers. For example, Samsung has joined NEC in the development of ASIC products, and Hyundai has teamed with two small U.S. firms, also for the purpose of developing ASIC devices. Korean firms are interested in diversifying out of memory chips, and have begun to do so through both joint ventures and licensing agreements. Samsung has licensed ASIC and microprocessor technology from U.S. firms. Hyundai has licensed smart card technology from SGS Thomson and various technologies from Intel. LG Semicon has recently licensed microprocessor technology from Hitachi and from Advanced RISC Machines of Europe.[58]

European Union

The EU is the world's fourth largest semiconductor producer, but a substantial portion of that production is attributable to foreign-owned facilities. There are only three EU-owned semiconductor

---

[51] Marks, "Industrial Policy at Work, or True Grit," pp. 29-33.

[52] Estimated by USITC staff based on ICE.

[53] Korea Economic Institute of America, *Korea's Economy 1996* (United States: Korea Economic Institute of America, 1997), pp. 45-47 and B. McLean, ed., *Mid-Term 1996*, p. 2-57.

[54] World Wide Web, retrieved Mar. 5, 1997, Electronic Industries Association of Korea (EIAK), http://eiak.com/overview.htm, EIAK, *Moving Towards a Soft Landing in 1996*.

[55] McLean, ed., *Mid-Term 1996*, p. 2-46.

[56] U.S. Department of State telegram, message reference 0010049.

[57] Estimated by USITC staff based on United Nations Trade Series D.

[58] McLean, ed., *Mid-Term 1996*, pp. 2-46 to 2-51.

manufacturers among the top twenty in global production: Philips based in the Netherlands; SGS-Thomson Microelectronics, based in France and Italy; and Siemens AG, based in Germany. In addition, there are relatively few European-owned small to medium-sized producers. The largest of these are TEMIC, GEC Plessey, Ericsson, Bosch, and Alcatel, with none expected to have sales in 1996 of over $500 million.[59] A number of leading foreign-owned firms have established production facilities in the EU including Fujitsu, Hitachi, IBM, Motorola, and TI. In general, these firms have located production in the EU in order to serve the EU market rather than to gain access to new technologies or production efficiencies. The value of EU production increased from $6 billion in 1992 to an estimated $9 billion in 1996, but did not keep pace with the growth trends in most other major producing regions. In general, EU-owned firms, like U.S. firms, have moved toward the production of more specialized, higher margin, application-specific devices. Currently, EU firms are among the world leaders in the production of certain non-volatile memories such as erasable programmable read only memories (EPROMs), microcontrollers, and communications ICs.[60] However, a broad variety of other products, including microprocessors and DRAMs, are also manufactured in the EU by EU-owned as well as U.S.- and Japanese-owned firms.

The structure of EU firms more closely resembles that of Japanese rather than U.S. firms. Most of the leading EU-owned semiconductor firms are diversified electronic systems manufacturers.[61] Like their Japanese counterparts, they have a relatively large rate of captive consumption, which guarantees a certain level of demand.[62] This is especially true in regard to firms such as Philips, Siemens, Ericsson, Bosch, and Alcatel.[63] To a certain degree, these companies have concentrated on the production of semiconductors which are most related to the end products they produce. Philips is a leader in the production of consumer electronics and concentrates its semiconductor output in logic devices and microcontrollers. Siemens, the only EU-owned manufacturer of DRAMs, is a global leader in industrial and communications electronics and has concentrated semiconductor production in microcontrollers for the industrial and automotive markets, and in communications ICs. SGS Thompson has also focused its production in semiconductors toward specific end-products, including volatile memories for computer applications, flash memory and analog ICs for communications equipment, and microcontrollers for automobiles.[64]

In order to increase competitiveness, EU-owned firms are becoming increasingly involved in various forms of international transactions, including technology licensing, joint ventures, foreign production, and exporting.[65] For example, SGS-Thomson licensed its smartcard technology to Hyundai of Korea for mass production. In addition, Philips licensed microprocessor technology from Silicon Graphics that will allow Philips to produce the controlling chips necessary for the next generation of consumer electronics products.[66] Siemens has been particularly active in joint ventures. In order to spread financial risk and gain access to new technologies, Siemens has entered into an agreement with IBM and Toshiba to develop the next generation of DRAMs. Siemens has also established a joint venture with Motorola to build a DRAM facility in Richmond, Virginia. Offshore EU production is increasing with a new SGS Thompson plant to be located in Singapore and EU exports are also increasing. During 1992-96, EU exports grew from $2.5 billion to an estimated $5 billion.[67] This growth rate is significantly larger than the rate of growth in EU production and reflects the growing globalization of the semiconductor industry.

---

[59] McLean, ed., *Mid-Term 1996*, p. 2-39.

[60] McLean, ed., *Mid-Term 1996*, p. 2-40.

[61] European Commission, *Panorama of EU Industry*, pp. 10-8 to 10-15.

[62] Arthur Gottschalk, "Asian Makers Storm Semiconductor Market," *The Journal of Commerce*, Aug. 27, 1996, p. A-1.

[63] Industry representative, interview by USITC staff, Dallas, TX, Dec. 2, 1996.

[64] McLean, ed., *Mid-Term 1996*, pp. 2-39 to 2-40.

[65] European Commission, *Panorama of EU Industry*, pp. 10-8 to 10-15.

[66] McLean, ed., *Mid-Term 1996*, p. 2-42.

[67] Estimated by USITC staff based on European Commission, *Panorama of EU Industry*.

Other Producers

In addition to those mentioned, there are a number of emerging semiconductor manufacturers, including Taiwan, various ASEAN countries, and China. Taiwan is quickly becoming a major producer, with output growing from about $2 billion to $3 billion during 1992-96.[68] The industry in Taiwan is concentrated among six firms that account for approximately 90 percent of production.[69] These firms are TSMC, UMC, Winbond, a Texas Instruments-Acer collaboration, Mosel-Vitelic, and Macronix. Current semiconductor production in Taiwan is largely in low-margin products such as SRAMs, EPROMs, and read only memories (ROMs). However, through licensing agreements, firms in Taiwan are moving toward higher margin products such as ASICs and flash memory.[70]

ASEAN countries, particularly Singapore, Malaysia, and Thailand, have been the center of global production-sharing in semiconductors since the 1970s. U.S., Japanese, and EU producers ship unfinished semiconductors to these countries for testing, packaging, and re-export. However, in recent years, these countries have begun to move into fabrication as well. Most of the fabrication facilities in this region are foreign-owned transplants, but there has been the development of some domestic industry. For instance, Charter Semiconductor of Singapore recently began construction of its third fabrication facility and its 1996 output is estimated to exceed $400 million.[71]

China is currently one of the fastest growing producers. Chinese manufacturing is largely in low-end areas such as the fabrication of low-tech discrete devices and contract assembly. However, major producing companies such as Intel and Motorola have made plans to locate assembly and fabrication facilities in China in the near future which may lead to further direct investment by other principal producers.

U.S. Market Profile

The United States is the world's largest consumer of semiconductors with a 1996 market estimated at $52 billion.[72] The 1996 figure represents an increase of nearly 85 percent over the $28 billion total for 1992. Growth in the market for semiconductors is primarily driven by demand for the electronic systems into which they are incorporated. After negative growth in the late 1980s, the U.S. electronics systems industry has experienced growth since 1991, and double digit growth since 1994.[73] The primary consumers of semiconductors are the manufacturers of end-products such as computer equipment, communications equipment, industrial electronics, and automobiles.

In the United States, consumption is dominated by the computer industry, which in 1996 accounted for an estimated 70 percent of total U.S. semiconductor consumption.[74] The growing share of semiconductor consumption by the computer industry in the United States is a function of the growth of the domestic computer industry, the increasing component value of semiconductors as a share of overall computer value, and the lack of significant demand by the domestic consumer electronics industry. Computer production in the United States rose by nearly 50 percent from 1992-96. Each new generation of computer incorporates

---

[68] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996.
[69] McLean, ed., *Mid-Term 1996*, p. 2-49.
[70] McLean, ed., *Mid-Term 1996*, pp. 2-49 to 2-52.
[71] McLean, ed., *Mid-Term 1996*, p. 2-53.
[72] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data,* 1994 and 1996.
[73] McLean, ed., *Mid-Term 1996,* pp. 1-3 to 1-6.
[74] McLean, ed., *Mid-Term 1996*, p. 1-10.

additional memory and processing power. For example, a personal computer in 1992 might contain 4 megabytes of DRAM while a 1996 model is typically shipped with 16 to 32 megabytes. Consequently, the semiconductor content of computers has risen to an estimated 35 percent of the sales value.[75] Other products that are driving semiconductor demand in the United States are communications equipment, especially portable phones, and automobiles, which, like computers, are becoming increasingly semiconductor intensive.

Increased consumption by the computer sector has also affected the composition of the U.S. market. Digital integrated circuits, which are used in computers, are increasing their share of the overall market. Although the demand for discrete semiconductors rose by nearly 90 percent during 1992-1996, the demand for integrated circuits grew by an estimated 140 percent. As a result, integrated circuits have increased their share of overall U.S. semiconductor consumption from 89 percent to 91 percent, while the share for discretes has dropped from 11 to 9 percent.[76] Computer applications have also contributed to the shift in the U.S. market to the greater use of digital rather than analog semiconductors.

Primarily because of the large degree of computer consumption in the U.S. market, the United States is also a leading semiconductor importer. Total U.S. semiconductor imports rose from $15.5 billion in 1992 to an estimated $37 billion in 1996. The largest foreign suppliers to the U.S. semiconductor market in 1996 were Japan ($8.7 billion), Korea ($6.2 billion), Malaysia ($5.1 billion), and Taiwan ($3 billion). Chief among these imports are DRAMs and SRAMs. DRAMs and SRAMs are essential components in computers but are not manufactured in large enough quantities domestically to satisfy demand. As a result, the United States fills much of its demand for these devices through imports.

The majority of DRAM and SRAM imports originate from Japan and Korea. In 1995, U.S. imports of DRAMs alone totaled over $12 billion.[77] While imports from Japan, Korea, and Taiwan were primarily memory devices, imports from Malaysia and other Southeast Asian countries such as Singapore, Thailand, and Indonesia were largely reimports of devices fabricated in the United States and shipped to production-sharing affiliates in Southeast Asia for assembly, testing, and export back to the United States. Production sharing imports to the United States in 1995 were estimated at $8.6 billion, or 22 percent of total imports. By 1999, the United States will have no tariffs on the importation of semiconductor devices. U.S. tariffs on semiconductors are scheduled to be eliminated under the Uruguay Round commitments by January 1, 1999. As a result, the ITA should have no impact on the opportunities for access to the U.S. market (table 5-2).[78]

Foreign Market Profiles

Japan

Japan is the world's second largest consumer of semiconductors. During 1992-96, the Japanese market rose by roughly 35 percent, from $26 billion to an estimated $35 billion.[79] However, growth in the

---

[75] McLean, ed., *Mid-Term 1996*, p. 1-25.

[76] McLean, ed., *Mid-Term 1996*, p. 1-18.

[77] USITC, *Shifts in U.S. Merchandise Trade in 1995*, p. 11-5.

[78] *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994. The Marrakesh Protocol is part of the General Agreement on Tariffs and Trade 1994 (GATT 1994), which is a multilateral agreement that is an annex to the Agreement Establishing the World Trade Organization. For tariffs on specific Harmonized Tariff Schedule categories see appendix G.

[79] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996.

Table 5-2
Final Uruguay Round tariffs on semiconductors for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	1-15
Canada	0
Costa Rica	([2])
Estonia	0
European Communities (15)	0-14
Hong Kong	0
Iceland	0
India	40
Indonesia	40
Israel	0-([2])
Japan	0
Korea	0
Macau	0
Malaysia	0
New Zealand	0-20
Norway	0.1-9
Romania	35
Singapore	10
Switzerland	0.1
Taiwan[3]	0-2
Thailand	30-([2])
Turkey	([2])
United States	0

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.

Source: *Most-Favoured-Nation Schedules, Annexes of Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations, (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994 and U.S. Department of Commerce working documents.

Japanese semiconductor market has not kept pace with growth in other Asian countries, the United States, and the EU. Although the Japanese computer industry has now become the driver for semiconductor demand in Japan, representing approximately one-half of semiconductor demand, overall Japanese consumption of semiconductors has not kept pace with computer-related consumption.[80] The economic downturn in Japan and the continuing movement offshore of Japanese consumer electronics manufacturers have contributed to reduced demand from non-computer industries such as consumer electronics, communications equipment, industrial equipment and automobiles, that comprise the remainder of the Japanese market.[81]

During 1992-96, Japanese imports increased at a faster rate than the market. Japanese imports rose from $4 billion to an estimated $10 billion and imports as a portion of domestic consumption grew from 15 percent to an estimated 28 percent.[82] The rise in imports as a share of consumption is due to the U.S.-Japan Semiconductor accords, the movement in Japan toward the predominance of computer usage of semiconductors, and the availability of low cost memories from Asian suppliers. The U.S.-Japan Semiconductor accords established mechanisms to increase foreign access to the Japanese market, including cooperative arrangements between Japanese users and foreign manufacturers as well as goals which were set for the level of foreign market share in Japan. In addition, greater consumption of computer equipment has led to greater imports, because most computers require a microprocessor as well as memory. Japanese semiconductor manufacturers are not major microprocessor manufacturers and, as a result, they are forced to import these products, largely from the United States. The same situation is true in certain telecommunications devices. Japanese semiconductor manufacturers are not leaders in the production of the chips that translate analog voice signals to digital, so are required to import these devices for consumption, most often from the United States. In recent years, low cost memory devices from Korea and Taiwan have also made headway in the Japanese market. Japan has already eliminated its tariffs on semiconductors and therefore the ITA should have no effect on market access.

European Union

The EU semiconductor market was an estimated $19 billion in 1996.[83] This represents nearly a 75-percent rise over the 1992 total of $11 billion. Semiconductor demand in the EU was driven by electronic systems production which is estimated to have grown by nearly 40 percent during 1992-96.[84] Computers and communications equipment were the primary consuming sectors and accounted for approximately 50 percent and 30 percent, respectively, of the value of EU demand.[85] The EU is largely served by U.S.-owned and Asian-owned producers. Of the top ten companies selling to the EU market, four are U.S.-owned, three are EU-owned, two are Japanese-owned, and one is Korean-owned.[86] Foreign-owned firms serve the EU market through exports as well as transplant production.

In 1996, the EU had a trade deficit in semiconductors estimated at $10 billion.[87] Much of this deficit is a result of the lack of production in the EU of semiconductors used in computer equipment. Semiconductor imports grew in the EU during 1992-96, from an estimated $7.5 billion to $15 billion. The

[80] EIAJ, *Facts and Figures of the Japanese Electronics Industry* (Tokyo, Japan: EIAJ, 1996), p. 35.
[81] McLean, ed.,, *Mid-Term 1996*, p. 1-10.
[82] Estimated by USITC staff based on United Nations Trade Series D.
[83] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data,* 1992 and 1996.
[84] European Commission, *Panorama of EU Industry*, p. 10-12.
[85] McLean, ed., *Mid-Term 1996*, p. 1-10.
[86] Estimated by USITC staff based on European Commission, *Panorama of EU Industry*, p. 10-13.
[87] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data,* 1992 and 1996.

EU imports large quantities of microcomponents and memory chips.[88] In addition, the EU imports a substantial portion of its consumption of ASICs and DSPs for communications equipment. In the absence of an ITA, duties of 0 to 7 percent would remain on EU semiconductor imports with smart cards at 14 percent. As a result, market access opportunities in the EU are likely to increase. In addition, enlargement of the EU will also result in expanded market access opportunities for semiconductor producers.

Other Markets

Many of the other major semiconductor markets are located in Asia. Chief among these are Korea and Taiwan. The combined markets of these two economies grew from $6.6 billion to an estimated $13.5 billion during 1992-96, an increase of over 100 percent.[89]

From 1992-96, the Korean market rose from $4 billion to an estimated $6.5 billion.[90] Korea has largely concentrated in the production of DRAMs and SRAMs, and is dependent upon foreign suppliers for other types of semiconductors. Much of Korea's semiconductor consumption is incorporated into its growing consumer electronics industry, which comprises approximately 10 percent of global consumer electronics production.[91] Primary consumer electronics products include color televisions, videocassette recorders, and audio equipment. In order to meet demand, Korean imports have risen from $3 billion in 1992 to an estimated $5 billion in 1996.[92] Under Uruguay Round commitments, Korea is already scheduled to eliminate its semiconductor tariffs by January 1, 1999. As a result, the ITA should have little effect on market access opportunities in Korea.

Taiwan's semiconductor market has shown significant growth, rising from $2.6 billion in 1992 to an estimated $7 billion in 1996.[93] Growth in Taiwan has been spurred by its emerging information technology industry, especially computer equipment. The largest semiconductor consumers in Taiwan include notebook computer, desktop computer, and motherboard manufacturers.[94] Like the EU market, the market in Taiwan is a competition zone for foreign manufacturers. Imports to Taiwan have grown to an estimated $6 billion for 1996 and account for nearly 90 percent of consumption.[95] In the absence of an ITA, duties of 0 to 2 percent would remain on semiconductor imports to Taiwan. As a result, increased market access opportunities under the ITA will be negligible.

Printed Circuits

Printed circuits are usually in the form of printed circuit boards (PCBs), also referred to as printed wiring boards. Printed circuits are used to mount and interconnect other electronic components such as semiconductors, capacitors, and resistors. The printed circuit provides both the physical structure for mounting and holding electronic components as well as the electrical interconnection lines between them. Assembled, or mounted printed circuits are essential elements in nearly all electronic systems including those

---

[88] European Commission, *Panorama of EU Industry*, p. 10-12.

[89] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1992 and 1996.

[90] Ibid.

[91] EIAK, *Moving Towards a Soft Landing in 1996.*

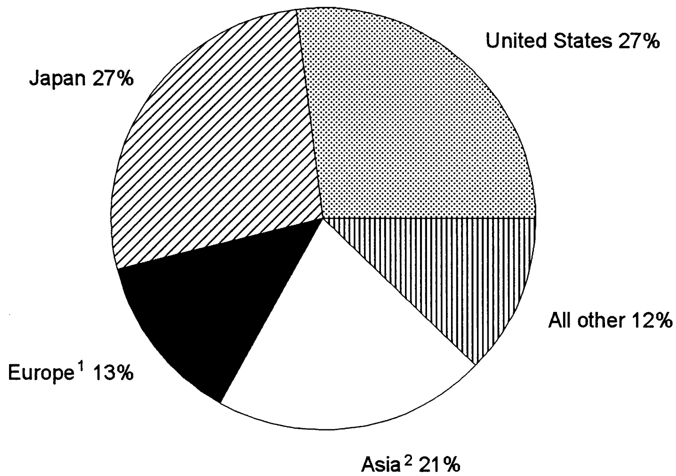
[92] Estimated by USITC staff based on United Nations Trade Series D.

[93] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1992 and 1996.

[94] World Wide Web, retrieved Mar. 5, 1997, National Trade Data Bank, http://www.stat-usa.gov/webdocs.cgi/public/market/, USDOC, "Taiwan-Semiconductors," Feb. 1, 1995.

[95] Estimated by USITC staff based on United Nations Trade Series D and USDOC, "Taiwan-Semiconductors."

Figure 5-6
Rigid printed circuit boards: World production, 1996



[1] Europe includes Germany, the United Kingdom, Italy, and France.
[2] Asia includes Taiwan, China, Korea, and Singapore.

Source: USITC staff estimates based on the Institute for Interconnecting and Packaging Electronics Circuits and Elsevier Advanced Technology.

in the automotive, computer, telecommunications, consumer, medical, and aerospace industries.[96] PCBs are produced and consumed by nearly all countries engaged in the manufacture of electronics products. The United States, Japan, and the EU are the leading producers and consumers along with various Asian economies (figure 5-6). For a complete list of printed circuit products included in the agreement see appendix A.

Innovation in the PCB industry is driven largely by change in the semiconductor industry. Semiconductor devices have become increasingly more complex, with higher pin counts (input/output attachments to the PCB), narrower line-widths between circuits, and faster information cycling speeds.[97] With each new development from the semiconductor and other electronic component industries, a complementary interconnection solution is required in the form of PCB innovation or modification. Current pressures toward miniaturization, weight reduction, and portability are leading toward the use of direct attachment of uncased, bare chips onto ever smaller PCBs. These new board structures are often referred to as multichip modules (MCMs) and are likely to become increasingly important shares of the overall PCB market.[98] New technologies which allow for the attachment to the circuit board of bare, uncased components are direct chip attach and chip scale assembly.[99]

---

[96] Printed circuits which have been assembled with components such as semiconductors, capacitors, and resistors are not classified in heading 8534 of the Harmonized Tariff Schedule. Assembled printed circuits are classified as parts of end products for which they are dedicated.

[97] USDOC, *U.S. Industrial Outlook, 1994,* p. 15-13.

[98] IPC, *The Technology Roadmap for Electronic Interconnections* (Northbrook, Il: The Institute for Interconnecting and Packaging Electronic Circuits (IPC), 1995), p. B-14.

[99] IPC, *The Technology Roadmap for Electronic Interconnections*, p. B-34.

In general, the fabrication of printed circuits is quite automated and capital intensive and can be divided into three phases: design, photography, and manufacturing.[100] Computer-aided design is often used to design an enlarged master of the circuit with emphasis on the placement of components. Photographs of the master are reduced and used to produce templates for the drilling of board holes and creation of circuit patterns.[101] A copy of the circuit, usually in the form of copper, is deposited onto the board by exposing a photo-sensitive resist. Any excess deposit is then etched away. In boards of two or more layers, plated through-holes provide circuit continuity from one side of the board to the other.

U.S. Industry Profile

U.S. producers initially dominated global production of PCBs and despite a steady decline in the world market share of U.S. producers, U.S. industry remains a global leader.[102] According to the market research firm Elsevier Advanced Technology, U.S. shipments of PCBs were expected to exceed $6.2 billion in 1996, which is roughly a 20-percent increase over the $5.2 billion total for 1992 (figure 5-7).[103] This trend represents a return to annual U.S. production increases which had been interrupted during a global PCB recession in 1989-91.[104]

In 1996, the U.S. PCB manufacturing industry was estimated to have employed approximately 79,000 workers.[105] Employment was spread throughout the United States with the greatest concentration in New York and California, which combined for approximately one-half of the total.[106] Although the industry's domestic shipments rose by over 20 percent during 1992-1996, employment for that period grew by only about 3,000 workers.[107] This trend resulted from the increased production efficiencies achieved by U.S. firms through the adoption of technologies that have made manufacturing relatively more automated and capital-intensive.[108]

As is the case with semiconductors, PCB production in the United States can be divided into merchant and captive. Merchant firms concentrate on the production of PCBs, and occasionally also the production of PCB assemblies, for sale in the open market. In contrast, captive producers are often divisions within OEMs which produce PCBs for consumption in their own end-products.[109] Captive U.S. producers include IBM, Lucent Technologies, Hewlett-Packard, and GM/Hughes. The merchant PCB industry in the United States is quite fragmented, with a large number of small firms. According to the Institute for Interconnecting and Packaging Electronic Circuits, (IPC), there were roughly 700 merchant producers

---

[100] The explanation of the production of PCBs draws upon the following: USITC, *Trends in International Trade in Printed Circuit Boards and Base Material Laminates*, USITC publication 1306, pp. 2-3 and L. K. Lee, "Printed Circuits," *McGraw-Hill Encyclopedia of Science and Technology* (United States: McGraw-Hill, 1987), p. 268.

[101] A second, lesser-used method is know as the additive process.

[102] Technology Marketing Research Council (TMRC), *World Market for Printed Wiring Boards and Substrate Materials, 1995* (Northbrook, IL: IPC, 1996), p. 39.

[103] Elsevier, *Yearbook of World Electronics Data,* 1993 and 1994.

[104] TMRC, *World Market for Printed Wiring Boards, 1995*, p. 37.

[105] Estimated by USITC staff based on USDOC, *Statistical Abstract of the United States: 1996* (Washington, DC: U.S. Bureau of the Census, 1996), p. 893.

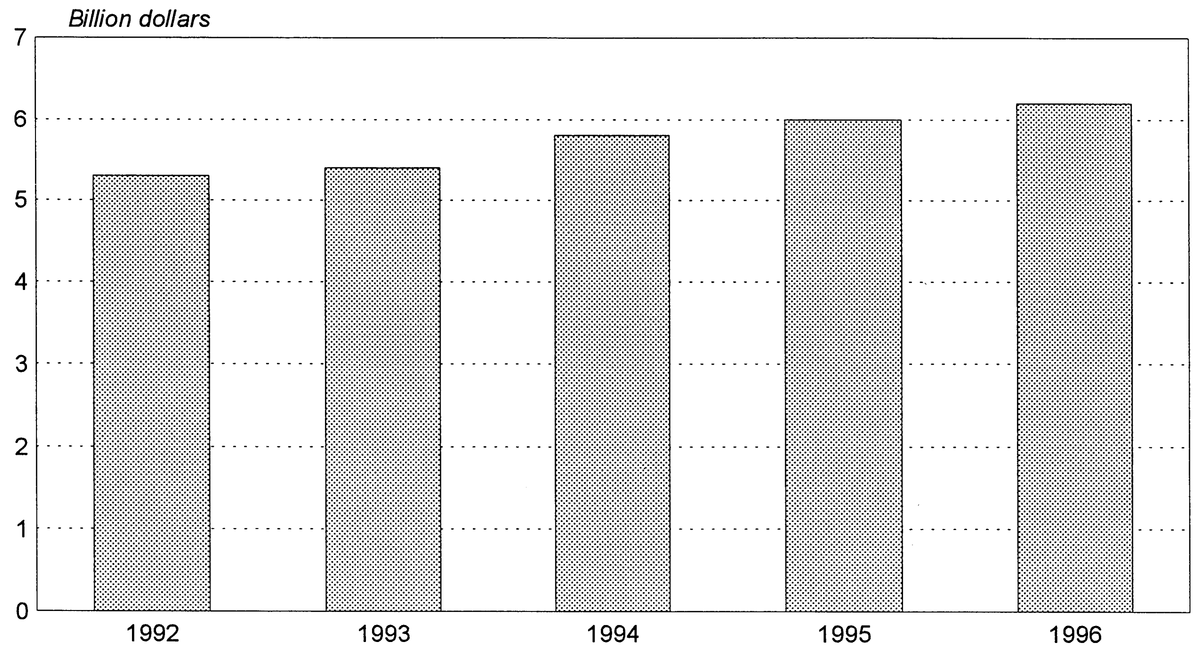
[106] Arsen Darnay, ed., *Manufacturing USA: Industry Analyses, Statistics, and Leading Companies* (Detroit, MI: Gale Research, 1996), p. 1890.

[107] USDOC, *Statistical Abstract of the United States: 1996* (5th edition), p. 893.

[108] *The Technology Roadmap for Electronic Interconnections*, p. C-2, and IPC representative, interview by USITC staff, Washington, DC, Jan. 17, 1997.

[109] USDOC, *U.S. Industrial Outlook, 1994*, p. 15-11.

Figure 5-7
Printed circuit boards: U.S. production, 1992-96



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

in the United States in 1996.[110] Ninety percent of these firms had sales of under $10 million each in 1995. The largest 125 merchant PCB manufacturers accounted for approximately 80 percent of all merchant production in 1995.[111] U.S. merchant firms with 1996 sales expected to exceed $100 million include Photocircuits Corp., Hadco Corp., Zycon Corp., Merix Corp., AMP Circuit and Packaging, Viktron, and Continental.

A significant trend in the structure of the PCB industry has been the shift away from OEM production toward greater merchant production.[112] In 1979, captive manufacturers accounted for nearly 60 percent of U.S. production while merchant firms produced about 40 percent. In 1995, OEMs accounted for only about 20 percent of PCB production while the merchant share had increased to approximately 80 percent.[113] Many OEMs have reduced or discontinued their PCB lines in the wake of the increasing costs related to PCB equipment and process modernization. OEMs have found that it is more cost-efficient to outsource their PCB needs to merchant producers than to produce the PCBs themselves.[114] This shift in production mirrors a larger trend in U.S. electronics manufacturing where U.S. OEMs are increasingly outsourcing to contract assemblers in order to cut production costs and remain competitive.[115]

---

[110] Letter from IPC representative to USITC staff, Oct. 9, 1996.

[111] USDOC, *U.S. Industrial Outlook, 1994*, p. 15-12.

[112] Letter from IPC representative to USITC staff, Oct. 9, 1996.

[113] USDOC, *U.S. Industrial Outlook, 1994*, p. 15-12 and IPC representative, interview by USITC staff, Washington, DC, Jan. 17, 1997.

[114] IPC representative, interview by USITC staff, Washington, DC, Jan. 17, 1997.

[115] Assembly Marketing Research Council, *The 1995 Market for Electronics Manufacturing Service Providers/ Contract Assembly Companies* (Northbrook, IL: IPC, 1996), p. 64 and report by Tim Sturgeon and Stephen Cohen, "Globalization of Electronics Manufacturing," presented at the Competitive Policy Council, Dec. 17, 1996.

Another trend has been the increase in the participation of merchant PCB makers with OEMs in the planning of future OEM products. OEMs routinely notify PCB manufacturers of their future interconnection product needs and work with them to meet those needs. This closer working relationship allows PCB manufacturers to accelerate their design and production schedule and thereby allows the OEMs to bring their products to market in a more expedited fashion.[116] Partly because of this close working relationship, PCB sales are usually conducted directly with OEMs or contract manufacturers, though distributors are also used.[117]

U.S. manufacturers are continuing to increase the degree of automation in their industry through the use of computer aided manufacturing (CAM) and computer aided design (CAD). CAM is currently being used by nearly all PCB manufacturers, though the use and complexity varies by manufacturer. According to the IPC, U.S. producers use CAM to reduce cycle times, tooling costs, and improve product quality.[118] CAD is used to design boards as well as to simulate electrical and thermal characteristics.[119] However, according to the IPC, the use of CAD has not yet been fully optimized by the industry, and on the whole, automation has not been deployed by the U.S. industry to the extent found in off-shore manufacturers.[120]

The production of PCBs is a function of the demand for the OEM end-products in which they are incorporated. In the United States, the computer and retail sectors have been the largest consumers of PCBs (figure 5-8), and because of the complexity of PCB requirements in computers, most U.S. PCB production has been in multi-layer form. However, increasing use of electronic components in automotive, communications, and consumer sectors have eroded the market share of computer and business equipment sector consumption. The share of PCB consumption held by the computer and business equipment sectors has dropped from approximately 50 percent in 1980 to 35 percent in 1995.

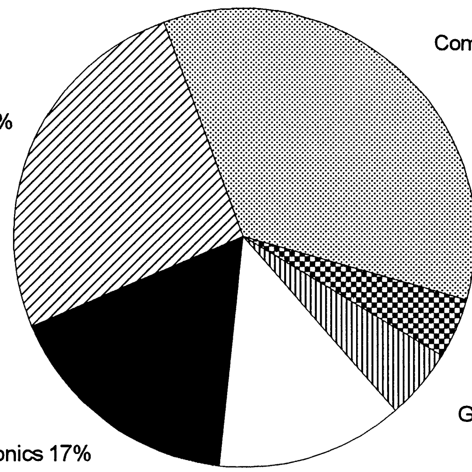
The U.S. PCB industry faces strong international competition. The strongest competition is from Asia, though competition also exists from the EU.[121] After decades of global leadership in PCB production, the U.S. producers were eclipsed by Japanese producers in the late 1980s. According to the IPC, higher costs associated with labor, raw materials, and environmental safety put the industry at a disadvantage to many Asian competitors. In addition, the U.S. industry lags Japan in the use of automated process improvement techniques and in some technology areas including design-tool development, implementation, and usage.[122] U.S. PCB manufacturers also are at a tax disadvantage in terms of equipment depreciation schedules. According to the IPC, Japanese firms are able to depreciate nearly 80 percent of the value of equipment in the first year, while U.S. firms can depreciate the value of equipment by only about 20 percent in the first year.[123]

Another concern for U.S. PCB manufacturers is funding for R&D. Historically, large OEMs had performed much of the industry R&D. However, U.S. PCB production has largely shifted from large OEMs to small merchant firms, most of which have annual sales of under $10 million. Many of these firms are not in a financial position to undertake comprehensive R&D projects. In response, the IPC created a PCB research consortia in 1994, the Interconnection Technology Research Institute.[124]

---

[116] IPC representative, interview by USITC staff, Washington, DC, Jan. 17, 1997.
[117] IPC representative, telephone interview by USITC staff, Jan. 29, 1997.
[118] *The Technology Roadmap for Electronic Interconnections*, p. C-1.
[119] Ibid.
[120] *The Technology Roadmap for Electronic Interconnections*, p. D-18.
[121] Letter from IPC representative to USITC staff, Oct. 9, 1996.
[122] Ibid.
[123] Ibid.
[124] Ibid.

Figure 5-8
Printed circuit boards: U.S. production by end markets, 1995



Source: The Institute for Interconnecting and Packaging Electronic Circuits.

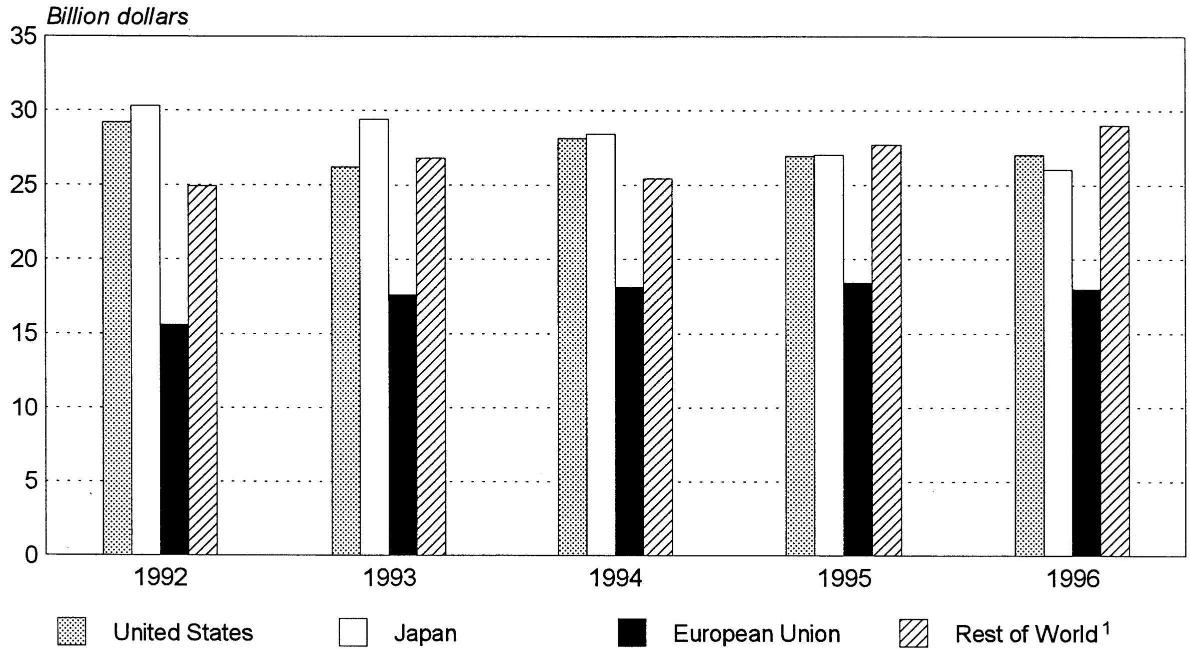
According to industry representatives, the U.S. PCB industry does have certain competitive advantages including leadership in materials development and production. In addition, it has gained important experience in the manufacture of more complex boards in response to U.S. OEM production of leading edge computer and communications equipment.[125] Also, U.S. producers often have quicker production cycles than foreign competitors due to the flexibility of relatively smaller company size.[126] Largely because of the increased production of computer and communications equipment in the United States, the U.S. PCB industry has staged a comeback and, in 1996, is estimated to have moved ahead of Japan in world market share (figure 5-9).[127]

Some of the rebound of the U.S. industry can be attributed to a greater emphasis on exporting and increased export opportunities in the North American region. According to an industry representative, the U.S. industry has not been export oriented in the past.[128] This has been due in part to the relatively small size of U.S. companies and the significant resources required in developing international trading networks. However, the U.S. industry increased its efforts in this area during the 1990s.[129] In 1992, exports accounted for about 20 percent of U.S. production, but by 1996, the share had risen to almost 30 percent.[130] During that

---

[125] Ibid.
[126] Ibid.
[127] TMRC, *World Market for Printed Wiring Boards and Substrate Materials, 1995*, p. 39.
[128] IPC representative, interview by USITC staff, Washington, DC, Jan. 17, 1997.
[129] Ibid.
[130] Estimated by USITC staff based on USDOC, *Current Industrial Reports MA36Q-1, Semiconductors, Printed Circuit Boards, and Related Equipment*, 1995, and official statistics of the USDOC.

Figure 5-9
Printed circuit boards: World market share by selected regions, 1992-96



[1]Estimated.
Source: The Institute for Interconnecting and Packaging Electronic Circuits.

period, the value of U.S. exports grew from roughly $1.2 billion to nearly $1.7 billion. Over two-thirds of the growth in PCB exports can be attributed to a rise in shipments to Mexico from roughly $91 million in 1992 to approximately $530 million in 1996.[131] The increase in exports to Mexico reflects the expansion of the maquiladora industries and their growing demand for components to incorporate into electronic end-products such as computers and televisions.[132] Canada is the United States' second largest export market for PCBs, with the 1996 total estimated at $525 million. Most of the PCBs exported to Canada are incorporated into telecommunications equipment, computers, and automobiles.[133] Canada and Mexico together accounted for nearly 60 percent of U.S. PCB exports in 1996.

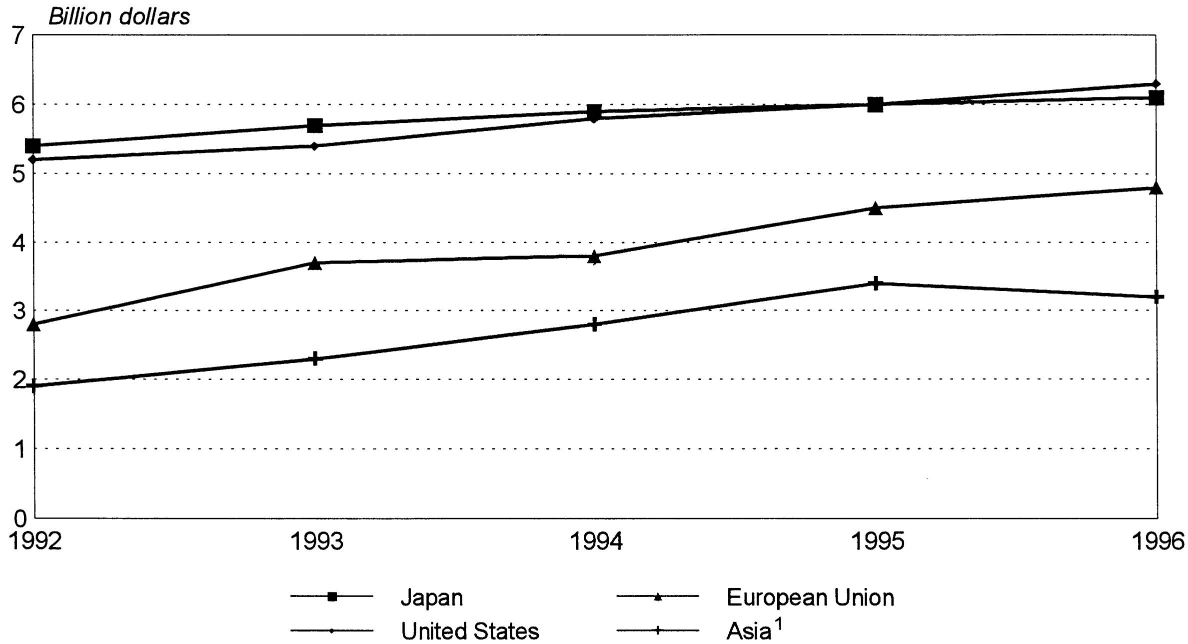
Foreign Industry Profiles

Japan

Japan was the world's largest producer of PCBs for much of 1992-96. During 1992-96 Japanese PCB production grew from $5.4 billion to an estimated $6.1 billion (figure 5-10).[134] Japanese producers

[131] Ibid.
[132] USDOC, "Electronic Components," *North American Free Trade Agreement, Opportunities for U.S. Industries* (Washington, DC: USDOC, 1993), p. 8.
[133] USDOC, "Electronic Components," p. 9.
[134] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data,* 1993, 1994, and 1996.

Figure 5-10
Trends in production of selected printed circuit board producers, 1992-96



[1] Includes Korea, China, Singapore, and Taiwan.

Source: USITC estimates based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

manufacture a range of PCB products including single-sided, double-sided, multi-layer, and flexible boards. Japanese firms also produce PCBs using nearly all substrates, including glass, paper, composite, and high performance materials.[135] The Japanese industry is strong in the development of design tools, their implementation, and usage. In addition, Japanese firms have been quick to adopt automated process improvement techniques that can result in increased yields and a rise in product quality.

The Japanese industry is relatively concentrated with the top ten manufacturers estimated to account for one-half of total production. Seven Japanese firms, including CMK, Hitachi, Nippon Mektron, Ibiden, Mitsubishi, Fujitsu, and Matsushita, are among the top ten in world production.[136] Other major Japanese producers include NEC, Toshiba, Sony, Toppan, and Yamamoto Manufacturing.[137] Japanese manufacturers are a mixture of captive and merchant firms. Many of the largest firms are vertically integrated conglomerates that produce entire electronic systems, of which PCBs are only a component. As such, these companies have a guaranteed level of captive consumption. Though Japan does have merchant firms, many of these firms have strong ties to Japanese electronic systems manufacturers and have thereby established a relatively stable demand within Japan.

During 1992-96, growth in Japanese exports accounted for a majority of the increases in production. While production increased by 13 percent, exports increased by nearly 150 percent, from $650 million to $1.6 billion. Much of the growth in exports can be attributed to growing electronics production in Asia, including the movement offshore of many Japanese consumer electronics manufacturers.

[135] TMRC, *World Market for Printed Wiring Boards and Substrate Materials, 1995*, pp. 7-17.
[136] Information provided by the IPC.
[137] TMRC, *PWBs in Asia* (Northbrook, IL: IPC, 1996).

European Union

During 1992-96, EU production of PCBs grew from $2.8 billion to $4.8 billion. The EU PCB industry somewhat resembles that of the United States. The EU industry is comprised of hundreds of relatively small firms. Germany alone is estimated to have as many as 300 PCB manufacturers.[138] Most of these firms have sales under $50 million and only ten have sales of over $100 million. Like the U.S. PCB industry, the EU industry is a mix of undiversified merchant firms and large electronics systems manufacturers. The largest EU producers include Philips, Johnson Matthey, Ericsson, ISL, Puba, and Alcatel. EU production is oriented toward PCBs for computer equipment, communications equipment, and automobiles. The EU's consumer electronics industry is relatively small, and as a result, there is little EU production of single-sided boards. The EU exports less than 10 percent of its production, with approximately 70 percent of its exports destined for developing countries. According to a U.S. industry representative, EU manufacturers are generally behind U.S. and Japanese manufacturers in design technology as well as material and tool development.[139] EU exports of PCBs grew during 1992-96, from an estimated $200 million to $300 million.[140]

Other Producers

The largest of the emerging producers are located in Asia and include Taiwan, China, and Korea. Producers in this area benefit from lower manufacturing costs, including lower labor rates and less stringent environmental regulation than their competitors in Japan, the EU, and United States. Asian PCB manufacturers have also been aided by the overall increase in consumer electronics production in the region which has increased local demand for printed circuit boards.[141]

Taiwan is the group's largest PCB manufacturer, and during 1992-96 its production rose from $1.2 billion to an estimated $1.8 billion.[142] Production in Taiwan is relatively concentrated with the top ten firms accounting for an estimated 60 percent of the total.[143] Two of these firms, Matsushita and Hitachi, are Japanese transplants. Unlike other Asian producers, Taiwan's PCB production is not heavily devoted to consumer electronics end-products. Taiwan's production is closely connected to the computer industry as an estimated 70 to 80 percent of Taiwan's PCBs are incorporated into computer equipment.[144] In fact, Taiwan accounts for nearly one-half of global production of PCBs used as central processing unit motherboards in personal computers. PCB firms in Taiwan are heavily export oriented with exports growing from $600 million in 1992 to an estimated $900 million in 1996.[145] However, a recent trend in Taiwan has been the movement off shore of production facilities, largely in search of lower labor rates.[146] Firms in Taiwan have established production facilities in China, Malaysia, and the Philippines.

China is the fastest growing member of this group with PCB output more than doubling from $400 million in 1992 to an estimated $900 million in 1996. Chinese PCB output is primarily focused on single-sided boards. Chinese production is largely concentrated in the Guangdong Province and exported

---

[138] USDOC, *U.S. Industrial Outlook, 1994*, p. 15-16.
[139] U.S. industry representative, telephone interview by USITC staff, Mar. 10, 1996.
[140] Estimated by USITC staff based on European Commission, *Panorama of EU Industry*, p. 10-9.
[141] USDOC, *U.S. Industrial Outlook, 1994*, p. 15-14.
[142] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics,* 1993, 1994, and 1996.
[143] Estimated by USITC staff based on TMRC, *PWBs in Asia.*
[144] TMRC, *PWBs in Asia.*
[145] Estimated by USITC staff based on United Nations Trade Series D.
[146] TMRC, *PWBs in Asia.*

through nearby Hong Kong.[147] Chinese exports during 1992-96 rose from $210 million to an estimated $400 million.[148] The Chinese industry is highly labor-intensive with little automation. However, due to relatively low labor costs, Chinese production is very price competitive in relation to other Asian manufacturers.[149] The Chinese industry is comprised of over 800 different producers but the bulk of production is accounted for by foreign transplants primarily from Hong Kong, Taiwan, and Japan. Only one of the top ten Chinese producers is Chinese-owned.[150]

The Korean industry is dominated by six producers, with the top four firms accounting for an estimated 60 percent of total production.[151] These companies include Daeduck Electronics, Korea Circuit, Lucky Goldstar Electronics, Saehan Electronics, Cheonju Electronics, and Samsung E-Mechanics, all of which are Korean-owned. The Korean industry is concentrated in the production of single-sided boards which are largely consumed in domestic electronics equipment production.[152] The majority of multilayer boards produced in Korea are exported. During 1992-96, Korean exports grew from $70 million to an estimated $180 million.[153] As in the case of Taiwan, in order to lower production costs through lower wage rates, Korean PCB manufacturers are establishing production facilities in Southeast Asia and Mexico.[154]

U.S. Market Profile

The United States is the largest world market for PCBs. The U.S. market was valued at approximately $6.5 billion in 1996, having grown at an average annual rate of approximately 5 percent from $5.4 billion in 1992.[155] Most of this growth was driven by production increases in the U.S. computer and telecommunications industries, which are the largest consumers of PCBs in the United States.[156] U.S. production of computers and of telecommunications equipment grew at an average annual rate of more than 10 percent from 1992 and 1996.[157] The United States consumes few circuit boards designed for consumer electronics as it is not a major producer of such products.[158]

U.S. imports of PCBs also have increased in recent years. From 1992 to 1996, U.S. imports of PCBs grew at an average annual rate of approximately 10 percent, from $1.3 billion in 1992 to $1.9 billion in 1996, comprising approximately 30 percent of U.S. consumption in 1996.[159] The majority of U.S. PCB

---

[147] Ibid.
[148] Estimated by USITC staff based on United Nations Trade Series D.
[149] TMRC, *PWBs in Asia.*
[150] Ibid.
[151] Ibid.
[152] Ibid.
[153] Estimated by USITC staff based on United Nations Trade Series D.
[154] TMRC, *PWBs in Asia.*
[155] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data,* 1996.
[156] IPC representative, interview by USITC staff, Washington, DC, Mar. 6, 1997.
[157] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data,* 1996.
[158] IPC representatives, telephone interviews by USITC staff, Jan. 29 and Mar. 6, 1997.
[159] USITC staff estimates based on official statistics of the USDOC. According to IPC officials, however, these import numbers may be inflated by as much as $1 billion due to the possible misclassification of mounted circuit boards in the printed circuit board category. IPC estimates that imports in 1996 were worth approximately $575 million and comprise closer to 10 percent of U.S. consumption. IPC representative, telephone interview by USITC staff, Mar. 7, 1997 and Technology Marketing Research Council, *The Market for Rigid Printed Wiring Boards in 1995* (Northbrook, IL: IPC, 1995), p. 57.

imports are from Taiwan and Japan, and to a lesser extent Hong Kong, Korea, and Singapore.[160] While imports from Japan grew from 1992 to 1996 at an average annual rate of less than 1 percent, imports from Hong Kong grew at approximately 13 percent and imports from Taiwan, Korea, and Singapore grew at close to 20 percent. Taiwan in particular has been successful in selling computer motherboards to the U.S. market. The faster import growth from these producers reportedly reflects their relative advantages vis-a-vis U.S. and Japanese producers in terms of lower labor costs, less stringent environmental regulations, and favorable government treatment, leading to lower prices.[161] In the absence of an ITA, duties of 2.7 percent would remain in 1999 after the last stage of Uruguay Round reductions (table 5-3).[162] Increase in market access opportunities under the ITA are expected to be minimal.

The U.S. PCB industry is represented by the Institute for Interconnecting and Packaging Electronic Circuits (IPC). The Commission has received a submission from the IPC that supports the ITA with certain reservations. The IPC supports the tariff elimination provisions of the ITA, but is also interested in having non-tariff barriers addressed. In addition, the IPC believes that the product landscape of the ITA was incomplete as it does not include the equipment and materials used in the manufacture of printed circuit boards. The IPC's submission can be seen in its entirety in appendix F.

Foreign Market Profiles

Japan

Japan is the second largest market in the world for PCBs. The Japanese market was valued at $4.9 billion in 1996, having grown at an average annual rate of 4 percent from $4.2 billion in 1992.[163] Like the United States, most PCBs are consumed in Japan by the computer and telecommunications industries, which grew at more than 10 percent and 18 percent during the period, respectively.[164] PCBs in Japan also are consumed by the consumer electronics industry.[165]

While Japanese PCB imports grew at an average annual rate of 18 percent from $100 million in 1992 to $200 million in 1996, they comprised only 4 percent of the Japanese market in 1996.[166] The vast majority of Japanese imports of PCBs are from Japanese PCB subsidiaries located in other Asian countries.[167] Japan has already eliminated its duties on the importation of PCBs, as a result, the ITA will have no effect on increasing market access.

---

[160] While Canada is listed in official import statistics as a major source of PCB imports, IPC officials state that most imports from Canada are printed circuit board assemblies, or mounted circuit boards, which should not be classified as printed circuit boards. IPC representative, telephone interview by USITC staff, Mar. 7, 1997.

[161] IPC representative, telephone interview by USITC staff, Mar. 6, 1997.

[162] *Most-Favoured-Nation Tariff Schedules.*

[163] Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data*, 1996.

[164] Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data*, 1994 and 1996.

[165] IPC representative, telephone interview by USITC staff, Mar. 6, 1997.

[166] Estimated by USITC staff based on United Nations Trade Series D.

[167] IPC representative, telephone interview by USITC staff, Mar. 6, 1997.

Table 5-3
Final Uruguay Round tariffs on printed circuits for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	17
Canada	0
Costa Rica	([2])
Estonia	0
European Communities (15)	2.7
Hong Kong	0
Iceland	([2])
India	40
Indonesia	40
Israel	10
Japan	0
Korea	8
Macau	0
Malaysia	5
New Zealand	30
Norway	3
Romania	35
Singapore	10
Switzerland	0.1-0.3
Taiwan[3]	7.5
Thailand	([2])
Turkey	14.5
United States	2.7

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol),* Marrakesh, April 15, 1994 and U.S. Department of Commerce working documents.

European Union

The EU is the third largest world market for PCBs. The EU market, valued at $4.2 billion in 1996, grew at an average annual rate of 7 percent from $3.2 billion in 1992.[168] Like the United States, the EU PCB market has been driven by its computer, automobile, and telecommunications industries. Germany, the United Kingdom, and France consume close to 60 percent of all PCBs in the EU.[169]

EU imports of PCBs have increased from roughly $400 million in 1992 to an estimated $900 million in 1996.[170] The major foreign suppliers to the EU market are the United States and Japan which accounted for approximately half of EU imports.[171] In the absence of an ITA, duties of 4.5 percent would remain on EU PCB imports (table 5-4). As a result, the ITA is expected to increase market access opportunities. In addition, EU enlargement will widen the duty-free market for foreign semiconductor producers.

Other markets

Taiwan, China, and Korea are relatively small but growing consumers of PCBs; these countries' markets in 1996 were valued at $1.1 billion, $800 million, and $500 million, respectively.[172] The average annual growth rates of these markets from 1992 to 1996 averaged between 15 and 20 percent, due in part to their large consumer electronics industries and growing computer and telecommunications industries.

Imports of PCBs into these countries also increased substantially from 1992 to 1996, at average annual rates ranging between 20 and 30 percent.[173] In 1996, imports accounted for between one-third and one-half of total PCBs consumption. Most imports into these countries came from Singapore, Malaysia, and Hong Kong. Additionally, China is a major supplier of PCBs to the Taiwan and Korean markets.[174] As the United States is not a major consumer electronics PCB maker, it is also not a major PCB supplier to these countries.[175]

Tariffs on PCBs into these countries are relatively high. China's 1992 tariffs on PCBs ranged from 25 to 40 percent, while Taiwan's tariffs were 7.5 percent.[176] Korean tariffs on PCBs as of January 1, 1999 will be 8 percent.[177] Based on duty elimination under the ITA, market access opportunities are likely to increase in Korea and Taiwan. However, market access opportunities in China should be unchanged as it is not an ITA signatory.

---

[168] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996.

[169] BPA (Technology & Management) Ltd., "Market Europe 1994," *PCB Service,* Dec. 1995, p, 22.

[170] Estimated by USITC staff based on European Commission, *Panorama of EU Industry*, p. 10-9.

[171] IPC representative, telephone interview by USITC staff, Mar. 6, 1997, and European Commission, *Panorama of EU Industry*, p. 10-12.

[172] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data,* 1996.

[173] Estimated by USITC staff based on United Nations Trade Series D.

[174] IPC representative, telephone interview by USITC staff, Mar. 6, 1997.

[175] Ibid.

[176] As neither of these countries are signatories to the WTO, they do not have tariff commitments. Further, these countries' tariffs are unbound, and thus can change at any time.

[177] *Most-Favoured-Nation Tariff Schedules*.

Capacitors and Resistors

Capacitors and resistors are passive components which perform integral functions in the operations of most electrical systems, including computers, communications equipment, automobiles, consumer electronics, and industrial equipment. They have a multitude of uses owing to their electrical characteristics, and are often used in concert with semiconductors to construct a functional circuit on a printed circuit board. Capacitors and resistors are largely produced and consumed in those countries that produce electronic systems. The United States, EU, Japan, and various other Asian countries are the leading producers and consumers (figure 5-11). For a complete list of products included in the agreement see appendix A.

Capacitors are electronic devices that have the ability to store and discharge energy. They are used for filtering, coupling, isolating, and storing current. In alternating current circuits, capacitors are often used as frequency filters, and in direct current circuits they are often used as a current blocker to isolate one portion of a circuit from another.[178] Capacitors are constructed either for electrical circuits, such as those used in power transmission or generation networks, or for electronic circuits, such as those used in consumer electronic goods, computers, and telecommunications equipment.[179] The industry producing electronic capacitors accounts for most of the value and quantity of total capacitor production.

Resistors provide resistance to the flow of electrical current. Resistors can control or limit the amount of current flowing in a circuit. In electrical circuits, resistors are often used for phase shifting. In electronic circuits, resistors are often used for voltage dropping and wave shifting. Like capacitors, most resistors are used in electronic circuits rather than in power supply applications.[180]

The processes, equipment, and technologies used in the manufacture of capacitors and resistors depend largely on the dielectric or resistive element used in constructing the devices. Capacitors and resistors are generally considered to be mature, commodity products, and the technology used to produce them is widely available.[181] These products are usually produced in extremely high volumes and orders are commonly awarded to the lowest bidder.

U.S. Industry Profile

U.S. production of capacitors was roughly $1.6 billion in 1996, an increase of 23 percent over 1992's total of $1.3 billion (figure 5-12).[182] The U.S. capacitor industry employed an estimated 20,000 workers in 1996, a 7-percent increase from the 1992 level of 18,700.[183] The capacitor industry is concentrated in South Carolina, California, North Carolina, and New York. These states combined for over one-half of domestic production and employment, with South Carolina accounting for approximately 30 percent.[184] U.S. resistor

[178] World Wide Web, retrieved Jan. 16, 1997, Tech Search, http://www.techweb.com/se/techsearch, "Quick Guide to Capacitors," *Electronic Buyers' News*.

[179] *McGraw-Hill Encyclopedia of Science and Technology*, vol. 3, pp. 187-189.

[180] *McGraw-Hill Encyclopedia of Science and Technology*, vol. 12, pp. 380-381.

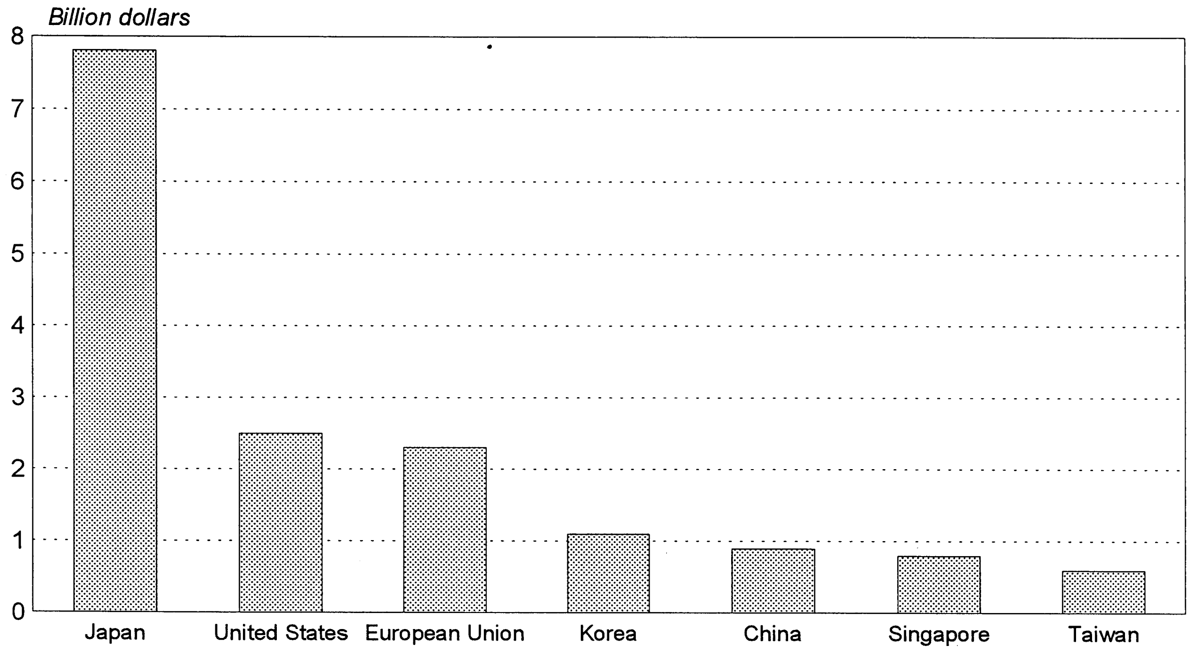
[181] U.S. industry representatives, telephone interviews by USITC staff, fall/winter 1996.

[182] Estimated by USITC staff based on official statistics of the USDOC.

[183] Bureau of Labor Statistics (BLS), *Employment and Wages Annual Averages, 1995* (Washington, DC: U.S. Dept. of Labor, 1996), p. 17, and *Employment and Wages Annual Averages, 1992* (Washington, DC: U.S. Dept. of Labor, 1993), p. 14.

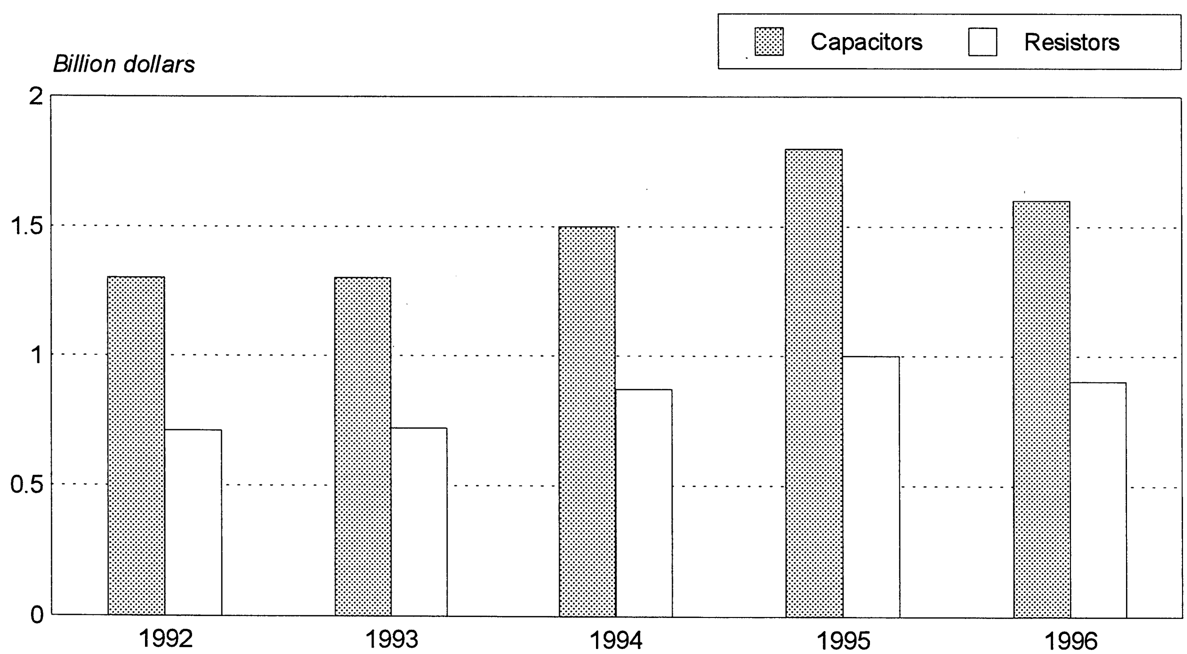
[184] Arsen Darnay, ed., *Manufacturing USA.*

Figure 5-11
Capacitors and resistors: Production by selected economies, 1996



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd.,1996).

Figure 5-12
Capacitors and resistors: U.S. production, 1992-96



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd.,1996).

production was roughly $900 million in 1996, a 27 percent increase over 1992's total of $710 million.[185] The U.S. resistor industry employed an estimated 10,000 workers in 1996, which was a 7-percent decrease from the 1992 level of 10,700.[186] Production and employment in the resistor industry is concentrated in California, Nebraska, Texas, Florida, and New Hampshire. California accounted for roughly 20 percent of U.S. production and 13 percent of employment, with no other state accounting for more than 10 percent of either production or employment.[187]

The U.S. capacitor and resistor industries are both comprised of several large firms which dominate production as well as a number of relatively small firms, most of which have annual sales under $50 million. AVX Corp., Kemet, and Vishay Intertechnology dominate the U.S. capacitor industry, and account for approximately two-thirds of the value of U.S. production.[188] The bulk of U.S. resistor production is reportedly accounted for by Vishay, IRC, and Bourns.[189] According to *Electronic Buyers' News*, AVX, Kemet, and Vishay are among the world's largest producers of capacitors and Vishay is one of the world's largest resistor manufacturers.[190] In both industries, merchant firms constitute nearly all of U.S. production and because of their end-use and customer similarities, many firms which produce capacitors also produce resistors.[191]

Globalization has had a major impact on the U.S. capacitor and resistor industries. Foreign ownership of U.S. production, the globalization of production, and increased involvement in international trade have become characteristic of both industries. Kyocera of Japan owns a majority share of AVX Corporation, the largest U.S. manufacturer of capacitors, comprising roughly one-quarter of the value of U.S. capacitor production.[192] In addition, Panasonic and Murata of Japan and Philips of the Netherlands have established sizable capacitor production facilities in the United States. Foreign ownership of U.S. production is also evident in the resistor industry. IRC, reportedly one of the two largest U.S. resistor producers, is a British-owned firm.[193] Also, a number of former U.S. resistor producers have been purchased by Japanese firms and no longer manufacture in the United States. These firms, including Rohm and KOA Speer, are now used solely to distribute Japanese manufactured electronic components.[194]

The globalization of passive component production has become commonplace, and, according to industry sources, necessary in both the capacitor and resistor industries. Globalization in production includes establishing foreign manufacturing facilities as well as production-sharing assembly facilities.[195] Reasons given for establishing foreign manufacturing facilities include enhancing customer service, circumventing tariff and non-tariff barriers, taking advantage of free trade agreements and foreign government financial

---

[185] Estimated by USITC staff estimates based on official data of the USDOC..

[186] BLS, *Employment and Wages Annual Averages, 1995*, p. 17, and BLS, *Employment and Wages Annual Averages, 1992*, p. 14.

[187] Arsen Darnay, ed., *Manufacturing USA*, p. 1903.

[188] U.S. industry representatives, telephone interviews by USITC staff, fall/winter 1996.

[189] U.S. industry representatives, telephone interviews by USITC staff, Jan. 1997.

[190] World Wide Web, retrieved Jan. 1, 1997, Electronic Buyers' News, http://www.techweb.com/se/techsearch, "The List," *Electronic Buyers' News*, Oct. 21, 1996.

[191] World Wide Web, retrieved Jan. 17, 1997, Electronic Buyers' News, http://www.techweb.com/se/search, Mark LaPedus, "Yageo Makes Growth Move," *Electronic Buyers' News*, Oct. 16, 1995.

[192] U.S. industry representatives, interviews by USITC staff, Raleigh, NC, Sept. 18, 1996.

[193] U.S. industry representatives, telephone interviews by USITC staff, Jan. 1997.

[194] Ibid.

[195] In general, production sharing in electronic components entails the division of the fabrication and assembly stages. The manufacturing of components is a relatively capital-intensive process and is conducted in the United States. The assembly of components is relatively labor-intensive and, in order to lower production costs, is conducted in a country with lower labor costs.

incentives, and lowering labor costs. Most major U.S. capacitor and resistor manufacturers have established international production operations (table 5-4). These firms have stated that the use of production-sharing facilities in lower wage countries and the establishment of manufacturing facilities in the regions where their products are marketed are essential to their ability to successfully compete internationally.[196] By using production-sharing operations, firms can effectively reduce labor and overall production costs in what are very price sensitive products. Also, locating in close proximity to customers allows for greater producer-consumer interaction and can result in improved customer service by facilitating faster responses to customer needs.

U.S. exports of capacitors and resistors reflect the trend toward production sharing and increased international transactions. Capacitor and resistor exports doubled from $900 million in 1992 to an estimated $1.8 billion in 1996 (figure 5-13).[197] By far, the largest market for U.S. exports is Mexico, which in 1996 was estimated to account for nearly 45 percent of the total. Reflecting the growth in the maquiladora electronics industries, U.S. exports to Mexico have grown from $270 million in 1992 to an estimated $910 million in 1996. U.S. exports to Mexico of finished capacitors and resistors are typically incorporated into computers, televisions, and other consumer electronics equipment.[198] Many of the exports to Mexico are in the form of unfinished components, which are usually assembled and packaged in Mexican production-sharing facilities and resold in the United States or elsewhere. The EU is the United States' second largest export market and accounts for roughly 15 percent of the total. Canada is third with 10 percent. Most of the exports to Canada are consumed by the Canadian telecommunications, computer, and office equipment industries.[199]

U.S. firms are also participating in international transactions in the form of distribution agreements and the resale of foreign produced products. AVX has a distribution agreement with its Japanese parent, Kyocera. The agreement allows AVX to use Kyocera's distribution system to market its products in Japan. In return, Kyocera markets some of its components through AVX in the United States. Both parties benefit, as they are able to offer a broader line of passive components to customers that are increasingly interested in one-stop shopping, the ability to purchase all or most of their component needs from one or two suppliers.[200] U.S. resistor firms are also involved in marketing foreign-manufactured product. In addition to manufacturing its own resistors, Bourns currently sells resistors manufactured under contract with Asian producers. Certain resistors, which Bourns does not produce, are imported and sold under the Bourns name. This process allows Bourns to broaden its resistor product line for customers interested in using a limited number of suppliers.[201]

U.S. manufacturers of capacitors and resistors often concentrate in the production of only a few varieties of their products. Specialization allows for greater economies of scale and greater technical focus. In the case of capacitors, specific types often require distinctive production processes and are most suited for certain end products. For example, ceramic and tantalum capacitors are most used in information technology products such as computers, cell phones, and automobiles, while aluminum and film capacitors are most often used in industrial applications such as air conditioners, motors, fluorescent lighting, and compressors. AVX,

[196] U.S. industry representatives, interviews by USITC staff, Myrtle Beach, SC, Feb. 11, 1997.

[197] Estimated by USITC staff based on official statistics of the USDOC.

[198] USDOC, "Electronic Components," *North American Free Trade Agreement, Opportunities for U.S. Industries*, pp. 8-9.

[199] Ibid.

[200] U.S. industry representatives, interviews by USITC staff, Myrtle Beach, SC, Feb. 11, 1997, and U.S. industry representatives, telephone interviews by USITC staff, Jan. 1997.

[201] U.S. industry representatives, telephone interviews by USITC staff, Jan. 1997.

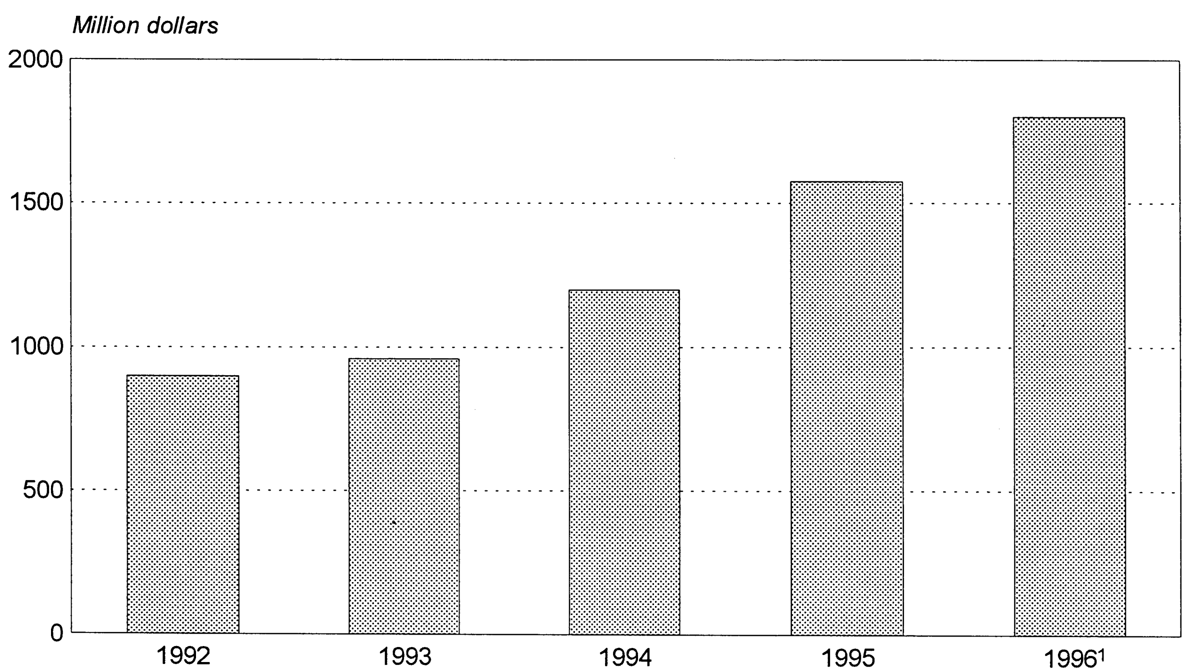
Table 5-4
Foreign production facilities of U.S. capacitor and resistor manufacturers

Company	Manufacturing facilities	Production-sharing facilities
AVX	Czech Republic, El Salvador, Germany, Ireland, Israel, Singapore, United Kingdom	Mexico
Kemet	([1])	Mexico
Vishay	Canada, Czech Republic, France, Germany, Israel, Portugal, United Kingdom	Mexico
Bourns	China, Costa Rica, Ireland, Taiwan, United Kingdom	([1])
Aerovox	([1])	Mexico

[1] Not available.

Source: Compiled by the staff of the USITC.

Figure 5-13
Capacitors and resistors: U.S. exports, 1992-96



[1] Estimated.
Source: Official statistics of the U.S. Department of Commerce, excepted as noted.

Vishay, and Kemet have concentrated on the production of ceramic and tantalum capacitors, products which account for approximately 75 percent of total U.S. capacitor production.[202] Other U.S. producers such as Aerovox, Cornell Dubilier, and Magnetek have concentrated in the production of aluminum and film-type capacitors which roughly account for the remaining 25 percent of total U.S. capacitor production.[203] U.S. resistor manufacturers have specialized to a lesser degree, and IRC and Vishay produce a variety of resistor products. However, Bourns has largely concentrated on the production of a single resistor product, "resistor networks," and imports all other types of resistors that it markets.[204]

In addition to specialization, a consolidation of suppliers has also occurred in the U.S. capacitor and resistor industries. Consolidation has to some degree been the result of efforts by producers to maintain a presence in multiple markets and increase access to greater R&D and capital resources.[205] Vishay has played a leading role in this market consolidation. Within the last 10 years, Vishay purchased two major U.S. capacitor producers, Sprague Electric Company and the U.S. operations of Vitramon, Inc. Vishay also purchased Dale Electronics, a leading U.S. resistor manufacturer. In addition to the U.S. operations, Vishay secured the European production of Sprague, Vitramon, and Draloric/Roederstein.[206] Vishay's purchases left it positioned as one of the global leaders in the production of both capacitors and resistors. AVX has also been active in purchasing U.S. and international capacitor producers in the last decade.[207] AVX's purchases and merger with Kyocera have positioned it as a global leader in the production of capacitors and has enabled AVX to offer broader lines of products to prospective customers. Further consolidation in the U.S. capacitor industry may occur, as Vishay has made overtures to Kemet regarding a potential merger which would result in the world's largest tantalum capacitor manufacturer and one of the largest ceramic manufacturers. Thus far, Kemet has resisted such an arrangement.[208] The resistor industry, too, has become further consolidated with the purchase of U.S. firms Speer and Rohm[209] by Japanese firms and the subsequent closing of their manufacturing facilities. KOA Speer and Rohm, as they are currently known, are now largely distribution arms and no longer have production facilities in the United States.[210]

Reflecting the needs of electronic systems manufacturers, the major trend in the capacitor and resistor industries is toward miniaturization. Research and development within the capacitor and resistor industries focuses on achieving existing or improved electrical performance from ever smaller devices in order to save board space on PCBs which then allows for smaller end-products such as palm-sized cellular telephones. Pressure toward miniaturization has resulted in capacitors and resistors that are quite small. A component that is becoming increasingly popular is the 0402 chip capacitor which is .04 inches in length by a width of .02 inches.[211] Because of the demand by the electronic systems manufacturers, U.S. as well as foreign capacitor and resistor producers feel pressure to develop ever smaller components.

A second method of reducing component size and the amount of board space consumed has been to develop alternative PCB mounting technologies. Like the rest of the electronic component industry, capacitor

---

[202] Ibid. and USDOC, *MA36Q*, 1995.
[203] Ibid.
[204] U.S. industry representatives, telephone interviews by USITC staff, Jan. 1997.
[205] USITC, *Industry and Trade Summary: Capacitors*, USITC publication 2728, Feb. 1994, p. 4.
[206] Vishay, *10-K Report*, 1996.
[207] USITC, *Industry and Trade Summary: Capacitors*, p. 4.
[208] World Wide Web, retrieved Oct. 25, 1996, Kemet, http://www.kemet.com/corp/new.htm, Kemet, *New at Kemet*, and U.S. industry representatives, telephone interviews by USITC staff, fall/winter 1996.
[209] Prior to its acquisition by a Japanese company, the name was R-ohm.
[210] U.S. capacitor industry representatives, interviews by USITC staff, Myrtle Beach, SC, Feb. 11, 1997.
[211] World Wide Web, retrieved Nov. 20, 1996, Electronic Business Today, http://www.ebtmag.com, Heidi Elliot, "Honey, They've Shrunk the Passives Again," *Electronic Business Today*, Oct. 1996.

and resistor manufacturers are changing from devices that are attached by metal leads to those that can be soldered directly to the board.[212] Because of their smaller size, surface mounted devices (SMDs) require less space on a PCB than conventional components, thus allowing for greater component density on circuit boards. Higher component density enables more functions or features to be offered in the same size unit and allows manufacturers of electronic systems to reduce the size of their end products. Also, the assembly of SMDs onto PCBs may be automated by means of computer-controlled "insertion" or "placement" machinery that can significantly reduce the time needed to assemble electronic equipment. Attaching directly to the PCB, SMDs allow for improved equipment reliability, better vibration performance, and greater immunity to electromagnetic interference.[213] According to industry representatives, SMDs are displacing leaded devices and most major U.S. capacitor and resistor manufacturers have converted or are in the process of converting production to surface mount technology (SMT) in those component types that require size reduction.[214]

The pressures toward miniaturization have resulted in components becoming increasingly difficult to handle and assemble onto PCBs. Newer generation components are so small that their mass is often insufficient to hold them in place on a board for attachment.[215] They are easily damaged and difficult for automated assemblers to grasp and manipulate. These handling challenges have resulted in the need for alternative methods of assembly, and innovations in packaging have recently offered some creative solutions. New trends include resistor networks, resistor arrays, and integrated passive components. Resistor networks contain as many as 23 resistors in a package and are similar to integrated circuits in appearance.[216] Resistor arrays are comprised of as many as four resistors but are not packaged. Integrated passive components combine capacitors and resistors in one package. These products, by incorporating a number of components in one piece, use less board space and offer the added benefit of a larger individual piece that is easier and less time consuming to mount on a PCB than the equivalent number of individual components. Currently, networks and arrays cost more than individual components, but, with increased production, the cost difference is expected to narrow. Many U.S. producers such as AVX and Bourns, as well as a number of importers, are introducing these products.

The U.S. capacitor and resistor industries face strong international competition. Passive components are mature products, largely interchangeable, and extremely price sensitive. According to industry sources, customer service and cost are the primary determinants in most sales, and U.S. producers have certain advantages and disadvantages in these areas.[217] As noted earlier, U.S. producers are mostly merchant and concentrate in the production of a limited variety of products. By devoting their resources toward a narrow line of products, U.S. companies can achieve greater economies of scale and also concentrate R&D and capital expenditures. For example, AVX, Kemet, and Vishay have decided to concentrate on the production of multilayer ceramic and tantalum capacitors. These types of capacitors are now the fastest growing segments of the world capacitor market, and as a result these companies appear well positioned to benefit

[212] U.S. capacitor industry representatives, interviews by USITC staff, Myrtle Beach, SC, Feb. 11, 1997.

[213] USITC, *Industry and Trade Summary: Capacitors*, p. 1.

[214] U.S. capacitor industry meeting, interviews by USITC staff, Feb. 11, 1997. Though a majority of U.S. production in capacitors and resistors is consumed in information technology products, a sizable portion of production is consumed in industrial applications. In these industrial applications, conserving board space is not usually a concern, and as a result there has been little pressure toward miniaturization or SMT in these types of capacitors and resistors.

[215] Heidi Elliot, "Honey, They've Shrunk the Passives Again."

[216] World Wide Web, retrieved Jan. 1, 1997, Electronic Buyers' News, http://www.techweb.com/se/search, Bettyann Liotta, "An Array of Resistor Alternatives," *Electronic Buyers' News*, Mar. 11, 1996, and World Wide Web, retrieved Feb. 2, 1997, Electronic Buyers News, http://www.techweb.cmp.com/ebn/section/passives.html, Gina Roos, "Philips' IPCs to Ease Space Constraints," *Electronic Buyers' News*.

[217] U.S. industry representatives, telephone interviews by USITC staff, Jan. 1997.

from the existing and future consumption trends. In addition, these companies have also made a commitment to convert to SMT, which appears to be the mounting technology of choice for the immediate future.[218]

However, concentration in production also has a disadvantage vis-a-vis foreign competitors which are often vertically integrated firms producing broad lines of components and end-products. According to industry representatives, the primary purchasers of passive components, electronics OEMs, are increasingly interested in dealing with a limited number of suppliers for all of their passive component needs.[219] Foreign firms are often able to offer an entire line of passive components while most U.S. producers manufacture only a few products and cannot individually fulfill that need. As noted earlier, U.S. companies are finding ways of getting around their production concentration to meet the needs of the OEM customers. For example, Bourns produces only a few types of resistor products in the United States but has been able to round out its product line by importing other types of resistors from Asia and reselling them under its name.[220] AVX has a similar arrangement with Kyocera to sell Kyocera components in the United States.[221] Vishay has also broadened its product offerings largely through acquisition. Vishay has purchased a number of component manufacturers and can now offer a broad line of products. Vishay has broadened its product mix while still allowing for some degree of specialization by permitting the acquired companies to continue output of the products in which they excel.[222]

Capacitors and resistors are marketed through a variety of channels, including distributors, independent sales representatives, and direct sales by company salesmen.[223] Distributors purchase and take possession of the components from the producers and then resell to customers. Independent sales representatives facilitate sales between customers and capacitor and resistor producers, but do not take possession of the products and are usually paid solely on a commission basis. Many companies also maintain regional sales staffs in important locations to provide technical and sales support.[224]

U.S. producers compete on customer service through closer relationships with their customers and the increased use of tools such as electronic data interchange (EDI). EDI is an automated program that provides for scheduling deliveries, placing orders, and electronic payments. OEMs are now commonly notifying component suppliers well in advance of their prospective new products and resulting component needs. Closer working relationships often require OEMs to lock into partnership agreements with component manufacturers and the use of EDI. These agreements can result in shorter lead times, greater flexibility in scheduling, a reduction of inventory levels, and shorter cycle times.[225] Many U.S. producers as well as foreign suppliers have already adopted EDI and closer supplier/customer relationships. To compete in a market where products are almost perfectly substitutable, continued innovation in customer service may be required to succeed.

In regard to price competition, the United States has relatively high labor rates and is therefore at a relative disadvantage in terms of production costs. As noted earlier, U.S. firms are addressing this problem largely through the increased use of automation and production sharing. According to industry representatives, U.S. companies are increasingly replacing labor with automated manufacturing processes to

---

[218] U.S. capacitor industry representatives, interviews by USITC staff, Myrtle Beach, SC, Feb. 11, 1997.
[219] U.S. industry representatives, telephone interviews by USITC staff, fall/winter 1996.
[220] U.S. industry representatives, telephone interviews by USITC staff, Jan. 1997.
[221] U.S. industry representatives, interview by USITC staff, Raleigh, NC, Sept. 18, 1996.
[222] U.S. industry representatives, telephone interviews by USITC staff, fall/winter 1996.
[223] U.S. industry representatives, telephone interviews by USITC staff, Jan. 1997.
[224] Ibid.
[225] World Wide Web, retrieved Jan. 17, 1997, Electronic Buyers' News, http://www.techweb.com/ se/search, Gina Roos, "Buying Strategies, How to Buy Resistors," *Electronic Buyers' News*, Jan. 17, 1997.

lower production costs and increase productivity and product quality.[226] For those areas of the manufacturing process that still require significant labor input, especially assembly and packaging, many companies have established affiliate facilities in low labor-rate areas. AVX, Kemet, and Vishay have all established facilities in Mexico for production sharing. According to these companies, production sharing facilities have allowed them to lower production costs and remain competitive in the face of foreign competition.

Foreign Industry Profiles

Japan

Japan is the world's dominant producer of capacitors and resistors. Production increased from $6.3 billion to an estimated $7.8 billion during 1992-96.[227] Much of Japanese capacitor and resistor production is incorporated into consumer electronics or exported. The structure of the Japanese industry is quite different from that of the U.S. industry. Japanese producers are often much larger than their U.S. competitors and often manufacture a wide variety of other electronic products. The largest Japanese capacitor producers include Murata, TDK Corp., Panasonic, Nippon Chemi-con, Nichicon, Kyocera, Hitachi, and Matsuo. Major Japanese resistor manufacturers include Rohm, KOA Speer, Panasonic, Fujitsu, Kyocera, and Susumu.[228] Japanese capacitor and resistor producers are usually closely integrated with Japanese manufacturers of consumer electronics, computers, and communications equipment, and as a result there is a high degree of captive consumption.[229] High levels of captive consumption, as well as significant product diversification, may offer advantages in guaranteed demand and the financial resources to sustain market downturns.

Many of the major Japanese producers are active in international trade, and from 1992-96 Japanese exports rose from $2.2 billion to an estimated $3.6 billion.[230] The roughly 65-percent growth in exports far exceeded the 24-percent growth in production. In order to lower production costs and better serve foreign markets, Japanese firms have also become active in establishing foreign production facilities. Kyocera purchased AVX, and Murata and Panasonic maintain capacitor manufacturing facilities in the United States. In addition, Matsushita entered into a joint venture with Siemens of Germany to produce components in the EU, and Nissei Electric of Japan purchased Black and Decker's EU production facilities.[231] Numerous Japanese producers have also begun to move production facilities to Asian countries. This effort in large part has been to follow the continuing movement off shore of Japanese consumer electronics manufacturing.[232]

European Union

The European Union is currently the world's third largest manufacturer of capacitors and resistors. EU production grew from $2.1 billion to an estimated $2.3 billion during 1992-96.[233] Production was largely

---

[226] U.S. capacitor industry representatives, interviews by USITC staff, Myrtle Beach, SC, Feb. 11, 1997.

[227] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data,* 1994 and 1996.

[228] "The List," *Electronic Buyer's News* and Dodwell Marketing Consultants, *Key Players in Japanese Electronics Industry* (Tokyo, Japan: Dodwell Marketing Consultants, 1985), pp. 322-323.

[229] *Japan Electronics Almanac '95/'96* (Tokyo, Japan: Dempa Publications, Inc., 1995), p. 125.

[230] Estimated by USITC staff based on United Nations Trade Series D.

[231] U.S. industry representative, telephone interview by USITC staff, Feb. 27, 1997.

[232] *Japan Electronics Almanac '95/'96*, p. 133.

[233] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data,* 1994 and 1996.

concentrated in Germany, the United Kingdom, and the Netherlands, which are centers for EU electronic systems manufacturing. The capacitor and resistor industries in the EU are a mix of foreign- and EU-owned firms, and production is dominated by a relatively small number of producers.[234] Major capacitor manufacturers include Siemens/Matsushita, Philips, Vishay, AVX, Thompson-CSF, WIMA, Arcotronics, VOX/RIFA, and ISKRA. Major resistor manufacturers include Philips, Vishay, Siemens, Beyschlag, Welwyn, Beckman, and Vitrohm.[235]

Many of the major EU-owned producers maintain significant levels of internal consumption. In addition, a number of major foreign-owned EU producers were established to serve that market. As a result, the EU exports a smaller share of its production relative to other major producers. From 1992-96 EU exports of capacitors and resistors are estimated to have grown from $900 million to $1.1 billion.[236]

Other Producers

Korea, China, Singapore, and Taiwan are the largest of the emerging capacitor and resistor manufacturers. From 1992-96 their combined production is estimated to have grown from $1.7 billion to $3.5 billion.[237] Among the large Korean producers are Samhwa Capacitor Co.; vertically integrated electronics conglomerates such as Samsung, Lucky Goldstar and Daewoo; and several Japanese transplants.[238] Taiwan is the group's largest producer of resistors, with 1996 production estimated at $230 million.[239] Resistor production in Taiwan is highly fragmented with over 150 producers. Some of the largest companies include Yageo, Ty-Ohm, Ever Ohms Industry, and First Resistor and Condenser Co. Ltd.[240] In both capacitors and resistors, China is the fastest growing producer, a trend that appears likely to continue as a number of companies in the region are transferring production to China to take advantage of lower production costs.[241] In addition to multinational firms, several Chinese state-run companies also produce and export capacitors and resistors. Though reportedly of suspect quality, Chinese components are often marketed at prices well below other major manufacturers.[242]

During 1992-96 exports of capacitors and resistors from Korea, China, and Singapore, and Taiwan more than doubled, rising from $1.2 billion to an estimated $2.6 billion. The rate of growth in exports from these Asian countries was slightly greater than that of the United States and much higher than the growth in Japanese and EU exports.[243]

---

[234] U.S. industry representative, telephone interview by USITC staff, Feb. 27, 1997.

[235] Letter from U.S. industry representative to USITC staff, Mar. 7, 1997.

[236] Estimated by USITC staff based on data from Eurostat and European Commission, *Panorama of EU Industry*, p. 10-9.

[237] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996.

[238] USITC, *Industry and Trade Summary: Capacitors*, p. 7.

[239] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996.

[240] Mark LaPedus, "Yageo Makes Growth Move."

[241] World Wide Web, retrieved Jan. 17, 1997, Electronic Buyers' News, http://www.techweb.com/se/techsearch, Mark LaPedus, "Taiwan Ups the Ante-Despite Higher Demand, Suppliers Plan Price Cuts," *Electronic Buyers' News*, Feb. 13, 1995.

[242] World Wide Web, retrieved Feb. 11, 1997, Electronic Buyers' News, http://www. techweb.com/se/techsearch, Mark LaPedus and Sandy Chen, "China Passives: Looking Abroad," *Electronic Buyers' News*, Jan. 27, 1997.

[243] Estimated by USITC staff based on United Nations Trade Data Series D and Elsevier, *Yearbook of World Electronics Data*, 1994 and 1996.

Global Market Profile

The production of capacitors and resistors closely follows the demand for the electronic systems in which they are incorporated. Chief among these are computers, telecommunications equipment, consumer electronics, and automobiles which are estimated to account for over three-quarters of consumption. Electrical systems such as air conditioners, motors, fluorescent lighting, and compressors also require passive components but are estimated to account for less than a one-quarter of capacitor and resistor consumption. There is a particularly close relationship between semiconductors and passive components, because semiconductors require passive components in order to function.[244] A change in the demand for semiconductors generally results in a corresponding change in the demand for capacitors and resistors. This relationship is especially pronounced for ceramic and tantalum capacitors because of their use in the manufacture of semiconductor-intensive information technology products, while aluminum and film capacitors are most often used in industrial products.

U.S. Market Profile

The market for capacitors and resistors in the United States increased irregularly during 1992-96, with noticeable increases in 1994 and 1995 and a decline in 1996. The U.S. market grew from $2.1 billion in 1992 to $2.4 billion in 1996.[245] Growth in the sector was driven by increased demands for information technology products, especially computers and telecommunications equipment. However, in 1996 the semiconductor market suffered a decline because high growth rates that occurred in the sale of information technology products in 1995 did not match expectations in 1996. As the market for capacitors and resistors closely follows the market for semiconductors, a similar decrease in growth occurred among these passive components.

Although consumption levels reflected little change, imports of capacitors and resistors increased noticeably between the years 1992 and 1996. In 1996, imports of these passive components into the United States equaled nearly $1.7 billion, compared with approximately $1.1 billion in 1992, representing an estimated average annual growth of roughly 11.5 percent.[246] In addition, the import to consumption ratio has increased dramatically since 1992. In 1992, imports made up slightly over half of all U.S. consumption of capacitors and resistors. By 1996, however, the percentage of imports to consumption increased to an estimated 71 percent. This rise primarily stemmed from increased use of production-sharing relationships with assemblers in Mexico as well as an increase in the number of products imported from Asia for relabeling or direct sale in the United States. U.S. tariff rates on January 1, 1999 on imports of capacitors are scheduled under the GATT Uruguay Round reductions to equal 9 percent while imports of parts for capacitors will equal 3.5 percent (table 5-5).[247] For resistors, most imports will be dutiable at a rate of 6 percent. However, fixed and wirewound resistors for a power handling capacity of over 20w or more will be dutiable at 3 percent. In addition, other variable resistors will be dutiable at either zero or 4.8 percent, depending on the type. Because of the commodity nature of these products, ITA duty elimination is likely to result in increased market access opportunities.

---

[244] World Wide Web, retrieved Jan. 23, 1997, Electronic Business Today, http://www.ebt.mag.com/issue/9701/01passive.htm, Heidi Elliot, "Passives Sing a Happy Tune," *Electronic Business Today*, Jan. 23, 1997.

[245] Estimated by USITC staff based on official statistics of the USDOC.

[246] Ibid.

[247] *Most-Favoured-Nation Tariff Schedules.*

Table 5-5
Final Uruguay Round tariffs on capacitors and resistors for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999	
	Capacitors	Resistors
Australia	15-17	15
Canada	5.1	0
Costa Rica	([2])	([2])
Estonia	0	0
European Communities (15)	2.7-3.7	2.7
Hong Kong	0	0
Iceland	([2])	([2])
India	40	40
Indonesia	40	40
Israel	5-12	([2])
Japan	0	0
Korea	13	13
Macau	0	0
Malaysia	0-30	0
New Zealand	30	0-25
Norway	3	3
Romania	35	35
Singapore	10	10
Switzerland	0.2-1.3	0.1-2.7
Taiwan[3]	1.25-12.5	1.25-3
Thailand	([2])	([2])
Turkey	8	14.1
United States	3.5-9	0-6

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15 1994 and U.S. Department of Commerce working documents.

The Commission has received submissions from a number of U.S. capacitor and resistor producers. All of the submissions contained statements opposing the inclusion of capacitors and resistors in the ITA. In general, these manufacturers are concerned that the elimination of U.S. tariffs will result in substantial import growth to the detriment of the U.S. industry. Further, growth in imports would not be offset by increased opportunities for export based on ITA duty elimination because of the continued existence of non-tariff barriers in other major markets. Submissions by the capacitor and resistor industries can be seen in their entirety in appendix F.

Foreign Market Profiles

Japan

Consumption of capacitors and resistors in Japan remained relatively unchanged at roughly $4.5 billion during the period.[248] In addition, as in the United States, demand for semiconductors declined in 1996 leading to a decline in the demand for capacitors and resistors. In comparison, imports of these passive components increased steadily from about $140 million in 1992 to an estimated $300 million in 1996.[249] This increase in imports translates to an average annual growth rate of nearly 20 percent. Despite high import growth rates, the import to consumption ratio in Japan remains extremely low. In 1992, imports comprised slightly over 3 percent of consumption, increasing to an estimated 7 percent of consumption in 1996. Relative to other markets, the import-to-consumption ratio for capacitors and resistors is dramatically lower than corresponding ratios in the United States, EU, and other Asian countries. According to U.S. industry representatives, the major Japanese consumers of passive components, large electronics OEMs, are resistant to purchasing products from outside of their industrial groupings.[250] Japanese passive component imports are mostly limited to products for which there is no domestically produced equivalent.[251] Japan has already eliminated its tariffs on capacitors and resistors, and as a result the ITA will not result in increased market access opportunities.

European Union

The countries that make up the EU accounted for an estimated $3 billion in consumption of capacitors and resistors in 1996.[252] Since 1992, when consumption equaled $2.5 billion, the annual average growth rate equaled an estimated 5 percent. Growth in the sector generally followed increased demand in the computer, telecommunications, and automobile sectors.[253] EU imports of capacitors and resistors are estimated to have grown during 1992-96 from $1.3 billion to $1.7 billion.[254] Imports represent roughly 60 percent of the EU market. The principle exporters to the EU market are Japan and the United States, which account for approximately one-half of all EU imports.[255] In the absence of an ITA, imports of capacitors into the EU on January 1, 1999 will be dutiable at rates ranging from a high of 3.7 percent to a low

---

[248] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996 and United Nations Trade Series D.

[249] Ibid.

[250] U.S. industry representatives, telephone interviews by USITC staff, fall 1996 and winter 1997.

[251] Ibid.

[252] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996 and United Nations Trade Series D.

[253] Industry representative, interview by USITC staff, Washington, DC, Mar. 7, 1997.

[254] European Commission, *Panorama of EU Industry*, pp. 10-9.

[255] Ibid, pp. 10-11.

of 2.7 percent. For resistors, import tariffs will equal 2.7 percent.[256] The ITA should result in a slight increase in market access. Further, as with semiconductors and PCBs, EU enlargement will also bring increased market access opportunities to foreign producers.

Other Markets

Korea, Taiwan, Singapore, and China accounted for consumption of approximately $3.6 billion of capacitors and resistors in 1996.[257] In 1992, these four countries consumed an estimated $2.1 billion of passive components which translates to an annual average growth rate of roughly 14 percent during 1992-96. Growth in the market is fairly closely tied to growth in the consumer electronics, computers, and telecommunications industries, and for Korea and China, the automobile sectors.[258] Imports of capacitors and resistors collectively grew at about the same rate as consumption during the period. Imports of these products equaled an estimated $2.7 billion in 1996, increasing from $1.6 billion in 1992. The import to consumption ratio has been fairly high throughout the period as these countries produce a smaller variety of components and have to import those not domestically produced. In the absence of an ITA, tariffs on capacitors and resistors are scheduled to be 13 percent in Korea and 10 percent in Singapore as of January 1, 1999.[259] As China and Taiwan are not WTO members, their rates are not bound, and may change at any time. In 1992, China's base tariff rates on capacitors and resistors ranged from a high of 40 percent to a low of 15 percent. Taiwan's tariff rates in 1992 were significantly lower than China's, with capacitors and resistors dutiable from a high of 12.5 percent to a low of 1.25 percent. Based on duty elimination under the ITA, market access opportunities should increase substantially in Taiwan, Singapore, and Korea. Market access will remain unchanged in China, since it is not an ITA signatory.

---

[256] *Most-Favoured-Nation Tariff Schedules.*

[257] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996 and United Nations Trade Series D.

[258] Industry representative, interview by USITC staff, Washington, DC, Mar. 7, 1997.

[259] *Most-Favoured-Nation Tariff Schedules.*

CHAPTER 6
Office Machines
USITC Staff

Office machines comprise many products used by individuals, enterprises, governments, and educational institutions in the course of everyday business. For example, almost every office uses photocopiers, calculators, and typewriters. Also, most retail operations use cash registers and point-of-sale (POS) terminals, most banks have automatic teller machines (ATMs), and some households have word processing machines, typewriters, and calculators. Finally, most movie and arts theaters, travel agencies, and parking garages have ticket issuing machines.

The Information Technology Agreement (ITA) covers only a portion of the products in the office machines sector, including word processing machines, ATMs, and the following items with calculating functions: calculators, pocket-sized data recorders, electronic cash registers, POS terminals, postage franking machines, and ticket issuing machines. Although the ITA covers direct process photocopiers and other copiers incorporating optical systems, it excludes electrostatic indirect process photocopiers (commonly called plain paper copiers), which are estimated to account for over 60 percent of production, imports, exports, and employment in the office machines sector. The ITA covers parts and accessories of all photocopiers regardless of type, as well as parts and accessories of the majority of the products listed above. It does not include parts and accessories of ATMs and some parts and accessories of word processing machines. For a complete list of products included in the agreement, see appendix A.

World production of the office machines covered under the ITA increased from about $14 billion in 1992 to approximately $16 billion in 1996, representing an average annual growth rate of 3 percent. The United States, Japan, and the European Union (EU) are the three largest producers of office machines, together accounting for close to 66 percent of world production in 1996 (figure 6-1).[1] Other nations in Asia account for much of the remainder of world office machine production. Generally, the office machines produced in the United States, the EU, and Japan are higher value, higher technology items, such as ATMs and POS terminals, while the items produced in the rest of the world are lower value commodity items, such as hand-held calculators.

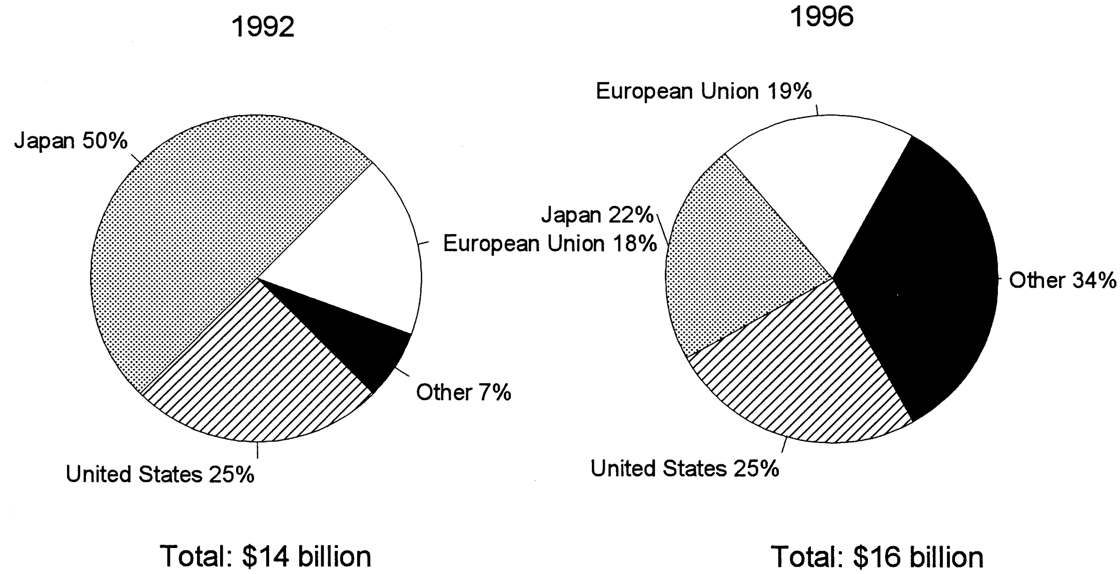
U.S. Industry Profile

U.S. production of office machines covered by the ITA rose from close to $3.5 billion in 1992 to approximately $4 billion in 1996, showing an average annual growth rate of 3 percent.[22] Production of some items, such as word processing machines, declined as their functions increasingly are better handled by higher technology machines, such as personal computers. U.S. production of hand held calculators and pocket-sized data recorders ceased for the most part during the period; these products' components are no longer made in

[1] The share of production estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996), 1996 ed.

[2] Ibid. and U.S. Department of Commerce (USDOC), Bureau of the Census, 1993, 1994, and 1995 *Current Industrial Report MA35R, Computer and Office and Accounting Machines*, 1993, 1994, and 1995.

Figure 6-1
World production of ITA office machines



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

the United States, and firms shifted their production overseas to be near sources of supply.[3] Production of ATMs and POS terminals increased, reflecting their growing use in banks and retail establishments. In addition, these products are increasing in value as they become more technology intensive. Similarly, U.S. production of ticket issuing machines also increased.

U.S. exports of these office machines remained steady at approximately $1 billion from 1992 to 1996.[4] In 1996, parts and accessories of photocopiers accounted for nearly one-half of these exports, and parts and accessories for accounting machines, cash registers, POS terminals, postage-franking, and similar machines accounted for about 25 percent. The principal markets for U.S. exports were the EU, Canada, Mexico, and Japan. Over one-third of U.S. exports to the EU were parts and accessories of photocopiers, most of which were intracompany transfers between major U.S. producers and their European subsidiaries. Similarly, over 40 percent of U.S. office machine exports to Canada consisted of parts and accessories of ITA items. Most parts and accessories of photocopiers exported to Canada go to U.S. photocopier producers that have moved production across the border. The largest share of exports to Mexico also included parts and accessories of photocopiers.

[3] Industry representatives, telephone interviews by USITC staff, Feb. 19 and Mar. 12, 1997.
[4] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996 and USDOC, *MA35R*, 1993, 1994, and 1995.

In 1996, the U.S. office machine sector consisted of over 100 firms. This number decreased from 1992 as smaller firms left the industry.[5] The sector is highly concentrated, with approximately 10 firms, all of which are U.S.-based, accounting for the majority of office machine shipments (table 6-1).[6] The remainder of the industry consists of smaller firms that operate in niche markets. Generally speaking, within each product group only a few firms dominate production. Pitney Bowes Inc. produces about 90 percent of U.S. postage franking equipment.[7] Diebold Incorporated manufactures the majority of U.S.-produced ATM machines,[8] with most of the remainder produced by the U.S. firm Triton.[9] NCR and IBM dominate U.S. production of POS terminals; Brother Industries (USA) Inc. manufactures most U.S.-made word processing machines;[10] NCR, IBM, and Swintec are major cash register producers and Boca is the leading U.S. producer of ticket issuing machines.[11] Hewlett-Packard (HP) and Texas Instruments (TI) were the major U.S. producers of calculators before ceasing production in the United States in the mid-1990s. Most dominant firms are multinational and almost all firms manufacture other products in addition to office machines.

The number of persons employed in the office machines sector declined from slightly more than 24,000 workers in 1992 to 18,000 workers in 1996, or by 25 percent.[12] This decline was partly due to companies streamlining their operations to reduce costs. While lower technology segments of the office machine industry are requiring fewer skills, the higher technology segments of the industry increasingly are demanding highly skilled computer engineers, systems analysts, purchasing agents, and technical writers.[13] This shift reflects a growing dependence on computer and software technology and interconnectivity, including telecommunications, local-area, and wide-area network technology. An emphasis on service and marketing employees reflects the growing importance of customer service as a competitive factor in the higher ends of the industry.

The evolution of office machine products has been greatly affected by the introduction and increasing penetration of computer systems and networks. Many of today's mature office machines, such as calculators and word processing machines, began as leading edge products. However, as personal computers became more affordable and performed the functions of word processing machines and calculators more efficiently, these products reached a plateau in terms of productivity enhancement. Most importantly, office machines like word processing machines and calculators could not easily transfer data from one user to another or from one application to another as could personal computer networks. These functions increasingly have been demanded by the service, retail, and banking sectors which are seeking ways to automate and increase their efficiency.

---

[5] Estimated by USITC staff based on Arsen J. Darnay, ed., *Manufacturing USA: Industry Analyses, Statistics, and Leading Companies*, 5th ed. (Detroit: Gale Research, 1996), pp. 1708-1715.

[6] Ibid.

[7] Shares of U.S. production are estimates provided by U.S. industry representatives, telephone interviews by USITC staff, Feb. and Mar. 1997.

[8] InterBold, a joint venture owned 70 percent by Diebold and 30 percent by IBM, is a leading global supplier of ATMs and has more ATMs installed worldwide than any other manufacturer. Diebold, Inc., http://www.diebold.com/overview.html#description, Jan. 27, 1997.

[9] Industry representative, telephone interview by USITC staff, Mar. 10, 1997.

[10] Industry representatives, telephone interviews by USITC staff, Feb. 1997.

[11] Industry representatives, telephone interviews by USITC staff, Mar. 12 and 13, 1997.

[12] Employment data are estimated by USITC staff based on data from selected companies and the estimate of U.S. production.

[13] Estimates for SIC 357 contained in Darnay, ed., *Manufacturing USA*, pp. 1708-1715.

Table 6-1
Major U.S. producers of ITA office machines, by industry segments, 1996

Calculators[1]/data organizers	Word processing machines
Hewlett-Packard Texas Instruments	Brother Industries
Postage franking machines	**Ticket issuing machines**
Neopost Pitney Bowes	Boca Systems
Electronic cash registers and POS terminals	**ATMs**
Diebold IBM NCR Swintek	Diebold Triton

[1] U.S. production of calculators ceased in 1996.

Source: Compiled by the staff of the USITC.

As a result, manufacturers of office machines covered in the ITA are transferring the production of mature technology goods to lower cost locations in Asia, or are ceasing production altogether, and focusing on higher value-added products. In fact, today's leading office machine producers incorporate the productivity enhancing features of computer and telecommunications networks to create service automation products like ATMs and POS terminals, postage franking machines, and ticket issuing machines which are increasingly using digital technology, integrated circuits, and software.[14] In particular, ATMs and POS terminals are using Pentium microprocessors similar to those found in personal computers.

The use of these networks allows information about a financial transaction or a retail sale to be transferred electronically to corporate databases to track items such as customer account balances, credit and debit card authorizations, as well as inventory control and marketing analyses. ATMs, POS terminals, ticket issuing machines, and postage franking machines are the front end hardware equipment to an underlying and complex network of computing and telecommunications hardware and software. Corporate end users increasingly are demanding such interconnected products that allow them to process information, such as product orders, quickly, responsively, and efficiently.

The increasing demand for such high technology office machines benefits U.S. producers, as the United States is the world leader in computer and telecommunications technologies.[15] Major U.S. producers of office machines are leaders in the computer and telecommunications industries, affording them a competitive advantage in advanced office machine production. IBM, a leader in computer hardware and software, benefits from its advantages in these areas in the development of POS terminals and in its joint venture with Diebold to produce ATMs. NCR also gains from its strength in the computer industry to produce technologically sophisticated electronic cash registers and POS terminals.

---

[14] Industry representatives, telephone interviews by USITC staff, Feb. 24 and Mar. 13, 1997.

[15] Computer Science and Telecommunications Board, *Keeping the U.S. Computer and Communications Industry Competitive* (Washington, DC: National Research Council, 1995), pp. 83-85.

In addition, U.S. firms enter research and development (R&D), production, and distribution alliances to take advantage of the convergence of the computer and telecommunication industries. NCR has an agreement with Lucent Technologies for research to support its key networking technologies.[16] Diebold, a leading U.S. producer of ATMs, jointly produces and markets ATMs as well as ATM and POS networks with IBM; this arrangement draws on Diebold's strengths in ATM manufacturing and IBM's strengths in marketing and technical resources.[17]

Some U.S. firms reduce costs by moving production abroad or outsourcing from overseas manufacturers. Production of relatively mature or commoditized office machine goods is generally based in low wage countries or outsourced to third party original equipment manufacturers (OEMs). For instance, HP moved its calculator manufacturing operations to Singapore to take advantage of lower production costs and to be near parts suppliers as well as the rapidly developing markets in Asia. TI, in comparison, develops the software and industrial design for its calculators but outsources production to third parties.[18] U.S. firms may produce abroad or outsource labor intensive parts and components of higher value products such as ATMs, POS terminals, and postage franking machines from overseas suppliers. For example, some U.S. producers of ATMs source money dispensing components for their machines from Latin America.[19]

Although firms may source certain labor intensive components from overseas, many firms that produce high value office equipment still manufacture the bulk of their products in the United States. Local manufacturing of products such as ATMs and POS terminals is necessary because such products require a great deal of customization. ATM providers need to adapt their software and equipment to conform to local accounting, telecommunications, and banking regulations and standards.[20] Importantly, the United States is the largest market in the world for these office machine products. Both U.S.- and foreign-headquartered firms choose to produce in the United States to facilitate communication with their customers. This ability is particularly important for high-end products with sophisticated features where a quick response by the manufacturer to the customer's problem is essential.

The industry's higher end products are more R&D intensive than lower end products, particularly as higher end products incorporate more digital technology.[21] Examination of several office machine producers' filings with the Securities and Exchange Commission indicated that R&D spending was about 5 percent of revenues in 1995 and 1996,[22] slightly higher than the average for the manufacturing industry as a whole.[23] However, according to interviews with industry representatives, the level of technology used by major U.S. manufacturers and their principal competitors in the EU and Japan is similar; competition is based more on pricing, service, and reliability than on a firm having a superior technology.[24]

One way that U.S. producers of high-end office machines compete successfully in the United States is by working closely with their customers and providing value-added services. Diebold can command a premium for its ATMs as it provides the equipment, software, and service required by banks to operate ATM

---

[16] AT&T, *1995 Annual Report.*

[17] World Wide Web, retrieved Feb. 5, 1997, Diebold, Inc., http://www.diebold.com/overview.html#description, "Diebold, Inc."

[18] Industry representative, telephone interview by USITC staff, Mar. 11, 1997.

[19] Ibid.

[20] Industry representatives, telephone interviews by USITC staff, Feb. and Mar. 1997.

[21] Industry representatives, telephone interviews by USITC staff, Mar. 1995.

[22] The firms were Diebold, NCR, Xerox, Kodak, and Lexmark. Since all of these firms manufacture products other than office machines, the level of R&D spending should be considered as an indicator rather than an absolute number.

[23] National Science Board, *Science & Engineering Indicators, 1995* (Washington, DC: GPO, 1996).

[24] Industry representatives, telephone interviews by USITC staff, Feb. 1997.

networks.[25] Office machine producers also use value-added resellers, or firms that sell the manufacturers' office machines as part of installations that often include specialized software, networks, and other products and services unavailable from the manufacturers. Producers and value-added resellers often work together with large customers that need both national or international equipment support and specialized equipment installations.[26] Finally, U.S. firms benefit from having brand names associated with quality and reliability.[27]

Foreign Industry Profiles

The major foreign producers of ITA office machines in 1996 were Japan and the EU. Between 1992 and 1996, Japan's share of world ITA office machine production fell from 50 percent to close to 20 percent, the United States maintained a steady 25 percent share, and the EU share rose slightly from 18 to 19 percent. The large decline in Japan's share of world production was due to weak domestic demand and the transfer of production offshore, in part, to alleviate trade friction.[28]

Smaller producers, namely China and Thailand, are the principal second tier producers of ITA office machines. These countries together accounted for nearly 10 percent of world production of these office machines in 1996. Many foreign producers have established manufacturing facilities in China and Thailand to take advantage of the lower wage rates, although much of the production in these countries is of commodity items.

Japan

Japan is one of the leading world producers of ITA office machines. However, production of these office machines in Japan fell at an average annual rate of 15 percent from close to $7 billion in 1992 to $3.5 billion in 1996.[29] This decline was caused in large part by falling Japanese production of word processing machines, calculators, and cash registers. Japanese producers moved many of these production facilities offshore in the 1980s and early 1990s due to rising trade friction. At the same time, the trend begun in the 1980s of Japanese manufacturers moving plants to other Asian countries to take advantage of lower costs was accelerated by the appreciation of the yen in the 1990s. For example, Casio, a large Japanese office machine manufacturer, expanded production in Southeast Asia in the 1990s to improve its profits.[30] Japanese exports of ITA office machines fell by nearly 25 percent annually, from about $1.4 billion in 1992 to approximately $430 million in 1996.[31] Japanese exports of ITA office machines accounted for only 12 percent of production in 1996, falling from 20 percent in 1992. Both of these trends reflect the shift to production abroad. Japan's major export markets in 1996 were the United States, the EU, Canada, and China.[32]

---

[25] Industry representatives, telephone interviews by USITC staff, Apr. 1995.

[26] Industry representatives, telephone interviews by USITC staff, Mar. 1995.

[27] Industry representatives, telephone interviews by USITC staff, Feb. 1997.

[28] *Japan Electronics Almanac '93/'94* (Tokyo: Dempa Publications, Inc., 1993), pp. 89, 95; *Japan Electronics Almanac '94/'95* (Tokyo: Dempa Publications, Inc., 1994), pp. 93-94; and *Japan Electronics Almanac '95/'96* (Tokyo: Dempa Publications, Inc., 1995), pp. 92, 105.

[29] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996 and official statistics of the Ministry of International Trade and Industry (MITI), Government of Japan, 1996.

[30] *Japan Company Handbook: Spring 1996* (Tokyo: Toyo Keizai, 1996), p. 791.

[31] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996 and official statistics of MITI, Japan.

[32] *Japan Exports & Imports: Commodity by Country* (Tokyo: Japan Tariff Association), Nov. 1996.

Japanese production of ITA office machines is dominated by Japanese firms (table 6-2). No major foreign-based firms produce these office machines in Japan. Like U.S. firms, some Japanese producers of higher end office machines, in particular ATM producers Fujitsu and Hitachi, also are leaders in the computer hardware and software as well as telecommunications industries. Unlike U.S. firms, however, many of the Japanese manufacturers, namely Sharp, Casio, Toshiba, Hitachi, and Oki, are integrated into large diversified firms that produce many other products, including consumer electronics. Such an organizational structure allows Japanese office machine manufacturers to obtain substantial portions of their input requirements internally, to share R&D expenditures, and to offer customers a wide array of products and services.

European Union

ITA office machine production in the EU grew slightly from over $2.5 billion in 1992 to $3 billion in 1996, at a rate of close to 5 percent per year.[33] EU exports of office machines, valued at $1 billion in 1992, rose at an average yearly rate of 15 percent to nearly $2 billion in 1996.[34]

The office machines sector in the EU is very concentrated, similar to the sector in the United States. Large EU firms include Siemens-Nixdorf of Germany, Olivetti of Italy, and Groupe Bull of France. Many of these large companies are diversified, vertically integrated multinational electronics firms. Affiliates of U.S. office machine manufacturers also produce ITA office machines in the EU (table 6-3).[35] Few Japanese-based firms are believed to produce ITA office machines in the EU; most Japanese-based EU production of office machines is of photocopiers and typewriters that are not covered by the ITA.

As in the United States, many foreign-based firms produce in the EU to be near the large market. Such proximity eases the adaptation of equipment to the EU's many languages and standards, increases responsiveness to customer needs, and permits better after-sales service. Such a presence is important to serve these markets effectively and to facilitate adaption of products to local languages, regulations, and standards. ATMs, for instance, must be integrated with existing or newly implemented financial transaction networks and software. Additionally, some foreign-based firms produce in the EU to avoid tariff and nontariff barriers.[36]

U.S.-based firms operating in Europe have done business routinely on an EU-wide basis, rather than in any one particular EU country. As a result, these companies have developed lower cost firm structures because of their economies of scale. By contrast, EU-based firms have only recently begun to address more than just their own national markets since the development of the Single Market, and their costs are still higher than those of U.S.-based firms operating in the EU.[37] EU-based office machine manufacturers are regarded as less technologically advanced than U.S.-based office machine producers because the EU firms lag in the software and digital technology necessary for innovation in the office machine industry. Compared to Japanese- and U.S.-based firms, European firms also are weak in integrating research and development,

---

[33] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996 and European Commission, *Panorama of EU Industry 95/96* (Luxembourg: Office for Official Publications of the European Communities, 1995).
[34] Ibid.
[35] European Commission, *Panorama of EU Industry 95/96*, p. 10-23.
[36] Industry representatives, telephone interviews by USITC staff, Mar. 1995.
[37] European Commission, *Panorama of EU Industry 95/96*, p. 10-23.

Table 6-2
Major Japanese producers of ITA office machines, by industry segments, 1996

Calculators/data organizers	Word processing machines
Casio Sharp	Casio Fujitsu Sharp
Postage franking machines	**Ticket issuing machines[1]**
Teraoka Seiko Tokyo Electric	
Electronic cash registers and POS terminals	**ATMs**
Oki Toshiba	Fujitsu Hitachi Oki Omron

[1] No firms producing ticket issuing machines in Japan have been identified.

Source: Compiled by the staff of the USITC.

Table 6-3
Major European Union producers of ITA office machines and headquarter locations, by industry segments, 1996

Calculators	Word processing machines
Texas Instruments (United States)	Olivetti (Italy)
Postage franking machines	**Ticket issuing machines**
Francotyp-Postalia (Germany) Neopost (France) Pitney Bowes (United States)	Ier (France) Ubi (Sweden)
Electronic cash registers and POS terminals	**ATMs**
NCR (United States)	Bull (France) Diebold (United States) NCR (United States) Olivetti (Italy) Siemens-Nixdorf (Germany)

Source: Compiled by the staff of the USITC.

innovation, standardization, and marketing.[38] As a result, U.S.-based firms dominate some of the industry segments. For example, U.S.-based NCR is the largest ATM producer in the EU, followed by U.S.-based Diebold and then the German firm Siemens-Nixdorf.[39]

---

[38] Ibid., pp. 10-5 and 10-14.
[39] "Europe now largest market for ATMs," *World of Banking*, June/July 1995, pp. 24-27.

Other Producers

China and Thailand are emerging manufacturers of office equipment covered in the ITA. These two countries accounted for slightly over $1 billion of production in 1996, a significant increase from approximately $600 million in 1992.[40] This represents an annual average growth rate of 15 percent during the period. These countries' exports also increased significantly, from about $300 million in 1992 to roughly $1 billion in 1996, at an annual average growth rate of 28 percent.

As mentioned above, companies based in countries that manufacture the dominant share of office equipment, such as Japan and the United States, are moving operations overseas to take advantage of lower costs of production. China and Thailand, in particular, provide companies with low cost manufacturing bases close to electronics parts suppliers as well as access to rapidly developing markets. For instance, in 1993 Diebold formed a joint venture with a Chinese firm to produce ATMs and to gain access to China's growing market for these products.[41]

In addition, these countries are increasing their share of outsourced production of commodity type products, such as calculators, which do not require leading edge technologies. For instance, OEM orders comprise about 80 percent of China's entire calculator output.[42] One producer in China, Shenzhen Weida Electronics Co. Ltd, states that 95 percent of production are OEM orders which are exported to Europe, Japan, Southeast Asia, and the United States.[43] In Thailand, Cal-Comp Enterprises produces both calculators and pocket-sized data organizers on an OEM basis for companies located in other countries.[44]

U.S. Market Profile

The United States was the world's largest market for ITA office machines in 1996. The U.S. market grew from almost $5 billion to almost $6 billion from 1992 to 1996, or by about 5 percent annually. The major products consumed were calculators, POS terminals, cash registers, and ATMs. Consumption of most office machines increased during this period. The consumption of calculators, particularly higher value machines with advanced functions, grew as these items increasingly are being used by U.S. students in math and science classes.[45] Consumption of ATMs is growing as U.S. banks are investing in these machines as alternatives to traditional tellers. In addition, many business establishments, such as grocery stores, malls, and casinos, are installing ATMs to give their customers quick access to cash.[46] Businesses that have traditionally relied on mechanical postage franking machines, which are prone to tampering and fraud, have since 1994 been mandated by the U.S. Postal Service to replace these machines with franking machines incorporating electronic meters.[47]

---

[40] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data 1996.*

[41] World Wide Web, retrieved Mar. 6, 1997, Diebold Inc., http://www.diebold.com., "Diebold Timeline."

[42] "Market Overcrowding Forces Prices Down by 30 Percent," *Asian Sources Electronics*, Oct. 1996, pp. 556-567.

[43] Ibid.

[44] World Wide Web, retrieved Mar. 12, 1997, PC&C Enterprises, http://www.actlab.com/business/pcc/about.htm, PC&C Enterprises, "About PC&C Enterprises."

[45] Industry representative, telephone interview by USITC staff, Mar. 12, 1997.

[46] Ibid.

[47] World Wide Web, retrieved Mar. 12, 1997, Neopost, http://www.neopost.com., "Comments on the United States Postal Service's Program for the Decertification of Certain Types of Postage Meters," *Neopost News*.

U.S. imports of ITA office machines grew from $2.4 billion to $2.8 billion from 1992 to 1996, or at an average annual rate of 4 percent.[48] The principal U.S. imports were parts and accessories for photocopying machines, accounting for approximately one-half of U.S. imports, followed by calculators, accounting for 20 percent of imports.[49] POS terminals and cash registers made up close to 10 percent of U.S. ITA office machine imports while the other products made up the remainder.[50] Intracompany flows account for a substantial portion of imports of parts and accessories of photocopying machines. Consumption of calculators is supplied completely by imports since these items are no longer made in the United States.

Japan remains the leading U.S. supplier, accounting for one-half of U.S. imports in 1996. China and Taiwan each supplied close to 10 percent of U.S. imports. Although imports from Japan declined by about 1 percent per year during 1992-1996, imports from China grew by over 27 percent per year as many producers established production facilities in China. Imports from Taiwan grew by over 7 percent per year. The U.S. duties on office machines covered in the ITA would be less than 2 percent as of January 1, 1999, the last step in tariff reductions negotiated under the Uruguay Round (table 6-4).[51] Thus, an ITA would increase access to the U.S. office machines market.

Foreign Market Profiles

European Union

The EU market for ITA office machines, valued at approximately $4 billion in 1992, grew at an average annual rate of approximately 5 percent to $5 billion in 1996.[52] The principal items consumed in the EU include calculators, cash registers, and parts of office machines. For similar reasons as in the United States, the consumption of ATMs and cash dispensing machines rose in the EU, and the EU became one of the largest markets in the world for these products in 1995.[53]

EU imports of ITA office machine products were estimated to be $2.5 billion in 1992 and rose at an average annual growth rate of 10 percent to $3.7 billion in 1996.[54] The United States was the source of over one-third of EU imports and Japan was the source of over 20 percent. As of January 1, 1999, when final Uruguay Round rates are in place, EU tariff rates for office machines covered by the ITA would range from zero to 6 percent.[55] An ITA would result in increased market access opportunities in the EU for foreign suppliers of certain ITA office machines.

---

[48] Estimated by USITC staff based on official data of the USDOC.

[49] Ibid.

[50] Ibid.

[51] *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994. The Marrakesh Protocol is part of the General Agreement on Tariffs and Trade 1994 (GATT 1994), which is a multilateral agreement that is an annex to the Agreement Establishing the World Trade Organization. See appendix G for final Uruguay Round Tariffs on specific Harmonized Tariff Schedule categories.

[52] European Commission, *Panorama of EU Industry 95/96.*

[53] "Europe Now Largest Market for ATMs," *World of Banking*, June/July 1996, pp. 24-25.

[54] Estimated by USITC staff based on European Commission, *Panorama of EU Industry 95/96* and Elsevier, *Yearbook of World Electronics Data*, 1996.

[55] *Most-Favoured-Nation Tariff Schedules.*

Table 6-4
Final Uruguay Round tariffs on office machines for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	0-7.5
Canada	0-2.6
Costa Rica	([2])
Estonia	0
European Communities (15)	0-6
Hong Kong	0
Iceland	24-35
India	([2])-40
Indonesia	40
Israel	0-16-([2])
Japan	0
Korea	5-13
Macau	([2])
Malaysia	5-30
New Zealand	0-16.5
Norway	0-3
Romania	18-35
Singapore	0-10-([2])
Switzerland	0.4-4.8
Taiwan[3]	0-7.5
Thailand	30
Turkey	([2]) -8.5
United States	0-1.9

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.

Source: *Most-Favoured Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994, and U.S. Department of Commerce working documents.

In addition, the ITA should have a more significant effect on EU market access as the EU becomes larger over time. As the size of the EU increases, the rewards of any efforts to improve market access with the EU increases. As countries join the EU, they adopt the common EU tariff and abide by trade agreements entered into by the EU. With EU enlargement, trade regimes in Europe will be simplified and it is likely that trade restrictions and tariffs currently imposed by countries awaiting EU admission will be lessened.

Japan

The Japanese market for ITA office machines fell from close to $6 billion in 1992 to approximately $3.5 billion in 1996, or at an average annual rate of about 13 percent.[56] Some of this decline can be attributed to the increasing use in Japan of personal computers at the expense of word processing machines. The market for POS terminals, particularly for credit and debit card transactions, is not growing as quickly in Japan as in the United States because many financial transactions in Japan are still cash-based. Finally, the recession in Japan in the first half of the 1990s dampened business spending on some of the higher end office machines.

Imports supplied about 3 percent of the Japanese market for ITA office machines in 1992 but rose to over 8 percent in 1996. This increase reflected the continual movement of Japanese producers of technologically mature products such as calculators, data organizers, and word processing machines to lower wage countries in Asia in order to remain competitive.[57] Most of Japan's imports were from these offshore plants. Calculators were the principal item imported by Japan. Given that as of January 1, 1999, Japan's duty rate on office machines would equal zero[58] an ITA would have no effect on access opportunities in the Japanese office machines market.

Other markets

Canada and Brazil are the next largest markets for ITA office machines. The combined market for these two countries in 1992 was valued at $580 million, and rose at an average annual rate of almost 2 percent to $620 million in 1996.[59] Like the United States, the primary products consumed by Canada were items such as calculators, POS terminals, cash registers, and ATMs. However, unlike the United States, Canada's consumption of most office machines remained relatively steady between 1992 and 1996. An exception was an increase in the consumption of cash registers and ATMs. However, as in the United States, more Canadians are using personal computers instead of word processing machines.[60] Brazil, by comparison, increased its consumption of both mature and leading edge office machines as the country continues to develop its economy.

Imports of ITA office machines in these two countries grew at an average annual rate of 4 percent from $420 million in 1992 to $490 million in 1996.[61] Canada decreased domestic production of commodity

---

[56] Estimated by USITC staff based on European Commission, *Panorama of EU Industry 95/96;* Elsevier, *Yearbook of World Electronics Data*, 1996; and MITI, Japan.

[57] *Japan Electronics Almanac '93/'94*, p. 93.

[58] *Most-Favoured-Nation Tariff Schedules.*

[59] Estimated by USITC staff based on European Commission, *Panorama of EU Industry 95/96* and Elsevier, *Yearbook of World Electronics Data*, 1996.

[60] Industry representative, telephone interview by USITC staff, Mar. 14, 1997.

[61] Estimated by USITC staff based on European Commission, *Panorama of EU Industry 95/96* and Elsevier, *Yearbook of World Electronics Data*, 1996.

products and sourced more of these products from abroad. Brazil's growing imports satisfied an increase in domestic consumption caused by rapid economic development. In the absence of an ITA, imports of ITA office machines into Canada would be duty free as of January 1, 1999, with the exception of ATM machines, which would be assessed a duty rate of 2.6 percent. Thus, an ITA would result in increased market access opportunities in Canada for foreign ATM suppliers. Duty rates in Brazil on ITA office machines will range from 20 to 35 percent as of January 1, 1999.[62] As Brazil is not an ITA signatory, the ITA would result in no changes in access opportunities to the Brazilian office machines market.

---

[62] *Most-Favoured-Nation Tariff Schedules.*

CHAPTER 7
Unrecorded Media

Danielle Kriz

The unrecorded media industry includes magnetic tape, magnetic disks, and recordable optical disks. These media are used for analog and digital recordings of audio and video programming, and for digital recordings of computer data. These media comprise the following major product segments and uses (table 7-1).

Table 7-1
Global unrecorded media industry: Major product segments and uses, 1996

Products	Uses
Consumer audio and video tape	Audiophiles, VCR users, video camera users, audiocassette and videoaudiocassette duplicators
Professional audio and video tape	Recording studios, television studios
Computer tape	Computer users
Magnetic disks (floppy)	Computer users, software industry
Magnetic disks (hard)	Disk-drive manufacturers, users of removable disk drives
Optical disks	Businesses, computer users, recording studios, audiophiles
Magnetic striping tape	Credit card and ticket industries

Source: Compiled by the staff of the USITC.

Magnetic and optical media are manufactured by depositing a thin magnetic film, usually consisting of fine particles, onto a substrate material; this process, known as coating, is the most expensive and technologically advanced step of the manufacturing process. Magnetic media are then fabricated, where tape is cut to the appropriate length and disks attached to hubs, and then assembled or packaged in cassettes, cartridges, or shells. Optical media are loaded as-is into packaging. Unrecorded media are sold either to the recorded media sector for the recording of programming or software before resale, or as packaged blank tape or disks directly to consumers.[1] The Information Technology Agreement (ITA) includes all unrecorded media except cards incorporating a magnetic stripe, which was excluded from ITA coverage. These cards comprise less than 5 percent of the unrecorded media industry.[2] Thus, the following industry description and analysis is reflective of the industry covered in the ITA. For a complete list of products included in the agreement, see

[1] USITC, *Industry and Trade Summary: Unrecorded Media*, USITC Publication 2879, May 1995, pp. 2-4.
[2] Estimated by USITC staff based on USITC, *Unrecorded Media* and industry officials, telephone interviews by USITC staff, Jan. 1997.

appendix A. The major producers of unrecorded media are the United States, Japan, and the EU, which together accounted for over 70 percent of world production in 1996 (figures 7-1 and 7-2).[3]

U.S. Industry Profile

In 1996, U.S. production of unrecorded media was valued at $4.9 billion, approximately 36 percent of world production (figure 7-2).[4] While U.S. production has grown, prices have declined,[5] and as a result the growth of the value of U.S. production of unrecorded media has slowed in recent years. Between 1992 and 1996, the value of U.S. production of unrecorded media grew at an average annual rate of 5.5 percent, from $4 billion in 1992 to $4.9 billion in 1996. However, while production value grew 12.1 percent from 1992 to 1993, it grew only 0.7 percent from 1995 to 1996.[6]

The U.S. industry is dominated by about 14 large firms which comprise a substantial majority of U.S. production; about one-half of these major firms are foreign-owned (table 7-2). The remainder of the U.S. industry consists of approximately 45 smaller firms, most of which operate in niche markets, performing small-scale product fabrication.[7] Total U.S. employment in the industry was approximately 17,000 in 1996.[8] However, employment in the industry fell at an average annual rate of 2.4 percent from 1992 to 1996, due in large part to increasing productivity as well as downsizing of the domestic industry.[9]

The unrecorded media industry is extremely price competitive. Demand for some established media products is falling, leaving some firms with excess capacity and pushing prices down. In addition, as different brands of many products are substitutable, firms often must cut prices to compete for customers.[10] As a result, the industry has become substantially globalized as firms attempt to cut manufacturing and distribution costs. Many firms produce in local markets to save shipping and duties and avoid costs related to exchange rate fluctuations. Firms also choose to locate near their customers to be able to produce and ship on demand and to avoid building up surplus inventories.[11] The four major Japanese producers, Sony, Fuji, TDK and Hitachi-Maxell, as well as some smaller Japanese firms, have subsidiaries producing unrecorded media in the United States as well as in Europe. A few U.S. firms produce computer tape and write-once recordable compact disks, or CD-R, in Europe.[12] A number of U.S. and Japanese hard-disk manufacturers operate disk plants in Singapore, Malaysia, and Thailand, where most disk-drive production occurs.[13] Further, firms cut costs by fabricating or assembling consumer tapes or disks in lower wage countries. Firms including Sony,

---

[3] Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science, Ltd, 1996), 1996.

[4] Ibid.

[5] Industry representative, telephone interview by USITC staff, Jan. 28, 1997.

[6] Estimated by USITC staff based on in Elsevier, *Yearbook of World Electronics Data*, 1996.

[7] Estimated by USITC staff based on U.S. Department of Commerce (USDOC), Current Industrial Reports *MA35R, Computer and Office and Accounting Machines*, 1995 and International Recording Media Association representative, telephone interview by USITC staff, Feb. 7, 1997.

[8] Estimated by USITC staff based on U.S. Department of Labor, Bureau of Labor Statistics (BLS), *Employment and Wages Annual Averages, 1995.*

[9] U.S. Department of Labor, BLS, *Employment and Wages Annual Averages.*

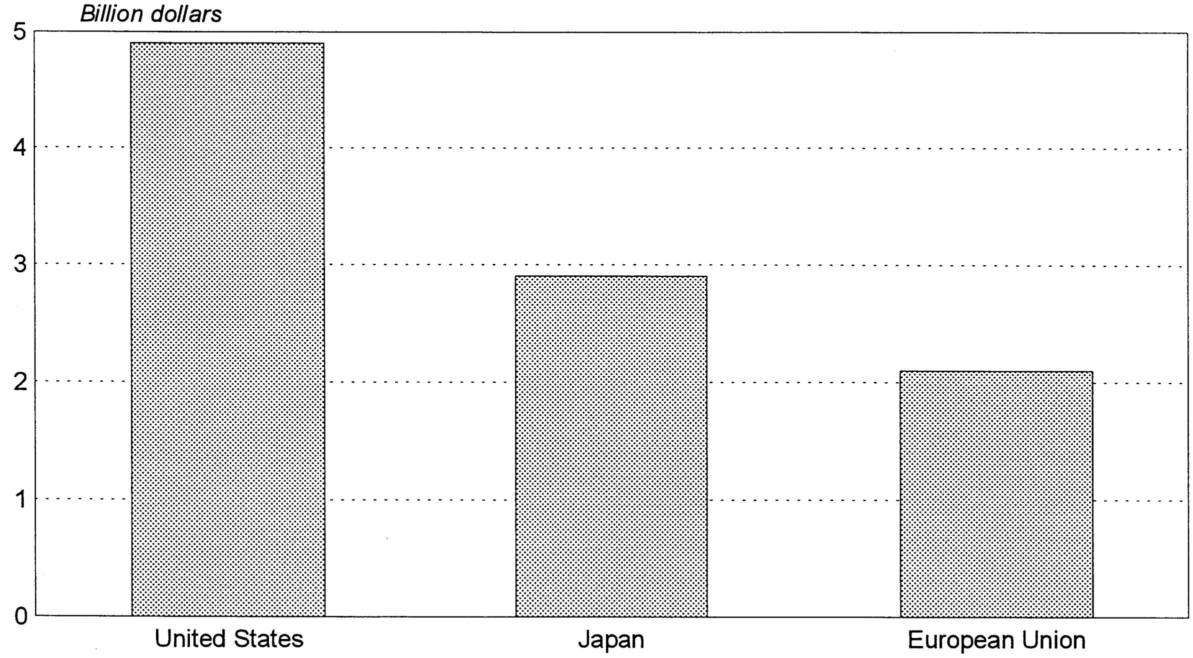
[10] *Magnetic Media International Newsletter*, vol. 15, No. 2, (Aug. 10, 1996), p. 16.

[11] Industry representatives, telephone interviews by USITC staff, Jan. 31 and Feb. 7 and 12, 1997.

[12] *Magnetic Media International Newsletter*, vol. 14, No. 6 (Jan 26, 1996), pp. 53-54; "Kodak Opens New Writable CD Production Facility in Ireland," Eastman Kodak press release, Jan. 13, 1997; and USITC, *Unrecorded Media,* p. 6.

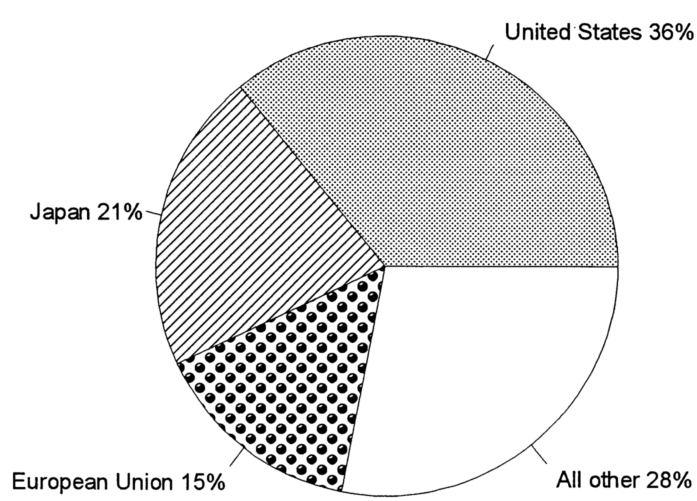
[13] Industry representative, telephone interview by USITC staff, Jan. 28, 1997.

Figure 7-1
Unrecorded media: Production of major producers, 1996



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

Figure 7-2
Unrecorded media: Share of world production of major producers, 1996



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

Table 7-2
Major U.S. producers and locations of their parent corporations, by industry segments, 1996

Consumer audio and video tape	Professional audio and video tape
Fuji Photo Film (Japan) JVC (Japan) Sony (Japan) 3M (United States)	Quantegy[1] (United States) Sony (Japan)
Computer tape	**Floppy disks**
Anacomp (United States) Imation[2] (United States)	Fuji Photo Film (Japan) Hitachi Maxell (Japan) Imation[2] (United States) Kao Infosystems (Japan) Sony (Japan) TDK (Japan) Verbatim (Japan)
Hard disks	**Optical disks**
IBM (United States) Komag (United States) Seagate (United States)	Eastman Kodak (United States) Imation[2] (United States) JVC (Japan) Verbatim (Japan)

[1] Formerly Ampex Media Corporation.
[2] A spin-off of 3M.

Source: Compiled by USITC staff based on *Magnetic Media International Newsletter*, vol. 15, No. 2, Aug. 10, 1996.

Hitachi, Verbatim, and Eastman Kodak manufacture or assemble in Mexico, taking advantage of lower Mexican wages and the NAFTA as well as access to the Latin American market.[14]

In the competitive U.S. industry, success depends on how low a company can push its manufacturing costs.[15] As a result, U.S. firms are moving away from producing lower technology products with lower margins and instead are purchasing these products from abroad to fill out their product lines.[16] Falling demand, oversupply due to increasing production efficiency, competition from lower cost imports from Korea and China, and pressures from mass merchandisers to keep prices low at the retail level have rendered it difficult for U.S. firms to profit from producing consumer audio and video tape and floppy disks.[17] For example, the retail price of floppy disks has fallen 50 percent in the past 5 years.[18] 3M, formerly the largest

---

[14] USITC, *Unrecorded Media,* p. 6.
[15] Industry representative, telephone interview by USITC staff, Jan. 31, 1997.
[16] Ibid.
[17] *Magnetic Media International Newsletter*, vol. 14 No. 6, p. 33; Jeff Ash, Director of Marketing, Computer Products Division, Fuji Photo Film USA, Inc, speech at the International Recording Media Association's Annual Forecast and Update Seminar, New York, Nov. 26, 1996; and industry representative, telephone interview by USITC staff, Jan. 31, 1997.
[18] Industry representative, telephone interview by USITC staff, Feb. 26, 1997.

producer of all of these media, ceased most production in 1996 because it was no longer profitable. Other U.S. firms such as Hitachi-Maxell, Ampex, and TDK ceased U.S. production of consumer tape within the past 2 years. However, production of some consumer tape is growing as Japanese firms have moved more of their production from Japan into the United States.[19] Though demand from software publishers for 1.44MB floppy disks is falling as software increasingly is published on CD, PC users continue to purchase large numbers of floppy disks,[20] and at least seven firms currently fabricate these disks in the United States to meet this demand.

By contrast, production of other higher technology, higher margin types of media has risen in the United States. Production of computer tape, which is used to back up computer hard drives, has risen to keep pace with the growing use of computers.[21] Production of professional audio and video tape has risen to keep pace with growing global markets for these products.[22] Three of the world's top hard disk manufacturers are located in the United States, and U.S. production of hard disks has risen over the past 5 years to provide storage for an increasing number of computers worldwide.[23] In addition, small U.S. firms such as Syquest and Iomega have developed popular removable hard disk drives and disks. However, some domestic hard disk production is moving offshore, as captive producers such as Seagate are making a broad move to shift media production to countries such as Singapore and Malaysia near their disk drive production facilities.[24] Finally, production of recordable optical media is increasing slightly, particularly of write-once recordable compact disks, or CD-R. While relatively high disk and drive prices had kept the market for CD-R limited to recording studios and software firms for small batch processing of CD-ROMs,[25] disk prices and drive prices have fallen below $10 and $600, respectively, creating new demand from PC users, particularly for hard disk back-up.[26] Eastman Kodak is the largest producer of CD-R in the United States,[27] although CD-R production in the United States by Japanese-based firms is beginning to grow, with the start-up of at least three Japanese-owned firms in the past year.[28] However, the recent weakening of the yen reportedly is causing some Japanese firms to consider slowing the movement of these production facilities to the United States.[29] Imation produces magneto-optical disks, or M-O, a recordable optical disk that is not as widely used in the United States because it is not compatible with CD-ROM drives.

Japanese-based firms in the United States are parts of global organizations in which R&D is centered for the most part in Japan, and performed in cooperation with affiliates producing media hardware. These firms have subsidiaries in countries such as the United States to produce media for local markets. In contrast, most U.S.-headquartered firms are not vertically integrated from the R&D stages of their products through to the hardware production associated with their products, with the exception of U.S.-based hard disk manufacturers such as Seagate and IBM, which produce hard disks as well as hard drives in which the disks are used. While many Japanese-headquartered firms license and produce the most important inputs, the chemicals used in the coating process, some U.S.-headquartered firms that coat their own media reportedly

---

[19] Industry representative, telephone interview by USITC staff, Feb. 25, 1997.

[20] Jeff Ash, speech at the International Recording Media Association's Annual Forecast and Update Seminar, New York, Nov. 26, 1996.

[21] Industry representative, telephone interview by USITC staff, Feb. 26, 1997.

[22] Industry representative, telephone interview by USITC staff, Feb. 25, 1997.

[23] Ibid.

[24] *Magnetic Media International Newsletter*, vol. 14, No. 6, p. 68.

[25] "CD-R: It's Not Just for Breakfast Anymore," *Software Developer & Publisher,* July/Aug. 1996, p. 34.

[26] Industry representative, telephone interview by USITC staff, Jan. 15, 1997.

[27] *Magnetic Media International Newsletter*, vol. 15, No. 2, p. 27.

[28] Industry representative, telephone interview by USITC staff, Jan. 28, 1997; "Recordable CD Industry Faces Growth Spurt," *Journal of the Electronics Industry (JEI),* Sept. 1996, p. 9; "CD-R Production Rise Aims at Extra Market Shares," *JEI*, Sept. 1996, p. 14; and "JVC to Begin DVD Production," *Replication News*, Dec. 1996, p. 1.

[29] Industry representative, telephone interview by USITC staff, Feb. 20, 1997.

prefer to purchase coating materials from chemical companies and other sources in order to have the flexibility to change sources.[30] However, this outsourcing is perceived by some industry sources to be a competitive disadvantage for these producers in the long run, as they lose the ability to develop and manufacture in-house leading-edge materials such as metal pigments and substrates.[31] An exception had been 3M, formerly the largest U.S. producer, which performed R&D on, as well as produced, the chemicals to coat its magnetic tape and disks. However, 3M exited most of the unrecorded media industry almost completely at the end of 1996.

Capital expenditures associated with building coating facilities in the United States reportedly are sufficiently high to deter many firms from investing in such facilities. As a result, coating of media is not performed widely in the United States. 3M used to coat a variety of media, but now coats its only remaining product, videotape it sells to duplicators. Most firms that currently coat in the United States are the earlier industry entrants such as Sony, Fuji Film, Verbatim, and JVC; additionally, coating performed in the United States by Japanese firms is reportedly for lower end product lines.[32] Japanese-based firms also fabricate and assemble coated material sourced from their facilities in Japan. With a few exceptions, most other U.S. firms fabricate coated tape and disk media sourced from abroad or from Japanese-based suppliers in the United States. Firms also outsource cassette and disk shells, often from overseas. Over 50 percent of the tape shells used for blank videotape came from China in 1995.[33]

Despite the intense price competition in the domestic industry and lower labor costs in other countries, many firms continue to produce unrecorded media in the United States for a few key reasons. Most importantly, the U.S. unrecorded media market is the largest in the world, and local production keeps shipping and distribution costs down. The United States has a substantial entertainment industry consuming professional audio and video tape, a booming video software industry producing pre-recorded movies,[34] and the most personal and office computers in the world, approximately 100 million in 1996,[35] whose users consume floppy disks, computer tape, and, in small but increasing quantities, optical disks. Japanese-based firms also reportedly choose to keep and even increase production in the United States because of the high labor costs associated with producing media in Japan, the desire to avoid anti-dumping duties, which were assessed on magnetic disks imported from Japan in 1989,[36] as well as the perception of the benefit of producing goods "made in America."[37]

The industry has been characterized in recent years by rapid technological change, including larger storage, faster random access data retrieval, and faster data transfer capabilities (the speed at which data can move between disk and drive), driven by the demands of increasingly powerful computers and complex data and multimedia programs. R&D in the industry focuses on increasing the density and reliability of information storage through improvements in magnetic and substrate materials and coating processes.[38] However, R&D expenditures in most segments of the domestic industry are estimated to be less than 3 or

---

[30] Industry representative, telephone interview by USITC staff, Jan. 23, 1997.

[31] *Magnetic Media International Newsletter*, vol. 14, No. 6, p. vii and industry representative, telephone interview by USITC staff, Jan. 24, 1997.

[32] Industry representatives, telephone interviews by USITC staff, Jan. 23 and Feb. 5, 1997.

[33] International Recording Media Association White Paper, 1996.

[34] Industry representative, telephone interview by USITC staff, Jan. 23, 1997.

[35] Karen Petska-Juliussen and Dr. Egil Juliussen, eds., *The 8th Annual Computer Industry Almanac* (NV: Computer Industry Almanac, Inc., Oct. 1996), p. 482.

[36] USITC, *3.5" Microdisks and Media Thereof from Japan*, (investigation No. 731-TA-389 (Final)), USITC publication 2170, Mar. 1989.

[37] Industry representative, telephone interview by USITC staff, Jan. 28, 1997.

[38] USITC, *Unrecorded Media*, p. 6.

4 percent of sales,[39] close to the average for U.S. manufacturing industries.[40] Much R&D in the United States is performed on current products, not advanced technologies.[41] Further, most of the newer optical media formats are being driven by Japanese hardware manufacturers' needs, and R&D on those products is performed mostly in Japan.

In 1996, U.S. exports of unrecorded media were approximately $2.5 billion, or slightly more than one-half of 1996 U.S. production; the value of U.S. exports of unrecorded media grew at an average annual rate of approximately 20 percent since 1992. Overall, the largest markets for U.S. unrecorded media in 1996 were Singapore, Thailand, and Malaysia, which imported hard magnetic disks for installation in hard disk drives manufactured in those countries. Exports of hard disk media to these countries rose steadily since 1992 in tandem with their rising disk drive production; currently, these three countries produce well over one-half of the world's hard disk drives.[42] Audio and video tape comprised the next largest segment of U.S. exports, most of which went to the EU, Mexico, and Japan; these exports also rose continually. Most professional audio and video tape went to the EU and Mexico, for use by their entertainment industries, as well as for some assembly in Mexico.[43] Consumer audio and video tape was sent to Mexico mostly for assembly, and consumer tape exported to Japan came from Japanese firms based in the United States that had moved production out of Japan due to high costs.[44] Computer tape was the third largest U.S. export, and most of this tape went to the EU. The Netherlands is used by some U.S. computer tape exporters as an EU distribution point, and the United Kingdom and Germany are large consumers of computer tape.[45] Computer tape exports rose during 1992-96, although exports to Germany fell in the past few years.[46]

Foreign Industry Profiles

Japan

Japan is the second-largest producer of unrecorded media in the world after the United States. In 1996, Japan's production of unrecorded media was valued at $2.9 billion, approximately 21 percent of world production.[47] However, like in the United States, the value of production in Japan is falling, caused in large part by the continual movement of fabrication and assembly out of Japan. Measured in U.S. dollars, Japanese production fell at an average annual rate of 2.8 percent from 1992 to 1996.[48]

Approximately 10 large firms and another 10 smaller firms account for almost all production of unrecorded media in Japan (table 7-3).[49] U.S.-headquartered Komag is the only foreign-based firm to manufacture in Japan, through a joint venture with the Japanese firm Asahi Glass.[50]

---

[39] Industry representative, telephone interview by USITC staff, Jan. 28, 1997.
[40] National Science Board, *Science & Engineering Indicators, 1995* (Washington, DC: GPO, 1996).
[41] Industry representative, telephone interview by USITC staff, Feb. 25, 1997.
[42] Ibid.
[43] Industry representative, telephone interview by USITC staff, Jan. 23, 1997.
[44] *Magnetic Media International Newsletter*, vol. 15, No. 2, pp. 57, 67.
[45] Industry representative, telephone interview by USITC staff, Feb. 26, 1997.
[46] Complied from official statistics of the U.S. Department of Commerce.
[47] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996.
[48] Ibid.
[49] Japan Recording Media Industries Association, fax to USITC staff, Feb. 12, 1997.
[50] *Magnetic Media International Newsletter*, vol. 15, No. 2, pp. 53-54.

Table 7-3
Major Japanese producers and locations of their parent corporations, by major product segments, 1996

Consumer audio and video tape	Professional audio and video tape
Fuji Photo Film (Japan) Hitachi Maxell (Japan) JVC (Japan) Matsushita Electric (Japan) Sony (Japan) TDK (Japan)	Fuji Photo Film (Japan) Hitachi Maxell (Japan) Sony (Japan) TDK (Japan)
Computer tape	**Floppy disks**
Fuji Photo Film (Japan) Hitachi Maxell (Japan) Sony (Japan) TDK (Japan)	Fuji Photo Film (Japan) Hitachi Maxell (Japan) Kao Infosystems (Japan) TDK (Japan) Teijin (Japan)
Hard disks	**Optical disks**
Asahi-Komag (Japan/United States) Fujitsu (Japan) Mitsubishi Chemical (Japan)	Hitachi Maxell (Japan) Mitsubishi Chemical (Japan) Mitsui Toatsu (Japan) Ricoh (Japan) Sony (Japan) Taiyo Yuden (Japan) Teijin (Japan)

Source: Compiled by USITC staff based on *Magnetic Media International Newsletter*, vol. 15, No. 2, Aug. 10, 1996.

Most Japanese firms are subsidiaries of major conglomerates that include consumer electronics companies producing hardware, including tape mechanisms and disk drives, for their related media.[51] For example, Sony, a leading coater of video tape, is part of the Sony Corporation which includes Sony Electronics, a major producer of consumer electronics and audio and video equipment, including VCRs. Matsushita/Panasonic, a producer of optical disks, is affiliated with Panasonic Communications and Systems Company, a producer of optical disk drives, as well as with Matsushita Electronics, which produces CD-ROM drives and VCRs.[52] Affiliation with hardware producers gives Japanese media producers access to knowledge about up-and-coming hardware trends as well as hardware specifications, a key competitive advantage.[53] Vertical integration also allows firms to invest heavily in R&D and helps insulate them from downturns.[54]

---

[51] "For the Record: Media Markets," *JEI*, Oct. 1996, p. 24.
[52] *Japan Company Handbook* (Tokyo: Toyo Keizai, Inc., Spring 1996).
[53] Industry representative, telephone interview by USITC staff, Jan. 23, 1997, and "Tape Drive Makers Target PCS and Try to Hold Off Optical Disks," *Electronic Business Buyer*, Jan. 1995, p. 27.
[54] "Unexpected Demand Polishes Prospects for Tape Makers," *JEI*, Oct. 1994, pp. 25-26.

Most coating of unrecorded media in the industry occurs in Japan, and media coated in Japan are reported by industry sources to be the best globally in terms of quality and consistency of product.[55] Many Japanese firms produce their own chemicals used in the coating process. Mitsui Toatsu Chemicals, which invented the chemical process used for recording on CD, manufactures CD-R itself, and also licenses its technology to other CD-R manufacturers in Japan that produce these chemicals in-house.[56] Mitsubishi Chemicals produces the coating chemicals used by its Verbatim subsidiary.

As in the United States, fabrication of magnetic tape and disks has fallen in Japan over the past decade. A prevailing downward trend in prices caused by intense competition in the 1980s prompted Japanese firms to begin moving fabrication abroad in search of lower labor costs.[57] The recession of the early 1990s and the subsequent appreciation of the yen accelerated this trend. Japanese firms also have moved fabrication abroad to avoid anti-dumping charges from the EU and the United States and to better serve these markets.[58] Despite high labor costs, many firms continue to coat in Japan partly due to the existence of large installed coating capacities as well as the high costs of building such facilities abroad.[59] However, as overseas markets grow, some firms are relocating and expanding coating operations outside of Japan, particularly in the EU and the United States.

Japan is the largest producer in the world of floppy disk media,[60] and floppy disk fabrication is not dropping as quickly in Japan as in the United States. PCS have become popular recently in Japan and consumers are purchasing PCS with floppy disk drives; however, demand for and production of floppy disks is expected to fall as more PCS are shipped with CD-ROM drives.[61] Though production of magnetic media is falling in Japan, production of optical media is growing. Currently, approximately 10 Japanese firms produce recordable optical media in Japan.[62]

Japanese firms reportedly perform the industry's leading-edge R&D.[63] Sony is one of the world leaders in advanced metal tape and particle technologies.[64] Many new media formats are driven by changes in the consumer electronics markets, the leading edge of which is dominated by Japanese firms such as Panasonic and Sony. As Japanese electronics firms recently have been focusing on developing optical disk drives, Japanese unrecorded media producers have been conducting R&D on recordable optical media.[65] Although Japanese firms initially are developing recordable optical disks to serve multimedia applications, it is said that the firms expect optical disks, because of their large storage capacity, eventually to replace computer floppy and tape drives.[66] At least eight firms are performing R&D on recordable optical disk technologies such as CD-R and rewritable CD-R. Some firms also are performing R&D on magneto-optical (M-O) disks, which are used in mini-disk (audio) recorders produced by Japanese electronics firms and sold mostly in Japan and other Asian countries.[67] Finally, firms are performing R&D on next possible generations of recordable media, including the digital versatile disk (DVD), a double-sided recordable disk capable of higher density recordings than CD-R.

---

[55] Industry representative, telephone interview by USITC staff, Jan. 28, 1997.
[56] Ibid.
[57] *Japan Electronics Almanac '95/'96* (Tokyo: Dempa Publications, Inc., 1995), p. 154.
[58] Ibid., pp. 153-154.
[59] Industry representative, telephone interview by USITC staff, Feb. 12, 1997.
[60] *Magnetic Media International Newsletter*, vol. 14, No. 6, p. 61.
[61] Ibid., p. 62.
[62] *Magnetic Media International Newsletter*, vol. 15, No. 2, p. 54.
[63] Industry representative, telephone interview by USITC staff, Jan. 23, 1997.
[64] "Sony Introduces Digital Tapes for High Density Video Recording," *JEI*, Oct. 1996, p. 22.
[65] Industry representative, telephone interview by USITC staff, Jan. 23, 1997, and "Changes in Media Technologies Widens Possibilities for TDK," *JEI*, Oct. 1994, p. 22.
[66] "Tape Drive Makers Target PCS and Try to Hold Off Optical Disks," p. 27.
[67] *Magnetic Media International Newsletter*, vol. 14, No. 6, p. 75.

Japan's exports of unrecorded media were valued at approximately $2 billion in 1996; exports have remained relatively steady over the past 5 years.[68] Most of Japan's exports are of coated, unfabricated media that it sends to subsidiaries or customers in countries for fabrication and assembly. The majority of Japanese exports go to the United States and the EU, and to a lesser extent Mexico, Korea, and China. Japanese exports of most types of consumer tape and disks have declined since the early 1990s as firms have expanded their overseas production.[69] However, Japanese exports of computer tape and hard disks rose from 1992 to 1996; much of this computer tape goes to the United States and to a lesser extent the EU, while the hard disks go to disk drive plants in Southeast Asia.[70] While Japanese exports of optical disks have risen in volume in the past few years, their export value has fallen as prices have decreased.[71] Most optical media exports go to the United States and the EU.

European Union

The EU is the third largest producer of unrecorded media in the world. In 1996, the EU's production of unrecorded media was valued at $2.1 billion, approximately 15 percent of world production.[72] EU production of unrecorded media fell at an average annual rate of 2 percent from 1992 to 1996.[73] While much of the European-headquartered industry was contracting in the early 1990s, foreign-based firms have been moving production into the EU to better serve the market there. There are currently approximately 9 major producers of unrecorded media in the EU (table 7-4).[74] The largest producer of unrecorded media in Europe is the former German-owned firm BASF Magnetics GmbH,[75] which was purchased by the Korean firm Kohap in 1996. The other leading European manufacturers also are foreign-based firms. There are a number of small locally owned firms, primarily fabricators but not coaters of tape products and floppy disks, in Germany, France, Ireland, the United Kingdom, Spain and Italy.[76] Almost all types of media are produced in the EU, including consumer and professional audio and video, computer tape, and floppy disks. Currently, CD-R is produced only at Eastman Kodak's plant in Ireland, and M-O by Philips in the Netherlands.

Many of the Japanese firms moved production to the EU in the early 1990s in response to fears of anti-dumping suits after one such suit was filed by the EU against Japan in 1991 on floppy disks.[77] Although the Japanese firms import most of their coated media from Japan for fabrication, a few Japanese firms have coating operations in the EU.[78] In addition, the Korean firm Sae Han operates a videotape coating facility in Ireland.[79]

---

[68] Estimated by USITC staff based on United Nations Trade Series D.

[69] Japan Tariff Association, *Japan Exports & Imports*, 1992, 1993, 1994, and 1995 and *Japan Electronics Almanac '95/'96*, pp. 153-154.

[70] Industry representative, telephone interview by USITC staff, Feb. 25, 1997, and Japan Tariff Association, *Japan Exports & Imports*.

[71] Electronic Industries Association of Japan (EIAJ), *Facts & Figures on the Japanese Electronics Industry* (Tokyo: Electronic Industries Association of Japan, 1996).

[72] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996.

[73] Ibid.

[74] Foreign industry representative, telephone interview by USITC staff, Feb. 25, 1997.

[75] After its acquisition by Kohap, BASF Magnetics' name was changed to EMTECH.

[76] USITC, *Unrecorded Media*, p. 8.

[77] *Japan Electronics Almanac '95/'96*, pp. 154-155.

[78] Industry representative, telephone interview by USITC staff, Feb. 10, 1997.

[79] Ibid.

Table 7-4
Major European Union producers and locations of their parent corporations, by major product segments, 1996

Consumer audio and video tape	Professional audio and video tape
BASF Magnetics (Korea) Sony (Japan) TDK (Japan)	BASF Magnetics (Korea)
Computer tape	**Floppy disks**
Anacomp (United States) BASF Magnetics (Korea)	BASF Magnetics (Korea) Fuji Photo Film (Japan) Hitachi Maxell (Japan) Kao Infosystems (Japan) Verbatim (Japan)
Hard disks[1]	**Optical disks**
	Eastman Kodak (United States) Philips (Netherlands)

[1] No producers of hard disks in the EU have been identified.

Source: Compiled by USITC staff based on *Magnetic Media International Newsletter*, vol. 15, No. 2, Aug. 10, 1996.

BASF produces almost all types of unrecorded media. BASF benefits from its large size, as it can price aggressively due to its large production volume.[80] BASF coats all of its own media; its coating capacity is reportedly one of the largest in the industry, with modern, high-tech operations that rival those of Japanese firms. To compete successfully in audio and video tape fields, BASF began rationalizing in 1991, closing plants in France, the United States, as well as Germany. It now produces all of its media at two state-of-the-art plants in Germany.[81]

Prior to its acquisition by Kohap, BASF Magnetics was vertically integrated, sourcing many of the coating components for its media from the chemical company BASF AG, then its parent firm.[82] Despite the change of ownership, BASF Magnetics is expected to continue to purchase these chemicals from BASF AG.[83] Unlike the major Japanese media producers, BASF Magnetics does not produce any hardware in which its media is used. R&D in the EU is performed primarily by BASF, which competes with Japanese firms to be at the leading edge of R&D technology for magnetic products, particularly leading edge metal-based tape.[84]

[80] *Magnetic Media International Newsletter*, vol. 15, No. 2, pp. 8-9.
[81] Ibid.
[82] Ibid.
[83] Industry representative, telephone interview by USITC staff, Feb. 11, 1997.
[84] *Magnetic Media International Newsletter*, vol. 15, No. 2, pp. 8-9.

Most media produced within the EU are sold within the EU; the EU exports very little media.[85] However, some media, mostly consumer and professional tape, is exported to the United States by BASF.[86] In addition, the EU exports small amounts of media to South America, Asia, the Middle East, and Eastern Europe.[87]

Korea

Korea is the fourth-largest producer of unrecorded media in the world. In 1996, Korea's production of unrecorded media was valued at $1.1 billion, approximately 8 percent of world production.[88] Measured in U.S. dollars, Korean production of unrecorded media grew at an average annual rate of 1 percent from 1992 to 1996.[89]

Korean companies became important producers of unrecorded media during the 1980s, focusing initially on consumer audio and video media and later on floppy disks as well.[90] Much of the world production of audio and video tape has shifted to Korea from Japan and the United States, as Korean firms can produce these products more cheaply.[91] Korea is one of the largest suppliers of videotape and audiotape in the world.[92] Floppy disk production reportedly is decreasing in Korea due to falling demand as well as competition from Chinese assemblers.[93] While the firm SKC is said to be working on developing optical media,[94] no optical media is produced currently in Korea.[95]

The Korean industry is very concentrated. The leading suppliers are Sae Han Media, SKC Limited, and LG Electronics, Inc. Additionally, four smaller Korean firms also produce media. Sony is currently moving most of its video tape fabrication to Korea under a recently negotiated joint venture with Sae Han, and will be the first foreign-based firm to produce unrecorded media in Korea.[96] The three main Korean producers are subsidiaries of large business conglomerates, which, like the major Japanese firms, helps cushion them against failure.[97] For example, LG Industries is one of Korea's four electronics giants; it also produces VCRs.[98] SKC is substantially integrated, pumping the oil that it uses to produce polyester film for its videotape.[99] Sae Han also produces many of its own base materials used in coating.[100] Unlike most U.S. producers, Korean firms coat their own media.

---

[85] Industry representatives, telephone interviews by USITC staff, Feb. 20 and 25, 1997.

[86] Industry representative, telephone interview by USITC staff, Feb. 25, 1997, and *Magnetic Media International Newsletter*, vol. 15, No. 2, p. 57.

[87] Industry representative, telephone interview by USITC staff, Feb. 25, 1997, and foreign industry representatives, telephone interviews by USITC staff, Feb. 25 and 28, 1997.

[88] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996.

[89] Ibid.

[90] USITC, *Unrecorded Media*, p. 9.

[91] Industry representative, telephone interview by USITC staff, Jan. 15, 1997.

[92] *Magnetic Media International Newsletter*, vol. 14, No. 6, pp. 31, 52.

[93] U.S. Embassy official in Seoul, Korea, fax to USITC staff, Feb. 12, 1997.

[94] "Feeling Competition in Tape Business, SKC takes Digital Path," *JEI*, Aug. 1996, p. 50.

[95] *Directory of Electronic & Electrical Manufacturers in Korea* (Seoul: Electronic Industries Association of Korea, 1996).

[96] *Magnetic Media International Newsletter*, vol. 14, No. 6, p. 43.

[97] "Unexpected Demand Polishes Prospects for Tape Makers."

[98] "Looking for High-End Status, LG Discards Goldstar Label," *JEI*, Aug. 1996, p. 44.

[99] Industry representative, telephone interview by USITC staff, Feb. 10, 1997.

[100] Industry representative, telephone interview by USITC staff, Feb. 14, 1997.

Korean firms have entered the world market aggressively, and Korean quality has been rising steadily.[101] However, labor and material costs are rising in Korea, and Korean producers are feeling increasing competition from low-wage countries such as China.[102] In response, firms such as SKC have moved videotape assembly operations to China to take advantage of lower labor costs there.[103]

Korea exports most of its unrecorded media. In 1996, Korean exports of unrecorded media were valued at approximately $1 billion, or approximately 90 percent of its production that year.[104] Korean exports have been rising since 1992, particularly for consumer video tape.[105] The majority of Korean exports are fully assembled consumer video tape and audio tape;[106] most of these products are exported to the United States, the EU, Japan and other Asian countries, as well as countries in Latin America. Some unassembled video tape is shipped to China for assembly.[107] While Korean tape is reported by industry sources to be high quality, Korean firms suffer internationally from a lack of name recognition, and as a result sell much of their media abroad under foreign labels.[108]

China

Chinese production of unrecorded media was valued at $988 million in 1996, or approximately 7 percent of world production,[109] and the value of Chinese production in U.S. dollars has grown at an average annual rate of 25 percent since 1992.[110] China produces consumer audio and video tape and floppy disks, and Chinese production consists of a number of small fabricators that are not vertically integrated. Chinese producers source most of their coated media from Japan and some from Korea.[111] While as many as 10 plants coat tape and disk media in China, media coated in China are reported by industry sources to be substandard.[112]

Much of China's production of unrecorded media began in the 1980s when Taiwan, Hong Kong, and Japanese firms moved their tape and disk fabrication and assembly to China to escape rising labor costs at home.[113] Hong Kong interests accelerated floppy disk fabrication in China during a global shortage of floppy disks in 1991 and 1992.[114] By 1994, China accounted for 30 percent of all floppy disk fabrication in the world,[115] and produced many of the floppy disks used during the release of Microsoft's Windows 95 in 1995.[116] China exports between 80 and 90 percent of its floppy disks, mostly to the United States.[117]

---

[101] "Unexpected Demand Polishes Prospects for Tape Makers."
[102] Ibid.
[103] Industry representative, telephone interview by USITC staff, Feb. 10, 1997, and "Feeling Competition in Tape Business, SKC takes Digital Path."
[104] Estimated by USITC staff based on United Nations Trade Series D.
[105] Ibid.
[106] Ibid.
[107] Industry representative, telephone interview by USITC staff, Feb. 10, 1997.
[108] "Unexpected Demand Polishes Prospects for Tape Makers."
[109] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996.
[110] Ibid.
[111] "Product Survey: 3.5-inch Diskettes," *Asian Computer Sources*, Feb. 1996, CD-ROM.
[112] *Magnetic Media International Newsletter*, vol. 14, No. 6, p. 70 and industry representative, telephone interview by USITC staff, Jan. 15, 1997.
[113] *Magnetic Media International Newsletter*, vol. 14, No. 6, pp. 68-70.
[114] USITC, *Unrecorded Media*, p. 9.
[115] *Magnetic Media International Newsletter*, vol. 14, No. 6, pp. 68-70.
[116] "Product Survey: 3.5-inch Diskettes."
[117] Ibid.

However, many disks are now being consumed internally by the growing computer software market. Production of videotape is growing in response to a growing domestic demand for recorded movies; in 1995, 3.2 million VCRs were sold in China.[118] Chinese exports of unrecorded media rose at an average annual rate of approximately 20 percent from 1992, and were valued at approximately $700 million in 1996.[119]

U.S. Market Profile

The United States is the largest market in the world for unrecorded media. The U.S. market for unrecorded media was valued at $5 billion in 1996, or approximately 41 percent of the world market.[120] The value of the U.S. market for unrecorded media grew at an average annual rate of 7 percent from 1992 to 1996.[121] However, as prices in the industry have tended to decline, some industry sources state that actual growth in terms of quantities may have been much higher.[122]

Consumption of most forms of media rose during this period. Consumer audio and video tape consumption increased; most of this increase was on the video side as the rising penetration rate of VCRs in U.S. households, which increased from 78 percent in 1992 to 89 percent in 1996,[123] has caused the video software industry to grow.[124] Consumption of professional audio and video tape rose as these U.S. markets grew 4 and 10 percent annually, respectively; this market growth is partly driven by new and expanding methods of information dissemination, such as growing numbers of cable TV stations, which have created a need for more programming material.[125] Consumption of computer tape in the United States rose in tandem with increasing computer sales. Consumption of optical disks rose, particularly in the past 2 years, driven by a rising demand for CD-R; the United States in 1996 accounted for more than 50 percent of world CD-R demand.[126] U.S. government and business offices increasingly are using CD-R, instead of microfilm and microfiche, to store confidential and legal data.[127] Additionally, as prices for drives and disks have fallen, CD-R increasingly is used by small-scale software publishers and recording studios.[128] Finally, the growth of CD-ROM drives, on which CD-R can be played, also contributes to rising demand.[129]

By contrast, U.S. consumption of computer disks has fallen. As hard disk drive manufacturers have shifted some disk drive production from the United States to Southeast Asia, the market in the United States has fallen accordingly. In addition, the U.S. consumption of floppy disks has contracted, particularly in recent years, as fewer U.S. software firms are replicating software on floppy disks.[130]

---

[118] *Magnetic Media International Newsletter*, vol. 14, No. 6, p. 69.
[119] Estimated by USITC staff based on United Nations Trade Series D.
[120] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996.
[121] Ibid.
[122] Industry representative, telephone interview by USITC staff, Feb. 26, 1997.
[123] Electronics Industries Association representative, telephone interview by USITC staff, Feb. 12, 1997.
[124] Computer and Electronics Marketing Association (CEMA) Market Research Department, as published in *Replication News*, Jan. 1997, p. 8.
[125] Industry representative, telephone interview by USITC staff, Feb. 25, 1997.
[126] "Spotlight Shines on CD-Rs: Speed, Security Lure Users," *JEI*, Nov. 1996, p. 29.
[127] Ibid. and industry representative, telephone interview by USITC staff, Feb. 7, 1997.
[128] "Spotlight Shines on CD-Rs: Speed, Security Lure Users."
[129] Ibid.
[130] Industry representative, telephone interview by USITC staff, Jan. 17, 1997.

Imports totaled $2.1 billion in 1996, comprising nearly one-half of U.S. consumption.[131] Imports as a share of consumption grew from 1992 to 1996, from approximately 45 to 50 percent. Import share in 1996 varied substantially by product, reaching approximately 60 percent for audio and video tape, over 30 percent for computer tape, over 60 percent for magnetic disks, and over 90 percent for optical disks. Import share has been higher for consumer audio and video tape than for professional audio and video tape, and much higher for floppy disks than for hard disks. The relatively low import shares for computer tape and hard disks reflects, in part, the U.S. industry's competitive advantage in these products, partly due to the proximity of a strong computer industry.[132] The United States is also competitive in the production of professional audio and video tape.[133] By contrast, the relatively high import share for consumer tape and floppy disks reflects the diffusion of technology for manufacturing low-tech tape and floppy disks to new foreign sources of supply.[134]

Major suppliers of U.S. imports of audio and video tape were the EU, particularly Germany, and Japan, and to a lesser extent Korea. The largest supplier of imported computer tape as well as optical disks was Japan, while China supplied most U.S. imports of floppy disks.[135] As of January 1, 1999, U.S. imports of all types of unrecorded media will enter free of duty, the last step of the five-stage reduction process negotiated during the Uruguay Round (table 7-5).[136] As a result, the ITA would have no effect on foreign producers' market access opportunities in the United States.

Foreign Market Profiles

European Union

The EU is the second largest market in the world for unrecorded media. In 1996, the EU market for unrecorded media was $3 billion, or 25 percent of the world market.[137] The value of the EU market for unrecorded media fell at an average annual rate of 3 percent from 1992 to 1996.[138] However, as in the United States, prices for media in the EU have fallen over the past 5 years, and according to industry sources, the EU market may have actually grown in terms of quantity.[139]

The EU consumes most types of media. The strong music and film entertainment industries in countries such as the United Kingdom and Italy consume professional audio and video tape, and, as in the United States, such tape also is being consumed in growing quantities as the demand for entertainment programming material is increasing.[140] The growing penetration of computers in the EU is driving

---

[131] Compiled from official statistics of the USDOC.

[132] USITC, *Unrecorded Media*, pp. 13-14.

[133] Industry representative, telephone interview by USITC staff, Feb. 25, 1997.

[134] USITC, *Unrecorded Media*, pp. 13-14.

[135] Compiled from official statistics of the USDOC; industry representatives, telephone interviews by USITC staff, Jan. and Feb. 1997; and *Magnetic Media International Newsletter*, vol. 15, No. 2, p. 67.

[136] *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994. The Marrakesh Protocol is part of the General Agreement on Tariffs and Trade 1994 (GATT 1994), which is a multilateral agreement that is an annex to the Agreement Establishing the World Trade Organization. See appendix G for final Uruguay Round tariffs on specific Harmonized Tariff Schedule categories.

[137] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996.

[138] Ibid.

[139] Industry representatives, telephone interviews by USITC staff, Feb. 26, 1997.

[140] Industry representative, telephone interview by USITC staff, Feb. 25, 1997.

consumption of floppy disks and computer tape.[141] The EU market for optical disks is growing, partly due to the fact that the EU intends to make CD-R the official recording media for state and legal documents; the Italian government has already instituted such a system.[142] The EU is not a large market for hard magnetic disks, as little, if any, hard disk drive manufacturing is performed there.[143]

Like in the United States, the portion of the EU market supplied by imports varies by media type. EU imports of consumer audio and video tape as well as floppy disks are not high as a percentage of consumption, in large part because many Japanese firms have located production in the EU to avoid anti-dumping duties,[144] although the EU imports some floppy disks from the United States.[145] The EU imports the vast majority of its professional audio and video tape from the United States and Japan, and these imports are said to be rising.[146] While Anacomp and BASF produce much of the computer tape consumed in the EU, imports of computer tape from the United States and Japan are said to be increasing.[147] Like the United States, the EU imports most of its optical media from Japan, although a number of firms are in the process of constructing optical media facilities in the EU to serve the growing market.[148] Currently, Eastman-Kodak and Philips produce optical media in the EU.

Tariffs for most types of unrecorded media imported into the EU would be 3.5 percent on January. 1, 1999. Exceptions would be on magnetic tape less than 4mm wide, the majority of which is audio cassette tape, which would have a duty of 2 percent, and hard magnetic disks, which would have no import duty.[149] Thus, foreign producers would realize increased market access opportunities in the EU for most unrecorded media because of the ITA.[150] In addition, EU enlargement should result in increased market access opportunities for unrecorded media producers as new EU members will adopt the common EU tariff and abide by the ITA tariff eliminations.

Singapore and Japan

Singapore is a small but growing market for unrecorded media. Singapore's market for unrecorded media was approximately $855 million in 1996, or 7 percent of the world market.[151] The value of the Singapore market grew at an average annual rate of about 8 percent from 1992 to 1996.[152]

The vast majority of Singapore's unrecorded media consumption is of hard magnetic disks, which are used by disk drive manufacturers located there. Singapore produces approximately 40 percent of the world's hard disk drives, and the world's four largest disk drive manufacturers, Seagate, Quantum, Western Digital, and IBM, have plants in Singapore.[153] Most of the hard disks consumed in Singapore are imported from the

---

[141] Industry representative, telephone interview by USITC staff, Feb. 26, 1997.
[142] "Spotlight Shines on CD-Rs: Speed, Security Lure Users."
[143] Industry representative, telephone interview by USITC staff, Feb. 26, 1997.
[144] Ibid.
[145] Industry representative, telephone interview by USITC staff, Jan. 17, 1997.
[146] Industry representative, telephone interview by USITC staff, Feb. 26, 1997.
[147] Ibid. and foreign industry representative, telephone interview by USITC staff, Feb. 28, 1997.
[148] *Magnetic Media International Newsletter*, vol. 15, No. 2, p. 63 and foreign industry representative, telephone interview by USITC staff, Feb. 28, 1997.
[149] *Most-Favoured-Nation Tariff Schedules.*
[150] Some magnetic tape and disks currently imported into the EU from Japan are subject to anti-dumping duties. These duties would not necessarily be affected by the ITA.
[151] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996.
[152] Ibid.
[153] Industry representative, telephone interview by USITC staff, Feb. 25, 1997.

United States, and to a lesser extent from Japan.[154] Additionally, some U.S. firms send to Singapore hard disks manufactured in third countries such as Malaysia.[155] However, production of hard disks in Singapore has grown slightly in recent years, as some firms have begun producing disks in Singapore to be near disk drive production.[156] Singapore's imports of unrecorded media increased at approximately the same rate as consumption from 1992 to 1996.[157] There currently are no tariffs on any magnetic disks imported into Singapore. As of January 1, 1999, magnetic tape and optical disks used to record video or sound would be assessed a tariff of 10 percent, and tape or optical disks used to record computer data would enter duty free.[158] The ITA would result in increased market access opportunities for foreign producers of unrecorded media used strictly for recording video or sound.

Japan's market for unrecorded media was $663 million in 1996, or approximately 5 percent of the world market.[159] The value of the Japanese market fell at an average annual rate of approximately 14 percent from 1992 to 1996.[160] Like other countries, however, much of this decline could be attributed to the fall in prices of unrecorded media. Japan's consumption of certain unrecorded media products rose from 1992 to 1996. Consumption of floppy magnetic disks and computer tape grew as computer purchases increased; the average annual growth rate of Japan's computer market was approximately 6 percent from 1992 to 1996.[161]

Japan's imports of unrecorded media rose from 1992 to 1996,[162] particularly as Japanese producers moved off-shore in the early 1990s to take advantage of lower production costs and began to supply the Japanese market from abroad. As a result, much of the consumer audio and video tape as well as floppy disks used in Japan are imported from subsidiaries of Japanese firms located in the United States and Korea.[163]

Consumption of optical media also rose, driven in part by the growing popularity in Japan of Mini-Disc players that use recordable M-O disks.[164] Japan imports some professional audio and video tape as well as computer tape from the United States.[165] However, Japan imports virtually no optical media. All types of unrecorded media currently are imported into Japan duty free.[166] Thus, the ITA would not result in increased Japanese market access opportunities for foreign producers of unrecorded media.

---

[154] Ibid.

[155] Industry representative, telephone interview by USITC staff, Feb. 21, 1997.

[156] *Magnetic Media International Newsletter*, vol. 14, No. 6, p. 68.

[157] Estimated by USITC staff based on United Nations Trade Series D.

[158] *Most-Favoured-Nation Tariff Schedules.*

[159] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data*, 1996.

[160] Ibid.

[161] Ibid.

[162] Japan Tariff Association, *Japan Exports & Imports*, 1992, 1993, 1994, and 1995 and EIAJ, *Facts and Figures on the Japanese Electronics Industry*, 1996 edition.

[163] *Magnetic Media International Newsletter*, vol. 15, No. 2 , pp. 57, 67.

[164] *Magnetic Media International Newsletter*, vol. 14, No. 6, pp. 77-82.

[165] Compiled from official statistics of the USDOC and industry representatives, telephone interviews by USITC staff, Feb. 17 and 26, 1997.

[166] *Most-Favoured-Nation Tariff Schedules.*

Table 7-5
Final Uruguay Round tariffs on unrecorded media for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	15
Canada	0-8.9
Costa Rica	([2])
Estonia	0
European Communities (15)	0-3.5
Hong Kong	0
Iceland	18-35
India	([2])
Indonesia	40
Israel	6-20
Japan	0
Korea	13
Macau	0
Malaysia	5-20
New Zealand	0-20
Norway	0
Romania	25
Singapore	0-10
Switzerland	0.4-1.9
Taiwan[3]	5-12.5
Thailand	30
Turkey	([2])
United States	0

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations, (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994, and Department of Commerce working documents.

CHAPTER 8
Semiconductor Manufacturing and Testing Equipment

Susan H. Lusi

The Information Technology Agreement (ITA) includes a wide range of semiconductor manufacturing and testing equipment (SMTE). The industrial products in the sector typically fall in one of three categories: wafer fabrication equipment, assembly equipment, or testing equipment. For a complete list of products included in the agreement see appendix A. Some materials commonly considered part of this industry, such as raw silicon and processing chemicals used in the manufacture of semiconductors, are not included in the ITA. However, unprocessed silicon wafers are included and are discussed in chapter 10 of this report. The ITA covers all wafer fabrication, assembly, and test equipment. Estimated global industry shipments for SMTE were $27 billion in 1996.[1]

Wafer fabrication equipment, the most highly valued class of equipment in the SMTE industry, accounted for 76 percent of the total value of world shipments in 1996 (figure 8-1). The equipment in this group is among the most technologically advanced industrial machinery. It is often referred to as front-end technology because of its role in the first stage of semiconductor production. Equipment in this category includes machinery used to make wafers from raw silicon. Wafer fabrication takes 10 to 30 days and is done in a clean room. It involves repeated heating, coating, and chemically treating raw silicon wafers to produce an integrated circuit. The process uses masks to protect areas around the geometric pattern to be etched onto silicon wafers and photolithographic equipment to create layered circuit patterns on the wafers. Wet or plasma etching involves sprayers, spin dryers, and chambers for gas treatment to remove certain layers from the wafers. Diffusion and oxidation equipment introduces impurities (dopants) onto the crystal wafer to create pathways for electrical currents (diodes and transistors); ion implantation equipment can also be used to introduce dopants onto wafers. Physical and chemical vapor deposition (PVD and CVD) machines are used to deposit thin-film layers formed with metal ions (PVD) or the chemical reaction of gases (CVD) to create semiconductor properties on the wafer.[2]

Assembly and testing equipment are less technologically sophisticated and therefore less expensive overall than front-end equipment. Assembly equipment includes dicing and die-separation machines that separate the silicon wafers into individual chips, or dice. A die-bonder secures the dice onto a lead frame, automatic wire bonders attach thin wire to each die, and the mounted chips undergo a process of molding and sealing to protect the die from the environment.[3] Assembly equipment such as die bonding, wire bonding, and molding and sealing equipment comprises nearly 6 percent of industry shipments and testing equipment, 18 percent.[4] Testing equipment, which includes wafer probers to test circuits before assembly onto a lead frame or other package, is becoming more important as the semiconductor production process demands more precision.

---

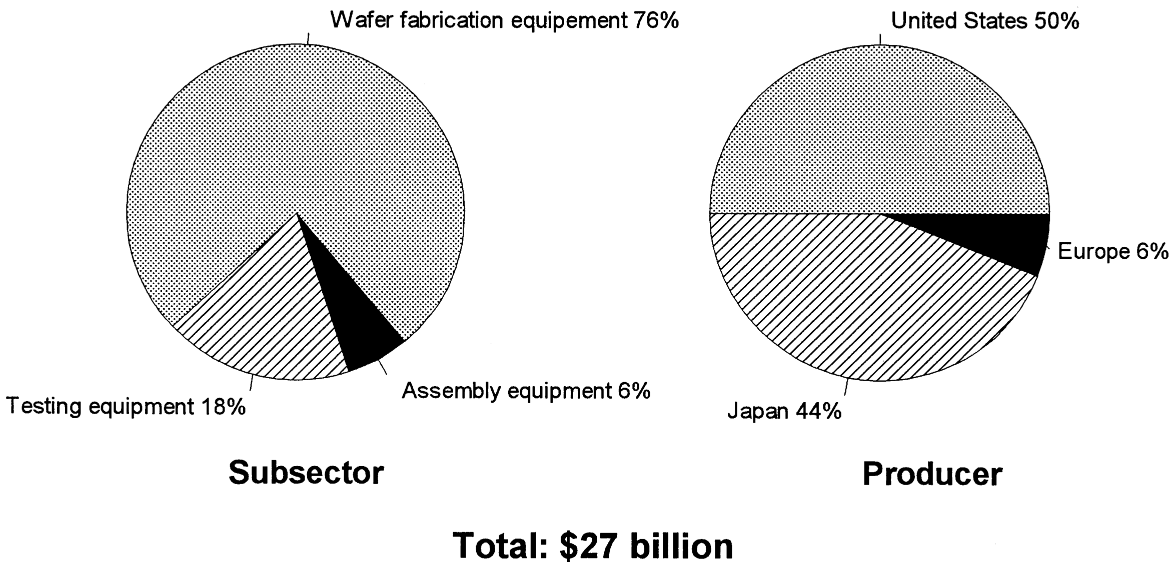
[1] Semiconductor Equipment and Materials International (SEMI), fax to USITC staff, estimated data, Jan. 21, 1997.

[2] For further explanation of wafer fabrication and other SMTE products and processes, see USITC, *Global Competitiveness of U.S. Advanced-Technology Manufacturing Industries: Semiconductor Manufacturing and Testing Equipment,* USITC publication 2434, Sept. 1991, appendix E.

[3] USITC, *Global Competitiveness.*

[4] SEMI fax to USITC staff, estimated data, Jan. 21, 1997.

Figure 8-1
Semiconductor manufacturing equipment: Share of world production, by subsector and by major producers, 1996



Source: Semiconductor Equipment and Materials International.

While most companies in the industry specialize in one of the three classes of equipment, the leading companies all produced wafer fabrication equipment in 1996. Leading U.S. producers include Applied Materials, Novellus, and Lam Research. Top Japanese producers include Tokyo Electron and Hitachi, and top European producers include ASM International, Leica, and ESEC (table 8-1). Many SMTE firms also supply equipment to manufacturers of flat panel displays, compact disc makers, optical systems for research laboratories, and other high-tech industries that utilize processes and equipment similar to those used in semiconductor manufacturing.

Competitive factors for the SMTE industry include quality of technology and product, price, customer support, system performance, and geographic location. Industry sources also indicate that cost of ownership,[5] product innovation and enhancements, timeliness of product introduction, system reliability, breadth of product line, and service are additional competitive factors. Established customer relationships are also significant considerations in purchasing decisions according to industry sources. As their customer base expands, SMTE producers compete in a more geographically diverse market.

---

[5] "Cost of ownership" is a calculation used by semiconductor producers to make equipment purchasing decisions based on long-term operation of the equipment (i.e., labor, maintenance, overhead, etc.). The "cost-of-ownership" model is a computer software program created by SEMATECH. SEMI/SEMATECH is the association representing the U.S. "supplier infrastructure" which includes software, services, equipment and materials manufacturers.

Table 8-1
Leading semiconductor equipment producers

Product	United States	Japan	Europe
Wafer fabrication equipment	Applied Materials, Inc. Novellus Lam Research Silicon Valley Group Etec Systems, Inc. Watkins Johnson Varian	Tokyo Electron Hitachi JEOL Nikon Canon Kokusai Electric Materials Research Co. (Sony) Advantest	ASM International ASM Lithography Balzers and Leybald Jenoptik INFAB
Testing equipment	KLA Instruments[1] Tencor Instruments Inspex Teradyne	Hitachi Nikon Dainippon Screen	Leica
Assembly equipment	Kulicke & Soffa	Apic Yamada Disco Corp. Kaijo Corp. NEC Electronics	ESEC FICO

[1] KLA Instruments announced their merger with Tencor Instruments in January 1997. The merger will be complete by summer 1997.

Source: Compiled by the staff of the USITC.

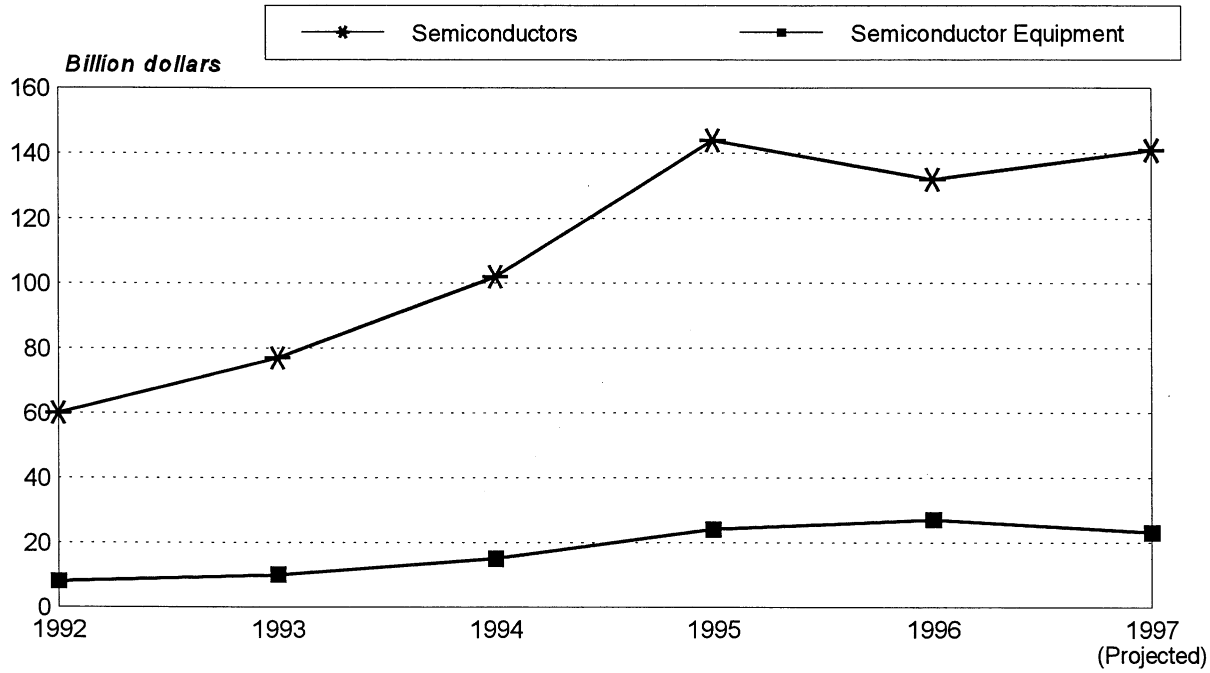
The SMTE industry is global in nature and leading firms compete in all major markets and product segments. The United States, Japan, and the EU are the three major producing and consuming regions of semiconductor manufacturing equipment. In 1996, U.S. firms delivered 50 percent of global SMTE shipments; Japanese firms, 44 percent; and EU firms, 6 percent (figure 8-1).[6] Currently, tariff rates for SMTE in all three major markets are zero with the exception of some parts in the EU.

U.S. Industry Profile

The SMTE industry follows the cycles of the semiconductor industry, in response to changes in semiconductor demand (figure 8-2). A large number of firms entered the U.S. SMTE industry in the early 1980s in anticipation of the rapidly expanding semiconductor industry.[7] However, both U.S. industries did

[6] SEMI, fax to USITC staff, estimated data, Jan. 21, 1997. Although SEMI refers to North America in its estimates of shipments by region, over 95 percent of shipments from North America originate in the United States.
[7] According to one industry source, there were 1,500 U.S. semiconductor equipment and material producers in the mid-1980s.

Figure 8-2
Semiconductor and semiconductor equipment: World shipments, 1992-97



Source: Semiconductor Industry Association and Semiconductor Equipment and Materials International.

not share in the global upswing largely because of a shift in semiconductor production to foreign markets and competitive pressure from Japanese SMTE firms. Consequently, the U.S. SMTE industry lost global market share during the 1980s. U.S. SMTE market share fell from 75 percent in 1980 to 45 percent in 1990, as U.S. semiconductor producers' market share declined from 67 percent in 1980 to 40 percent in 1990.[8] At the time, many small SMTE producers left the industry or were absorbed into other companies.

This loss of market share by U.S. semiconductor and semiconductor equipment producers was viewed by Congress as a serious threat to U.S. economic stability and the U.S. Government responded by funding research consortia and promoting industry cooperation.[9] SEMATECH[10] was created in 1987 to help strengthen the U.S. base of equipment suppliers from whom U.S. semiconductor producers had begun to demand better quality equipment.[11] Collaboration between the large semiconductor producers and SMTE producers became more common and resulted in improved domestic equipment and higher productivity yields

---

[8] See USITC, *Global Competitiveness*, p. 1-4.

[9] Japan's rise to prominence in semiconductor manufacturing in the 1980s, the U.S. response to the loss in memory chip market share, and the role of industry groups such as the Semiconductor Industry Association (SIA), the Semiconductor Research Corporation (SRC), and SEMATECH in regaining U.S. competitiveness in semiconductor technology are discussed in U.S. Congress, Office of Technology Assessment (OTA), *Contributions of DOE Weapons Labs and NIST to Semiconductor Technology*, OTA-ITE-585 (Washington, DC: GPO, Sept. 1993).

[10] SEMATECH began with 14 member companies and now has 10 major U.S. semiconductor manufacturers who contribute matching funds for consortium research. Government funding for SEMATECH ended in 1996 and the program is currently funded entirely by private sources. See Integrated Circuit Engineering Corporation (ICE), *Mid-Term 1996, a Report on the Integrated Circuit Industry* (Scottsdale, AZ: ICE, 1996).

[11] SEMATECH official, interview by USITC staff, Austin, TX, Oct. 1996.

for U.S. semiconductor producers. By 1992, the global market share for U.S. SMTE producers reached almost 50 percent.[12]

The United States SMTE industry currently consists of approximately 400 firms (most with annual revenues of less than $10 million), and is dominated by several multinational companies with annual revenues of over $150 million.[13] Applied Materials, the largest U.S. producer, with $4 billion in 1996 annual revenues, dominates the front-end equipment market.[14] Novellus, Varian, Lam Research, KLA, and Tencor Instruments generate annual revenues of $100 million to $800 million, and supply most of the semiconductor producers located in the United States with manufacturing equipment (table 8-1). Relatively smaller producers such as Brooks Automation and Uniphase Corporation routinely supply larger SMTE companies with subsystems for multi-million dollar machines, while most large SMTE producers directly supply the semiconductor industry. Smaller companies are less prepared to meet orders of the magnitude and range required to outfit a new fabrication plant, and so must subcontract with larger firms to get contracts; otherwise they supply the replacement market.[15] In the case of both large and small SMTE firms, there generally is not a lot of diversification outside the SMTE industry; business lines are concentrated within the industry.[16]

During the past 5 years, the SMTE industry has undergone significant consolidation driven largely by the high cost of product development and rapid changes in technology.[17] In addition, foreign competition has pressured many small equipment producers to exit the industry, or to merge with other companies. During the same period, U.S. producers expanded their business overseas due to the globalization of the semiconductor industry. In some cases, this has meant relocating production or sales facilities. In others, expansion has taken the form of joint ventures as a means to enter foreign markets. Proximity to fabrication plants has become an important consideration for equipment suppliers, as semiconductor producers prefer to do business with suppliers who have made a commitment to the region in which the production facilities are located.[18] Applied Materials has been in Japan since 1979, and the company's early presence there is cited as a reason for its strong competitive position in the region today.[19] A regional presence is a competitive advantage because it allows a company to respond quickly to customer needs for maintenance and other services. Many U.S. suppliers have arranged, through joint ventures, foreign direct investment, or distribution arrangements, to increase their business presence in Southeast Asia and China.

U.S. production of semiconductor manufacturing equipment totaled $13 billion in 1996, or 50 percent of world shipments. Wafer fabrication equipment accounted for $10 billion, or 77 percent, of U.S. production. After four years of growth averaging 36 percent annually and record growth in 1995 (up 65 percent from 1994), the SMTE industry's growth slowed to 11 percent in 1996.[20] Industry sources predict negative growth in 1997; however, the long-term outlook for the industry is very good. As many as 133 new

---

[12] SEMI, fax to USITC staff, estimated data, Jan. 21, 1997.

[13] SEMI/SEMATECH official, telephone interview by USITC staff, Feb. 1997 and TASC, Inc., *Assessment of the Semiconductor Wafer Processing Materials and Equipment Industry*, unpublished draft report, Nov. 1995.

[14] Applied Materials, *10-K Report 1996.*

[15] SEMI/SEMATECH official, telephone interview by USITC staff, Feb. 1997.

[16] The lack of diversification outside the SMTE industry may be attributed to highly specialized conditions under which manufacturers must work. For example, manufacturers of subcomponents for larger machines must often perform operations in a clean room facility in order to meet the specifications supplied by their customers.

[17] Walter Mathews, "Togetherness Fever Hits the Industry," *Channel*, Apr. 1996, vol. 9, No. 3, pp. 4-6.

[18] Fusion Systems official, telephone interview with USITC staff, Feb. 1997.

[19] Applied Materials, *Company Background Information*, Aug. 1996.

[20] SEMI, fax to USITC staff, estimated data, Jan. 21, 1997.

or expanded semiconductor fabrication facilities are scheduled to open worldwide between 1997 and 1999;[21] 50 of these will reportedly cost $1 billion each, and another 14 will cost $1.5 billion each. Since roughly 75 percent of the capital for new wafer fabrication facilities is typically invested in equipment, this could translate into at least $65 billion in equipment orders. Given current U.S. market share, this could mean $32 billion in new orders for the U.S. SMTE industry. Employment trends in the industry also reflect steady growth. The industry employed more than an estimated 28,000 workers in 1991;[22] the workforce, by some estimates, had at least tripled by 1996.[23]

The U.S. industry is competitive in most wafer fabrication equipment. In particular, U.S. companies are responsible for approximately 60 percent of world production of chemical vapor deposition and sputtering equipment and 63 percent of production in the etch and clean segment (mainly dry etching equipment).[24] The competitiveness of U.S. firms in this sector is attributable to leading-edge technology coupled with exceptional quality and reliability. In contrast, the U.S. industry is not a strong competitor in lithographic exposure tools. The Silicon Valley Group (SVG) manufactures photolithography exposure equipment capable of creating line widths of 1.25 micron, but as technology advances, the line widths required to accommodate circuitry on wafers shrink. SVG's competitor Nikon produces photolithography equipment using a different technology that is currently capable of creating a 0.25 micron line width.[25] Relatively poor U.S. performance in lithography equipment is attributed to fierce competition from Japanese producers. The high costs of R&D required to stay competitive and the pace at which the technology changes further challenges U.S. producers.[26] As the most expensive type of wafer fabrication equipment, and as a strategic technology for semiconductor manufacturing, the U.S. industry has been concerned about this weakness for several years. In 1995, U.S. companies accounted for only 8 percent of domestic market share in optical steppers, a photolithographic tool, down from 11 percent in 1990.[27]

The U.S. industry is also competitive in testing equipment in part due to the evolution of U.S. strength in advanced laboratory equipment and electronics, from which a large proportion of semiconductor testing equipment has evolved. U.S. companies produce about one-half of the world's wafer inspection, thin film measurement, and optical critical dimension equipment. KLA Instruments is a major U.S. producer; with Tencor Instruments and Inspex, these three companies provide nearly three-quarters of the world's wafer inspection equipment.[28] In 1995, the U.S. global market share of testing equipment was approximately 43 percent, up from 18 percent in 1990.[29]

U.S. producers experience tough foreign competition in assembly equipment, but are increasing their global market share in some equipment in the sector.[30] U.S. producers were responsible for an estimated 30 percent of global shipments of assembly equipment in 1996, while Japan reportedly produced almost

---

[21] George Burns, "New Fabs: What the Recovery Will Look Like," *Channel*, Jan. 1997. Consumers of SMTE like Intel and Motorola typically spend 20 percent of their revenue expanding their manufacturing facilities or building new ones. Intel announced a $4-billion annual budget for capital investment in January 1997.

[22] Peggy Haggerty, VP of SEMI/SEMATECH, as cited in OTA, *Contributions of DOE Weapons Labs*, p. 54.

[23] Fusion Systems official, telephone interview with USITC staff, Feb. 1997.

[24] USITC staff estimates in this paragraph are based on TASC report, chapter 3. Estimates do not include assembly equipment.

[25] Silicon Valley Group (SVG) Inc., "Competition," *10-K Report*, Sept. 30, 1995.

[26] See OTA, *Contributions of DOE Weapons Labs*, p. 17.

[27] SEMI/SEMATECH, fax to USITC staff, based on VLSI research, Jan. 23, 1997. *Contributions of DOE Weapons Labs* notes U.S. global market share for lithography equipment was 90 percent in 1981 and fell to 10 percent in 1991, based on information collected at an SIA workshop in 1993.

[28] In January 1997, KLA Instruments announced plans to merge with Tencor Instruments. It is estimated that the new KLA-Tencor will supply 40 percent of the world market for semiconductor testing equipment.

[29] SEMI/SEMATECH, fax to USITC staff, based on VLSI research, Jan. 23, 1997.

[30] U.S. global market share in auto wire bonders increased to 50 percent in 1995 from 36 percent in 1990.

50 percent.[31] Kulicke and Soffa Industries is the only U.S. company among the world's top ten assembly equipment producers, according to one survey,[32] but is the world leader in this sector, producing wire bonders, dicing saws, and expendable tools such as bonding wire.[33]

U.S. SMTE exports rose steadily during 1992-96, from $1.2 billion in 1992 to $5.5 billion in 1996.[34] Increasing U.S. revenues from export sales is another indicator of the international expansion of the SMTE industry. U.S. SMTE exports increased from 31 percent of total shipments in 1992 to 41 percent in 1996. The majority (80 percent) of U.S. exports are wafer fabrication equipment, bearing out the strength of U.S. equipment in that sector. The principal destinations of U.S. exports have been Japan and Europe; however, Asia, the fastest growing region for semiconductor production, has become a major importer of U.S. SMTE. U.S. exports to Korea and Taiwan totaled $1.8 billion in 1996, triple the 1994 level of $580 million.

Marketing and Pricing

The leading U.S. SMTE manufacturers reported that an average of 18 percent of net sales is devoted to marketing and administrative expenses, most of which are direct selling costs and after sales services.[35] The marketing practices of U.S. SMTE firms depend somewhat on the size of the firm. Large firms like Applied Materials and Lam Research, and even some medium sized firms like Fusion Systems, directly represent themselves to their customers. Representatives of large equipment suppliers are often based in the wafer fabrication plants of their customers.[36] In-house supplier representatives can train equipment operators, provide routine machinery maintenance, work as troubleshooters, and also help ensure a smooth working relationship. Small producers often employ manufacturers' representatives to arrange customer sales and service.

The price of semiconductor manufacturing equipment typically increases by 15 percent annually,[37] partially because of the degree of equipment customization. It is estimated that between 50 and 90 percent of all SMTE equipment is customized, adding an average 30 percent to the production cost.[38] The cost of R&D to support the constantly evolving technological sophistication of the equipment also contributes to price increases. However, as semiconductor producers are very cost-conscious, there is constant pressure on SMTE producers to lower customer costs through price reductions, or by developing new, less costly technologies. One trend in equipment design is toward improving process controls to detect defects in wafers. The standardization of some equipment and use of software to customize machine operations can reduce costs associated with semiconductor production. Design improvements could potentially eliminate the need to run test wafers, one of the highest costs associated with bringing new equipment on-line.[39] Also, the development of equipment that can handle more than one generation of chips would reduce overall production

---

[31] SEMI, fax to USITC staff, estimated data, Jan. 21, 1997.

[32] U.S. Department of Defense (DOD), *Semiconductor Packaging: A DOD Dual Use Assessment*, Apr. 15, 1996, p. IV-7.

[33] Kulicke and Soffa Industries, *10-K Report*, Sept. 30, 1995.

[34] Data compiled from official statistics of the U.S. Department of Commerce (USDOC).

[35] TASC, *Assessment*, p. 3-8.

[36] One semiconductor producer claimed to have 30 representatives from different SMTE companies located in their fabrication plant. Motorola official, interview by USITC staff, Research Triangle Park, NC, Sept. 1996.

[37] Draft section on semiconductor manufacturing and testing equipment for USDOC, *U.S. Industry Trade Outlook*, to be published by McGraw Hill in 1997.

[38] TASC, *Assessment*, p. 3-29.

[39] The trends in the design of semiconductor manufacturing is discussed in "Smaller is faster," and "A signal runs through it," *Machine Design*, Jan. 16, 1997.

costs by eliminating the need to retool every time chip design advances. This is especially important since equipment suppliers compete not strictly on the basis of price, but on the overall cost of ownership of the equipment.

Technology and Innovation

Research and development (R&D) is critical to maintain competitiveness in the SMTE industry. Demand for sophisticated machinery to accommodate advances in semiconductor design has intensified over the past 5 years, requiring SMTE companies to invest heavily in R&D. The short time horizon for innovations in the SMTE industry requires steady funding for R&D.[40] Typically, SMTE companies spend at least 10 percent of sales on R&D, and in some cases, as much as 20 percent.[41] Smaller companies typically have less money to invest in product development and, as a result, find it more difficult to gain a long-term foothold in the market.[42] Large companies can more easily provide the requisite amount of capital for R&D to compete in the industry.

Given the competitive implications of technology development for SMTE customers, it is not surprising that the semiconductor manufacturers help sponsor R&D for equipment. For example, in February 1995, the Silicon Valley Group formed a business agreement with three of its customers, Intel, Motorola, and Texas Instruments, as part of an arrangement to help fund development of SMTE technologies based on the future needs of chip makers.[43] Several specific areas of research supported by SMTE and semiconductor manufacturers are producing equipment that is capable of handling more than one generation of microchips, reducing the number of steps in the manufacturing process, and developing sensors for feedback controls in machines.[44] The major focus that connects these research areas is the development of equipment to produce the next generation of microchips.[45] It is estimated that the retooling required to make the production transition from 200mm to 300mm wafers will cost the SMTE and materials industry $13 billion.[46] Most funding in this area is privately sourced.

Government funding for R&D in the industry has diminished recently. In November 1995, SEMATECH, which no longer receives U.S. Government funding, formed the International 300mm Initiative (I300I), an organized effort to develop technology for the next generation of semiconductor manufacturing.[47] There are 13 semiconductor manufacturers in the consortium including Intel, IBM, Motorola, Hyundai, Samsung, SGS-Thompson, and Siemens, and the program is funded at $26 million for

---

[40] According to one industry official, machinery is obsolete as it is shipped. "Semiconductor Equipment is Facing a Slump in 1997," *The Journal of Commerce*, Dec. 24, 1996.

[41] For example, Applied Materials annual R&D spending was 17 percent in 1990 and declined to 11 percent in 1995. Applied Materials, *Company Background Information*, Aug. 1996.

[42] For example, SpeedFam, a company that manufactures chemical mechanical polishing (CMP) systems, expects to meet tough competition from Applied Materials, as they recently introduced their own CMP system. SpeedFam does not have the capital that Applied has to invest in R&D to insure a leading position in the CMP market.

[43] SVG Inc., "Company Description," *10-K Report*, Sept. 30, 1995.

[44] The trend in the industry is toward smaller machines with higher productive capacity. Robert Ristelhueber, "Wafer fabs: Getting more bang for the buck," *Electronic Business Today*, July 1996.

[45] Semiconductor wafers are now 6 (150mm) or 8 (200mm) inches in diameter, and the next generation of chips will be 12 inches, or 300mm.

[46] World Wide Web, retrieved Feb. 2, 1997, SEMI, http://www.semi.org., SEMI public policy paper, "U.S. Semiconductor Manufacturing and the 300mm Challenge."

[47] The activities of I300I include developing performance standards for equipment and reprocessing test wafers.

the first 18 months, beginning in July 1996.[48] Japanese semiconductor manufacturers declined to participate in I300I and have formed their own 300mm research consortium.

Foreign Industry Profiles

Japan has the second largest SMTE industry in the world with $12 billion (44 percent) of global shipments in 1996, and is highly competitive in all types of equipment: wafer fabrication, assembly, and testing. The EU industry produces significantly less volume than U.S. and Japanese companies ($1.6 billion, or 6 percent, of total world shipments),[49] and although competitive in assembly equipment (20 percent of global shipments), produces 6 percent and 1 percent, respectively, of wafer fabrication and test equipment.

The marketing practices of foreign SMTE producers are similar to U.S. companies. Suppliers often have in-house representation in their customers' fabrication plants,[50] training and service is often included in the price of equipment, and after-sales service is reportedly important.[51] Pricing pressures experienced by foreign SMTE firms are similar to those in the United States as the costs of development are comparable and are reflected in the price of equipment. Foreign producers also recognize the importance of R&D investment in the industry. As in the United States, major foreign SMTE and semiconductor producers are sponsoring R&D to develop technology for the transition to 300mm semiconductor wafers.

Japan

Japanese SMTE producers are the strongest competitors faced by U.S. industry, especially in lithography equipment, where the majority of world market share is held by Japanese producers. Compared to U.S. firms, Japanese companies are fewer in number, larger, and more diversified. Tokyo Electron Limited (TEL) and Hitachi are the two largest producers. Nikon, Canon, DaiNippon Screen, Advantest, and Kokusai are also major producers. Unlike U.S. companies, most of which began as small start-ups, many Japanese SMTE producers began with an established technology base in optics, microwave components, and quartz tubes.[52] According to one source, most of the 50 or so Japanese SMTE manufacturers are associated with keiretsu-like organizations, and these producers supply 64 percent of the domestic market.[53] Japanese SMTE producers have operations in Europe, the United States,[54] and particularly Southeast Asia where capacity for semiconductor production is greatly expanding. During the industry downturn caused by the drop in dynamic random access memory (DRAM) chip prices in 1996, smaller Japanese SMTE producers primarily supplying the domestic market felt the drop in equipment consumption much more than companies supplying foreign

---

[48] SEMI public policy paper, "U.S. Semiconductor Manufacturing and the 300mm Challenge."

[49] SEMI, fax to USITC staff, estimated data, Jan. 21, 1997.

[50] In Singapore, supplier representatives are usually not stationed in customer plants due to the close proximity of all manufacturing facilities and their suppliers. SGS-Thomson official, interview by USITC staff, Singapore, Dec. 2, 1996.

[51] Reportedly after-sales service is more important to Asian SMTE consumers than those in the United States. Keteca Singapore official, interview by USITC staff, Singapore, Dec. 1996.

[52] TASC, *Assessment*, p. 2-21.

[53] Ross Young, "Keirestsu, equipment and materials: A strategic US response," *Solid State Technology*, March 1995. An in-depth study of Japan's distribution system can be found in USITC, *Phase I: Japan's Distribution System and Options for Improving U.S. Access*, USITC publication 2291, June 1990.

[54] Tokyo Electron (TEL) recently opened operations in Boston, MA and Austin, TX. Initially planned as sales offices and show rooms, TEL announced the addition of production facilities in both states that will open this year.

markets. These producers are now concerned about developing their ability to compete with non-Japanese firms in overseas markets.[55]

The Japanese industry's greatest competitive advantage is in photolithography equipment, a critical technology in the manufacture of DRAMs. This advantage can be traced to the cooperative efforts of Japanese DRAM manufacturers and SMTE producers, an arrangement that provided advantageous access to capital and R&D cooperation. Nikon, a company with extensive experience in optical instruments, worked with DRAM producer Toshiba in the government-sponsored VLSI Project to develop an indigenous capacity for photolithography equipment in the late 1970s. The two companies worked together for several years resulting in Nikon becoming the dominant exposure tool producer in Japan, and currently holding over one-half of global market share in lithographic steppers.[56] The success of Nikon is attributable to strong base in optical instruments and a cooperative effort to develop products according to the needs of the customer, in this case, Toshiba. Even today, Japanese SMTE producers reportedly are more often involved with their customers and at earlier stages of technology development than are U.S. producers.[57]

The Japanese government and private sector are also aggressively supporting cooperative technology development for semiconductor manufacturing. The Semiconductor Industry Research Institute of Japan (SIRIJO), a private sector group of ten leading electronics manufacturers, is coordinating the effort to develop advanced semiconductor technology.[58] Three consortia were created in 1996: Semiconductor Leading Edge Technologies, Inc. (SELETE); Association of Super-Advanced Technology Development Organization (ASET); and Semiconductor Technology Academia Research Center (STARC). SELETE, which is funded by major Japanese semiconductor producers, began with $50 million in capital with $300 million more to be invested over the next 5 years. Member companies also support SELETE by loaning employees to perform research. Japan's Ministry of International Trade and Industry provided $100 million to ASET, which will work on DRAM-associated technologies such as advanced microlithography and plasma-process measurement and control. The STARC initiative is designed to promote cooperation between private industry and universities to address specific research problems in the industry.[59] Industry sources characterize the official infusion of R&D funds by the Japanese government as an attempt to regain the market share lost to U.S. companies in recent years.[60]

Japan, the world's second largest exporter of SMTE, competes with the United States for export market share in third country markets. It is estimated that Japan exported nearly $6 billion in SMTE in 1995.[61] Japan's exports to the EU and the United States were concentrated in front-end equipment. Similar to U.S. exports, Japan's exports to Korea and Taiwan have expanded dramatically, from approximately $2 billion in 1994 to slightly more than $3 billion in 1995. Most of this increase was in testing equipment. Japan also exports a wide range of equipment to China, Malaysia, and Thailand.

---

[55] SEMI official, telephone interview by USITC staff, Feb. 1997.
[56] TASC, *Assessment*, p. 2-22.
[57] TASC, *Assessment*, p. 3-32.
[58] SEMI public policy paper, "U.S. Semiconductor Manufacturing and the 300mm Challenge."
[59] Ibid.
[60] World Wide Web, retrieved Oct. 23, 1996, Tech Investor, http://www.techstocks.com, Tech Investor, "Tech Rally Stands On Weak Ground."
[61] USITC staff estimates based on *Japan Tariff Association, Commodity by Country* (Japan Tariff Association: Tokyo, Japan), Dec. 1995.

Other Producers

EU firms rank third among the major SMTE producers, with total shipments amounting to $1.6 billion in 1996. The most globally competitive European firms include Netherlands-based ASM Lithography, a manufacturer specializing in photolithography equipment; Leica, a testing equipment producer; and ESEC, an assembly equipment producer. Europe, specifically Germany, Sweden, and the Netherlands, exports lithography equipment to Japan and the United States.

Production in Korea, Taiwan, and other regions is estimated at $450 million. The steady expansion of semiconductor manufacturing capacity and production in Korea and Taiwan has attracted U.S. and Japanese equipment suppliers; many have opened facilities or formed joint ventures with local producers in those markets. U.S.-based Applied Materials and Japan's Tokyo Electron have opened manufacturing facilities in Korea. Although neither Korea nor Taiwan is currently a major SMTE producer, they may become more important in the future. The Korean Government has announced the strategic importance of the SMTE industry and has implemented policies, such as accelerated depreciation and state-sponsored R&D, to encourage development of an indigenous SMTE industry.[62] Taiwan is also beginning to produce some SMTE equipment. One indicator of increased R&D activity in those countries is the number of U.S. patents awarded in the semiconductor manufacturing processes category. In 1993, applications in this class of patents were among the top five categories applied for by inventors from Korea and Taiwan; only ten years earlier, no such patents were requested by either country.[63] Korea and Taiwan appear to be supplying their domestic market with assembly equipment, the least technologically sophisticated of the three classes of SMTE technology.

The EU, Singapore, Korea, and Taiwan are also investing in SMTE technology development under government-sponsored consortia. The EU set up the Joint European Submicron Silicon Initiative (JESSI) in 1988 to help improve the production capability of European semiconductor manufacturers and reduce European dependence on U.S. and Japanese technology. Although the program ended in December 1996, a new research consortium called Micro-Electronics Development for European Application will continue the effort.[64] Although there are no major SMTE producers in Korea, Taiwan, or Singapore, their governments also sponsor research on key process capabilities for advanced semiconductor manufacturing.[65] The Highly Advanced National Project of Korea, funded at $5.3 million in 1995, is charged with developing next-generation semiconductor equipment.[66] Participants in the project are eligible for R&D tax benefits. The Taiwan Government supports semiconductor technology development through the Industrial Technology Research Institute which sponsors cost-shared R&D for wafer fabrication and assembly equipment and through tax incentives for SMTE producers. Singapore sponsors research on advanced technology training for operation of future wafer fabrication plants. The Singapore Government also subsidizes 50 percent of the cost of training for engineers and researchers as well as foreign companies located in Singapore that are in the semiconductor-related industry. [67]

---

[62] Korean Semiconductor Association representative, telephone interview by USITC staff, July 1996.
[63] National Science Board, *Science and Engineering Indicators, 1996* (Washington, DC: GPO), 1996.
[64] Horst Nasko, "Multimedia: The technology driver for Europe," *Channel*, Feb.-Mar. 1996, pp. 14-15.
[65] SEMI policy paper, "U.S. Semiconductor Manufacturing and the 300mm Challenge."
[66] Ibid.
[67] Applied Materials representative, interview by USITC staff, Singapore, Dec. 1996.

Global Market Profile

The market for SMTE is concentrated in the United States, Japan, and Europe, but that is changing.[68] Southeast Asia and China are the fastest growing markets for SMTE; these regions will accommodate 40 percent of new semiconductor production capacity in the next three years,[69] a result of joint ventures and foreign direct investment by major U.S., Japanese, and European semiconductor producers. Also, the governments of Korea, Singapore, and Taiwan support the development of indigenous semiconductor industry and equipment suppliers.[70] Although none of the Southeast Asian states have yet established indigenous SMTE industries, some equipment is supplied domestically from U.S. and Japanese equipment suppliers located in the region. It is expected that, in time, Thailand and China will produce equipment to supply their domestic semiconductor industry.

After DRAM prices fell in 1996, causing delays in new fabrication plants, SMTE equipment orders fell. SMTE producers were able to sustain sales in 1996 due to a backlog of orders, although sales are expected to fall 14 percent in 1997 despite expectations of a strong recovery and long-term market growth.[71] No significant trade barriers exist in the major SMTE markets. The United States, Japan, and the EU have had zero tariffs for most semiconductor manufacturing equipment since January 1, 1995 (table 8-2).[72] Consequently, no change in market access opportunities is expected in these markets as a result of the ITA. According to industry representatives some nontariff barriers exist outside the major markets. In the past, U.S. companies claimed that customs procedures in Korea constitute a nontariff barrier. Excessive paperwork, lack of predictability in the procedures, and different tariff classifications for systems and parts caused delays in their ability to service their customers.[73]

U.S. Market Profile

The United States is the largest consumer of SMTE, estimated at $9.4 billion in 1996.[74] A 12-percent decline in the 1996 capital equipment commitments of U.S. semiconductor manufacturers is expected to adversely effect equipment suppliers in 1997. After a dip in consumption in 1997, the SMTE industry is expected to grow 13 percent in 1998.[75] U.S. investment in SMTE may also be hindered by the

---

[68] Parts and components for semiconductor equipment require sophisticated technological facilities, and at this time the majority of parts are made in the three major producer regions.

[69] George Burns, "New Fabs: What the Recovery Will Look Like," *Channel,* Jan. 1997.

[70] "This Island is Crazy for Chips," *Business Week*, Sept. 16, 1996.

[71] "Semiconductor Equipment is Facing a Slump in 1997," *The Journal of Commerce*, Dec. 24, 1996. SEMI estimates a 5.5 percent decline of sales in 1997. World Wide Web, retrieved Dec. 10, 1996, SEMI, http://semi.org, SEMI press release, "SEMI members expect upturn in 1998 consensus forecast for semiconductor equipment."

[72] *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994. The Marrakesh Protocol is part of the General Agreement on Tariffs and Trade 1994 (GATT 1994), which is a multilateral agreement that is an annex to the Agreement Establishing the World Trade Organization.

[73] SEMI, informal survey of members, telephone interview by USITC staff, Oct. 1995.

[74] USITC staff estimate and draft section on semiconductor manufacturing and testing equipment for USDOC, *U.S. Industry Trade Outlook*, to be published by McGraw Hill in 1997.

[75] SEMI press release, "SEMI members expect upturn in 1998 consensus forecast for semiconductor equipment."

Table 8-2
Final Uruguay Round tariffs on semiconductor manufacturing and testing equipment for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	5-23
Canada	3.3-7
Costa Rica	([2])
Estonia	0
European Communities (15)	0-6.7
Hong Kong	0
Iceland	6-24
India	25-40
Indonesia	5-40
Israel	10-12
Japan	0
Korea	0-13
Macau	([2])
Malaysia	5-25
New Zealand	5-30
Norway	3-5
Romania	10-35
Singapore	10
Sweden	1.2-2.7
Switzerland	0.1-2.5[3]
Thailand	20-30
Taiwan[4]	2.5-7.5
Turkey	8-23
United States	0

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Switzerland also assesses tariffs based on weight. Tariffs for semiconductor manufacturing and testing equipment range from 3.5 to 186 Swiss francs per 100 kg.
[4] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994 and U.S. Department of Commerce working documents.

lack of accelerated depreciation for SMTE compared with Japan and Europe.[76] U.S. imports grew from$424 million in 1992 to $1.3 billion in 1995, and are estimated to be $1.5 billion in 1996.[77] U.S. SMTE imports are mostly photolithography equipment and are increasing. Japan supplied 63 percent of U.S. SMTE imports in 1995.

Foreign Market Profiles

Japan

Japan's SMTE market is estimated to be smaller in size than that of the United States, at about $7 billion. Japanese SMTE producers expect to experience the effects of the 1996 market slowdown in 1997. The rising cost of fabrication plants and expensive labor in Japan have driven some semiconductor producers offshore. However, Japan's leading semiconductor producers continue to expand domestic production capacity; 28 new fabrication plants are scheduled to be built between 1997 and 2002.[78] While Japan supplies the majority of its SMTE market, imports in the sector were estimated to be $2 billion in 1995. Most Japanese imports come from the United States and Europe, but imports from Korea are increasing.

Other Markets

The estimated value of the SMTE market in the EU, Korea, and Taiwan is $3 billion each. Korea and Taiwan are fast becoming major consumers of SMTE as semiconductor production has shifted to the region. Local sources supplied an estimated 16 percent of the $1.5 billion semiconductor equipment market in Korea in 1994.[79] The worldwide capital equipment investment surge of 1995 (73-percent growth) slowed to 15 percent in 1996;[80] however, semiconductor producers in Korea and Taiwan continued to invest an estimated 87 and 62 percent of sales, respectively.[81] The semiconductor equipment market in Taiwan is expected to grow to $5 billion by 1998.

In the EU, there are zero tariffs on most SMTE, with minimal rates placed on parts.[82] The enlargement of the EU should enhance EU market access opportunities since as countries join the EU they agree to adopt the common EU tariffs and to abide by EU trade agreements. Although capacity for semiconductor production in Europe is not expanding as fast as it is in Asia, a lessening of trade restrictions and tariffs currently in place in countries awaiting admission to the EU could attract more semiconductor manufacturers and SMTE producers to the region.

---

[76] U.S. tax code allows 3 to 5 years for depreciation where as Japan allows up to 88 percent of depreciation in the first year. Germany Korea, Taiwan, and Singapore also have accelerated depreciation for SMTE. World Wide Web, retrieved Mar. 9, 1997, http://semi.org "SEMI 1996 Public Policy Position: Accelerated Depreciation of Semiconductor Equipment."

[77] Compiled from official statistics of the USDOC.

[78] "Japanese Fab Expansion Plans Continue Despite Production Slowdown," *Channel,* Nov.-Dec. 1996.

[79] "Korean Semiconductor, LDC Markets Show Increasing Strength," *Channel*, Oct. 1994.

[80] ICE, *Mid-Term 1996*, p. 2-54.

[81] Bill McClean, of ICE, in a presentation at SEMI Industry Strategy Symposium 1997, "Worldwide IC Industry Economic Update and Forecast," Jan. 6, 1997.

[82] *Most-Favoured-Nation Tariff Schedules.*

The countries of Southeast Asia impose a wide range of tariffs on SMTE.[83] Korea has eliminated most tariffs and agreed to make further reductions. Equipment imported into Taiwan's Hsinchu Industrial Park, where most semiconductor manufacturers are located, avoid tariffs for SMTE. The ITA will have its greatest impact on improving market access opportunities to the Southeast Asian countries that maintain significant SMTE tariffs but where capacity for semiconductor production is expanding. These emerging markets, in particular Thailand, Indonesia, and Malaysia, have 5 to 40 percent tariffs on SMTE and, in the absence of an ITA, these duties would remain. China maintains 15 to 40 percent tariffs on SMTE.

[83] Ibid.

CHAPTER 9
Measuring, Testing, and Analyzing Instruments
Christopher Johnson

This section includes all measuring, testing, and analyzing instruments except semiconductor testing equipment, which is discussed in chapter 8 of this report. Such products include almost all measuring and testing instruments used for industrial, scientific, and commercial purposes, including apparatus designed specifically for measuring and checking telecommunications functions and capabilities; spectrometers, chromatographs, and electrophoresis instruments; and most other analytical instruments used in medical, scientific, and industrial laboratories and applications. For a complete list of products included in the agreement see appendix A. The portion of U.S. production of these instruments covered by the ITA is approximately 55 percent.

U.S. Industry Profile

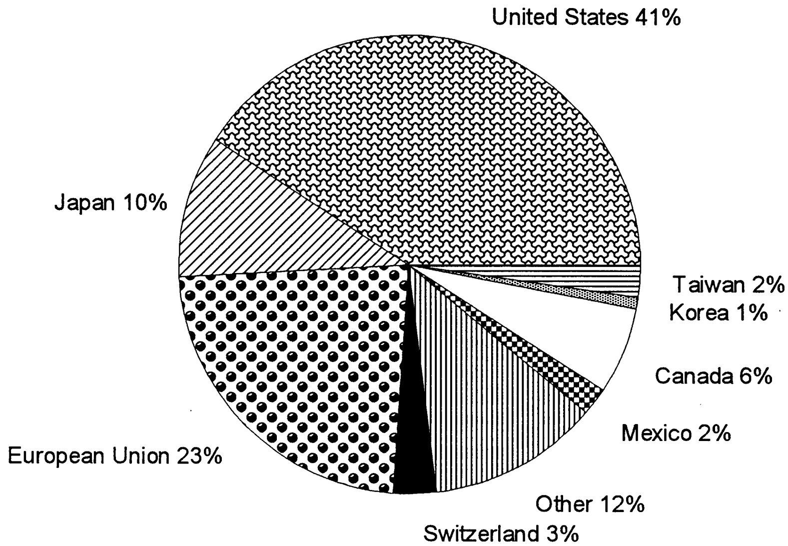
The United States is the world's largest producer and user of measuring, testing, and analyzing instruments, accounting for $28 billion, or 41 percent of total global production of $70 billion in 1996 (figure 9-1).[1] There are over 3,200 producers of measuring, testing, and analyzing instruments in the United States. They consist of a wide range of small, medium, and large multinational manufacturers, such as Hewlett-Packard Co., Beckman Instruments Inc., Perkin-Elmer Corp., Varian Associates Inc., and Bio-Rad Laboratories, Inc. (table 9-1). These companies also are major consumers of instruments used in the control and testing of the manufacturing process. A number of U.S.-owned corporations maintain manufacturing affiliates in the EU, Asia, and Canada and engage in a substantial amount of intracompany trade of components, subassemblies, and finished instruments.

The U.S. industry maintains the leading position in the global measuring, testing, and analyzing instruments industry due to several factors, including significant investment in research and development (R&D), technologically sophisticated products, advanced manufacturing processes, competitive prices, and excellent after-sales service.[2] In 1995, the U.S. instrument industry spent over 7 percent of sales on R&D, more than double the average of all U.S. manufacturing industries.[3] However, increased competition from foreign producers in recent years has lowered profit margins of U.S. companies, requiring them to significantly cut costs, including R&D expenditures.[4] Consequently, research projects have become more selective and have focused on essential and priority R&D projects.

Instrument manufacturers have become increasingly reliant on advances in other high technology sectors, including a number of products and components covered by the ITA. For example, producers of measuring, testing, and analyzing instruments are continually integrating into their products the latest advances in solid-state and digital technology to improve the performance capabilities of these instruments.[5] In recent years, an increasing number of these instruments have incorporated advanced microprocessors to

[1] Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).
[2] U.S. and Japanese investment analysts, telephone interviews by USITC staff, Feb. 11-12, 1997.
[3] National Science Board, *Science & Engineering Indicators*, 1995 (Washington, DC: GPO, 1996).
[4] U.S. industry representatives and investment analysts, telephone interviews by USITC staff, Feb. 3, 11, and 12, 1997.
[5] U.S. industry representatives, telephone interviews by USITC staff, Feb. 3, 11, and 12, 1997.

Figure 9-1
Instruments: Major producing countries, 1996



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

Table 9-1
Leading instrument producers, 1996

United States	Foreign
Beckman Instruments	Advantest Corp. (Japan)
Bio-Laboratories	Carl Zeiss (Germany)
Foxboro Co.	Hitachi Ltd. (Japan)
Hewlett-Packard	Massilla S.A. (France)
Johnson Controls	Oxford Instruments (U.K.)
Perkin-Elmer Corp.	Rohde and Schwarz (Germany)
Varian Associates	Schlumberger Ltd. (France)
	Siemens GmbH (Germany)
	Toshiba Corp. (Japan)
	Yokogawa Electric Corp. (Japan)

Source: Compiled by USITC staff from various government and private sector sources.

improve the speed, measurement, and analytical capabilities of the instruments. In addition, computer hardware and software technologies have become key elements in improving the accuracy, reliability, speed, and versatility of the instruments and systems produced in this industry.[6] Because some of the larger U.S. instrument producers, such as Hewlett-Packard, also are leading producers of computers and other information technology products, they are able to benefit directly from newly developed information technology that is incorporated in their measuring, testing, and analyzing apparatus, conferring an advantage on the U.S. industry.

Since the instrument industry is highly technology-intensive, skilled workers and professionals make up a large share of the work force.[7] Most of the employees are engaged in R&D, engineering, operation of high-technology capital equipment, and provision of after-sales services. During 1992-96, total employment in the U.S. measuring, testing, and analyzing instrument industry declined slightly from 230,000 to 228,000. The decline was principally due to improved production efficiencies and outsourcing of some highly labor-intensive parts and components to low-labor-cost countries.

In recent years, foreign investment in the U.S. instrument industry has increased sharply. During 1986-96, direct foreign investment in the U.S. industry tripled to over $10 billion. U.S. direct investment abroad in the instrument industry during the same period declined by 8 percent to about $2 billion. Within the last 6 to 8 years, a number of leading U.S. companies were acquired by, or entered into partnership with, foreign entities. These U.S. companies are producing advanced measuring, testing, and analytical instruments for such industries as the petrochemical, petroleum-refining, paper and pulp, food processing, environmental, and telecommunications equipment industries.[8]

During 1992-96, U.S. exports of measuring, testing, and analyzing instruments covered specifically by the ITA rose by an average annual rate of nearly 10 percent to over $7 billion in 1996.[9] The EU was the largest market for U.S.-made instruments, accounting for just under 30 percent of the total, followed by Japan with 17 percent, and Canada with 9 percent. Other major markets for U.S. exports were Korea, Singapore, Taiwan, Mexico, and Malaysia. U.S. exports of technology-intensive instruments have grown particularly in the areas of telecommunications testing instruments, instruments for measuring or checking electrical quantities, and miscellaneous measuring and checking instruments covered under the ITA.

U.S. exports of telecommunications testing instrumentation grew by over 35 percent from just 1995 to 1996 as rapid expansion of telecommunications systems in liberalized telecommunications markets in Japan, the United Kingdom, and other Asian and EU countries increased the demand for imported telecommunications test equipment.[10] In addition, an increase in exports has been generated by U.S. shipments of parts and components to U.S.- and other foreign-owned assembly plants located in Mexico, as well as U.S. shipments of instruments purchased by Mexico's petroleum industry and rapidly growing manufacturing sector.[11]

---

[6] European Commission, "Measuring, Precision, and Control Instruments," *Panorama of EU Industry 95/96* (Luxembourg: Office for Official Publications of the European Communities, 1995), pp. 12-9 through 12-32.

[7] U.S. investment analysts, telephone interviews by USITC staff, Feb. 11, 1997.

[8] U.S. industry representatives, telephone interviews by USITC staff, Jan. 21-23, 1997.

[9] Compiled from official statistics of the U.S. Department of Commerce (USDOC).

[10] U.S., Japanese, and EU industry representatives and investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.

[11] Mexican industry representatives, interviews by USITC staff, Mexico City, Feb. 4-7, 1997.

Foreign Industry Profiles

The U.S. instrument industry is highly integrated into the global economy. Most of the leading producers have production facilities in many of the industrialized countries.[12] The U.S. industry is responsible for a significant portion of European, Latin American, and Canadian production through wholly owned subsidiaries, joint ventures, and licensing agreements.[13] In Japan and Korea, U.S. manufacturers are engaged in production primarily through joint venture and licensing agreements with Japanese and Korean firms. Several wholly owned subsidiaries of U.S. companies are located in low-labor-cost Pacific Rim countries for assembling highly labor-intensive electronic parts, components, and subassemblies into finished instruments and systems.[14]

European Union

Two countries, Germany and the United Kingdom, accounted for over 75 percent of total EU production of slightly over $16 billion in 1996 (figure 9-1).[15] Among the second tier of EU producers within this sector were Italy, France, and Spain. In general, the composition of the EU measuring, testing, and analyzing instrument industry is mostly characterized by an array of small and medium-sized companies, although several large producers, such as Siemens (table 9-1), produce a broad range of products in various sectors, such as consumer electronics, computers, and motor vehicles.[16] R&D investment is largely limited to the multinational corporations, and total spending is much less than that in the United States and Japan. In Germany, R&D expenditures have actually been declining in the past several years.[17] European industry analysts assert that due to the generally smaller scale of the European instrument industry, increased mergers or cooperative research and development among these firms are necessary if EU companies are to succeed against U.S. and Japanese competitors.[18] In the past few years, a series of mergers have taken place, such as the Siebes (UK) acquisition of Foxboro and Siemens' (Germany) purchase of the Industrial System Division of Texas Instruments, Inc. in the United States.

Employment in the EU instrument industry declined annually from 120,000 in 1992 to 103,000 in 1996,[19] as recessions in Germany and sluggish growth in a number of other EU countries led to downsizing in many industrial sectors, including the instrument sector. Although improved labor productivity was also a factor in the decline in EU employment in the measuring, testing, and analyzing instrument industry, the rise in productivity was modest compared to that occurring within the U.S. industry.[20] Further, combined with a

---

[12] U.S. industry representatives, telephone interviews by USITC staff, Jan. 21-23, 1997.

[13] U.S. investment analysts, telephone interviews by USITC staff, Feb. 16-20, 1997.

[14] U.S. industry representatives, telephone interviews by USITC staff, Jan. 21-23, 1997 and information contained in corporate annual reports of major U.S. producers.

[15] Estimated by USITC staff based on official statistics of the USDOC and Elsevier, *Yearbook of World Electronics Data*, 1996.

[16] European Commission, "Measuring, Precision, and Control Instruments," *Panorama of EU Industry 95/96*, pp. 12-9 through 12-32.

[17] Germany has dropped from third to eighth place among top investing countries in research and development during the past five years. U.S. Department of State telegram, "Germany Losing the Innovation Race?," message reference No. 001426, prepared by U.S. Embassy, Bonn, Feb. 5, 1997.

[18] European Commission officials, telephone interviews by USITC staff, Feb. 19, 1997.

[19] European Commission, "Measuring, Precision, and Control Instruments," *Panorama of EU Industry 95/96*, pp. 12-9 through 12-32.

[20] Ibid.

similar rise in unit labor costs, the rise in productivity did not result in any meaningful change in gross operating rates in the EU instrument sector.[21]

Recent developments such as the EU single market program to reduce differences in technical standardization and the removal of other nontariff trade barriers should benefit the EU instrument industry by providing European companies with economies of scale in producing for an effectively larger domestic market. Those companies producing measuring, testing, and analyzing instruments for purposes of regulating and reducing environmental damage should also benefit from tighter controls required to meet growing environmental concerns.[22]

EU exports of measuring, testing, and analyzing instruments grew by an estimated average annual rate of 8 percent to almost $7 billion during 1992-96, despite a sharp contraction in 1995.[23] The United States remained the largest single country market for EU exports, accounting for almost 20 percent of the total in 1996. However, the burgeoning importance of emerging markets in the Pacific Rim region reduced the U.S. share by several percentage points over the period. Japan also is an important market for EU exports, accounting for over 5 percent of such exports in 1996.

Japan

Japanese companies have not enjoyed the overall success in measuring, testing, and analyzing instruments that U.S. companies have; however, they have done especially well within specific areas such as certain measuring apparatus, particularly weighing instrumentation.[24] After sluggish growth in 1992 and 1993, Japanese production of measuring, testing, and analyzing instruments rose moderately to $7 billion, or 10 percent of total world production in 1996.[25] Japanese companies such as Toshiba, Hitachi, Advantest, and Yokogawa Electric tend to be extremely large, particularly relative to the small and medium-sized European enterprises.[26] As such, Japanese producers benefit from a more significant corporate research infrastructure as well as the synergies and economies of scale that often accompany larger operations.[27]

Japanese exports grew negligibly from 1992-94 before rebounding remarkably during the latter years of the period to reach $3.8 billion in 1996, representing an average annual growth of 15 percent for the entire period.[28] Leading markets for Japanese exporters were the United States, the EU, and the rapidly growing economies of Asia whose growing industries require advanced measuring, testing, and analyzing instrumentation for their newly established manufacturing processes.

---

[21] European Commission officials, telephone interviews by USITC staff, Feb. 19, 1997.

[22] European Commission, "Measuring, Precision, and Control Instruments," *Panorama of EU Industry 95/96*, pp. 12-9 through 12-32.

[23] Estimated by USITC staff based on information and data in European Commission, "Measuring, Precision, and Control Instruments," *Panorama of EU Industry 95/96*, pp. 12-9 through 12-32.

[24] U.S. and European investment analysts, telephone interviews by USITC staff, Feb. 18, 1997 and European Commission, "Measuring, Precision, and Control Instruments," *Panorama of EU Industry 95/96*, pp. 12-9 through 12-32.

[25] Estimated by USITC staff based on official statistics of the USDOC and Elsevier, *Yearbook of World Electronics Data*, 1996.

[26] U.S. and Japanese investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.

[27] Ibid.

[28] Estimated by USITC staff based on official statistics of the USDOC; Elsevier, *Yearbook of World Electronics Data*, 1996; and Japanese investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.

Global Market Profile

Global consumption of the products covered by the ITA has been rising by over 5 percent annually in recent years as sales have benefited from increases in demand from clinical laboratories, and in the pharmaceutical, chemical, environmental, and food processing industries.[29] Growth in U.S. and foreign consumption has been driven by the rapid expansion of various technology-sensitive manufacturing sectors that use these instruments to increase productivity and to gain greater consistency in quality control.[30] Global efforts to expand and improve telecommunications and information infrastructures are contributing greatly to the rapid growth in high-technology equipment manufacturing sectors that use instruments such as automatic regulating and controlling instruments, instruments for measuring and checking electrical quantities, and analyzing systems to improve their manufacturing processes. In the environmental sector, as countries tighten environmental laws and establish regulatory bodies with stricter enforcement capabilities, international demand for instruments is rising due to direct demand for instruments for the analysis and monitoring of pollution particulates and secondary demand for instruments that measure and check manufacturing processes and quality control for environmental instruments. Finally, the pharmaceutical and biotechnology industries particularly have increasingly used high-performance liquid chromatographs, capillary electrophoresis instruments, and combined analytical instrumentation to improve the quality and efficiency of their production processes.

U. S. Market Profile

During 1992-96, estimated apparent consumption of measuring, testing, and analyzing instruments in the United States grew at an annual average rate of about 5 percent to $24 billion in 1996. Slightly less than one-half of this consumption is accounted for by instruments covered under the ITA. This trend is expected to continue due to rapid growth in technology-sensitive manufacturing sectors in the U.S. market that use these instruments to increase productivity and to attain greater consistency in quality control.[31]

A growing portion of U.S. apparent consumption of measuring, testing, and analytical instruments has been supplied by imports in recent years.[32] During 1992-96, U.S. imports of the instruments covered by the ITA rose by an average annual rate of 13 percent to nearly $3 billion.[33] The EU and Japan were, by far, the largest suppliers of imports to the United States, accounting for almost two-thirds of the total. Canada, Taiwan, and Mexico were also important suppliers of the measuring, testing, and analyzing instruments covered by the ITA to the United States. Most import growth has been stimulated by the availability of a growing number of advanced-technology and competitively priced foreign-made instruments. In addition, continued expansion of the liberalized telecommunications and information infrastructure in the United States has led to increased imports of telecommunications test equipment. Finally, increased intracompany trade and increased value of U.S. imports from Canada and Mexico due to NAFTA also have contributed to higher U.S. import figures. In the absence of an ITA, U.S. tariffs on measuring, testing, and analyzing instruments will range from zero on instruments used in civil aircraft to a high of 3.5 percent ad valorem on most

---

[29] U.S. and EU industry representatives, telephone interviews by USITC staff, Feb. 18-20, 1997.
[30] U.S. industry representatives, telephone interviews by USITC staff, Feb. 18-20, 1997.
[31] U.S., EU, and Japanese investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.
[32] Based on official statistics of the USDOC.
[33] Ibid.

analyzing instruments (table 9-2).[34] Thus, the ITA will result in increased market access opportunities for competitive foreign producers in the U.S. market with the elimination of these remaining tariffs.

Foreign Market Profiles

European Union

Despite an almost 10-percent decline in EU apparent consumption of measuring, testing, and analyzing instruments between 1992-93 due to sharp recessions in several EU countries, apparent consumption rebounded at an average 6-percent annual growth during the remaining years of the period to amount to $13 billion in 1996. Approximately one-half of this amount was accounted for by instruments specifically covered by the ITA. EU imports of instruments covered under the ITA during the period grew by an average annual rate of about 12 percent to $2.2 billion in 1996. The United States was the largest supplier of imports to the EU in 1996 with an estimated 25 percent of the total. Meanwhile there has been a deterioration in the shares of Japanese and Swiss producers.[35] In the absence of an ITA, EU tariffs on measuring, testing, and analyzing instruments will be similar to those in the United States, ranging from zero for most instruments used in civil aircraft to a high of 3.2 percent ad valorem for measuring instruments.[36] However, the EU will have higher tariffs (4.2 percent) than the United States (1.7 percent) for measuring and checking apparatus specifically designed for testing telecommunications apparatus. Thus, the ITA will result in improved market access opportunities in the EU for U.S. and other foreign exporters of measuring, testing, and analyzing instruments. Foreign suppliers will further benefit from increased market opportunities as a result of future EU enlargement to include new member countries.

Japan

Despite sluggish growth in the Japanese economy, Japanese apparent consumption of measuring, testing, and analyzing instruments grew by an estimated average annual rate of 5 percent during 1992-96 to approximately $10 billion in 1996.[37] Similar to the United States and the EU, instruments covered under the ITA accounted for approximately one-half of Japanese consumption. Imports contributed to a growing portion of Japanese consumption during the period, largely due to imports from affiliate assembly plants in less-developed Asian countries.[38] However, the 8-percent ratio of imports-to-apparent consumption in 1996 was still less than one-half that of the United States and the EU. The United States, the EU, Korea, Taiwan,

---

[34] *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994. The Marrakesh Protocol is part of the General Agreement on Tariffs and Trade 1994 (GATT 1994), which is a multilateral agreement that is an annex to the Agreement Establishing the World Trade Organization. See appendix G for final Uruguay Round tariffs on specific Harmonized Tariff Schedule categories.

[35] Estimated by USITC staff based on U.S. and EU investment analysts, telephone interviews by USITC staff, Feb. 18, 1997 and European Commission, "Measuring, Precision, and Control Instruments," *Panorama of EU Industry 95/96*, pp. 12-9 through 12-32.

[36] *Most-Favoured-Nation Tariff Schedules.*

[37] Estimated by USITC staff based on Elsevier, *Yearbook of World Electronics Data* 1996 and U.S. and Japanese investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.

[38] U.S. and Japanese investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.

and other East Asian countries were the principal suppliers of imported instruments to Japan during the period. In the absence of an ITA, Japan will have no tariffs on any of the measuring, testing, and analyzing instruments covered under the ITA. These duties have already been eliminated by that country.[39]

[39] *Most-Favoured-Nation Tariff Schedules.*

Table 9-2
Final Uruguay Round tariffs on measuring, testing, and analyzing instruments for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	0-16
Canada	0-5.1
Costa Rica	([2])
Estonia	0
European Communities (15)	0-4.2
Hong Kong	0
Iceland	0-5
India	25-40
Indonesia	([2])
Israel	5-16
Japan	0
Korea	8-13
Macau	0
Malaysia	0-5
New Zealand	0-2.5
Norway	([2])
Romania	0-35
Singapore	0
Switzerland	0.1-40
Taiwan[3]	0-12.5
Thailand	30
Turkey	([2])
United States	0-3.5

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994 and U.S. Department of Commerce working documents.

CHAPTER 10
Miscellaneous Products
Christopher Johnson

The miscellaneous products covered in this chapter include silicon wafers, dictionary and translation devices, indicator panels, and proximity cards and tags. Silicon wafers and indicator panels are important inputs for other information technology products while the remaining products are increasingly important tools for businesses, schools, and households.

Silicon Wafers

Silicon wafers are used for the manufacture of virtually all semiconductor devices, which in turn are the active components of almost all information technology products. Although the silicon wafer industry has been dominated by foreign-based firms since the exit of Monsanto and other smaller U.S. firms in the 1980s, the United States remains one of the largest producers of silicon wafers (figure 10-1) in the world largely by virtue of the production of U.S. foreign affiliates of Japanese and German companies (table 10-1). Even though the United States, Japan, and the EU continue to perform the more technically sophisticated processes of semiconductor wafer manufacturing, an increasing amount of production is moving to rapidly developing Asian countries such as Malaysia and Singapore as semiconductor manufacturing technologies have spread to that region of the world in recent years. All silicon wafer production is covered by the Information Technology Agreement (ITA).

U.S. Industry Profile

In 1996, U.S. shipments of silicon wafers amounted to an estimated $1.4 billion. This represented 28 percent of total world production of $5 billion in 1996.[1] The largest U.S. producers of silicon wafers are principally owned by Japanese and German chemical or industrial manufacturing companies and account for the bulk of the estimated $1.4 billion in domestic production (table 10-1).[2] For instance, SEH, based in Washington state, is an affiliate of a Japanese chemicals company, and MEMC Electronic Materials, Inc. (MEMC), located in St. Peters, MO, is an affiliate of Huels, a German-based chemicals producer which purchased MEMC from Monsanto in 1989. Four U.S.-based merchant silicon wafer producers remain, but they are very small in comparison to the industry leaders. The two largest merchant producers, Unisil and Crysteco, each generated about $22 million in sales in 1993. Unisil acquired a Japanese wafer company in 1994 and is more than doubling its capacity. Virginia Semiconductor and Recticon are small niche players. The multinational U.S.-based telecommunications and electronic producers Motorola and Lucent Technologies (formerly AT&T Technologies) also produce silicon wafers but such production is for captive supply to their own electronics and telecommunications manufacturing operations.[3]

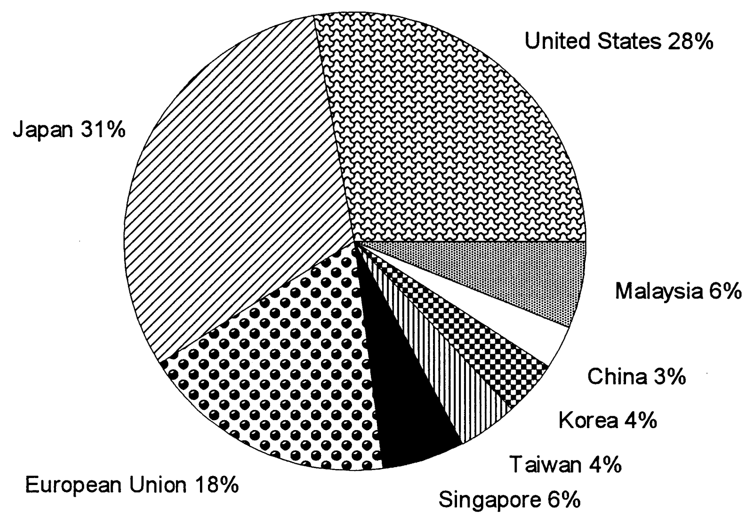
---

[1] Estimated by USITC staff based on Dataquest, *Silicon Consumption Forecast*, Jan. 1997; Rose Associates, "WW Wafer FAB Materials Forecast," *Process Materials Overview*, presentation at 1997 Industry Strategy Symposium, Pebble Beach, CA, Jan. 1997; and TASC Inc., *Assessment of the Semiconductor Wafer Processing Materials & Equipment Industry*, unpublished draft report, Nov. 1995, pp. 2-33-35 and 3-18 -20.

[2] Representatives of a U.S. affiliate of a German-based silicon wafer producer, interview by USITC staff, Spartanburg, SC, Nov. 1996.

[3] U.S. industry representatives, telephone interviews by USITC staff, Feb. 18-20, 1997.

Figure 10-1
Silicon wafers: Major producing countries, 1996



Source: Estimated by USITC staff based on TASC, *Assessment of the Semiconductor Wafer Processing Materials and Equipment Industry*, Nov. 1995 and Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

Table 10-1
Leading silicon wafer producers, 1996

United States	Foreign
Crysteco	Komatsu (Japan)
Lucent Technologies	MEMC (Germany)
Motorola	Mitsubishi Silicon (Japan)
Recticon	Okmetic (Finland)
Unisil	SEH (Japan)
Virginia Semiconductor	Siltronix (France)
	Siltron/Tymar (Korea)
	Sumitomo Sitiz (Japan)
	Toshiba (Japan)
	Tupsil (Denmark)
	Wacker (Germany)

Source: Compiled by USITC staff from various government and private sector sources.

The silicon wafer industry operates in an extremely price competitive environment. High capital investments and increasingly aggressive pricing pressures among U.S. and foreign silicon wafer producers beginning in the late 1980s have led to reduced profit margins in the industry.[4] Net income in the industry averages only 3 percent of sales when demand is strong while producers often incur losses as high as 5 percent when demand is down.[5] Low profitability was the principal reason for the exit of Monsanto and a number of smaller U.S. silicon producers from the industry during the 1980s. Declining margins also led several larger U.S. companies to divest themselves of their captive silicon wafer divisions. According to some industry analysts, foreign suppliers have shown greater resilience in remaining in the industry under such adverse profit margin conditions "because of their belief in the strategic nature of this bedrock technology."[6]

Some U.S. silicon wafer producers have been disadvantaged in recent years from insufficient manufacturing capacity. For instance, according to industry sources, some U.S. production operations have experienced periodic capacity constraints, and have been operating wafer manufacturing facilities at or near installed equipment capacity.[7] This results in missed market opportunities during periods of high demand and consequent erosion of market share for the U.S. silicon wafer industry.[8]

U.S. employment in the silicon wafer industry was an estimated 12,000 in 1996, representing a 20-percent increase from 1992.[9] Although U.S. producers of silicon wafers generally experience higher labor costs than firms in Southeast Asia, U.S. manufacturers benefit from a highly skilled workforce and efficient production processes capable of producing larger wafers than many of their foreign competitors.[10] According to industry representatives, because many semiconductor devices, or chips, are made from the same wafer, and because all chips from a particular wafer are manufactured and processed simultaneously at each stage in the device manufacturing process, the "larger sized wafers allow for a greater yield from the same semiconductor manufacturing process and allow semiconductor manufacturers to spread their fixed costs of production over a larger volume of finished products."[11]

Research and development efforts in the U.S. silicon wafer industry are driven by business strategy and focus mainly on the development and improvement of large diameter and advanced silicon wafer products and manufacturing processes, enhancing existing products, and increasing efficiency. Expenditures for product development activities[12] have averaged an estimated 6 percent of sales during 1992-96, though such expenditures have declined slightly in 1995 and 1996 due to business fluctuations.[13]

Other factors of competition in the silicon wafer manufacturing industry include quality, reliability, device line performance, flexibility, the size of each manufacturer's customer base, customer support, and

---

[4] TASC, *Assessment*, pp. 2-33-35 and 3-18 -20.

[5] U.S. industry representatives, interview by USITC staff, Spartanburg, SC, Nov. 1996 and TASC, *Assessment*, pp. 2-33-35 and 3-18 -20.

[6] TASC, *Assessment*, pp. 2-33-35 and 3-18 -20.

[7] MEMC Electronic Materials, Inc., *1995 10-K Report*, Mar. 1, 1996, p. 5 and U.S. silicon wafer industry representatives, telephone and personal interviews by USITC staff, Dec.1996-Feb. 1997.

[8] U.S. industry representatives, telephone interviews by USITC staff, Feb. 18-20, 1997.

[9] Estimated by USITC staff, based on various information sources, including company annual reports and newsletters.

[10] U.S. industry representatives, telephone interviews by USITC staff, Feb. 18-20, 1997.

[11] MEMC Electronic Materials, Inc., *1995 10-K Report*, Mar. 1, 1996, p. 5 and U.S. silicon wafer industry representatives, telephone and personal interviews by USITC staff, Dec.1996-Feb. 1997.

[12] Product development activities include both those in the laboratory and on the manufacturing lines that are included in manufacturing, administration, and technology expenses, and cost of goods sold, respectively.

[13] Estimated by USITC staff based on various information sources including company annual reports and newsletters.

breadth of product line. U.S. investment analysts assert that U.S. companies, particularly the U.S. manufacturing facilities of MEMC and SEH, compete favorably in each of these areas in world markets against competitors in Europe and Asia.

The silicon wafer industry is highly globalized. MEMC has manufacturing facilities and joint-venture arrangements in the United States, Japan, Malaysia, Korea, Italy, Taiwan, and China, while SEH has plants in the United States, Japan, Malaysia, the United Kingdom, and Taiwan. The next largest manufacturer of silicon wafers in the world is Sumitomo Sitix, a subsidiary of the large Japanese chemical and electronics conglomerate Sumitomo.

U.S. exports of silicon wafers grew by an average annual rate of over 25 percent during 1992-96 to an estimated $500 million with the largest increases during the last three years of the period.[14] The EU, Japan, Korea, Taiwan, and Singapore were the largest markets for U.S. exports. U.S. exports to Japan alone more than doubled over the period, with particularly high growth in exports in 1995 as that country's semiconductor manufacturing industry rebounded after several years of sluggish growth.[15]

Foreign Industry Profiles

The major foreign producers of silicon wafers include the European and Asian affiliates of SEH and MEMC; Sumitomo Sitix, Komatsu, and Toshiba of Japan; Wacker, Sitronix, Okmetic, and Tupsil of EU; and Siltron/Tymar of Korea (table 10-1). Leading silicon wafer producing countries in 1996 included Japan with estimated shipments of $1.6 billion, or 32 percent of global production; the EU with estimated shipments of $900 million, or 18 percent of world production; and Malaysia and Singapore, each with $300 million in shipments. Other notable producers included Taiwan, China, and Korea.

The primary strength of EU manufacturers such as Wacker and Huels in Germany are their affiliations with large chemical manufacturing companies.[16] This enables them to take advantage of long-term research and development capabilities in creating silicon products and chemical doping techniques important in silicon wafer development.[17] They also have highly trained and skilled workforces. However, the EU companies have severe disadvantages compared to U.S., Japanese, and emerging Asian producers resulting from higher labor costs and legal impediments with respect to managing labor force requirements. EU exports, primarily supplied by Germany, amounted to an estimated $300 million in 1996, with particularly substantial growth in 1995. The largest markets for EU exports were the United States and Japan. However, exports grew more rapidly to other Asian countries because of increased demand by semiconductor manufacturing producers in such countries as Malaysia and Singapore. Korea and Taiwan were also important markets.[18]

Japanese manufacturers such as Sumitomo, Mitsubishi, and Komatsu are less sophisticated than EU producers in research, development, and design capabilities.[19] However, Japanese manufacturers lead all foreign competitors in the efficiency, cost-effectiveness, and sophistication of their manufacturing

---

[14] Compiled from official statistics of the U.S. Department of Commerce (USDOC).
[15] U.S. and Japanese investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.
[16] U.S. industry representatives, interviews by USITC staff, Spartanburg, SC, Nov. 1996.
[17] U.S. industry representatives, telephone interviews by USITC staff, Feb. 18-20, 1997.
[18] Eon-Oh Lee, "Prospects for Korea's Semiconductor Industry," *Korea's Economy 1997* (Washington, DC: Korea Economic Institute of America, 1997), pp. 44-47.
[19] Japanese investment analyst, telephone interview by USITC staff, Feb. 18, 1997.

processes.[20] One Japanese company, Sumitomo Sitix, also possesses some of the advantages of the larger EU producers in benefiting from affiliation with a large chemical manufacturer.[21] Japanese exports grew by an average annual rate of more than 40 percent to $1 billion during 1992-96, with the largest growth toward the latter part of the period. The United States, followed by the EU, Korea, Thailand, and Malaysia were the largest markets for Japanese exports.

Most of the Asian producers of silicon wafers are subsidiaries of Japanese and European-owned companies.[22] The principal advantages of rapidly emerging countries such as Singapore, Malaysia, and China as manufacturing locations for silicon wafers are their low labor costs.[23] However, limitations in research, development, and design capabilities of producers in those countries limit much of their production to low-value-added silicon wafers for use in the manufacture of less-sophisticated semiconductors.[24] These limitations also make producers in these less developed Asian markets more dependent on their parent companies or contracting firms in Japan and the EU. Nevertheless, countries such as Malaysia increased their exports significantly during the period. For example, Malaysia's exports to the United States almost tripled during the period to just under $90 million in 1996.[25] The sharpest growth in Malaysian exports occurred in 1993, when manufacturing capacity for silicon wafers more than doubled for the Malaysian affiliates of the largest global silicon wafer companies.[26]

Global Market Profile

Major customers of U.S. silicon wafer companies include U.S., EU, and Asian semiconductor and electronics companies such as Intel, IBM, National Semiconductor, Philips, Samsung, SGS-Thomson Microelectronics, and Texas Instruments.[27] Demand for silicon wafers depends, in turn, on demand for semiconductors and products utilizing semiconductors. The semiconductor industry historically has been cyclical and has experienced periodic downturns, which have had an adverse impact on that industry and on suppliers to the semiconductor industry, including manufacturers of silicon wafers.[28] Geographic diversification of the operations of the major U.S., EU, and Japanese companies has partially reduced the effect of regional downturns in the semiconductor industry.

The largest markets for silicon wafers are concentrated in Japan, the United States, and the EU where semiconductor manufacturing is most predominant. These three markets together accounted for approximately 70 percent of total consumption of $5 billion in 1996, down from an estimated 80 percent of total consumption in 1992. The decline was due to increased demand for silicon wafers by semiconductor manufacturing operations in Asia. Although Korea, Singapore, and Taiwan continued to be the next largest consumers of silicon wafers during 1992-96, Southeast Asia and China are the most rapidly growing

---

[20] U.S., Japanese, and EU investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.
[21] Japanese investment analyst, telephone interview by USITC staff, Feb. 18, 1997.
[22] TASC, *Assessment*, pp. 2-33-35 and 3-18 -20.
[23] U.S., Japanese, and EU investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.
[24] Ibid.
[25] Estimated by USITC staff based on official statistics of the USDOC.
[26] U.S., Japanese, and EU investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.
[27] MEMC Electronic Materials, Inc., *1995 10-K Report*, Mar. 1, 1996, p. 5 and U.S. silicon wafer industry representatives, telephone and personal interviews by USITC staff, Dec. 1996-Feb. 1997.
[28] Ibid.

markets for wafers since they are also the fastest growing semiconductor manufacturing regions in the world, as a result of joint ventures and foreign direct investment by Japanese, U.S., and EU semiconductor producers.[29]

Imports of silicon wafers in each of the major producing areas of the world fluctuated during the period but were largely dependent upon changing capacity and product specialization conditions in the various regions. Import trends also reflected changing patterns in intracompany shipments among affiliates of the major global producers to adjust to changing demand for semiconductors. U.S. imports of silicon wafers nearly tripled during the period to an estimated $700 million in 1996.

In the absence of an ITA, India, Australia, Iceland, and New Zealand are projected to have the highest tariffs on silicon wafers among ITA participants, with customs duties of 8 percent ad valorem or higher (table 10-2).[30] Countries with tariffs of more than 5 percent but less than 8 percent will include the EU, Canada, Korea, and Norway. Thus, the ITA will result in increased market access opportunities with the elimination of the remaining tariffs in those countries. In the EU, such market opportunities will further increase with accession of new member countries as a result of EU enlargement. Neither the United States nor Japan will have any tariffs on silicon wafers.[31]

Dictionary and Translation Devices

The ITA includes all electronic machines with dictionary or translation functions. Dictionary and translation devices are a fast-growing segment of the handheld electronic device industry which also markets handheld calculators, electronic organizers, electronic books, and other personal productivity tools. Estimated total world production of dictionary and translation devices amounted to over $200 million in 1996.[32] The major producers of these devices are Japanese-owned consumer electronics producers such as Casio, Sharp, Sony, and Matsushita (table 10-3). However, although the design, research, and development of these products is conducted principally in Japan, an increasing number of these products are manufactured in lower wage countries in Southeast Asia such as Malaysia and China. Franklin Electronic Publishers Inc. of the United Kingdom, the world's largest publisher of electronic books, is also a major supplier of dictionary and foreign language translation devices;[33] however, its devices are also largely manufactured in the Asia-Pacific region.[34]

---

[29] U.S., Japanese, and EU investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.

[30] *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994. The Marrakesh Protocol is part of the General Agreement on Tariffs and Trade 1994 (GATT 1994), which is a multilateral agreement that is an annex to the Agreement Establishing the World Trade Organization. See appendix G for specific Harmonized Tariff Schedule categories.

[31] Ibid.

[32] Estimated by USITC staff based on information provided by U.S. and Japanese investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.

[33] "Franklin Named Number One Handheld Electronic Brand in United Kingdom," *New Release*, Jan. 30, 1997, pp. 1-2.

[34] U.S. retailers, interviews by USITC staff, Silver Spring and Laurel, MD, Feb. 8, 1997.

Table 10-2
Final Uruguay Round tariffs on silicon wafers for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	10
Canada	6.5
Costa Rica	([2])
Estonia	0
European Communities (15)	6.5
Hong Kong	([2])
Iceland	10
India	40
Indonesia	([2])
Israel	5
Japan	0
Korea	6.5
Macau	([2])
Malaysia	([2])
New Zealand	8
Norway	6
Romania	0.5
Singapore	6.5
Switzerland	0.1-1.5
Taiwan[3]	([2])
Thailand	([2])
Turkey	([2])
United States	0

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final* Act *Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994, and U.S. Department of Commerce working documents.

Table 10-3
Leading global dictionary and translation device producers, 1996

Company	Country
Casio	Japan
Sharp	Japan
Sony	Japan
Matsushita	Japan
Samsung	Korea
Goldstar	Korea
Franklin Publishers	United Kingdom

Source: Compiled by USITC staff from various government and private sector sources.

U.S. Industry Profile

U.S. production of dictionary and translation devices is believed to be negligible (figure 10-2).[35] However, U.S. producers supply many critical components used in dictionary and translation devices including software and electronic components. In addition to larger software and electronic component producers, a number of smaller producers have written software used in the principally Asian-manufactured dictionary and translation devices.[36] In fact, producers of dictionary and translation devices are likely to face increasing competition from dictionary and translation applications software developed for PCs and other computers.[37]

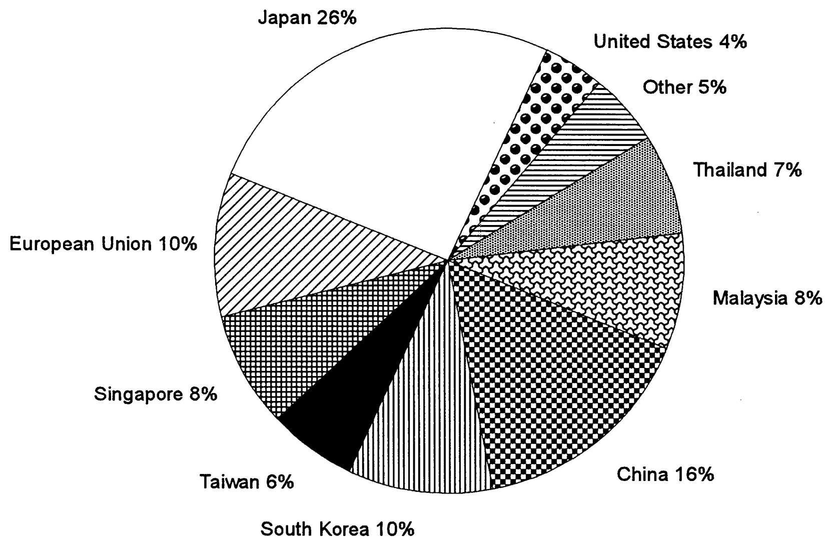
Much of the research and development relevant to the handheld electronic device industry is in components such as software and electronic components, including microprocessors and liquid crystal displays covered elsewhere in this report. Much of the design and development directly applicable to the dictionary and translation devices themselves is related to packaging of the devices.

Global Market Profile

The United States, followed by the EU and Japan, are the largest consumers of translation and dictionary devices. In the United States and the EU almost all of these devices are imported. Japan, followed by China and Korea, and rapidly developing Asian countries (including Malaysia, China, Taiwan, Thailand, and Singapore) are the principal suppliers of imports of dictionary and translation devices to the major industrialized countries.[38] Total U.S. consumption of dictionary and translation devices amounted to

[35] Ibid.
[36] U.S. and Japanese investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.
[37] U.S. retailers, interviews by USITC staff, Silver Spring and Laurel, MD, Feb. 8, 1997.
[38] U.S. and Japanese investment analysts, telephone interviews by USITC staff, Feb. 18-20, 1997.

Figure 10-2
Dictionary and translation devices: Major producing countries, 1996



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996) and official statistics of the U.S. Department of Commerce.

almost $100 million in 1996.[39] Although imports in the United States, the EU, and Japan grew rapidly during 1992-96, consumer demand for these products is expected to moderate as demand for more general software programs containing dictionary and translation functions increases. In the absence of an ITA, the EU will have tariffs of as high as 4 percent on dictionary and translation devices (table 10-4). Thus, the ITA will result in increased market opportunities for competitive U.S. and other foreign suppliers to the EU market. The opportunities in the EU market will further increase with EU enlargement. U.S. tariffs will be negligible and Japan will have no tariffs in the absence of an ITA.

Indicator Panels

The Information Technology Agreement includes indicator panels that incorporate liquid crystal devices (LCDs) or light emitting diodes (LEDs) and parts of such indicators. Indicator panels incorporating LCDs and LEDs often appear as illuminated figures or letters on the face of instruments, boxes, boards, or panels. They are used to signal and present quantitative data and qualitative information on such products as instruments, scales, household appliances, electronic devices, and emergency and other signaling devices such as pagers and timers. Indicator panels are often used in hospitals, offices, hotels, and factories for calling

---

[39] Estimated by USITC staff, based on personal and telephone interviews with U.S. industry representatives, Feb. 1996.

Table 10-4
Final Uruguay Round tariffs on dictionary and translation devices for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	([2])
Canada	([2])
Costa Rica	([2])
Estonia	0
European Communities (15)	([2])
Hong Kong	([2])
Iceland	([2])
India	40
Indonesia	([2])
Israel	([2])
Japan	([2])
Korea	([2])
Macau	([2])
Malaysia	([2])
New Zealand	([2])
Norway	([2])
Romania	([2])
Singapore	([2])
Switzerland	([2])
Taiwan[3]	([2])
Thailand	([2])
Turkey	([2])
United States	1.6

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final* Act *Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994, and U.S. Department of Commerce working documents.

personnel, indicating where a certain person or service is required, and whether a room is free or not. However, only those indicator panels incorporating LCDs and LEDs are covered here and in the sections that follow.

Global Industry Profile

Japan is by far the largest producer of indicator panels in the world, accounting for $2 billion, or approximately one-half of total global production of $4 billion in 1996 (figure 10-3). The United States is the second largest producer, accounting for just over $500 million, or 13 percent, of total world production in 1996. The EU produced just slightly less than the United States in 1996. Other leading producers of indicator panels included Thailand, Hong Kong, the Philippines, Taiwan, Malaysia, Korea, and China (table 10-5).

U.S. and EU manufacturers of instruments and other equipment incorporating LCD and LED indicator panels depend largely on contract manufacturing and assembly in Asia for final production of their indicator panels. The bulk of the U.S. and EU production in this industry consists of the design and manufacture of parts and subassemblies of panel indicators. These parts are exported to Japan and other Asian countries for incorporation into finished indicator panels. Although major U.S. and EU electronics companies were among the first to develop LED and LCD technology, they have not been nearly as successful as the Japanese in developing low-cost, mass production techniques for manufacturing LCD indicator panels on a large scale.

Japan's position as the leading producer and exporter of indicator panels is also increasingly due to its clear leadership in LCD technology and output.[40] Major advances in display technology, and large price cuts from production increases, have enabled Japanese producers to focus on small-footprint, flicker-free alternatives to larger indicator panels. As a result, Japanese LCD indicator panels are increasingly used on handheld electronic instruments and personal information tools. Major improvements have included increased brightness and viewing angles to many more applications.

Other leading Asian suppliers of indicator panels, such as Thailand, Hong Kong, the Philippines, Malaysia, and China, produce less technologically sophisticated indicator panels, particularly those incorporating LED technology.[41] Their chief competitive advantage consists of low-labor costs and well-trained electronic assembly workers. Although Korea is far behind Japan as a major global producer of LCD indicators, industry analysts expect it to become a serious challenger to Japan in this area, too, with four suppliers currently active in Korea. In Taiwan, government-sponsored R&D aimed at bringing advanced LCD production to the island to support the massive notebook PC industry should also assist the country increase its capabilities as a major global supplier of LCD indicator panels.

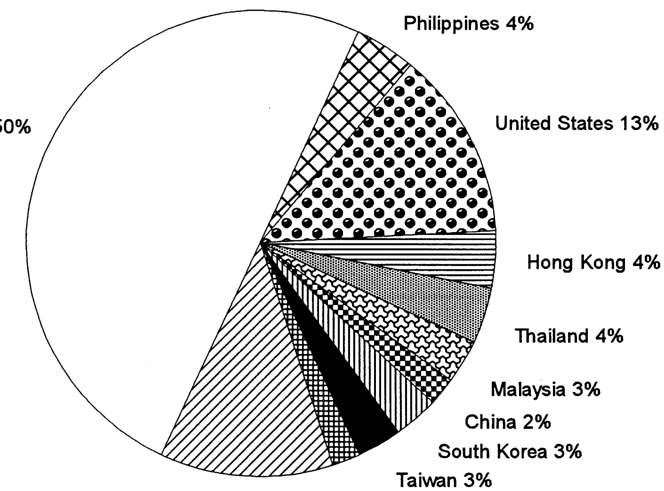
Global Market Profile

The United States, the EU, and Japan are the leading consumers of indicator panels incorporating LED and LCD technology. Consumption patterns fluctuate primarily by demand for the products in which the indicator panels are incorporated. During 1992-1996, U.S. consumption of indicator panels almost

---

[40] "Displays: High Outputs Making TFT Top LCD Technology," *Multimedia Products*, July 1996, pp. 128-144.
[41] Ibid.

Figure 10-3
Indicator panels: Major producing countries, 1996



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

Table 10-5
Leading indicator panel producers, 1996

Ledtronics, Incorporated
Wavetec Corporation
VAS Engineering
Lumex Opto/Components, Incorporated
Marl International Limited

Source: Compiled by USITC staff from various government and private sector sources.

doubled to just under $1.4 billion. This was due to an increase in U.S. consumption of increasingly sophisticated testing, measuring, and signaling instrumentation, incorporating Japanese advances in LCD indicator panel technology. Over one-half of U.S. apparent consumption of indicator panels was supplied by imports. Japan was by far the leading supplier of U.S. imports of indicator panels, accounting for over 40 percent of all such devices, and almost 60 percent of all LCD indicator panels in 1996. Lesser developed Asian countries, such as Malaysia, Thailand, and the Philippines were the largest suppliers of U.S. imports of LED indicator panels. In the absence of an ITA, Thailand, Singapore, New Zealand, Iceland, Korea, and Australia will have the highest tariff rates on indicator panels, all exceeding 10 percent ad valorem (table 10-6). In the middle range will be Canada and the EU, with tariffs ranging from 4-6.8 percent ad valorem.[42] The United States has customs duties of just 1.3 percent, while Japan, Malaysia, and Estonia will have no tariffs on indicator panels in the absence of an ITA. As a result of the ITA, market access opportunities will increase most in those markets above which would otherwise have the highest tariffs in the absence of an ITA. Market access opportunities in the EU will grow further with future EU enlargement.

Proximity Cards and Tags

The ITA includes all proximity cards and tags. Proximity cards and tags are devices that utilize electronic sensor technology to permit entry into rooms, buildings, or other controlled spaces and that eliminate the requirement for physical contact between card and reader.[43] They can also be used for inventory security in stores and as bus and subway passes.[44] Many proximity cards and tags are field programmable to enable easy installer encoding. This industry is dominated by a handful of companies worldwide, with two U.S. producers accounting for the largest portion of world production (figure 10-4), which amounted to an estimated $10 million in 1996.[45] Major foreign competitors are in the EU, Canada, and Japan.

U.S. Industry Profile

The manufacture of proximity cards in the United States is done primarily by HID Corporation (HID)[46] and Indala Corp. (Indala), a subsidiary of Motorola (table 10-7).[47] Other U.S. suppliers include Texas Instruments, Wiegand Corp., Match Right, DataCard Corporation, and CoTAG, Inc. During 1992-96,

---

[42] *Most-Favoured-Nation Tariff Schedules.*

[43] Proximity card technology consists of incorporating radio frequency identification electronics in thin, plastic packages approximately the size of a standard credit card or a device approximately the size of an automotive key. The electronics of a proximity card consist of one integrated circuit and antenna embedded in the plastic body of the card. The integrated circuit contains nonvolatile memory to hold identification information, capacitors to absorb energy from the antenna; and digital-to-analog conversion capability to convert the digital data contained in the integrated circuit memory to radio frequency signals for transmission to the reader via the card antenna. Naval Surface Warfare Center, Integrated Security Systems Branch, "Overview and Applications of Proximity Card Technology," *Integrated Security and Identification System Project*, Feb. 25, 1996, pp. 1-5.

[44] World Wide Web, retrieved Feb. 12, 1997, U.S. Department of Transportation, http://www.fta.dot.gov., "Proximity Cards," *Electronic Fare Payment*, 1996, A-3.

[45] Frost & Sullivan, *Electronic Security Systems*, 1996, p. 1.

[46] HID Corporation was divested by Hughes Corporation as an independent company in 1996.

[47] The vast majority of proximity-card systems sold involve communication of the card to the reader with no communication from the reader to the card. However, HID Corporation sells a relatively expensive proximity-card system that has the capability of the reader communicating and changing information in the card. Indala Corporation plans to offer a similar product soon. Naval Surface Warfare Center, Integrated Security Systems Branch, "Overview and Applications of Proximity Card Technology," *Integrated Security and Identification System Project*, Feb. 25, 1996, pp. 1-5.

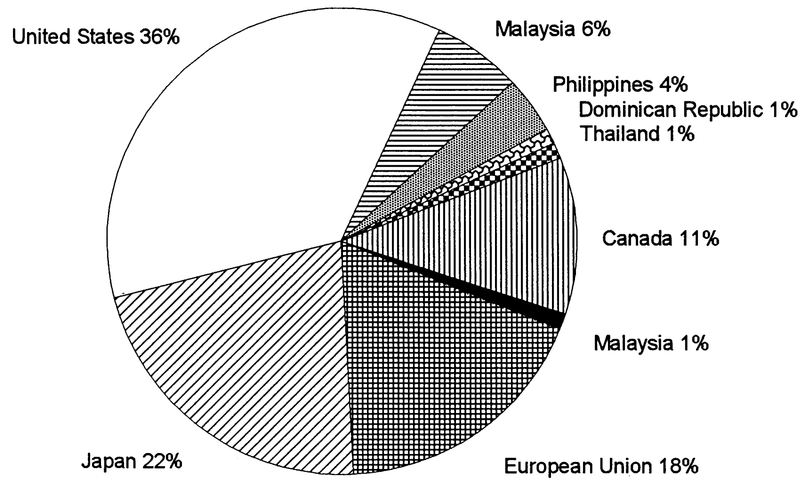
Table 10-6
Final Uruguay Round tariffs on indicator panels for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	10
Canada	0-6.8
Costa Rica	([2])
Estonia	0
European Communities (15)	0-4
Hong Kong	([2])
Iceland	15-24
India	([2])
Indonesia	([2])
Israel	([2])
Japan	0
Korea	13
Macau	([2])
Malaysia	0
New Zealand	20
Norway	3
Romania	0.5
Singapore	25
Switzerland	0.1-29
Taiwan[3]	([2])
Thailand	30
Turkey	([2])
United States	1-3

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final* Act *Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994, and U.S. Department of Commerce working documents.

Figure 10-4
Proximity cards: Major producing countries, 1996



Source: Estimated by USITC staff based on Elsevier Advanced Technology, *Yearbook of World Electronics Data* (Oxford: Elsevier Science Ltd., 1996).

total U.S. shipments of proximity cards increased by an average annual rate of 18 percent to an estimated $5 million.

Both HID and Indala have received contracts and R&D support sponsored by the Department of Defense to develop access control systems to ensure that authorized personnel are granted access to secure defense facilities while denying access to unauthorized individuals.[48] Although proximity-card technology has existed for a number of years, the cost of such systems was not practical for most commercial

Table 10-7
Leading proximity card producers, 1996

United States	Foreign
CoTag Corp. Data Card Corp. HID Corp. Indala Corp (Motorola) Match Right Texas Instruments Wiegand Corp.	Buscom Oi (Finland) Cortex Security and Control (Canada) Diesler (Germany) PAC International (UK)

Source: Compiled by USITC staff from various government and private sector sources.

[48] U.S. industry representative, telephone interview by USITC staff, Feb. 11, 1997.

applications until recently. During the past decade, proximity card sales have increased significantly as proximity-card system prices have fallen with the reduction in costs associated with integrated-circuit technology.[49]

Major factors of competition in the industry include acquisition price and maintenance costs over a relatively long period, quality factors including operational and technical properties, the experience and reliability of the supplier, delivery time, and technical support and maintenance services offered by the supplier. Exports accounted for about one-third of total U.S. shipments of proximity devices in 1996, or $3 million, up from about 10 percent in 1992 due to increasing interest in use of proximity technology for industrial, commercial, and government security purposes in Japan and the EU.

Foreign Industry Profile

The major foreign producers of proximity cards are Diesler, Buscom Oi, and PAC International of the EU, and Cortex Security and Control Systems and Diesler of Canada. Buscom Oi, a major Finnish manufacturer of proximity cards, primarily supplies these cards and the electronic devices for reading them throughout Scandinavia. However, it has also supplies cards to Germany. In 1996, Buscom Oi joined a consortium led by Olivetti's Finnish subsidiary Olivetti Oi as the supplier of proximity cards for a new electronic fare collection system that employs proximity technology to identify riders and permit entry to the transit system. The EU and other foreign countries exported less of their own domestic production than did the United States.

Diesler of Germany, believed to be the largest EU producer of proximity cards, also manufactures proximity cards in Canada. Diesler has not had much success in penetrating the U.S. market.[50] None of these companies has the advanced technological capabilities in proximity technology that the two major U.S. producers possess.

Global Market Profile

The major consumers of proximity cards are the United States, EU, and Japan, but demand for proximity cards is expanding rapidly throughout the world due to increased concerns and requirements for maintaining secure environments not only in military and government facilities and spaces but in the industrial and commercial sectors as well. The United States was the largest consumer of proximity cards in the world during 1992-96, accounting for nearly one-half of the total. However, the EU and Japanese markets for these cards are growing fast. Imports are of increasing importance in the U.S. market, accounting for approximately 10 percent of apparent consumption. However, imports account for a much more substantial portion of total consumption in the EU, Japan, and other foreign markets. In the absence of an ITA, U.S. tariffs on proximity cards will be 3.1 percent (table 10-8). Thus, an ITA will result in increased market opportunities for foreign suppliers of proximity cards and tags to the United States and to the markets of other ITA participants that would otherwise maintain tariffs on such products. U.S. and other foreign producers of proximity cards and tags should further benefit from increased market opportunities in the EU as a result of future EU enlargement to include additional European countries.

---

[49] Investment analysts, telephone interviews by USITC staff, Feb. 18, 1997.

[50] U.S. industry representative, telephone interview by USITC staff, Feb. 12, 1997 and Frost & Sullivan, *Electronic Security Systems*, 1996, p. 1.

Table 10-8
Final Uruguay Round tariffs on proximity cards and tags for ITA participants

Participants	Ad Valorem Rate[1] as of Jan. 1, 1999
Australia	([2])
Canada	([2])
Costa Rica	([2])
Estonia	0
European Communities (15)	([2])
Hong Kong	([2])
Iceland	([2])
India	40
Indonesia	([2])
Israel	5
Japan	([2])
Korea	([2])
Macau	([2])
Malaysia	([2])
New Zealand	([2])
Norway	([2])
Romania	([2])
Singapore	([2])
Switzerland	([2])
Taiwan[3]	([2])
Thailand	([2])
Turkey	([2])
United States	3.1

[1] Ranges are indicative of the range of ad valorem rates on all products in the sector.
[2] Not available.
[3] Taiwan has not yet acceded to the WTO. Tariff rates are based on DOC documents showing 1992 unbound rates.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final* Act *Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994, and U.S. Department of Commerce working documents.

CHAPTER 11
Distilled Spirits
USITC Staff

At the same time the Information Technology Agreement (ITA) was agreed upon, a reciprocal agreement was made between the European Union (EU) and the United States on distilled spirits. The agreement includes both brown and white distilled spirits[1] but it does not extend to ethyl alcohol, beer, wine, malts, or other alcoholic beverages. The agreement stipulates that the United States and the EU will eliminate tariffs on an MFN basis on whisk(e)y,[2] brandy, gin, vodka, liqueurs, cordials and certain other distilled spirits in four equal stages beginning on July 1, 1997, and ending on January 1, 2000. Tariff reductions on "high quality" rum will be staged to 2003 and a series of price breaks for bulk and bottled rum will exclude low cost rum from the agreement. For a description of this agreement, see appendix E.

Distillation is the process of boiling fermented fruit or plant juice, or a starchy mixture that has been fermented, then collecting and condensing the alcohol vapors released during the boiling. Today's state-of-the-art distillation technology has not changed drastically since the 1820s.[3] Whisk(e)ys and white spirits result most often from distilling grain; brandies result from distilling grape wine, grape marc, or other fruit; and rums and cane spirits result from distilling such sugar cane-based materials as molasses.[4]

The production of distilled spirits[5] is concentrated in a few geographical areas. The United States and the EU are the largest producers of distilled spirits and accounted for more than 40 percent of total world production in 1996 (figure 11-1). Although distilled spirits are manufactured in nearly every country in the world, these two producers, together with the Former Soviet Union, Brazil, and Japan are responsible for more than three-quarters of world production. This chapter will profile only the participants in the distilled spirits agreement, the United States and the EU.

U.S. Industry Profile

U.S. distilled spirits production in 1996 was estimated at $3.8 billion, an increase of about 1 percent from 1995 and about 11 percent since 1992.[6] The growth rate in the value of production, although low, was

[1] Whisk(e)ys and brandies are classified as brown spirits and all other distilled spirits are white. U.S. Distilled Spirits Council (DISCUS), telephone interview by USITC staff, Jan. 22, 1997.

[2] For products of U.S. origin, the spelling is whiskey and for products originating elsewhere it is whisky. The term whisk(e)y will be used when both types are discussed.

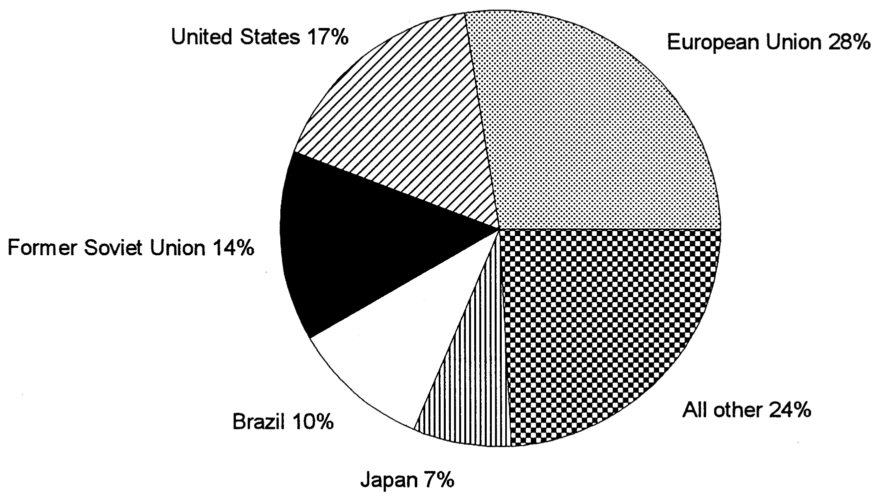
[3] Implications of an unchanging distillation technology may result in reduced producer competition through cost-cutting innovations, decreased incentives for new producers to enter the industry, and an ability of government authorities to influence production and consumption through tax policy and new regulations.

[4] Marc is the pulpy residue left after the juice has been pressed from grapes, apples, or other fruits. G. Brown, *Classic Spirits of the World: A Comprehensive Guide*, pp. 59-70, 153-188, and 191-193.

[5] The distilled spirits industry includes SIC 2085, Distilled and Blended Liquors; part of SIC 2084, Wines, Brandy, and Brandy Spirits, except where noted; and part of SIC 5182, Wine and Distilled Alcoholic Beverages, which includes bottling of some U.S. distilled spirits imports.

[6] As reported and estimated from A. Darnay, ed. *Manufacturing USA: Industry Analyses, Statistics, and Leading Companies,* 5th Edition, vol. 1, (Detroit, MI: Gale Research Inc., 1996), and based on Census of Manufactures statistics, which do not include taxes or imports. Production is measured in value for SIC 2085 and excludes brandy. Brandy production is estimated at 5 percent of SIC 2084, or about $250 million in 1996.

Figure 11-1
Distilled spirits: Share of world production, by major producers, 1996



1996 world production: 3.8 million liters pure alcohol

Source: Estimated by the staff of the USITC based on Produktshap Voor Gedistilleerde Dranken, *World Drink Trends 1996*, (NTC Publications Ltd., UK) 1996.

positive during 1992-96; however, the volume of production declined over the same period. The Adams/Jobson Beverage Group characterizes the industry as "stagnant," with case sales, production, per capita consumption, and employment having continuously declined over the last decade and a half, and with such downward trends expected to continue. For 1991-95, the volume of U.S. distilled spirit production fell by nearly 5 percent.[7]

Industry analysts estimate that employment in the U.S. distilled spirits industry fell from 7,100 in 1992 to 4,900 in 1996.[8] The drop in employment was partly in response to declining volume production caused by falling distilled spirits consumption and partly attributable to restructuring and downsizing of U.S. distilleries and/or their parent companies.[9] According to Standard and Poor's, 1995 and 1996 were challenging years for the nation's leading distilled beverage companies.[10] The restructuring, downsizing, and cost-cutting that are occurring in the distilled spirits industry are expected to continue contributing to the long term decline in industry labor levels. However, there are certain sub-sectors that have been growing. New products such as flavored vodkas have been successfully marketed on an increasing scale.[11] Aggressive advertising has created demands for such products as single-malt Scotches and imported vodkas at the expense of less expensive domestically produced whiskeys and vodkas.[12]

---

[7] Adams/Jobson Beverage Group, *Adams/Jobson's 1996 Liquor Handbook* (New York, NY: Adams/Jobson Publishing Company, 1996), pp. 4 and 250-251.

[8] Darnay, ed., *Manufacturing USA,* p. 171. Employment is only for SIC 2085. The 1996 value is projected.

[9] Adams/Jobson Beverage Group, *Adams/Jobson's 1996 Liquor Handbook,* p. 5.

[10] *Standard and Poor's Industry Surveys: Alcoholic Beverages & Tobacco,* Apr. 25, 1996, pp. F4-F5.

[11] Adams/Jobson Beverage Group, *Adams/Jobson's 1996 Liquor Handbook,* p. 4.

[12] Ibid.

The distilled spirits industry in the United States consists of a few large companies that account for the bulk of production and a number of smaller firms that serve niche markets or have supplier relationships with the larger companies. There were 43 establishments in the United States in 1996, a decline of 34 percent since 1992.[13] In 1992, the most recent year for which official data are available, the four largest companies in the United States accounted for 62 percent of domestic production and the eight largest companies accounted for 82 percent of domestic production.[14] Industry data for more recent years indicate that ten companies account for over 80 percent of sales in the U.S. market, with the top three accounting for more than 40 percent of the volume.[15] Most of the largest distilled spirits producers are diversified companies that make numerous other products, principally consumer goods. In addition, most have extensive alliances with foreign producers and own distilleries in many different countries (table 11-1). The major distilled spirits companies operating in the United States are Joseph E. Seagram and Sons; Brown-Forman; Jim Beam Brands, an American Brands subsidiary; Bacardi, a Bermuda-headquartered firm; Heublein, a subsidiary of the U.K. firm Grand Metropolitan; and United Distillers, a subsidiary of the U.K. firm Guinness.

In the U.S. distilled spirits industry, multinational and multi-industry conglomerates compete with each other and with independent distilleries. These conglomerates often produce and market distilled spirits in the United States, own foreign distilleries that compete with U.S.-made products, export U.S.-produced distilled spirits abroad, and import foreign distilled spirits into the United States. International alliances are a necessity in the distilled spirits industry and all of the larger firms have established global distribution and supply networks. Because well known brand names are so important to success and distribution networks are expensive and difficult to maintain, companies form alliances with foreign producers that broaden their product lines and at the same time give them access to established distribution systems. Some alliances are simple marketing agreements, others are mergers. An example of the latter is the Bacardi-Martini & Rossi merger which significantly broadened the product lines of the two companies with complementary products and gave Bacardi access to an extensive European distribution network.[16]

Alliances are crucial to increasing breadth of product line and, in turn, customer base in the distilled industry since many spirits are only produced in certain geographic areas. Whisk(e)y is an example of this type of regional production; bourbon is only produced in the United States, Scotch in Scotland, Canadian whisky in Canada, and Irish whisky in Ireland. In order to meet consumer demands for each of these whisk(e)ys, firms must either own or enter into agreements with distilleries in these locations. Regionalization of production affects other distilled spirits as well. Cognac is only produced in a certain region of France and, although it is a type of brandy, consumers perceive a difference between cognac and brandies produced elsewhere. In fact, Hennessy cognac has the largest share of the U.S. market for cognac.

A typical example of the web of foreign ownership, domestic ownership, and agency marketing relationships for distilled spirit merchandisers with U.S. market interests is The Seagram Company Ltd. Seagrams, directly or through affiliates and joint ventures in 41 countries and territories, produces, markets, and distributes more than 225 brands of distilled spirits and more than 210 brands of wines, which are sold in over 150 countries and territories. Some of these products are sold worldwide and others only in the

---

[13] Darnay, ed., *Manufacturing USA,* p. 171. The 1996 number is projected.

[14] World Wide Web, retrieved Mar. 28, 1997, Bureau of the Census, http://www.census.gov/mcd/mancen/download/mc92cr.sum, *1992 Census of Manufactures Report MC92-S-2,* "Concentration Ratios in Manufacturing."

[15] *Standard & Poor's Industry Surveys: Alcoholic Beverages & Tobacco* (New York: McGraw-Hill, 1997), p. 6.

[16] World Wide Web, retrieved Mar. 31, 1997, Barcardi, http://www.bacardi.com/textonly/corporate.html, "Club Bacardi: Family History."

Table 11-1
Major U.S. distilled spirits producers, location of production facilities, and selected products

Company (headquarters location)	Distilled spirits: Production location	Distilled spirits: Products	Other products and lines of businesses
Joseph E. Seagram & Sons (Canada)	North America South America Europe Asia Australia	whisk(e)ys cognacs gin rum premixed drinks	wines fruit juices entertainment (film and music) theme parks publishing
Brown-Forman (United States)	United States Canada U.S. Virgin Islands Ireland Italy	whisk(e)ys tequila brandies premixed drinks	wines and beer fine china and crystal silver and pewter giftware luggage business cases and personal leather accessories
American Brands (United States)	United States Canada Australia United Kingdom	whisk(e)ys gin vodka cordials	hardware and home improvement products office products golf and leisure products tobacco products (scheduled to be divested)
Heublein (subsidiary of IDV and Grand Metropolitan) (United Kingdom)	North America Europe	whisk(e)ys brandies vodka tequila liqueurs premixed drinks	wines food products restaurants
Bacardi-Martini USA (Bermuda)	North America Central America South America the Caribbean Europe	rum whisk(e)ys brandies gin tequila vodka	vermouth port wine and beer
United Distillers USA (United Kingdom)	North America Europe	whisk(e)ys gin vodka brandies	beer and wine luggage leather goods and accessories perfumes and beauty products

Source: Compiled by the staff of the USITC.

geographic area where they are produced. In addition to marketing company-owned brands, the company also distributes spirits and wines produced by others.[17]

The U.S. distilled spirits industry's major input costs are neutral spirits, aged whiskey, and glass containers, which combined account for over 60 percent.[18] Materials for packaging, cooperage, and feed grains each account for less than 10 percent of industry input costs.[19] Although higher packaging costs in early 1995 were generally covered by price increases, competitive conditions remained difficult in most established markets with continued downward pressure on profit margins since markets in both the United States and in mature regions abroad are either declining or barely growing. Because the industry is not labor intensive and input costs are rising, it is difficult for distilled spirits manufacturers to cut costs of production. Some firms, such as American Brands, have invested in state-of-the-art packaging equipment and have switched from glass to plastic containers for some products to reduce costs.[20]

A vast array of Federal, State, and local regulations affect all aspects of the industry, including marketing and advertising, pricing, brand registration, container sizes, sales, distribution, taxation, the number and type of permissible establishments, and licenses for manufacturers and sellers. These regulations affect both domestic and imported spirits equally and have the effect of increasing companies' costs to some extent. Federal regulation of the industry is uniform nationwide and, although distilled spirits companies must operate within these regulations, they are transparent and stable.[21] More problematic are State and local government regulations which vary widely. Regulation is used as a source of revenue and as a way of fighting alcohol abuse, by imposing taxes at levels high enough to reduce sales and consumption, and by regulating prices.

State regulations may be more strict than, but must not conflict with, Federal laws. The widely varying State and local government regulations prevent a firm from devising marketing, distribution, and production plans on a national scale. For example, a distillery must market its products to private entrepreneurs in some states and localities, but must market to state liquor control authorities in others. Such restrictions limit competitiveness by restricting the number of retail outlets, pricing policies, and type of enterprises that can merchandize distilled spirit products. Vertical integration is not permitted in this industry; the United States has a strict three-tier system separating producers from wholesalers and retailers.[22]

A typical bottle of spirits is taxed at far higher rates than most other products--the Distilled Spirits Council of the United States (DISCUS) claims seven times higher. On average, taxes make up 44 percent of the retail price on a typical 750 ml bottle of 80 proof spirits.[23] In addition, Federal and many State and local governments place unique taxes or higher levels of taxes on distilled spirits products. These added taxes are often of two types, excise taxes and such ad valorem taxes as sales taxes. Excise taxes are levied on producers, raise production costs and prices, and result in decreased consumption.[24] The Federal excise tax on distilled spirits was raised by 19 percent in 1985 and by 8 percent in 1991, and is currently $13.50 per

---

[17] Seagram Co. Ltd., *10-K Report*, for the transition period from Feb. 1, 1996 to June 30, 1996.

[18] Darney, ed., *Manufacturing USA*. The 1996 number is projected.

[19] U.S. Department of Commerce (USDOC), *Benchmark Input-Output Accounts for the U.S. Economy 1982* (Washington, DC: GPO, July 1991) and Darney, ed., *Manufacturing USA*, p. 171. The 1996 number is projected..

[20] World Wide Web, retrieved Mar. 1, 1997, American Brands, http://www.ambrands.com/finance/fininfo.htm), *1995 Annual Report*.

[21] Industry representative, telephone interview by USITC staff, Jan. 22, 1997.

[22] DISCUS, *Summary of State Laws & Regulations Relating to Distilled Spirits*, 29th ed., Jan. 1996, p. 1-10.

[23] World Wide Web, retrieved Mar. 31, 1997, DISCUS, http://www.discus.health.org/udrink/udrink3.html, DISCUS, "The Extra Tax Burden on Distilled Spirits."

[24] J. Gould and C. Ferguson, *Microeconomic Theory* (Homewood, IL: Richard D. Irwin, Inc., 1980), pp. 279-281.

proof gallon.[25] Ad valorem taxes such as sales taxes imposed on distilled spirits by State and local governments decrease consumption by directly raising the price paid for the product.[26]

Competition among various distilled spirits producers is focused on marketing efforts, increased advertising, and promotional efforts to switch brand or related product allegiances, rather than on technological innovation in the production process. In 1995, total U.S. advertising expenditures for distilled spirits increased 12.4 percent to $230.5 million, reversing a 5-year downward trend.[27] Magazine advertising, which accounted for 87 percent of total advertising in 1995, increased by 17 percent to over $200 million. Broadcast advertising increased by 88 percent in 1995, but represented less than 0.2 percent of total advertising. While general promotions dropped by 50 percent, more money is being spent on brand promotions.[28]

U.S. exports of distilled spirits grew from $335 million in 1992 to $385 million in 1996, an increase of 15 percent. The largest markets for U.S. distilled spirits exports in 1996 were the EU, Japan, and Australia. The EU's share of U.S. exports grew from 32 percent in 1992 to 41 percent in 1996, while Japan's share fell from 33 percent in 1992 to 19 percent in 1996 (figure 11-2).[29]

Whiskey was by far the largest export in 1996, accounting for over three-quarters of total U.S. exports. No other single product exceeded 5 percent of total U.S. exports. Exports of whiskey increased by slightly more than $40 million from 1992-96, or by nearly 20 percent, and the EU market accounted for one-half of U.S. whiskey exports. Rum, produced in Puerto Rico and the Virgin Islands, is among the fastest growing exported distilled spirits, growing by about 48 percent between 1995 and 1996, to $19 million. Foreign demand for U.S. exports of distilled spirits is affected by a variety of market factors in other countries, such as tastes and preferences. Currently, bourbon and rum are gaining in popularity in the EU at the expense of EU-produced whisky and other brown spirits.

European Union Industry Profile

The EU is the world's largest producer of distilled spirits.[30] EU production in 1996 was estimated at 14.3 billion ECU, or $18.2 billion, a 2-percent increase over 1992.[31] From 1992-1996, EU spirits production (in ECUs) has remained relatively flat.[32] From 1992 to 1996, employment in the spirits industry declined moderately from 44,700 to an estimated 38,000, or by 15 percent;[33] in comparison, U.S.

---

[25] DISCUS, "The Extra Burden on Distilled Spirits." Information on the increases in Federal excise taxes was received by USITC staff in a facsimile transmission from DISCUS, Feb. 5, 1997. A proof gallon is a gallon of liquid at 15.56°C (60°F) which contains 50 percent (100 proof) by volume of ethyl alcohol having a specific gravity of 0.7939 at 15.56°C (60°F) referred to water at 15.56°C (60°F) as unity or the alcoholic equivalent thereof.

[26] Gould and Ferguson, *Microeconomic Theory*, pp. 284-285.

[27] Adams/Jobson Beverage Group, *Adams/Jobson's 1996 Liquor Handbook*, p. 227.

[28] Ibid.

[29] All U.S. import and export data are compiled from official statistics of the USDOC unless otherwise noted.

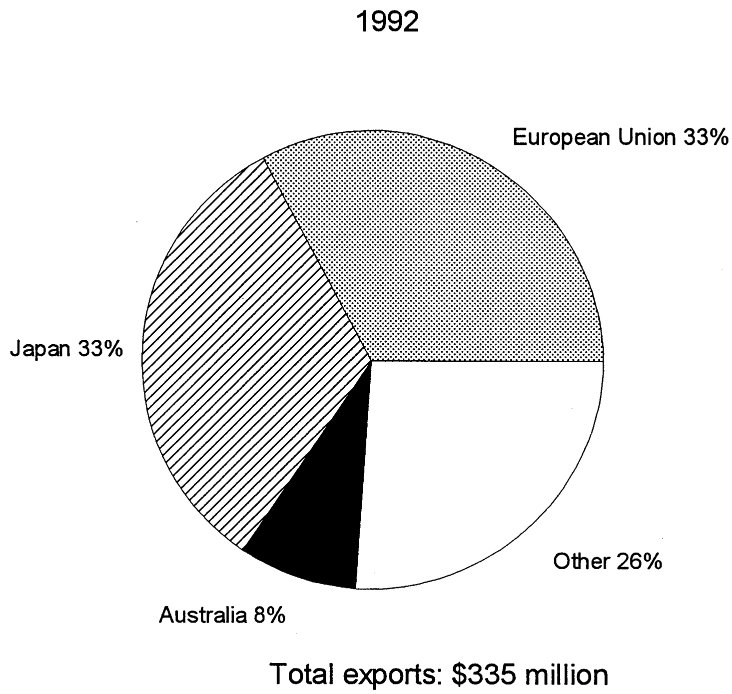
[30] European Commission, *Panorama of EU Industry '95/'96* (Luxembourg: Office for Official Publications of the European Commission, 1994), pp. 13-105-106.

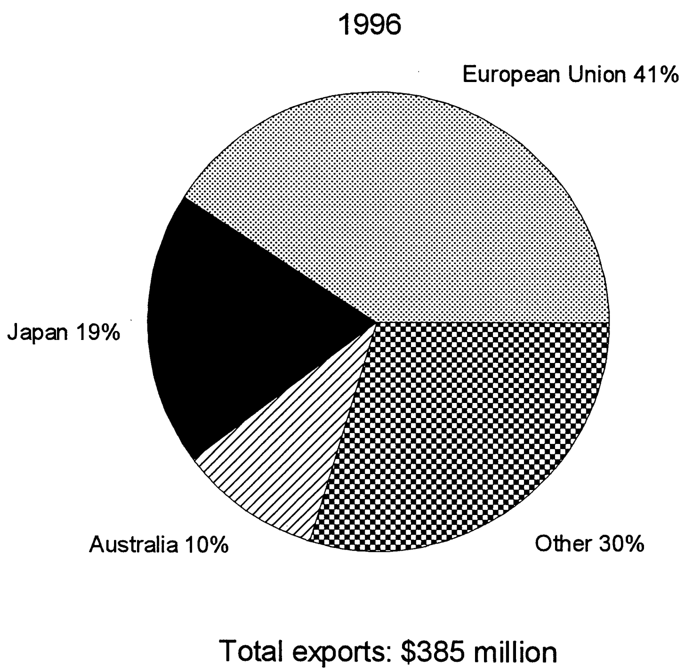
[31] European Commission, *Panorama of EU Industry '95/'96*, p. 13-106. EU production includes ethyl alcohol which is believed to constitute a small share of total distilled spirits production. Data for 1994 through 1996 are estimated.

[32] USDOC, telephone interview by USITC staff, Feb. 12, 1997 and European Commission, *Panorama of EU Industry '95/'96*, p. 13-105.

[33] EU employment is estimated by USITC staff based on European Commission, *Panorama of EU Industry 95/96*, pp. 13-104, 105. Data for 1994 through 1996 are estimated.

Figure 11-2
Distilled spirits: U.S. exports to selected markets, 1992 and 1996





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

employment dropped by an estimated 25 percent. The decline in EU employment was due to declining demand leading to reduced orders and production, several labor-saving technological improvements, and many mergers and acquisitions resulting in layoffs.[34]

Certain regions within the EU tend to specialize in certain types of spirits. For example, whisky is produced in Scotland and Ireland, gin in England and the Netherlands, and vodka in Sweden and Finland. France specializes in brandy.[35] The regionalization of certain distilled spirits and their popularity worldwide have contributed to the high share of production that is exported from the EU and to the globalization of the major firms in the industry.

This highly concentrated industry is dominated by large multinational corporations (table 11-2). The multinationals compete on the international market through different strategies, product innovation, and investments and acquisitions to extend brand portfolios and distribution networks. Cost savings are achieved through acquisitions and other types of cooperation such as marketing and distribution agreements. Enlarged portfolios enable firms to offer a broader range of products in order to satisfy the widely varying and fragmented consumer preferences. There are also a number of small niche firms (i.e. grappa producers in Italy) that focus on a particular market segment and fill consumer needs in these small specialty areas.[36]

Acquisitions also allow companies to strengthen distribution networks. In the early 1990s, there were several significant acquisitions which enabled EU firms to become market leaders. In 1992, Allied-Lyons (UK) bought the Spanish company, Pedro Domecq, and became Allied Domecq, which enabled it to become the world leader in brandy and second in tequila.[37] Also, Bacardi acquired Martini & Rossi in 1993, which gave Bacardi access to a widespread distribution network in the EU and also expanded Bacardi's product portfolio in the United States. Several of the producers are globalized companies acting as distributors/importers for a variety of distilled alcoholic beverages with production facilities both within and without the EU. For example, Glenlivet Scotch Whisky, distilled and bottled in Scotland, is imported into the United States by a branch of Glenlivet Distilling Co. of New York, owned by the Canadian firm The Seagram Company, Ltd.[38] United Distillers is a subsidiary of the UK firm, Guinness PLC, and has offices all over the world (including the United States) to promote its European brands and products. However, it also imports bourbon into the EU from its U.S. subsidiary in order to offer more products and meet market demands. While these highly globalized firms compete with U.S. firms in the European market, they also have U.S. operations which export U.S. spirit beverages into the EU.

In general, the EU regulates distilled spirits to a lesser extent than the United States.[39] Distilled spirits sold in the EU are subject to an array of regulations, most of which are EU-wide, designed to harmonize both marketing and product quality, similar to Federal regulations in the United States. However, there are differing taxes and other fiscal considerations among the EU member states, much like those of the individual States and localities of the United States. Regulation is used as a source of revenue and also as a

---

[34] European Commission, *Panorama of EU Industry '95/'96*, p. 13-104.
[35] European Commission, *Panorama of EU Industry '95/'96*, p. 13-108.
[36] European Commission, *Panorama of EU Industry '95/'96*, p. 13-104, 108.
[37] European Commission, *Panorama of EU Industry '95/'96*, p. 13-109.
[38] Brown, *Classic Spirits of the World: A Comprehensive Guide*, p. 35.
[39] DISCUS, interview by USITC staff, Mar. 6, 1997.

Table 11-2
Major European Union companies producing distilled spirits, selected affiliates, and lines of business

Company	Foreign affiliates/parent	Lines of business
Grand Metropolitan/ International Distillers and Vintners (United Kingdom)	Heublein (United States) José Cuervo (Mexico)	distilled spirits food products wine restaurants
Allied Domecq (United Kingdom)	Hiram Walker (United States)	distilled spirits wine restaurants
Guinness/LVMH Moet Hennessy Louis Vuitton (United Kingdom/France)	United Distillers (United States) Schieffelin & Somerset (United States)	distilled spirits wine luggage leather goods beauty products
Pernod Richard (France)	Austin Nichols (United States) Boulevard Distillers (United States)	distilled spirits wine soft drinks
Remy Cointreau (France)	Remy Amerique (United States)	distilled spirits wine
Martini & Rossi (Italy)	Bacardi International (Bermuda)	distilled spirits wine
Chivas Brothers (United Kingdom)	Seagrams (Canada)	distilled spirits
Glenlivet Distillers (United Kingdom)	Seagrams (Canada)	distilled spirits
Martell (France)	Seagrams (Canada)	distilled spirits
White & Mackay (United Kingdom)	American Brands/Jim Beam (United States)	distilled spirits

Source: Compiled by the staff of the USITC.

way of fighting alcoholism, as well as the problems and costs associated with alcohol abuse.[40] It is accomplished by regulating prices, collecting taxes for revenue, and imposing taxes at levels high enough to reduce sales and consumption.[41]

All spirits marketed in the EU must be in conformity with the EU Spirit Drinks Regulation as well as individual country laws. Regulation is aimed at the harmonization and monitoring of alcohol policies to promote free trade within the EU and better health by restricting the consumption of alcohol.[42] Each country

---

[40] Ron Brazeau and Nancy Burr, Brewers Association of Canada, *International Survey: Alcoholic Beverage Taxation and Control Policies,* 8th ed., Nov. 1992 (Ontario, Canada: 1993), pp. 495, 509-510.
[41] Ibid.
[42] European Commission, *Panorama of EU Industry '95/'96,* p. 13-109.

in the EU regulates the production and distribution of alcoholic beverages. While laws and regulation vary widely by country, there tend to be stronger regulations in the northern EU members and weaker regulations in the southern members.[43]

Spirits are an important source of revenue through excise taxes, VAT, and other taxes. About 14 billion ECU per year is generated by excise taxes and VAT on spirits for national governments, and account for about 40 percent of taxes on all alcoholic beverages.[44] There are two levels of taxation: those imposed by the European Commission on all member states and those imposed by individual member states within their respective borders. The top priority of the European Commission is moving towards the single market, and the harmonization of tax systems plays an important role. Harmonization will enhance the benefits and economies of scale by removing some of the major differences that impede the flow of trade within and outside of the single market. Although harmonization is a priority, some differences (i.e. monopoly versus market controls) will persist. Pricing, as in the United States, varies widely among the EU members, and depends largely on whether or not they are set by a monopoly or the market.

EU exports of distilled spirits are estimated to have grown from approximately $4.6 billion in 1992 to $6.3 billion in 1996.[45] The largest markets for EU exports were the United States and Japan, but Asian markets and former Eastern Bloc countries represent a growing market for EU distilled spirits production. By far the largest export category in terms of volume and value was whisky, principally from Ireland and the United Kingdom. The next largest export group was cognac, a product of France. EU exports account for approximately one-third of total EU production and are largely the result of transactions between related parties, either through intracompany transfers or distribution agreements.

Global Market Profile

Global consumption of distilled spirits is estimated between $55 and $65 billion in 1996, and the United States and the European Union are the largest markets.[46] Other important markets include Canada, Asia (most importantly Japan), and Australia. The industry is shifting its focus to the markets of the Pacific Rim, Latin America, and Eastern Europe, driven by declining demand in the developed markets and the growing political stability of many developing markets.[47] There has been a trend away from spirits with higher alcohol content to spirits of lower alcohol content, as a result of pressure from the anti-alcohol lobby and growing health awareness.[48] There also has been a trend towards clear spirits and away from brown spirits, perhaps because consumers perceive clear beverages to be more healthful, regard whisk(e)y to be old-fashioned, or prefer fruit juice-based drinks.[49] The exception to the trend away from brown spirits seems to be bourbon, a brown spirit produced in the United States, which is experiencing growing consumption, especially in the EU.[50]

---

[43] Ibid.

[44] Confederation of European Spirits Producers, "The Spirit Drinks Industry in the European Union: Its Economic Importance and Its Priority Issues 1995-2000," GEN.DOC 1/95 Final, Mar. 2, 1995, p. 2.

[45] Estimated by USITC staff based on European Commission, *Panorama of EU Industry '95/'96*, p. 13-105, and Eurostat data.

[46] Fred J. Ruppel, "U.S. and World Trade in Distilled Spirits," unpublished research paper, Economic Research Service, U.S. Department of Agriculture, Jan. 1997.

[47] "Special Report: World Trends," *Drinks International Executive Bulletin*, Jan. 13, 1995.

[48] Ibid.

[49] DISCUS, interview by USITC staff, Mar. 6, 1997.

[50] Ibid.

U.S. Market Profile

In terms of volume, U.S. consumption of distilled spirits, particularly bourbon and other whisk(e)ys, generally has declined in recent years, resulting in increased price competition as competitors vie for market share.[51] In spite of the downward trend in volume, the value of U.S. consumption of distilled spirits rose from $4.8 billion in 1992 to $5.5 billion in 1996.[52] The U.S. market for beverage alcohol has in recent years demanded an increasingly broad variety of products. It is estimated that unit sales of distilled spirits (which do not include bulk sales) in the United States declined by approximately 2 to 3 percent annually during 1993-95.[53] Whisk(e)ys accounted for almost one-half of 1996 U.S. spirit consumption, but suffered the largest declines from 1992-95. Virtually all whisk(e)ys registered moderate to severe declines. Gin and vodka also declined moderately. Rum, one of the more popular distilled spirits, was one of the few products for which consumption increased.

Both aggregate and per capita consumption has been declining in recent years and the outlook is for continued decline. Some of the reasons for the decline in this sector have to do with driving-while-intoxicated (DWI) rules, concerns about consumption by under-age consumers, anti-alcohol campaigns, and health and fitness concerns.[54] In addition, Federal excise taxes were raised twice, by 19 percent on October 1, 1985, and by 8 percent on January 1, 1991,[55] which raised costs, increased prices, and reduced consumption.

U.S. imports of distilled spirits rose from $1.5 billion in 1992 to $1.8 billion in 1996, a 19-percent increase. The EU and the NAFTA partners are the largest suppliers, accounting for 70 percent and 25 percent, respectively, of total U.S. imports in 1996 (figure 11-3). In 1996, the largest imports, by value, were bottled Scotch and Irish whiskies ($359 million, or 19 percent), bottled liqueurs and cordials ($346 million, or 19 percent), other bottled whiskies ($264 million, or 14 percent), bottled grape brandy valued over $3.43/liter ($238 million, or 13 percent), and bottled vodka valued at over $2.05/liter ($219 million, or 12 percent). The volume of distilled spirits imported remained fairly flat during 1992-96, ranging from 340 million proof liters[56] to 362 million proof liters. Slightly less than one-half (46 percent) of the total volume of imports (valued at $238 million or 13 percent in 1996) is spirits imported in bulk (in containers larger than 4 liters), with the remainder being imported already bottled. Large amounts of foreign-produced spirits are imported in bulk to reduce transportation costs, then bottled within the United States and placed in bonded warehouses in order to defer Federal tax collections.[57]

---

[51] American Brands, *10-K Report* for the fiscal year ending Dec. 31, 1995.

[52] Consumption was derived from production plus imports less exports. Production excludes brandy, while imports and exports include brandy.

[53] Ibid.

[54] Adams/Jobson Beverage Group, *Adams/Jobson's 1996 Liquor Handbook*, p. 276.

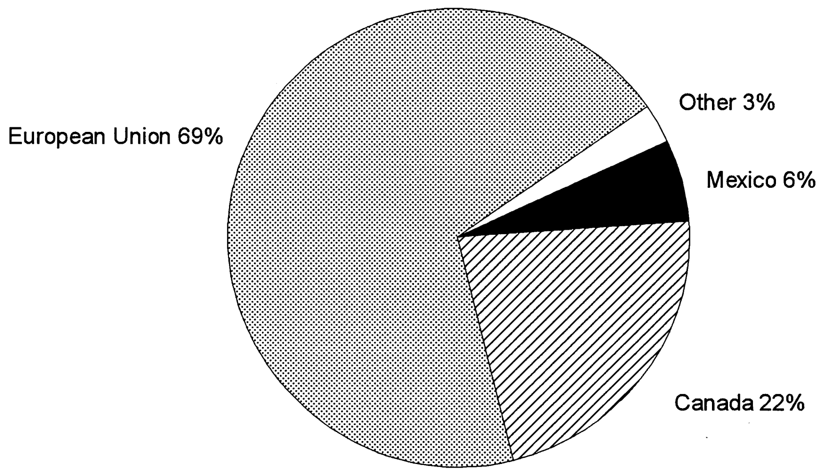
[55] DISCUS, "The Extra Burden on Distilled Spirits." Information on the increases in Federal excise taxes was received by USITC staff in a facsimile transmission from DISCUS, Feb. 5, 1997. The official rates were raised from $10.50 per proof gallon to $12.50 and then $13.50.

[56] A proof liter is a liter of liquid at 15.56°C (60°F) which contains 50 percent (100 proof) by volume of ethyl alcohol having a specific gravity of 0.7939 at 15.56°C (60°F) referred to water at 15.56°C (60°F) as unity or the alcoholic equivalent thereof.

[57] DISCUS, telephone interview by USITC staff, Feb. 6, 1997. In 1995, U.S. bottling of distilled spirits imported in bulk accounted for about one-third of the volume of total U.S. bottling of distilled spirits. Adams/Jobson Beverage Group, *Adams/Jobson's 1996 Liquor Handbook*, pp. 250-252.

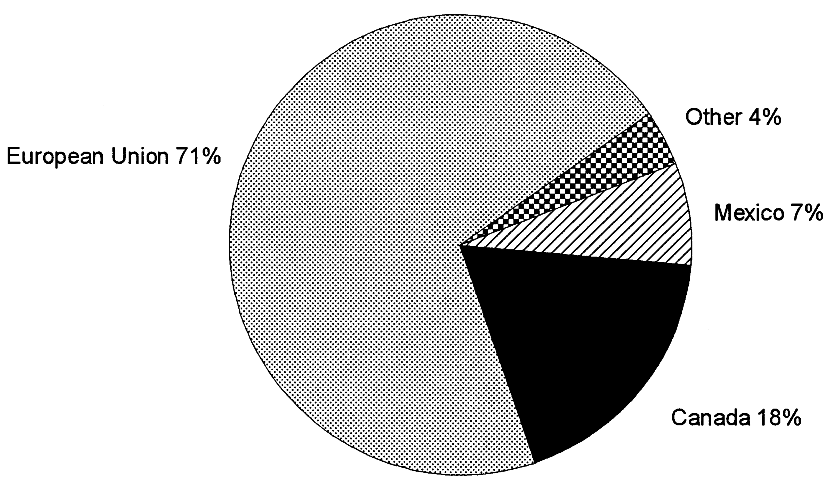
Figure 11-3
Distilled spirits: U.S. imports by major trading partners, 1992 and 1996

1992



Total imports: $1,542 million

1996



Total imports: $1,840 million

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

The U.S. final Uruguay Round rates[58] of duty on imported distilled spirits range from 0 to 97 cents per proof liter. Tariffs on tequila and mescal have already been eliminated and tariffs on brown spirits are scheduled to be eliminated in 2004. Of the remaining products, imitations of brandy and other spirituous beverages have the highest tariffs and rum has the second-highest tariffs. However, rum producers from the Caribbean enjoy duty free access to the U.S. market under the Caribbean Basin Economic Recovery Act. As a result of the distilled spirits agreement, the United States and the EU will phase in tariff reductions on white spirits and accelerate the reductions on brown spirits with the goal of eliminating tariffs by January 1, 2000. The exception to this schedule is rum. Bulk rum valued at $.69 or less per proof liter and bottled rum valued at $3.00 or less per proof liter are excluded and will continue to face existing tariffs. In addition, tariffs on higher value rum will not be eliminated until 2003.

A number of submissions received by the USITC regarding the distilled spirits initiative expressed support for the agreement. In addition, one company opined that, in order for preference programs to continue to benefit Caribbean exporters of rum to the United States, all rum should be excluded from the agreement.

European Union Market Profile

The EU market for distilled spirits, estimated at about $12.5 billion in 1995, is a little more than twice the size of the U.S. market.[59] Per capita consumption of distilled spirits has been declining in recent years in most of Europe as a result of several different factors. The growing trend on the part of consumers to adopt a healthy lifestyle, combined with anti-alcohol campaigns and government regulation and taxation have contributed to the decline in consumption.[60] Despite the lack of growth in the EU market, opportunities do exist for distilled spirits producers. Per-capita consumption of distilled spirits is higher in France, Germany, Spain, and Greece than in the United States and as EU enlargement proceeds, the size of the market is expected to increase rapidly, just as the German market did after unification.[61]

Imports into the EU are principally from North America and the Caribbean and account for less than 5 percent of consumption throughout the 1992-96 period. Imports were increasing through 1993 when they totaled slightly under $500 million; since then, they have fallen more than 25 percent to approximately $375 million in 1996. The principal products imported into the EU were rum and whiskey.[62]

The EU and United States calculate tariffs differently. The United States calculates tariffs on the amount of alcohol on a proof basis and uses proof liters, while the EU calculates tariffs on a volume basis and uses degree of alcohol by volume (in hectoliters) in their calculation formulas. The EU uses simple tariff

---

[58] *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994. The Marrakesh Protocol is part of the General Agreement on Tariffs and Trade 1994 (GATT 1994), which is a multilateral agreement that is an annex to the Agreement Establishing the World Trade Organization.

[59] European Commission, *Panorama of EU Industry '95/'96*, p. 13-104.

[60] Ibid.

[61] Produktschap Voor Gedistilleerde Dranken, *World Drink Trends 1996* (United Kingdom: NTC Publications Ltd., 1996), pp. 140-155.

[62] Estimated by USITC staff based on European Commission, *Panorama of EU Industry 95/96*, p. 13-104, and on Eurostat data.

rates on bulk spirits and compound tariff rates for bottled spirits.[63] The United States does not use compound rates.[64] The EU final Uruguay Round rates of duty for major categories of spirits are shown in table 11-3.

In order to compare rates between the EU and United States, unit conversions must be made and adjustments must be made for different alcohol content for each product. EU tariff rates on bulk spirits are higher per unit than the U.S. rates, and the United States will gain more from the elimination of tariffs than the EU (table 11-4).

Table 11-3
Final Uruguay Round tariffs on distilled spirits for the European Union, bulk and bottled

Product	Bulk (ECU/% vol/HL)	Bottled (ECU%/vol/HL+ECU/HL)
Whisk(e)ys	0.16	0.16 + 1.2
Gin or rum	0.60	0.50 + 3.2
Brandies	0.64	0.64 + 4.0
Vodka	0.80	0.80 + 3.2
Other spirits (except liqueurs)	0.64	0.64 + 4.0
Liqueurs	1.00	1.00 + 6.4

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994.

[63] *Most-Favoured-Nation Tariff Schedules* and International Customs Tariffs Bureau (ICTB), *Douanes, International Customs Journal, European Union, Number 14, 17th Edition, 1994-1995*, Organ of the International Union for the Publication of Customs Tariffs (Brussels, Belgium: ICTB Printing Department, 1995), pp. 107-108.

[64] *Most-Favoured-Nation Tariff Schedules.*

Table 11-4
Final Uruguay Round tariffs on bulk distilled spirits, comparison of the United States and the European Union

Product	U.S. tariff (¢/proof liter)	EU tariff (¢/proof liter)
Whisk(e)ys[1]	0	10.5[2]
Brandies	0	25.6[2]
Gin[1]	8.4	31.4[2]
Liqueurs[1]	8.4	52.4[2]
Vodka	21.1	41.9[2]
Rum[1]	23.7	39.3[3]

[1] U.S. tariff rate is not separated into bulk versus non-bulk.
[2] Calculated by USITC staff based on 80 proof, or 40%/vol.
[3] Calculated by USITC staff based on 100 proof, or 50%/vol.

Source: *Most-Favoured-Nation Tariff Schedules, Annexes to Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations (Marrakesh Protocol)*, Marrakesh, Apr. 15, 1994.

CHAPTER 12
Market Access Opportunities

The Information Technology Agreement (ITA) should lead to improved global market access opportunities for competitive information technology (IT) manufacturing industries in developed economies such as the United States, Japan, and the European Union (EU), as well as in a number of rapidly emerging IT producing countries in Asia. Trade barriers, such as tariffs, that increase final prices of IT products limit opportunities that would otherwise exist for competitive manufacturers of high-quality, advanced IT products.[1] For these reasons, IT industry representatives assert that the ITA is vital to their industry and a first step toward a new scenario of open markets and zero tariffs at a world level.[2]

Information Technology Agreement

The market access opportunities likely to result from the ITA vary by country or customs territory. Several of the ITA participants, especially those that have significant IT industries, currently have low tariffs on some or all ITA products. However, in nearly all cases, the ITA results in greater market access opportunities in some sectors of participants' markets. The following table shows the range of duties, by sector, for many IT markets. For WTO members, these are final Uruguay Round (UR) rates of duty that will be in place on January 1, 1999, and for non-WTO members, China and Taiwan, the duties are current rates. For the countries participating in the ITA, these duties will be eliminated by January 1, 2000 (table 12-1).

European Union

As a result of duty elimination under the ITA, access opportunities in the EU market will likely be increased in semiconductors, printed circuits, capacitors, silicon wafers, office machines, telecommunications equipment, and most unrecorded media. However, in the past, EU classification of certain IT imports into higher tariff categories, rather than the classifications used by most countries, has impeded market access to the EU.[3] If such problems continue, it is possible that the market access opportunities anticipated under the ITA could be limited.

The most significant tariffs are on semiconductors. These tariffs have recently been lowered from 7-14 percent to 0-7 percent, with the exception of smart cards which are still dutiable at 14 percent. This level of tariff on commodity inputs to price-sensitive IT products has made non-EU semiconductors less competitive in the EU market and has increased the costs of manufacturing IT products in the EU. These

---

[1] *European Information Technology Observatory 1996* (Frankfurt: European Economic Interest Grouping, 1996), pp. 10-40 and European Commission, Office of Press and Public Affairs, "European Commission Advances IT Package," *European Union News*, No. 9/97, Mar. 5, 1997.

[2] EUROBIT, "The European IT Industry Welcomes the Consensus Reached at the WTO Ministerial Conference in Singapore, " EUROBIT Press release, Dec. 13, 1996, pp. 1-2 and Information Technology Industry Council and Electronics Industry Association of Japan (EIAJ), telephone interviews by USITC staff, Feb. 25, 1997.

[3] For example, the EU has classified computers with the capability of receiving television signals as television receivers, which are subject to a significantly higher rate of duty and are not included in the ITA. World Wide Web, retrieved Apr. 2, 1997, United States Trade Representative (USTR), http://www.ustr.gov/reports/nte/1997/contents.html, USTR, *1997 National Trade Estimate*.

Table 12-1
Final Uruguay Round tariff rates, effective January 1, 1999, scheduled to be eliminated by the ITA, except as noted, by market and sector

Sector	Markets			
	United States	**European Union**	**Japan**	**Other Markets**
Computers	0-2.4 percent	0-2.5 percent	free	Brazil: 15-35 percent [1] Canada: free China: 9-50 percent [2] India: 40 percent Indonesia: 40 percent
Software	0-4.8¢/m^2 of recording surface	0-3.5 percent	free	Indonesia: 40 percent Korea: 13 percent Malaysia: 5-10 percent Singapore: 1-10 percent Thailand: 30 percent
Unrecorded media	free	0-3.5 percent	free	Singapore: 0-10 percent Indonesia: 40 percent Malaysia: 5-20 percent
Telecommunications	0-8.5 percent	0-8 percent	free	Canada: 0-8.7 percent Korea: 6-13 percent Malaysia: 5-30 percent Thailand: 5-30 percent
Semiconductors	free	0-14 percent	free	Korea: free Taiwan: 1-2 percent [3]
Printed circuits	2.7 percent	4.5 percent	free	Taiwan: 7.5 percent
Capacitors	3.5-9 percent	2.7-3.7 percent	free	Korea: 13 percent Singapore: 10 percent China: 15-40 percent [2] Taiwan: 1.25-12.5 percent[3]
Resistors	0-6 percent	2.7 percent	free	Korea: 13 percent Singapore: 10 percent China: 15-40 percent[2] Taiwan: 1.25-12.5 percent[3]
Office machines	0-1.9 percent	0-6 percent	free	Canada: 0-2.6 percent Brazil: 20-35 percent[1]
Semiconductor manufacturing and testing equipment	free	0-6.7 percent	free	Thailand: 5-40 percent Indonesia: 5-40 percent China: 15-40 percent[2]
Measuring, testing, analyzing instruments	0-3.5 percent	0-4.2 percent	free	Korea: 8-13 percent Taiwan : 0-12.5 percent
Silicon wafers	free	6.5 percent	free	India: 8 percent Australia: 8 percent

[1] Brazil is not a participant in the ITA, therefore, this duty will not be eliminated.
[2] China is not a participant in the ITA, therefore, this duty will not be eliminated. All tariff rates for China are unbound as China is not a member of the WTO.
[3] All tariff rates for Taiwan are unbound as Taiwan is not a member of the WTO; however, Taiwan is a signatory to the ITA.

Source: Compiled by the staff of the USITC.

tariffs have also caused some semiconductor manufacturers to move production to the EU market to avoid the duty rather than supply their customers with imports. Although the tariffs on silicon wafers, PCBs, capacitors, and resistors are not quite as high as those on semiconductors, they have had similar effects on the production of IT products in the EU. The elimination of duties on these inputs to IT products is expected to increase the competitiveness of foreign suppliers and to reduce the costs of producing IT products in the EU.[4]

The elimination of tariffs on office machines and telecommunications equipment is likely to increase market access opportunities because final UR tariffs on these products range from 3.5 percent to 8.0 percent. The ITA would eliminate EU tariffs on office machines, many of which would otherwise be 6 percent ad valorem by the year 1999. Although market penetration of point-of-sale terminals and automatic teller machines in the EU is low compared to that of the United States, it is projected to grow substantially over the near term, thereby creating market access opportunities for foreign suppliers of these products. The elimination of tariffs on telecommunications equipment is likely to make foreign producers more competitive in the EU market, especially at a time when deregulation is opening up markets and EU economies are expected to recover. Market access opportunities for unrecorded media are also likely to increase if duties are removed. Although tariffs on unrecorded media are not as high as those on office machines or telecommunications equipment, these products are much more price sensitive and smaller duty reductions could have noticeable effects on market access.

The ITA should have a more significant effect on EU market access over time because of EU enlargement. While the EU presently consists of 15 members, 13 other countries have applied for membership.[5] The benefits of improved market access in the EU are likely to increase as the size of the EU market grows because countries joining the EU must adopt the common EU tariff schedule and abide by EU trade agreements. The result of EU enlargement will be a simplification of the trade regimes in Europe and, in many cases, a lessening of trade restrictions and tariffs currently imposed by countries awaiting admission to the EU. With the exception of Switzerland, these countries are considered developing countries.[6] As such, these countries are emerging markets for IT, and are not likely to be significant producers of IT products. The economies of these countries are expected to grow rapidly, especially after joining the EU, and this is likely to cause their markets for IT products to grow at above average rates as both government and business upgrade and modernize infrastructure.

United States

The ITA would likely liberalize access in only a few sectors of the U.S. IT market. There would be little change in sectors such as computers and semiconductors where U.S. tariffs on most products will be zero by January 1, 1999. Most of the remaining products will have final UR duties of less than 3 percent ad valorem by the year 1999. Increased market access opportunities are likely for capacitors, certain telecommunications equipment, and resistors. Final UR duties on these IT products are among the highest U.S. tariffs that will be eliminated by the ITA. In fact, U.S. tariffs on many telecommunications products were not reduced following the UR because reductions were conditional upon a sufficient number of WTO

---

[4] Institute for Interconnecting and Packaging Electronic Circuits (IPC) representative, telephone interview by USITC staff, Oct. 2, 1996.

[5] World Wide Web, retrieved Mar. 10, 1997, Europa, http://europa.eu.int/en/agenda/appmen.html. The 13 countries are Bulgaria, Poland, Cyprus, Romania, Czech Republic, Slovakia, Estonia, Slovenia, Hungary, Switzerland, Lithuania, Turkey, and Malta.

[6] These countries have been designated beneficiary developing countries for the purposes of the Generalized System of Preferences, provided for in Title V of the Trade Act of 1974, as amended (19 U.S.C. 2461 *et seq.*), Harmonized Tariff Schedule of the United States (1997), general note 4.

members becoming signatories to the Government Procurement Agreement. This restriction has been eliminated by the ITA, thus clearing the way to reduce these tariffs.

Japan

Japanese final UR duties on ITA products will be zero by January 1, 1999.[7] As a result, although the ITA will provide staged duty elimination beginning July 1, 1997, market access opportunities in the Japanese market are not expected to increase.

Other Participant Markets

Some of the most dynamic market access opportunities for IT products are expected to be in Asia, especially in the economies of Hong Kong, Singapore, India, Indonesia, Thailand, Malaysia, Korea, and Taiwan.[8] Although some tariffs on IT equipment have already been eliminated by Singapore and Hong Kong, significant tariffs remain. India, Indonesia, and Thailand, all Asian countries with large populations and huge potential demand for IT products, have agreed to eliminate tariffs, most of which range from 30 to 40 percent. Malaysia and Korea have somewhat lower tariffs on the products covered by the ITA, but these duties are still five to twenty times those of the United States. Taiwan, although not yet a member of the WTO, has agreed to eliminate its IT tariffs, most of which range from 5 to 15 percent. Given prospective demand for such information products as many of these emerging markets establish their planned national information infrastructures, elimination of remaining tariffs should accelerate market opportunities for the globally competitive exporters of IT goods. However, the benefits of duty elimination as a result of the ITA may be tempered by intellectual property rights protection problems in some of these countries.

A combination of factors will likely contribute to increased opportunities--rapidly expanding industrial bases, upgrades and expansion of communications infrastructure, and growing disposable income, as well as the elimination of relatively high tariff rates on IT products. For example, expanding semiconductor production in the region--40 percent of new production capacity in the next 3 years will be located in Southeast Asia and China--is expected to lead to greater demand for semiconductor manufacturing and testing equipment. Deregulation of telecommunications services and the growth of service industries in many of these countries are increasing demand for telecommunications equipment, computers, and business machines. Finally as the IT industries in Asia grow, so does the market for components and parts of IT products. The combination of rapidly growing markets and tariff elimination under the ITA could make these Asian countries much more significant markets for exporters.

Major Non-Participant Markets

China, the most populous country in the world and widely regarded as having significant market opportunities for IT products, is not a signatory to the ITA or a member of the WTO. As a result, market access opportunities in China will not increase when the ITA is implemented. Nevertheless, market access opportunities for exporters to China could be enhanced when China accedes to the WTO because ITA

---

[7] Tariffs of 4.8 percent remain on certain insulated wire but this represents a negligible amount of trade in telecommunications products.

[8] U.S. IT industry representatives, personal and telephone interviews by USITC staff, 1996 and 1997.

participants intend to seek duty reductions on the ITA product list from all countries acceding to the WTO.[9] However, the elimination of both tariff and non-tariff barriers is necessary to make improvements in market access opportunities for IT products in China.

Brazil is another emerging market with substantial potential demand for IT products. Market opportunities in general have improved recently in Brazil because of strengthened intellectual property rights protection, elimination of informatics restrictions, and lowering of other restrictions such as export requirements. However, since Brazil is not a party to the ITA, suppliers to that market will continue to face relatively high Brazilian tariffs and will see no improvement in market access opportunities as a result of the ITA.

Distilled Spirits Agreement

The EU maintains relatively high tariffs, compared with the United States, on both white and brown spirits (table 12-2). With the elimination of EU tariffs, market access opportunities for foreign suppliers of spirits are likely to be increased. Although current EU import penetration is quite low--less than 5 percent--the elimination of these duties coupled with changing consumer preferences could lead to an increase in demand for imported products. The distilled spirits agreement should have a more significant effect on EU market access over time because of EU enlargement. Several of the countries that have applied for EU membership are also sizeable markets for the distilled spirits products covered in the agreement and, as they are accepted into the EU, access to their distilled spirits markets should increase as well.

Market access opportunities in the U.S. market are also likely to be increased. Under the distilled spirits agreement the elimination of UR tariffs on brown spirits will be accelerated by 4 years and the tariffs on white spirits, which were not reduced in the UR, will be eliminated. Given the price pressure in the distilled spirits market, the elimination of these duties could increase the competitiveness of imported spirits in the U.S. market.

Table 12-2
Final Uruguay Round tariff rates, effective January 1, 1999, scheduled to be eliminated by the distilled spirits agreement, except as noted, by market and sector

	Markets	
Sector	**United States**	**European Union**
Brown spirits	free[1]	10.5-25.6¢/proof liter [2]
White spirits	8.4-23.7¢/proof liter [2]	31.4-52.4¢/proof liter [2]

[1] U.S. tariffs on brown spirits are scheduled to be eliminated in stages through 2004 under UR commitments. The ITA will accelerate the staging so that tariffs will be eliminated in 2000.
[2] A proof liter is a liter of liquid at 15.56°C (60°F) which contains 50 percent (100 proof) by volume of ethyl alcohol having a specific gravity of 0.7939 at 15.56°C (60°F) referred to water at 15.56°C (60°F) as unity or the alcoholic equivalent thereof.

Source: Compiled by the staff of the USITC.

[9] U.S. Department of State telegram, "Information Technology Agreement Meets Deadline," message reference No. 000615, prepared by U.S. Mission, Geneva, Feb. 3, 1997.

Submissions from the Public

Submissions from the public were received on several ITA sectors as well as distilled spirits. A number of U.S. capacitor producers expressed strong opposition to including capacitors in the agreement and one company cited opposition to including resistors. The Institute for Interconnecting and Packaging Electronic Circuits and Leica, Inc. were in favor of the agreement but thought that the agreement was too narrow. A number of submissions received by the USITC regarding the distilled spirits initiative expressed support for the agreement. However, one company states that, in order for the preferential programs to continue to benefit Caribbean exporters of rum to the United States, all rum should be excluded from the agreement. No opposition was cited in any other submission. All submissions received by the Commission during this investigation are included in appendix F.

APPENDIX A

REQUEST LETTER FROM USTR

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE
WASHINGTON, D.C. 20508

FEB 25 1997

The Honorable Marcia E. Miller
Chairman
U.S. International Trade Commission
500 E Street, NW
Washington, D.C. 20436

Dear Chairman Miller:

Achieving improved market access through elimination of tariff barriers has been a U.S. objective that was advanced in the context of the Uruguay Round negotiations and the creation of the World Trade Organization (WTO). As a matter of policy, the U.S. Government has placed a high priority on expanding the agreements on tariff elimination, both by increasing the number of countries that agree to sectoral tariff elimination and by expanding the number of sectors in which reciprocal tariff elimination is agreed. The Statement of Administrative Action accompanying the Uruguay Round Agreements Act (URAA) cites the partial success achieved in the negotiations to eliminate tariffs in some sectors, such as information technology products and distilled spirits.

A major step toward the elimination of tariffs on information technology products was taken at the WTO Ministerial Conference in Singapore when economies representing over 80 percent of world trade in these products declared their intention to bind and eliminate customs duties and other duties and charges on a broad range of products. At the same time, the United States agreed to eliminate the tariffs on "white" distilled spirits and accelerate the elimination of tariffs on "brown" distilled spirits. In that context, I am requesting the Commission's continued assistance in fulfilling the statutory requirements for implementation of tariff cuts under authority of the URAA.

The Commission, in the context of preparing for and implementing the results of the Uruguay Round negotiations, undertook an investigation under section 131 of the Trade Act of 1974, *Probable Economic Effect on U.S. Industries and Consumers of Modification of U.S. Tariffs* (prepared for USTR in June 1989) and an investigation under section 332 of the Tariff Act of 1930, *Potential Impact on the U.S. Economy and Industries of the GATT Uruguay Round Agreements* (prepared for the Senate Finance Committee and the House Ways and Means Committee in June 1994). These reports provided information that was one of the bases for Congress to authorize the President to proclaim tariff reductions resulting from the Uruguay Round and authorize further cuts in certain sectors.

In section 111(b) of the URAA, Congress explicitly authorized the President to proclaim further modifications of any duty for articles contained in a tariff category that was part of the U.S. zero-for-zero initiative. This authority is subject only to the conditions set forth in section 111 which include compliance with the consultation and layover provisions of section 115 of the URAA. One of the requirements set out in section 115 is that the President "obtain advice regarding the proposed action" from the Commission.

While we have received technical assistance from Commission staff on an ongoing basis prior to the Singapore Ministerial, I request, pursuant to section 115 and section 332 of the Tariff Act of 1930, that the Commission provide information and advice to USTR on the information technology products and distilled spirits currently under consideration for tariff modification (a listing of covered products is attached). Specifically, I request that the Commission provide industry profiles on a sectoral basis for the United States and major foreign producers. These profiles should include, to the extent possible, a description of the industry and its relative strengths, trends in production, a brief analyses of current tariffs, an assessment of patterns of imports and exports, and an indication of potential increased market access opportunities resulting from proposed tariff modifications.

I request that the Commission provide its advice at the earliest possible date, but not later than April 4, 1997. After we receive the Commission's advice, the 60-day consultation and layover period may commence. It is the intent of this office to make the Commission's report available to the public in its entirety. Therefore, the report should not contain any confidential business or national security classified information.

I appreciate your assistance and cooperation on this matter and look forward to working with you and your staff on these issues in the future.

Sincerely,

Charlene Barshefsky
U.S. Trade Representative-Designate

INFORMATION TECHNOLOGY PRODUCTS

Attachment A lists the HS headings or parts thereof to be covered.

Attachment B lists specific products to be covered wherever they are classified in the HS.

ATTACHMENT A, SECTION 1

HS96	HS description
3818	Chemical elements doped for use in electronics. in form of discs. wafers or similar forms: chemical compounds doped for use in electronics
8469 11	Word processing machines
8470	Calculating machines and pocket¡size data recording, reproducing and displaying machines with a calculating function: accounting machines. postage franking machines, ticket¡issuing machines and similar machines, incorporating a calculating devices: cash registers:
8470 10	Electronic calculators capable of operating without an external source of electric power and pocket size data recording. reproducing and displaying machines with calculating functions
8470 21	Other electronic calculating machines incorporating a printing device
8470 29	Other
8470 30	Other calculating machines
8470 40	Accounting machines
8470 50	Cash registers
8470 90	Other
8471	Automatic data processing machines and units thereof: magnetic or optical readers. machines for transcribing data onto data media in coded form and machines for processing such data. not elsewhere specified or included:
8471 10	Analogue or hybrid automatic data processing machines
8471 30	Portable digital automatic data processing machines. weighing no more than 10 kg. consisting of at least a central processing unit. a keyboard and a display
8471 41	Other digital automatic data processing machines comprising in the same housing at least a central processing unit and an input and output unit. whether or not combined
8471 49	Other digital automatic data processing machines presented in the form of systems
8471 50	Digital processing units other than those of subheading

		8471 41 and 8471 49, whether or not in the same housing one or two of the following types of units: storage units, input units, output units
	8471 60	Input or output units, whether or not containing storage units in the same housing
	8471 70	Storage units, including central storage units, optical disk storage units, hard disk drives and magnetic tape storage units
	8471 80	Other units of automatic data processing machines
	8471 90	Other
ex	8472 90	Automatic teller machines
	8473 21	Parts and accessories of the machines of heading No 8470 of the electronic calculating machines of subheading 8470 10, 8470 21 and 8470 29
	8473 29	Parts and accessories of the machines of heading No 8470 other than the electronic calculating machines of subheading 8470 10, 8470 21 and 8470 29
	8473 30	Parts and accessories of the machines of heading No 8471
	8473 50	Parts and accessories equally suitable for use with machines of two or more of the headings Nos. 8469 to 8472
ex	8504 40	Static converters for automatic data processing machines and units thereof, and telecommunication apparatus
ex	8504 50	Other inductors for power supplies for automatic data processing machines and units thereof, and telecommunication apparatus
	8517	Electrical apparatus for line telephony or line telegraphy, including line telephone sets with cordless handsets and telecommunication apparatus for carrier¡current line systems or for digital line systems; videophones:
	8517 11	Line telephone sets with cordless handsets
	8517 19	Other telephone sets and videophones
	8517 21	Facsimile machines
	8517 22	Teleprinters
	8517 30	Telephonic or telegraphic switching apparatus
	8517 50	Other apparatus, for carrier¡current line systems or for digital line systems
	8517 80	Other apparatus including entry¡phone systems
	8517 90	Parts of apparatus of heading 8517
ex	8518 10	Microphones having a frequency range of 300 Hz to 3,4 Khz with a diameter of not exceeding 10 mm and a height not exceeding 3 mm, for telecommunication use
ex	8518 30	Line telephone handsets
ex	8518 29	Loudspeakers, without housing, having a frequency range of 300 Hz to 3,4 KHz with a diameter of not exceeding 50 mm, for telecommunication use

	8520	20	Telephone answering machines
	8523	11	Magnetic tapes of a width not exceeding 4 mm
	8523	12	Magnetic tapes of a width exceeding 4 mm but not exceeding 6.5 mm
	8523	13	Magnetic tapes of a width exceeding 6.5 mm
	8523	20	Magnetic discs
	8523	90	Other
	8524	31	Discs for laser reading systems for reproducing phenomena other than sound or image
ex	8524	39	Other : - for reproducing representations of instructions. data. sound. and image. recorded in a machine readable binary form. and capable of being manipulated or providing interactivity to a user. by means of an automatic data processing machine
	8524	40	Magnetic tapes for reproducing phenomena other than sound or image
	8524	91	Media for reproducing phenomena other than sound or image
ex	8424	99	Other : - for reproducing representations of instructions. data. sound. and image. recorded in a machine readable binary form, and capable of being manipulated or providing interactivity to a user. by means of an automatic data processing machine
ex	8525	10	Transmission apparatus other than apparatus for radio-broadcasting or television
	8525	20	Transmission apparatus incorporating reception apparatus
ex	8525	40	Digital still image video cameras
ex	8527	90	Portable receivers for calling. alerting or paging
ex	8529	10	Aerials or antennae of a kind used with apparatus for radio-telephony and radio-telegraphy
ex	8529	90	Parts of: - transmission apparatus other than apparatus for radio-broadcasting or television - transmission apparatus incorporating reception apparatus - digital still image video cameras. - portable receivers for calling. alerting or paging
	8531	20	Indicator panels incorporating liquid crystal devices (LCD) or light emitting diodes (LED)
ex	8531	90	Parts of apparatus of subheading 8531 20
	8532		Electrical capacitors. fixed. variable or adjustable (pre-set)

	8532 10	Fixed capacitors designed for use in 50/60 Hz circuits and having a reactive power handling capacity of not less than 0.5 kvar (power capacitors)
	8532 21	Tantalum fixed capacitors
	8532 22	Aluminum electrolytic fixed capacitors
	8532 23	Ceramic dielectric, single layer fixed capacitors
	8532 24	Ceramic dielectric, multilayer fixed capacitors
	8532 25	Dielectric fixed capacitors of paper or plastics
	8532 29	Other fixed capacitors
	8532 30	Variable or adjustable (pre-set) capacitors
	8532 90	Parts
	8533	Electrical resistors (including rheostats and potentiometers), other than heating resistors:
	8533 10	Fixed carbon resistors, composition or film types
	8533 21	Other fixed resistors for a power handling capacity not exceeding 20 W
	8533 29	Other fixed resistors for a power handling capacity of 20 W or more
	8533 31	Wirewound variable resistors, including rheostats and potentiometers, for a power handling capacity not exceeding 20 W
	8533 39	Wirewound variable resistors, including rheostats and potentiometers, for a power handling capacity of 20 W or more
	8533 40	Other variable resistors, including rheostats and potentiometers
	8533 90	Parts
	8534	Printed circuits
ex	8536 50	Electronic AC switches consisting of optically coupled input and output circuits (Insulated thyristor AC switches)
ex	8536 50	Electronic switches, including temperature protected electronic switches, consisting of a transistor and a logic chip (chip-on-chip technology) for a voltage not exceeding 1000 volts
ex	8536 50	Electromechanical snap-action switches for a current not exceeding 11 amps
ex	8536 69	Plugs and sockets for co-axial cables and printed circuits
ex	8536 90	Connection and contact elements for wires and cables
	8541	Diodes, transistors and similar semiconductor devices; photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light-emitting diodes; mounted piezo-electric crystals:
	8541 10	Diodes, other than photosensitive or light-emitting diodes

	8541 21	Transistors, other than photosensitive transistors, with a dissipation rate of less than 1 W
	8541 29	Transistors, other than photosensitive transistors, with a dissipation rate of 1 W or more
	8541 30	Thyristors, diacs and triacs, other than photosensitive devices
	8541 40	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes
	8541 50	Other semiconductor devices
	8541 60	Mounted piezo-electric crystals
	8541 90	Parts
	8542	Electronic integrated circuits and microassemblies
	8542 12	Cards incorporating an electronic integrated circuit ('smart' cards)
	8542 13	Metal oxide semiconductors (MOS technology)
	8542 14	Circuits obtained by bipolar technology
	8542 19	Other monolithic digital integrated circuits, including circuits obtained by a combination of bipolar and MOS technologies (BIMOS technology)
	8542 30	Other monolithic integrated circuits
	8542 40	Hybrid integrated circuits
	8542 50	Electronic microassemblies
	8542 90	Part
	8543 81	Proximity cards and tags
ex	8543 89	Electrical machines with translation or dictionary functions
ex	8544 41	Other electric conductors, for a voltage not exceeding 80 V, fitted with connectors, of a kind used for telecommunications
ex	8544 49	Other electric conductors, for a voltage not exceeding 80 V, not fitted with connectors, of a kind used for telecommunications
ex	8544 51	Other electric conductors, for a voltage exceeding 80 V but not exceeding 1000 V, fitted with connectors, of a kind used for telecommunications
	8544 70	Optical fibre cables
	9009 11	Electrostatic photocopying apparatus, operating by reproducing the original image directly onto the copy (direct process)
	9009 21	Other photocopying apparatus, incorporating an optical system
	9009 90	Parts and accessories
	9026	Instruments and apparatus for measuring or checking the flow, level, pressure or other variables of liquids or gases (for example, flow meters, level gauges, manometers, heat meters), excluding instruments and

	apparatus of heading No 9014, 9015, 9028 or 9032:
9026 10	Instruments for measuring or checking the flow or level of liquids
9026 20	Instruments and apparatus for measuring or checking pressure
9026 80	Other instruments and apparatus for measuring or checking of heading 9026

	9026 90	Parts and accessories of instruments and apparatus of heading 9026
	9027 20	Chromatographs and electrophoresis instruments
	9027 30	Spectrometers. spectrophotometers and spectrographs using optical radiations (UV. visible. IR)
	9027 50	Other instruments and apparatus using optical radiations (UV, visible. IR) of heading No 9027
	9027 80	Other instruments and apparatus of heading No 9027 (other than those of heading No 9027 10)
ex	9027 90	Parts and accessories of products of heading 9027. other than for gas or smoke analysis apparatus and microtomes
	9030 40	Instruments and apparatus for measuring and checking, especially designed for telecommunications (for example, cross-talk meters. gain measuring instruments. distortion factor meters. psophometers)

ATTACHMENT A, SECTION 2

Semiconductor manufacturing and testing equipment and parts thereof

	HS Code	Description	Comments
ex	7017 10	Quartz reactor tubes and holders designed for insertion into diffusion and oxidation furnaces for production of semiconductor wafers	For Attachment B
ex	8419 89	Chemical vapor deposition apparatus for semiconductor production	For Attachment B
ex	8419 90	Parts of chemical vapor deposition apparatus for semiconductor production	For Attachment B
ex	8421 19	Spin dryers for semiconductor wafer processing	For Attachment B
ex	8421 91	Parts of spin dryers for semiconductor wafer processing	For Attachment B
ex	8424 89	Deflash machines for cleaning and removing contaminants from the metal leads of semiconductor packages prior to the electroplating process	For Attachment B
ex	8424 89	Spraying appliances for etching, stripping or cleaning semiconductor wafers	For Attachment B
ex	8424 90	Parts of spraying appliances for etching. stripping or cleaning semiconductor wafers	For Attachment B
ex	8456 10	Machines for working any material by removal of material. by laser or other light or photo beam in the production of semiconductor wafers	For Attachment B
ex	8456 91	Apparatus for stripping or cleaning	For Attachment B

		semiconductor wafers	
	8456 91	Machines for dry-etching patterns on semiconductor materials	For Attachment B
ex	8456 99	Focused ion beam milling machines to produce or repair masks and reticles for patterns on semiconductor devices	For Attachment B
ex	8456 99	Lasercutters for cutting contacting tracks in semiconductor production by laser beam	For Attachment B
ex	8464 10	Machines for sawing monocrystal semiconductor boules into slices, or wafers into chips	For Attachment B
ex	8464 20	Grinding, polishing and lapping machines reprocessing of semiconductor wafers	For Attachment B
ex	8464 90	Dicing machines for scribing or scoring semiconductor wafers	For Attachment B
ex	8466 91	Parts for machines for sawing monocrystal semiconductor boules into slices, or wafers into chips	For Attachment B
ex	8466 91	Parts of dicing machines for scribing or scoring semiconductor wafers	For Attachment B
ex	8466 91	Parts of grinding, polishing and lapping machines for processing of semiconductor wafers	For Attachment B
ex	8466 93	Parts of focused ion beam milling machines to produce or repair masks and reticles for patterns on semiconductor devices	For Attachment B
ex	8466 93	Parts of lasercutters for cutting contacting tracks in semiconductor production by laser beam	For Attachment B
ex	8466 93	Parts of machines for working any material by removal of material, by laser or other light or photo beam in the production of semiconductor wafers	For Attachment B
ex	8456 93	Parts of apparatus for stripping or cleaning semiconductor wafers	For Attachment B
ex	8466 93	Parts of machines for dry-etching patterns on semiconductor materials	For Attachment B
ex	8477 10	Encapsulation equipment for assembly of semiconductors	For Attachment B
ex	8477 90	Parts of encapsulation equipment	For Attachment B
ex	8479 50	Automated machines for transport, handling and storage of semiconductor wafers, wafer cassettes, wafer boxes and other material for semiconductor devices	For Attachment B
ex	8479 89	Apparatus for growing or pulling monocrystal semiconductor boules	For Attachment B
ex	8479 89	Apparatus for physical deposition by	For Attachment B

		sputtering on semiconductor wafers	
ex	8479 89	Apparatus for wet etching, developing, stripping or cleaning semiconductor wafers and flat panel displays	For Attachment B
ex	8479 89	Die attach apparatus, tape automated bonders, and wire bonders for assembly of semiconductors	For Attachment B
ex	8479 89	Encapsulation equipment for assembly of semiconductors	For Attachment B
ex	8479 89	Epitaxial deposition machines for semiconductor wafers	For Attachment B
ex	8479 89	Machines for bending, folding and straightening semiconductor leads	For Attachment B
ex	8479 89	Physical deposition apparatus for semiconductor production	For Attachment B
ex	8479 89	Spinners for coating photographic emulsions on semiconductor wafers	For Attachment B
ex	8479 90	Part of apparatus for physical deposition by sputtering on semiconductor wafers	For Attachment B
ex	8479 90	Parts for die attach apparatus, tape automated bonders, and wire bonders for assembly of semiconductors	For Attachment B
ex	8479 90	Parts for spinners for coating photographic emulsions on semiconductor wafers	For Attachment B
ex	8479 90	Parts of apparatus for growing or pulling monocrystal semiconductor boules	For Attachment B
ex	8479 90	Parts of apparatus for wet etching, developing, stripping or cleaning semiconductor wafers and flat panel displays	For Attachment B
ex	8479 90	Parts of automated machines for transport, handling and storage of semiconductor wafers, wafer cassettes, wafer boxes and other material for semiconductor devices	For Attachment B
ex	8479 90	Parts of encapsulation equipment for assembly of semiconductors	For Attachment B
ex	8479 90	Parts of epitaxial deposition machines for semiconductor wafers	For Attachment B
ex	8479 90	Parts of machines for bending, folding and straightening semiconductor leads	For Attachment B
ex	8479 90	Parts of physical deposition apparatus for semiconductor production	For Attachment B
ex	8480 71	Injection and compression moulds for the manufacture of semiconductor devices	For Attachment B
ex	8514 10	Resistance heated furnaces and ovens for the manufacture of semiconductor devices on semiconductor wafers	For Attachment B

ex	8514 20	Inductance or dielectric furnaces and ovens for the manufacture of semiconductor devices on semiconductors wafers	For Attachment B
ex	8514 30	Apparatus for rapid heating of semiconductor wafers	For Attachment B
ex	8514 30	Parts of resistance heated furnaces and ovens for the manufacture of semiconductor devices on semiconductor wafers	For Attachment B
ex	8514 90	Parts of apparatus for rapid heating of wafers	For Attachment B
ex	8514 90	Parts of furnaces and ovens of Headings No 8514 10 to No 8514 30	For Attachment B
ex	8536 90	Wafer probers	For Attachment B
	8543 11	Ion implanters for doping semiconductor materials	For Attachment B
ex	8543 30	Apparatus for wet etching, developing, stripping or cleaning semiconductor wafers and flat panel displays	For Attachment B
ex	8543 90	Parts of apparatus for wet etching, developing, stripping or cleaning semiconductor wafers and flat panel displays	For Attachment B
ex	8543 90	Parts of ion implanters for doping semiconductor materials	For Attachment B
	9010 41 to 9010 49	Apparatus for projection, drawing or plating circuit patterns on sensitized semiconductor materials and flat panel displays	For Attachment B
ex	9010 90	Parts and accessories of the apparatus of Headings No 9010 41 to 9010 49	For Attachment B
ex	9011 10	Optical stereoscopic microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or reticles	For Attachment B
ex	9011 20	Photomicrographic microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or reticles	For Attachment B
ex	9011 90	Parts and accessories of optical stereoscopic microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or reticles	For Attachment B
ex	9011 90	Parts and accessories of photomicrographic microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or	For Attachment B

		reticles	
ex	9012 10	Electron beam microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or reticles	For Attachment B
ex	9012 90	Parts and accessories of electron beam microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or reticles	For Attachment B
ex	9017 20	Pattern generating apparatus of a kind used for producing masks or reticles from photoresist coated substrates	For Attachment B
ex	9017 90	Parts and accessories for pattern generating apparatus of a kind used for producing masks or reticles from photoresist coated substrates	For Attachment B
ex	9017 90	Parts of such pattern generating apparatus	For Attachment B
	9030 82	Instruments and apparatus for measuring or checking semiconductor wafers or devices	
ex	9030 90	Parts and accessories of instruments and apparatus for measuring or checking semiconductor wafers or devices	For Attachment B
ex	9030 90	Parts of instruments and appliances for measuring or checking semiconductor wafers or devices	For Attachment B
	9031 41	Optical instruments and appliances for inspecting semiconductor wafers or devices or for inspecting masks, photomasks or reticles used in manufacturing semiconductor devices	For Attachment B
ex	9031 49	Optical instruments and appliances for measuring surface particulate contamination on semiconductor wafers	For Attachment B
ex	9031 90	Parts and accessories of optical instruments and appliances for inspecting semiconductor wafers or devices or for inspecting masks, photomasks or reticles used in manufacturing semiconductor devices	For Attachment B
ex	9031 90	Parts and accessories of optical instruments and appliances for measuring surface particulate contamination on semiconductor wafers	For Attachment B

ATTACHMENT B

Positive list of specific products to be covered by this agreement wherever they are classified in the HS.

Where parts are specified, they are to be covered in accordance with HS Notes 2(b) to Section XVI and Chapter 90, respectively.

Computers: automatic data processing machines capable of 1) storing the processing program or programs and at least the data immediately necessary for the execution of the program; 2) being freely programmed in accordance with the requirements of the user; 3) performing arithmetical computations specified by the user; and 4) executing, without human intervention, a processing program which requires them to modify their execution, by logical decision during the processing run.

The agreement covers such automatic data processing machines whether or not they are able to receive and process with the assistance of central processing unit telephony signals, television signals, or other analogue or digitally processed audio or video signals. Machines performing a specific function other than data processing, or incorporating or working in conjunction with an automatic data processing machine, and not otherwise specified under Attachment A or B, are not covered by this agreement.

Electric amplifiers when used as repeaters in line telephony products falling within this agreement, and parts thereof.

Flat panel displays (including LCD, Electro Luminescence, Plasma and other technologies) for products falling within this agreement, and parts thereof.

Network equipment: Local Area Network (LAN) and Wide Area Network (WAN) apparatus, including those products dedicated for use solely or principally to permit the interconnection of automatic data processing machines and units thereof for a network that is used primarily for the sharing of resources such as central processor units, data storage devices and input or output units - including adapters, hubs, in-line repeaters, converters, concentrators, bridges and routers, and printed circuit assemblies for physical incorporation into automatic data processing machines and units thereof.

Monitors: display units of automatic data processing machines with a cathode ray tube with a dot screen pitch smaller than 0.4 mm not capable of receiving and processing television signals or other analogue or digitally processed audio or video signals without assistance of a central processing unit of a computer as defined in this agreement.

The agreement does not, therefore, cover televisions, including high definition televisions.

Optical disc storage units, for automatic data processing machines (including CD drives and DVD-drives), whether or not having the capability of writing/recording as well as reading, whether or not in their own housings.

Paging alert devices , and parts thereof.

Plotters whether input or output units of HS heading No 8471 or drawing or drafting machines of HS heading No 9017.

Printed Circuit Assemblies for products falling within this agreement, including such assemblies for external connections such as cards that conform to the PCMCIA standard.

Such printed circuit assemblies consist of one or more printed circuits of heading 8534 with one or more active elements assembled thereon, with or without passive elements "Active elements" means diodes, transistors, and similar semiconductor devices, whether or not photosensitive, of heading 8541, and integrated circuits and micro assemblies of heading 8542.

Projection type flat panel display units used with automatic data processing machines which can display digital information generated by the central processing unit.

Proprietary format storage devices including media therefor for automatic data processing machines, with or without removable media and whether magnetic, optical or other technology, including Bernoulli Box, Syquest, or Zipdrive© cartridge storage units.

Multimedia upgrade kits for automatic data processing machines, and units thereof, put up for retail sale, consisting of, at least, speakers and/or microphones as well as a printed circuit assembly that enables the ADP machines and units thereof to process audio signals (sound cards). Set top boxes which have a communication function : a microprocessor-based device incorporating a modem for gaining access to the Internet, and having a function of interactive information exchange.

DISTILLED SPIRITS

HS	
2208.20	spirits obtained by distilling grape wine or grape marc (grape brandy)
2208.30	whiskies
ex 2208.40	rum and tafia (to be defined)
2208.50	gin and geneve
2208.60	vodka
2008.70	liqueurs and cordials
ex 2208.90	other than 2208.90.80

N.B.: HS number 2008.70, above, should be 2208.70.

APPENDIX B

CHAIRMAN'S RESPONSE LETTER TO USTR

CHAIRMAN

UNITED STATES INTERNATIONAL TRADE COMMISSION

WASHINGTON, D.C. 20436

March 5, 1997

The Honorable Charlene Barshefsky
United States Trade Representative
600 17th Street, NW
Washington, DC 20506

Dear Madam Ambassador:

In response to your letter of February 25, 1997, the U.S. International Trade Commission has instituted, pursuant to section 115 of the Uruguay Round Agreements Act and section 332 of the Tariff Act of 1930, an investigation entitled *Advice Concerning the Proposed modification of Duties on Certain Information Technology Products and Distilled Spirits*.

Enclosed for your information is a copy of the Commission's notice announcing the institution of the investigation, which will be published in the *Federal Register*. As you requested, the Commission will submit its report to you by April 4, 1997.

Please continue to call on us whenever we can be of assistance to you.

Sincerely,

Marcia E. Miller

Enclosure

APPENDIX C

FEDERAL REGISTER NOTICE

INTERNATIONAL TRADE COMMISSION

[Investigation 332-380]

Advice Concerning the Proposed Modification of Duties on Certain Information Technology Products and Distilled Spirits

AGENCY: United States International Trade Commission.

ACTION: Institution of investigation.

EFFECTIVE DATE: March 5, 1997.

SUMMARY: Following receipt on February 27, 1997 of a request from the United States Trade Representative, the Commission instituted investigation No. 332-380, Advice Concerning the Proposed Modification of Duties on Certain Information Technology Products and Distilled Spirits, under section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)).

As requested by the USTR, the Commission will provide: (1) Profiles of the domestic and foreign information technology and distilled spirits industries, including a description of the industry and its relative strengths, (2) trends in production, (3) a brief analysis of current tariffs, (4) an assessment of patterns of imports and exports, and (5) an indication of potential increased market opportunities resulting from proposed tariff modifications. As requested, the Commission will submit its report to the USTR by April 4, 1997.

FOR FURTHER INFORMATION: Information on general aspects of the study may be obtained from John Kitzmiller, Office of Industries (202-205-3387) or, on legal aspects, from William Gearhart, Office of the General Counsel (202-205-3091). The media should contact Margaret O'Laughlin, Office of External Relations (202-205-1819). Hearing impaired individuals are advised that information on this matter can be obtained by contacting the TDD terminal on (202-205-1810). A copy of this notice and the annex listing the products under consideration can be downloaded from the Commission's Internet server (http://www.usitc.gov) or may be obtained by contacting the Office of the Secretary, U.S. International Trade Commission, 500 E Street, SW, Washington, DC, 20436, or at 202-205-1802.

BACKGROUND: At the WTO Ministerial Conference in Singapore in December 1996, economies representing over 80 percent of world trade in information technology products declared their intention to bind and eliminate customs duties and other duties and charges on a broad range of products. At the same time, the United States agreed to eliminate its tariffs on "white" distilled spirits and accelerate the elimination of tariffs on "brown" distilled spirits.

Section 111(b) of the Uruguay Round Agreements Act (the Act) authorizes the President, subject to the consultation and layover requirements of section 115 of the Act, to proclaim further modifications of any duty for articles contained in a tariff category that was part of the U.S. "zero-for-zero" initiative. This authority is subject only to the conditions set forth in section 111 which include compliance with the consultation and layover provisions of section 115 of the URAA. One of the requirements set out in section 115 is that the President obtain advice regarding the proposed action from the Commission. Accordingly, the Commission has been asked, pursuant to section 115 of the Act and section 332 of the Tariff Act of 1930, to provide information and advice concerning the proposed action.

WRITTEN SUBMISSIONS: Interested persons are invited to submit written statements concerning the matters to be addressed in the report. All written submissions will be made available for inspection by interested persons in the Office of the Secretary to the Commission. To be assured of submission to USTR with the report, written statements relating to the Commission's report should be submitted at the earliest practical date and should be received no later than March 21, 1997. All submissions should be addressed to the Secretary, U.S. International Trade Commission, 500 E Street SW, Washington, DC, 20436. Persons with mobility impairments who will need special assistance in gaining access to the Commission should contact the Office of the Secretary at 202–205–2000.

By order of the Commission.

Issued: March 6, 1997.

Donna R. Koehnke,

Secretary.

[FR Doc. 97–6133 Filed 3–10–97; 8:45 am]

BILLING CODE 7020–02–P

APPENDIX D

INFORMATION TECHNOLOGY AGREEMENT

MINISTERIAL DECLARATION ON TRADE IN INFORMATION TECHNOLOGY PRODUCTS

SINGAPORE, 13 DECEMBER 1996

Ministers,

Representing the following Members of the World Trade Organization ("WTO"), and States or separate customs territories in the process of acceding to the WTO, which have agreed in Singapore on the expansion of world trade in information technology products and which account for well over 80 per cent of world trade in these products ("parties"):

Australia
Canada
European Communities
Hong Kong
Iceland
Indonesia
Japan
Korea
Norway
Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu
Singapore
Switzerland[1]
Turkey
United States

Considering the key role of trade in information technology products in the development of information industries and in the dynamic expansion of the world economy,

Recognizing the goals of raising standards of living and expanding the production of and trade in goods;

Desiring to achieve maximum freedom of world trade in information technology products;

Desiring to encourage the continued technological development of the information technology industry on a world-wide basis;

Mindful of the positive contribution information technology makes to global economic growth and welfare;

Having agreed to put into effect the results of these negotiations which involve concessions additional to those included in the Schedules attached to the Marrakesh Protocol to the General Agreement on Tariffs and Trade 1994, and

Recognizing that the results of these negotiations also involve some concessions offered in negotiations leading to the establishment of Schedules annexed to the Marrakesh Protocol,

Declare as follows:

1. Each party's trade regime should evolve in a manner that enhances market access opportunities for information technology products.

---

[1]On behalf of the customs union Switzerland and Liechtenstein.

2. Pursuant to the modalities set forth in the Annex to this Declaration, each party shall bind and eliminate customs duties and other duties and charges of any kind, within the meaning of Article II:1(b) of the General Agreement on Tariffs and Trade 1994, with respect to the following:

(a) all products classified (or classifiable) with Harmonized System (1996) ("HS") headings listed in Attachment A to the Annex to this Declaration; and

(b) all products specified in Attachment B to the Annex to this Declaration, whether or not they are included in Attachment A;

through equal rate reductions of customs duties beginning in 1997 and concluding in 2000, recognizing that extended staging of reductions and, before implementation, expansion of product coverage may be necessary in limited circumstances.

3. Ministers express satisfaction about the large product coverage outlined in the Attachments to the Annex to this Declaration. They instruct their respective officials to make good faith efforts to finalize plurilateral technical discussions in Geneva on the basis of these modalities, and instruct these officials to complete this work by 31 January 1997, so as to ensure the implementation of this Declaration by the largest number of participants.

4. Ministers invite the Ministers of other Members of the WTO, and States or separate customs territories in the process of acceding to the WTO, to provide similar instructions to their respective officials, so that they may participate in the technical discussions referred to in paragraph 3 above and participate fully in the expansion of world trade in information technology products.

Annex: Modalities and Product Coverage

Attachment A: list of HS headings

Attachment B: list of products

ANNEX

Modalities and Product Coverage

Any Member of the World Trade Organization, or State or separate customs territory in the process of acceding to the WTO, may participate in the expansion of world trade in information technology products in accordance with the following modalities:

1. Each participant shall incorporate the measures described in paragraph 2 of the Declaration into its schedule to the General Agreement on Tariffs and Trade 1994, and, in addition, at either its own tariff line level or the Harmonized System (1996) ("HS") 6-digit level in either its official tariff or any other published versions of the tariff schedule, whichever is ordinarily used by importers and exporters. Each participant that is not a Member of the WTO shall implement these measures on an autonomous basis, pending completion of its WTO accession, and shall incorporate these measures into its WTO market access schedule for goods.

2. To this end, as early as possible and no later than 1 March 1997 each participant shall provide all other participants a document containing (a) the details concerning how the appropriate duty treatment will be provided in its WTO schedule of concessions, and (b) a list of the detailed HS headings involved for products specified in Attachment B. These documents will be reviewed and approved on a consensus basis and this review process shall be completed no later than 1 April 1997. As soon as this review process has been completed for any such document, that document shall be submitted as a modification to the Schedule of the participant concerned, in accordance with the Decision of 26 March 1980 on Procedures for Modification and Rectification of Schedules of Tariff Concessions (BISD 27S/25).

(a) The concessions to be proposed by each participant as modifications to its Schedule shall bind and eliminate all customs duties and other duties and charges of any kind on information technology products as follows:

(i) elimination of such customs duties shall take place through rate reductions in equal steps, except as may be otherwise agreed by the participants. Unless otherwise agreed by the participants, each participant shall bind all tariffs on items listed in the Attachments no later than 1 July 1997, and shall make the first such rate reduction effective no later than 1 July 1997, the second such rate reduction no later than 1 January 1998, and the third such rate reduction no later than 1 January 1999, and the elimination of customs duties shall be completed effective no later than 1 January 2000. The participants agree to encourage autonomous elimination of customs duties prior to these dates. The reduced rate should in each stage be rounded off to the first decimal; and

(ii) elimination of such other duties and charges of any kind, within the meaning of Article II:1(b) of the General Agreement, shall be completed by 1 July 1997, except as may be otherwise specified in the participant's document provided to other participants for review.

(b) The modifications to its Schedule to be proposed by a participant in order to implement its binding and elimination of customs duties on information technology products shall achieve this result:

(i) in the case of the HS headings listed in Attachment A, by creating, where appropriate, sub-divisions in its Schedule at the national tariff line level; and

(ii) in the case of the products specified in Attachment B, by attaching an annex to its Schedule including all products in Attachment B, which is to specify the detailed HS headings for those products at either the national tariff line level or the HS 6-digit level.

Each participant shall promptly modify its national tariff schedule to reflect the modifications it has proposed, as soon as they have entered into effect.

3. Participants shall meet periodically under the auspices of the Council on Trade in Goods to review the product coverage specified in the Attachments, with a view to agreeing, by consensus, whether in the light of technological developments, experience in applying the tariff concessions, or changes to the HS nomenclature, the Attachments should be modified to incorporate additional products, and to consult on non-tariff barriers to trade in information technology products. Such consultations shall be without prejudice to rights and obligations under the WTO Agreement.

4. Participants shall meet as soon as practicable and in any case no later than 1 April 1997 to review the state of acceptances received and to assess the conclusions to be drawn therefrom. Participants will implement the actions foreseen in the Declaration provided that participants representing approximately 90 per cent of world trade[2] in information technology products have by then notified their acceptance, and provided that the staging has been agreed to the participants' satisfaction. In assessing whether to implement actions foreseen in the Declaration, if the percentage of world trade represented by participants falls somewhat short of 90 per cent of world trade in information technology products, participants may take into account the extent of the participation of States or separate customs territories representing for them the substantial bulk of their own trade in such products. At this meeting the participants will establish whether these criteria have been met.

5. Participants shall meet as often as necessary and no later than 30 September 1997 to consider any divergence among them in classifying information technology products, beginning with the products specified in Attachment B. Participants agree on the common objective of achieving, where appropriate, a common classification for these products within existing HS nomenclature, giving consideration to interpretations and rulings of the Customs Co-operation Council (also known as the World Customs Organization or "WCO"). In any instance in which a divergence in classification remains, participants will consider whether a joint suggestion could be made to the WCO with regard to updating existing HS nomenclature or resolving divergence in interpretation of the HS nomenclature.

6. The participants understand that Article XXIII of the General Agreement will address nullification or impairment of benefits accruing directly or indirectly to a WTO Member participant through the implementation of this Declaration as a result of the application by another WTO Member participant of any measure, whether or not that measure conflicts with the provisions of the General Agreement.

7. Each participant shall afford sympathetic consideration to any request for consultation from any other participant concerning the undertakings set out above. Such consultations shall be without prejudice to rights and obligations under the WTO Agreement.

8. Participants acting under the auspices of the Council for Trade in Goods shall inform other Members of the WTO and States or separate customs territories in the process of acceding to the WTO of these modalities and initiate consultations with a view to facilitate their participation in the expansion of trade in information technology products on the basis of the Declaration.

---

[2]This percentage shall be calculated by the WTO Secretariat on the basis of the most recent data available at the time of the meeting.

9. As used in these modalities, the term "participant" shall mean those Members of the WTO, or States or separate customs territories in the process of acceding to the WTO, that provide the document described in paragraph 2 no later than 1 March 1997.

10. This Annex shall be open for acceptance by all Members of the WTO and any State or any separate customs territory in the process of acceding to the WTO. Acceptances shall be notified in writing to the Director-General who shall communicate them to all participants.

There are two attachments to the Annex.
Attachment A lists the HS headings or parts thereof to be covered.
Attachment B lists specific products to be covered by an ITA wherever they are classified in the HS .

Attachment A, Section 1

	HS96		HS description
	3818		**Chemical elements doped for use in electronics, in form of discs, wafers or similar forms; chemical compounds doped for use in electronics**
	8469	**11**	**Word processing machines**
	8470		**Calculating machines and pocket-size data recording, reproducing and displaying machines with a calculating function; accounting machines, postage franking machines, ticket-issuing machines and similar machines, incorporating a calculating devices: cash registers:**
	8470	10	Electronic calculators capable of operating without an external source of electric power and pocket size data recording, reproducing and displaying machines with calculating functions
	8470	21	Other electronic calculating machines incorporating a printing device
	8470	29	Other
	8470	30	Other calculating machines
	8470	40	Accounting machines
	8470	50	Cash registers
	8470	90	Other
	8471		**Automatic data processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machines for processing such data, not elsewhere specified or included:**
	8471	10	Analogue or hybrid automatic data processing machines
	8471	30	Portable digital automatic data processing machines, weighing no more than 10 kg, consisting of at least a central processing unit, a keyboard and a display
	8471	41	Other digital automatic data processing machines comprising in the same housing at least a central processing unit and an input and output unit, whether or not combined
	8471	49	Other digital automatic data processing machines presented in the form of systems
	8471	50	Digital processing units other than those of subheading 8471 41 and 8471 49, whether or not in the same housing one or two of the following types of units : storage units, input units, output units
	8471	60	Input or output units, whether or not containing storage units in the same housing
	8471	70	Storage units, including central storage units, optical disk storage units, hard disk drives and magnetic tape storage units
	8471	80	Other units of automatic data processing machines
	8471	90	Other
ex	**8472**	**90**	**Automatic teller machines**
	8473	**21**	**Parts and accessories of the machines of heading No 8470 of the electronic calculating machines of subheading 8470 10, 8470 21 and 8470 29**
	8473	**29**	**Parts and accessories of the machines of heading No 8470 other than the electronic calculating machines of subheading 8470 10, 8470 21 and 8470 29**
	8473	**30**	**Parts and accessories of the machines of heading No 8471**

	8473	50	Parts and accessories equally suitable for use with machines of two or more of the headings Nos. 8469 to 8472
ex	8504	40	Static converters for automatic data processing machines and units thereof. and telecommunication apparatus
ex	8504	50	Other inductors for power supplies for automatic data processing machines and units thereof. and telecommunication apparatus
	8517		Electrical apparatus for line telephony or line telegraphy, including line telephone sets with cordless handsets and telecommunication apparatus for carrier-current line systems or for digital line systems: videophones:
	8517	11	Line telephone sets with cordless handsets
	8517	19	Other telephone sets and videophones
	8517	21	Facsimile machines
	8517	22	Teleprinters
	8517	30	Telephonic or telegraphic switching apparatus
	8517	50	Other apparatus. for carrier-current line systems or for digital line systems
	8517	80	Other apparatus including entry-phone systems
	8517	90	Parts of apparatus of heading 8517
ex	8518	10	Microphones having a frequency range of 300 Hz to 3,4 KHz with a diameter of not exceeding 10 mm and a height not exceeding 3 mm. for telecommunication use
ex	8518	30	Line telephone handsets
ex	8518	29	Loudspeakers. without housing. having a frequency range of 300 Hz to 3.4 KHz with a diameter of not exceeding 50 mm. for telecommunication use
	8520	20	Telephone answering machines
	8523	11	Magnetic tapes of a width not exceeding 4 mm
	8523	12	Magnetic tapes of a width exceeding 4 mm but not exceeding 6.5 mm
	8523	13	Magnetic tapes of a width exceeding 6.5 mm
	8523	20	Magnetic discs
	8523	90	Other
	8524	31	Discs for laser reading systems for reproducing phenomena other than sound or image
ex	8524	39	Other : - for reproducing representations of instructions. data. sound. and image. recorded in a machine readable binary form. and capable of being manipulated or providing interactivity to a user. by means of an automatic data processing machine
	8524	40	Magnetic tapes for reproducing phenomena other than sound or image
	8524	91	Media for reproducing phenomena other than sound or image
ex	8424	99	Other : - for reproducing representations of instructions. data. sound. and image. recorded in a machine readable binary form. and capable of being manipulated or providing interactivity to a user. by means of an automatic data processing machine
ex	8525	10	Transmission apparatus other than apparatus for radio-broadcasting or television
	8525	20	Transmission apparatus incorporating reception apparatus
ex	8525	40	Digital still image video cameras
ex	8527	90	Portable receivers for calling. alerting or paging

N.B.: HS96 number 8424.99, above, should be 8524.99.

ex	8529	10	**Aerials or antennae of a kind used with apparatus for radio-telephony and radio-telegraphy**
ex	8529	90	**Parts of:** **transmission apparatus other than apparatus for radio-broadcasting or television** **transmission apparatus incorporating reception apparatus** **digital still image video cameras.** **portable receivers for calling, alerting or paging**
	8531	20	**Indicator panels incorporating liquid crystal devices (LCD) or light emitting diodes (LED)**
ex	8531	90	**Parts of apparatus of subheading 8531 20**
	8532		**Electrical capacitors, fixed, variable or adjustable (pre-set):**
	8532	10	Fixed capacitors designed for use in 50/60 Hz circuits and having a reactive power handling capacity of not less than 0.5 kvar (power capacitors)
	8532	21	Tantalum fixed capacitors
	8532	22	Aluminium electrolytic fixed capacitors
	8532	23	Ceramic dielectric, single layer fixed capacitors
	8532	24	Ceramic dielectric, multilayer fixed capacitors
	8532	25	Dielectric fixed capacitors of paper or plastics
	8532	29	Other fixed capacitors
	8532	30	Variable or adjustable (pre-set) capacitors
	8532	90	Parts
	8533		**Electrical resistors (including rheostats and potentiometers), other than heating resistors:**
	8533	10	Fixed carbon resistors, composition or film types
	8533	21	Other fixed resistors for a power handling capacity not exceeding 20 W
	8533	29	Other fixed resistors for a power handling capacity of 20 W or more
	8533	31	Wirewound variable resistors, including rheostats and potentiometers, for a power handling capacity not exceeding 20 W
	8533	39	Wirewound variable resistors, including rheostats and potentiometers, for a power handling capacity of 20 W or more
	8533	40	Other variable resistors, including rheostats and potentiometers
	8533	90	Parts
	8534		Printed circuits
ex	8536	50	Electronic AC switches consisting of optically coupled input and output circuits (Insulated thyristor AC switches)
ex	8536	50	Electronic switches, including temperature protected electronic switches, consisting of a transistor and a logic chip (chip-on-chip technology) for a voltage not exceeding 1000 volts
ex	8536	50	Electromechanical snap-action switches for a current not exceeding 11 amps
ex	8536	69	Plugs and sockets for co-axial cables and printed circuits
ex	8536	90	Connection and contact elements for wires and cables
	8541		**Diodes, transistors and similar semiconductor devices; photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light-emitting diodes: mounted piezo-electric crystals:**
	8541	10	Diodes, other than photosensitive or light-emitting diodes
	8541	21	Transistors, other than photosensitive transistors, with a dissipation rate of less than 1 W

	8541	29	Transistors, other than photosensitive transistors, with a dissipation rate of 1 W or more
	8541	30	Thyristors, diacs and triacs, other than photosensitive devices
	8541	40	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes
	8541	50	Other semiconductor devices
	8541	60	Mounted piezo-electric crystals
	8541	90	Parts
	8542		**Electronic integrated circuits and microassemblies**
	8542	12	Cards incorporating an electronic integrated circuit ('smart' cards)
	8542	13	Metal oxide semiconductors (MOS technology)
	8542	14	Circuits obtained by bipolar technology
	8542	19	Other monolithic digital integrated circuits, including circuits obtained by a combination of bipolar and MOS technologies (BIMOS technology)
	8542	30	Other monolithic integrated circuits
	8542	40	Hybrid integrated circuits
	8542	50	Electronic microassemblies
	8542	90	Part
	8543	81	Proximity cards and tags
ex	8543	89	Electrical machines with translation or dictionary functions
ex	8544	41	Other electric conductors, for a voltage not exceeding 80 V, fitted with connectors, of a kind used for telecommunications
ex	8544	49	Other electric conductors, for a voltage not exceeding 80 V, not fitted with connectors, of a kind used for telecommunications
ex	8544	51	Other electric conductors, for a voltage exceeding 80 V but not exceeding 1000 V, fitted with connectors, of a kind used for telecommunications
	8544	70	Optical fibre cables
	9009	11	Electrostatic photocopying apparatus, operating by reproducing the original image directly onto the copy (direct process)]
	9009	21	Other photocopying apparatus, incorporating an optical system
	9009	90	Parts and accessories
	9026		Instruments and apparatus for measuring or checking the flow, level, pressure or other variables of liquids or gases (for example, flow meters, level gauges, manometers, heat meters), excluding instruments and apparatus of heading No 9014, 9015, 9028 or 9032:
	9026	10	Instruments for measuring or checking the flow or level of liquids
	9026	20	Instruments and apparatus for measuring or checking pressure
	9026	80	Other instruments and apparatus for measuring or checking of heading 9026
	9026	90	Parts and accessories of instruments and apparatus of heading 9026
	9027	20	Chromatographs and electrophoresis instruments
	9027	30	Spectrometers, spectrophotometers and spectrographs using optical radiations (UV, visible, IR)
	9027	50	Other instruments and apparatus using optical radiations (UV, visible, IR) of heading No 9027

	9027	80	**Other instruments and apparatus of heading No 9027 (other than those of heading No 9027 10)**
ex	9027	90	**Parts and accessories of products of heading 9027, other than for gas or smoke analysis apparatus and microtomes**
	9030	40	**Instruments and apparatus for measuring and checking, specially designed for telecommunications (for example. cross-talk meters, gain measuring instruments. distorsion factor meters. psophometers)**

Attachment A. Section 2

Semiconductor manufacturing and testing equipment and parts thereof

	HS Code	Description	Comments
ex	7017 10	Quartz reactor tubes and holders designed for insertion into diffusion and oxidation furnaces for production of semiconductor wafers	For Attachment B
ex	8419 89	Chemical vapor deposition apparatus for semiconductor production	For Attachment B
ex	8419 90	Parts of chemical vapor deposition apparatus for semiconductor production	For Attachment B
ex	8421 19	Spin dryers for semiconductor wafer processing	
ex	8421 91	Parts of spin dryers for semiconductor wafer processing	
ex	8424 89	Deflash machines for cleaning and removing contaminants from the metal leads of semiconductor packages prior to the electroplating process	
ex	8424 89	Spraying appliances for etching, stripping or cleaning semiconductor wafers	
ex	8424 90	Parts of spraying appliances for etching, stripping or cleaning semiconductor wafers	
ex	8456 10	Machines for working any material by removal of material, by laser or other light or photo beam in the production of semiconductor wafers	
ex	8456 91	Apparatus for stripping or cleaning semiconductor wafers	For Attachment B
	8456 91	Machines for dry-etching patterns on semiconductor materials	
ex	8456 99	Focused ion beam milling machines to produce or repair masks and reticles for patterns on semiconductor devices	
ex	8456 99	Lasercutters for cutting contacting tracks in semiconductor production by laser beam	For Attachment B
ex	8464 10	Machines for sawing monocrystal semiconductor boules into slices, or wafers into chips	For Attachment B
ex	8464 20	Grinding, polishing and lapping machines for processing of semiconductor wafers	
ex	8464 90	Dicing machines for scribing or scoring semiconductor wafers	
ex	8466 91	Parts for machines for sawing monocrystal semiconductor boules into slices, or wafers into chips	For Attachment B
ex	8466 91	Parts of dicing machines for scribing or scoring semiconductor wafers	For Attachment B
ex	8466 91	Parts of grinding, polishing and lapping machines for processing of semiconductor wafers	
ex	8466 93	Parts of focused ion beam milling machines to produce or repair masks and reticles for patterns on semiconductor devices	
ex	8466 93	Parts of lasercutters for cutting contacting tracks in semiconductor production by laser beam	For Attachment B
ex	8466 93	Parts of machines for working any material by removal of material, by laser or other light or photo beam in the production of semiconductor wafers	
ex	8456 93	Parts of apparatus for stripping or cleaning semiconductor wafers	For Attachment B
ex	8466 93	Parts of machines for dry-etching patterns on semiconductor materials	
ex	8477 10	Encapsulation equipment for assembly of semiconductors	For Attachment B
ex	8477 90	Parts of encapsulation equipment	For Attachment B

ex	8479 50	Automated machines for transport, handling and storage of semiconductor wafers, wafer cassettes, wafer boxes and other material for semiconductor devices	For Attachment B
ex	8479 89	Apparatus for growing or pulling monocrystal semiconductor boules	
ex	8479 89	Apparatus for physical deposition by sputtering on semiconductor wafers	For Attachment B
ex	8479 89	Apparatus for wet etching, developing, stripping or cleaning semiconductor wafers and flat panel displays	For Attachment B
ex	8479 89	Die attach apparatus, tape automated bonders, and wire bonders for assembly of semiconductors	For Attachment B
ex	8479 89	Encapsulation equipment for assembly of semiconductors	For Attachment B
ex	8479 89	Epitaxial deposition machines for semiconductor wafers	
ex	8479 89	Machines for bending, folding and straightening semiconductor leads	For Attachment B
ex	8479 89	Physical deposition apparatus for for semiconductor production	For Attachment B
ex	8479 89	Spinners for coating photographic emulsions on semiconductor wafers	For Attachment B
ex	8479 90	Part of apparatus for physical deposition by sputtering on semiconductor wafers	For Attachment B
ex	8479 90	Parts for die attach apparatus, tape automated bonders, and wire bonders for assembly of semiconductors	For Attachment B
ex	8479 90	Parts for spinners for coating photographic emulsions on semiconductor wafers	For Attachment B
ex	8479 90	Parts of apparatus for growing or pulling monocrystal semiconductor boules	
ex	8479 90	Parts of apparatus for wet etching, developing, stripping or cleaning semiconductor wafers and flat panel displays	For Attachment B
ex	8479 90	Parts of automated machines for transport, handling and storage of semiconductor wafers, wafer cassettes, wafer boxes and other material for semiconductor devices	For Attachment B
ex	8479 90	Parts of encapsulation equipment for assembly of semiconductors	For Attachment B
ex	8479 90	Parts of epitaxial deposition machines for semiconductor wafers	
ex	8479 90	Parts of machines for bending, folding and straightening semiconductor leads	For Attachment B
ex	8479 90	Parts of physical deposition apparatus for for semiconductor production	For Attachment B
ex	8480 71	Injection and compression moulds for the manufacture of semiconductor devices	
ex	8514 10	Resistance heated furnaces and ovens for the manufacture of semiconductor devices on semiconductor wafers	
ex	8514 20	Inductance or dielectric furnaces and ovens for the manufacture of semiconductor devices on semiconductors wafers	
ex	8514 30	Apparatus for rapid heating of semiconductor wafers	For Attachment B
ex	8514 30	Parts of resistance heated furnaces and ovens for the manufacture of semiconductor devices on semiconductor wafers	
ex	8514 90	Parts of apparatus for rapid heating of wafers	For Attachment B
ex	8514 90	Parts of furnaces and ovens of Headings No 8514 10 to No 8514 30	
ex	8536 90	Wafer probers	For Attachment B
	8543 11	Ion implanters for doping semiconductor materials	
ex	8543 30	Apparatus for wet etching, developing, stripping or cleaning semiconductor wafers and flat panel displays	For Attachment B

ex	8543 90	Parts of apparatus for wet etching, developing, stripping or cleaning semiconductor wafers and flat panel displays	For Attachment B
ex	8543 90	Parts of ion implanters for doping semiconductor materials	
	9010 41 to 9010 49	Apparatus for projection, drawing or plating circuit patterns on sensitized semiconductor materials and flat panel displays	
ex	9010 90	Parts and accessories of the apparatus of Headings No 9010 41 to 9010 49	
ex	9011 10	Optical stereoscopic microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or reticles	For Attachment B
ex	9011 20	Photomicrographic microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or reticles	For Attachment B
ex	9011 90	Parts and accessories of optical stereoscopic microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or reticles	For Attachment B
ex	9011 90	Parts and accessories of photomicrographic microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or reticles	For Attachment B
ex	9012 10	Electron beam microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or reticles	For Attachment B
ex	9012 90	Parts and accessories of electron beam microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or reticles	For Attachment B
ex	9017 20	Pattern generating apparatus of a kind used for producing masks or reticles from photoresist coated substrates	For Attachment B
ex	9017 90	Parts and accessories for pattern generating apparatus of a kind used for producing masks or reticles from photoresist coated substrates	For Attachment B
ex	9017 90	Parts of such pattern generating apparatus	For Attachment B
	9030 82	Instruments and apparatus for measuring or checking semiconductor wafers or devices	
ex	9030 90	Parts and accessories of instruments and apparatus for measuring or checking semiconductor wafers or devices	
ex	9030 90	Parts of instruments and appliances for measuring or checking semiconductor wafers or devices	
	9031 41	Optical instruments and appliances for inspecting semiconductor wafers or devices or for inspecting masks, photomasks or reticles used in manufacturing semiconductor devices	
ex	9031 49	Optical instruments and appliances for measuring surface particulate contamination on semiconductor wafers	
ex	9031 90	Parts and accessories of optical instruments and appliances for inspecting semiconductor wafers or devices or for inspecting masks, photomasks or reticles used in manufacturing semiconductor devices	
ex	9031 90	Parts and accessories of optical instruments and appliances for measuring surface particulate contamination on semiconductor wafers	

Attachment B

Positive list of specific products to be covered by this agreement wherever they are classified in the HS.

Where parts are specified, they are to be covered in accordance with HS Notes 2(b) to Section XVI and Chapter 90, respectively.

Computers: automatic data processing machines capable of 1) storing the processing program or programs and at least the data immediately necessary for the execution of the program; 2) being freely programmed in accordance with the requirements of the user; 3) performing arithmetical computations specified by the user; and 4) executing, without human intervention, a processing program which requires them to modify their execution, by logical decision during the processing run. The agreement covers such automatic data processing machines whether or not they are able to receive and process with the assistance of central processing unit telephony signals, television signals, or other analogue or digitally processed audio or video signals. Machines performing a specific function other than data processing, or incorporating or working in conjunction with an automatic data processing machine, and not otherwise specified under Attachment A or B, are not covered by this agreement.
Electric amplifiers when used as repeaters in line telephony products falling within this agreement, and parts thereof
Flat panel displays (including LCD, Electro Luminescence, Plasma and other technologies) for products falling within this agreement, and parts thereof.
Network equipment: Local Area Network (LAN) and Wide Area Network (WAN) apparatus, including those products dedicated for use solely or principally to permit the interconnection of automatic data processing machines and units thereof for a network that is used primarily for the sharing of resources such as central processor units, data storage devices and input or output units - including adapters, hubs, in-line repeaters, converters, concentrators, bridges and routers, and printed circuit assemblies for physical incorporation into automatic data processing machines and units thereof.
Monitors : display units of automatic data processing machines with a cathode ray tube with a dot screen pitch smaller than 0.4 mm not capable of receiving and processing television signals or other analogue or digitally processed audio or video signals without assistance of a central processing unit of a computer as defined in this agreement. The agreement does not, therefore, cover televisions, including high definition televisions.[3]
Optical disc storage units, for automatic data processing machines (including CD drives and DVD-drives), whether or not having the capability of writing/recording as well as reading, whether or not in their own housings.
Paging alert devices, and parts thereof .
Plotters whether input or output units of HS heading No 8471 or drawing or drafting machines of HS heading No 9017.
Printed Circuit Assemblies for products falling within this agreement, including such assemblies for external connections such as cards that conform to the PCMCIA standard. Such printed circuit assemblies consist of one or more printed circuits of heading 8534 with one or more active elements assembled thereon, with or without passive elements "Active elements" means diodes, transistors, and similar semiconductor devices, whether or not photosensitive, of heading 8541, and integrated circuits and micro assemblies of heading 8542.
Projection type flat panel display units used with automatic data processing machines which can display digital information generated by the central processing unit.

[3] Participants will conduct a review of this product description in January 1999 under the consultation provisions of paragraph 3 of the Declaration

Proprietary format storage devices including media therefor for automatic data processing machines, with or without removable media and whether magnetic, optical or other technology, including Bernoulli Box, Syquest, or Zipdrive cartridge storage units.
Multimedia upgrade kits for automatic data processing machines, and units thereof, put up for retail sale, consisting of, at least, speakers and/or microphones as well as a printed circuit assembly that enables the ADP machines and units thereof to process audio signals (sound cards).
Set top boxes which have a communication function: a microprocessor-based device incorporating a modem for gaining access to the Internet, and having a function of interactive information exchange

APPENDIX E

FACT SHEET ON U.S.-EU DISTILLED SPIRITS INITIATIVE

FACT SHEET ON U.S. - EU DISTILLED SPIRITS INITIATIVE

±In the Uruguay Round, the United States and EU actively pursued a zero tariff initiative on distilled spirits, including on white spirits (vodka, gin, rum, liqueurs and cordials). Agreement was reached to eliminate tariffs on whiskies and brandy by 2004, but white spirits were not part of the final agreement.

±Since the conclusion of the Uruguay Round in 1994, the distilled spirits industries in Europe and the United States continued to pursue tariff elimination for this sector. The EU is the largest overall market for U.S. distilled spirits exports, and the second largest export market for U.S. rum.

±Section 111 of the Uruguay Round Agreements Act (URAA) provides the President the authority to continue to pursue tariff reductions to accomplish the sectoral initiatives that the United States had sought, but did not achieve, in the Round. This includes white distilled spirits, as noted in the U.S. Statement of Administrative Action which accompanied the URAA.

±At the WTO Ministerial Conference in December 1996, along with the Information Technology Agreement (ITA), the United States and EU agreed to further market access liberalization for spirits. This included acceleration of tariff cuts for brown spirits and expansion of the zero-for-zero initiative to include white spirits.

--The United States and EU agreed to eliminate tariffs on brandy and whisky by the year 2000, four years ahead of the timetable agreed to in the Uruguay Round.

--The duties on ±white± distilled spirits such as vodka, gin and liqueurs will be eliminated by 2000, and on high-valued rum by 2003.

Provisions for whisky, brandy, gin, vodka, liqueurs, cordials

±The U.S. and EU will eliminate tariffs on the following products in 4 equal stages, beginning July 1, 1997, followed by further reductions on January 1, 1998, January 1, 1999 and January 1, 2000:

2208.30 spirits obtained by distilling grape wine or grape marc (grape brandy)
2208.30 whiskies
2208.50 gin and geneva
2208.60 vodka
2208.70 liqueurs and cordials
2208.90other spirits, excluding undenatured ethyl alcohol of an alcoholic strength by volume of less than 80 percent

Provisions for rum (2208.40)

±The results expand U.S. export opportunities for high-quality, brand-name rum into Europe, a key objective for U.S. producers. At the same time, several features of the rum package were designed to accommodate concerns of the Virgin Islands and other Caribbean producers.

±To address these concerns, the Agreement:

--Stages the tariff reductions on high quality rum to 2003, similar to the staging for rum reductions under NAFTA.

--eSTAEstablishes a system of price breaks for bulk and bottled rum the result of which is that low cost rum is not included in the agreement.

±In the United States, bulk rum valued at 69 cents a proof liter or less, and bottled rum valued at $3.00 a proof liter or less, are excluded from the deal and continue to face existing tariffs. These price breaks protect Virgin Island and Caribbean suppliers of bottled product and low-cost bulk product from third country competition.

±Since the EU import values include the cost of freight, handling and shipping (while U.S. imports do not include these costs), the price breaks are set at higher levels: 2 ECU per liter of 100 percent alcohol for bulk rum and 7.9 per liter of 100 percent alcohol for bottled rum. In 1995, the average price of U.S. rum exports to the EU exceeded these levels, so the price breaks should not hinder U.S. export growth.

±±Traditional± rum exported by Jamaica and other Caribbean islands is also exempted from tariff reductions in Europe where there is an historic market for the product. The United States did not make a similar exemption because there is little consumption of ±traditional± rum in the United States.

±The EU will employ a transitional tariff-rate quota on high-valued rum that will expand annually, allowing growth in U.S. export opportunities during the transition period. The tariff-rate quota will be eliminated in 2003.

U.S. Import Profile for Rum

(all data are based on 11 month imports figures for 1996)

±In 1996, the distilled spirits industry estimates that 69 percent of U.S. rum shipments are from Puerto Rico, about 22 percent from the Virgin Islands, and about 8 percent from CBI/NAFTA. Imports from third countries are less than 1 percent of the U.S. total.

±Puerto Rico also is a substantial supplier of rum to other markets, particularly Europe. One company in Puerto Rico, Bacardi, operates the largest rum distillery in the world. The U.S. distilled spirits industry estimates that more than 2,600 jobs currently are created directly or indirectly by rum distilling in Puerto Rico. The new initiative should further enhance the economic potential of the Puerto Rican rum industry.

±The Virgin Islands sells all of its low-cost bulk rum (averaging about 38 cents a proof liter) in the U.S. market.

--Under the Caribbean Basin Recovery Act and the Internal Revenue Code, the Virgin Islands government receives most of the excise taxes it collects on the shipments of V.I. rum, as much as $50 million annually according to the government of the Virgin Islands. The rebate is used to secure bonds for local capital improvements and a portion also goes into the V.I. general fund. The new tariff initiative on rum will not disturb these tax arrangements for the Virgin Islands.

±Caribbean countries export bulk and bottled rum to the United States and receive duty-free treatment for this rum under the Caribbean Basin Initiative. The provisions of the CBI on rum are not altered by the new tariff initiative.

--Some Caribbean rum competes directly with the low-cost product of the Virgin Islands (e.g., bulk rum from Barbados enters the U.S. at the same average price as V.I. rum). This rum is excluded from tnot included in the initiative.

--Other Caribbean nations export high-quality rum that has brand name recognition in the United States, Europe and other major markets. This rum is included in the initiative, but the current source of competition is from U.S. or other Caribbean producers.

APPENDIX F

SUBMISSIONS

APPENDIX F CONTENTS

Page

SUBMISSIONS

Collier, Shannon, Rill & Scott, PLLC
Attorneys-at-Law
3050 K Street, N.W.
Suite 400
Washington, D.C. 20007

Tel.: (202) 342-8400
Fax: (202) 342-8451

10 Barrack Street
Level 12
Sydney, NSW 2000, Austral
Tel.: 61-2-262-6700
Fax: 61-2-262-3263

(202) 342-8545

March 21, 1997

'97 MAR 21 P5:10

Ms. Donna R. Koehnke
Secretary
U.S. International Trade Commission
500 E Street, SW
Washington, DC 20436

Re: <u>Proposed Modification of Duties on Certain Information Technology Products</u>

Dear Ms. Koehnke:

On behalf of Symbol Technologies, Inc. ("Symbol") of Bohemia, New York, we submit this letter concerning the proposed modification of duties on certain information technology products pursuant to the ITC's March 11, 1997 request for comments, 62 Fed. Reg. 11222. Symbol is the world leader in bar code capture system technology, manufacturing and sales. Symbol currently exports over $200 million of scanners and terminals annually. Symbol believes that inclusion of laser scanners and terminals as part of the initial phase-out of duties under the Information Technology Agreement ("ITA" or "the Agreement") will significantly increase U.S. exports of these products. Therefore, Symbol requests that the U.S. government explicitly include scanners and terminals in the ITA.

Laser scanners and terminals input data into computer systems by reading information that is encoded in bar code format. One common use for scanners is as a point-of-sale device in retail stores, but scanners and terminals also are used in a variety of more sophisticated computer applications, including use as stand-alone, hand-held automatic data processing ("ADP") systems. In all of their uses, Symbol's products serve the same function as other ADP machines; Symbol's products merely input data by means of an optical scanning process rather than by keyboard or other input device. Scanners and terminals generally are classified under subheadings 8471.30, 8471.60, 8471.80 and 8525.20 of the Harmonized Tariff Schedule.

Symbol's export sales of scanners have expanded rapidly, doubling over the past five years. Inclusion of scanners and terminals in the ITA could further accelerate this growth because many of the most promising emerging markets for Symbol's products currently limit imports with high tariffs on scanners and terminals, some greater than 20 percent. Tariffs for these products in the United States, in contrast, already are quite low, generally 1.5 percent. Thus, inclusion of scanners and terminals in the ITA will greatly benefit U.S. exports while incurring very little cost. As the world leader in the manufacture of scanners and terminals, Symbol is well positioned to expand its export sales in the rapidly expanding markets of Asia and Latin America.

The purpose of the ITA is to reduce tariffs on information technology products. Scanners and terminals represent important examples of ADP machines of which the United States is the leading producer. Scanners and terminals should be included in the ITA, and Symbol requests that the U.S. government explicitly include these products in the final Agreement. If you have any questions or would like further information, please contact the undersigned.

Sincerely,

JOHN B. BREW
CRAIG L. SILLIMAN

Counsel to Symbol Technologies, Inc.

Aerovox® Corporate Offices

ar 21, 1997

Fax # 202/ 205-2104

o: Honorable Donna R. Koehnke
U.S. International Trade Commission

: Mary Mandeville
Manager, Communications

Re: Information Technology Agreement

Dear Secretary Koehnke:

nd separate cover, we are sending you 14 copies
e attached letter.

ncerely hope, for the sake of all of our employees,
a the Commission will see fit to exclude capacitors
c the ITA.

ours truly,

Mary Mandeville

ar Mandeville

or hn A. Chmura Jr.

: Mr. Robert Carr, ITA
Mr. Horace Johnson, EIA

Fe e Corner Road, North Dartmouth, MA 02747-1217 USA TEL (508) 995-8000 FAX (508) 995-3000

Aerovox®

Corporate Offices

March 21, 1997

The Honorable Donna R. Koehnke
U.S. International Trade Commission
500 E. Street, S.W.
Washington, DC 20436

'97 MAR 24 ... OFC OF ... US INT'L TRADE ...

Dear Secretary Koehnke:

Aerovox has been in business since 1922, providing employment for a goodly number of hard working citizens who would like to keep their jobs. I am writing this letter on behalf of the more than 700 employees in the United States who depend on Aerovox for their livelihood. We are deeply concerned about the impending ratification of the Information Technology Agreement, scheduled for April 1, 1997.

Elimination of the present tariffs affecting capacitors will jeopardize the job security of our U.S. employees as well as the job security of the thousands of people employed by other U.S. capacitor manufacturers.

Aerovox's major objections to the proposed agreement are the following:

1. European duties on capacitors are already low and U.S. and European companies are already trading in a competitive but equitable environment.
2. The Japanese and Korean markets are in fact closed to U.S. capacitor products due to non-tariff barriers. The ITA does not address the non-tariff trade barriers in these countries which renders the Agreement unfair.
3.. American capacitor manufactures receive little, if anything, in return for surrendering our market to the Japanese and Korean capacitor manufacturers who will be eligible to join the ITA.

Our overall concern is that the Far East philosophy of gaining market share at low prices to support "jobs" in their countries and at the same time maintaining their domestic market share at higher prices with non-tariff trade barriers will result in serious, if not fatal, erosion of U.S. capacitor manufacturing. If the ITA is ratified without exclusion of capacitors, it is likely the only viable alternative will be for domestic U.S. capacitor manufacturers to pursue opening or expanding manufacturing locations offshore (Mexico or the Far East).

370 Faunce Corner Road, North Dartmouth, MA 02747-1217 USA TEL (508) 995-8000 FAX (508) 995-3000

We ask you to reconsider the inclusion of capacitors in this Agreement. Otherwise, many U.S. capacitor manufacturing jobs are at risk.

Sincerely,

John A. Chmura Jr

John A. Chmura, Jr.
Senior Vice President
Aerovox

cc: Mr. Robert Carr, ITA
(202) 205-3161
Mr. Horace Johnson, EIA
(703) 907-7501

JC/gb

Aerovox® INC.

Corporate Offices
370 Faunce Corner Rd.
North Dartmouth, MA 02747

TEL (508) 995-8000
FAX (508) 995-3000

FAX MESSAGE

IF YOU DO NOT RECEIVE ALL PAGES, PLEASE CALL US AS SOON AS POSSIBLE.

To: *Mr. Les Glick*
Company: Porter. Right. Morris & Arthur
From: J. Chmura
Subject: ITA Tariff Reduction

FAX No.: (202) 778-3063
Date: February 21, 1997

Dear Les:

Aerovox Inc., a $125M manufacturing company of AC metallized film, AC motor-start capacitors, aluminum electrolytic capacitors and large DC aluminum electrolytic capacitors with operations in the U.K., Massachusetts, Alabama, and Mexico, is strongly opposed to the recently negotiated ITA tariff reduction due to the following:

1. Aerovox products are not utilized in PCs, monitors, or other types of electronic equipment. Aerovox's products are utilized in industrial and large household appliances; i.e. washers, refrigerators, room air conditioners, industrial pumps and motors. Thus, there is great difficulty in understanding the "technology" driven needs to reduce duties for components used in these products.

2. Aerovox has facilities in several countries and has not found the present tariffs to be a hinderance to business. However, Aerovox has found non-tariff issues are far more difficult to overcome, and essentially bar sales of components to the Japanese and Korean markets. Combined with these non-tariff barrier issues and what at times appears to be a predatory pricing philosophy to maintain full employment in some of the Far East countries, the ITA tariff reduction/elimination proposal will truly jeopardize AC film, AC motor start and large can aluminum electrolytic manufacturers.

Aerovox also believes the present phase-out schedule which will effectively eliminate duties and tariffs from 9% to 0 in three years and four months is overly aggressive. A more responsible time phase-out, similar to the Canada/U.S. trade agreement of 1%/yr., would allow present U.S. manufacturers to adjust. Any consideration of accelerating tariff schedules would inflict harsh consequences upon Aerovox and its industry in general.

Thus, Aerovox truly believes the present agreement opens the U.S. market to all competition while not reducing foreign non-duty trade barriers and the present proposed schedule is unfair to local manufacturers. We strongly believe the section affecting capacitor manufacturers should be eliminated from the proposed ITA agreement.

Regards,

Jack Chmura

Jack Chmura

JC/bs:ITA2.TAr

ASC®
CAPACITORS

March 12, 1997

'97 MAR 21 A9:44

Secretary, U.S. International Trade Commission
500 E Street SW
Washington, DC 20436

Dear Mr. Secretary:

On behalf of the 250 employees here at ASC Capacitor, I would like to express our concern for the Information Technology Agreement scheduled for ratification on April 1, 1997. We feel the elimination of tariffs on capacitors jeopardizes our job security and the security of thousands of employees at other U.S. producers of capacitors.

Our company is one of many small U.S. manufacturers of film capacitors that are already fighting to survive against the much larger foreign manufacturers that have entered our market in the last ten years. We are working hard to restructure our organization and re-engineer our products to survive against the giants from oversees based on today's competitive situation. However, if the duty is eliminated and we have to reduce our prices another 10% to stay even, we'll be forced out of business on many products. These foreign competitors can sell at or below cost in our market to gain market share because they have the luxury of fat profits in their home market.

We ask you to reconsider the inclusion of capacitors in this agreement, especially film capacitors where the U.S. producers are already struggling to survive. Our jobs and the jobs of many other small capacitor companies are threatened by this agreement.

Sincerely,

Chuck Robertson
General Manager

301 West O Street • Ogallala, NE 69153
Telephone: (308) 284-3611 • FAX Numbers: (308) 284-2708 • (308) 284-8324 • (308) 284-4141

Kitzmiller

Industrial/Midwec Capacitor Corporation
A Charles Industries Company

Charles Center
5600 Apollo Drive
Rolling Meadows, Illinois 60008

Telephone: (847) 806-6300
FAX: (847) 806-6231

I/M®

'97 MAR 17 P3:51

March 12, 1997

Secretary
U.S. International Trade Commission
500 E. Street SW
Washington, DC 20436

Dear Secretary, U.S. International Trade Commission:

The intent of this letter is to express our desire that capacitors NOT be included for tariff reductions in the Information Technology Agreement (ITA). If the agreement is signed as it stands now, we would expect that all materials used in all types of capacitors listed in this agreement also have any tariffs eliminated. This would allow all capacitor manufacturer's the opportunity to purchase their materials at the best possible price and compete in the world market.

Industrial/Midwec Capacitor Corporation is a division of Charles Industries, Ltd., Rolling Meadows, Illinois. We manufacture film capacitors in Scottsbluff, Nebraska, using all available poly dielectrics. We employ 90 people at this location.

We appreciate your assistance in the matter.

Sincerely,

Mike Ritter

Mike Ritter
National Sales Manager

MR:ljg

Kitzmiller

MALLORY

North American Capacitor Company

March 12, 1997

Secretary
U. S. International Trade Commission
500 E. Street S.W.
Washington, DC 20436

'97 MAR 18 A9:28

Subject: Information Technology Agreement

Dear Secretary:

The inclusion of capacitors in the ITA document poses significant harm to an industry that is already buffeted by low labor cost countries. The removal of tariffs on capacitors will provide a market price advantage to these foreign countries that will be devastating to the U.S. owned companies like ourselves.

The North American Capacitor Co. (NACC) has facilities in small towns in Indiana and Kentucky where they are a major employer and contribute to the communities well being. These facilities are modern and well equipped and the employees well trained and experienced. The adverse market impact of the removal of these tariffs in the time frame outlined will be sorely felt. NACC is a major producer of certain types of capacitors and has been manufacturing these critical components for many years. NACC is privately owned and operated by U.S. individuals. The original company - Mallory Capacitor Co.- has been in business for over 65 years.

The inclusion of capacitors in the ITA was a significant mistake and (as indicated by one of the negotiators) only done to satisfy European pressure. Please don't compound the mistake by allowing the agreement to proceed without:

- Removing capacitors from it or
- Extending the phase in period to 2007.

Sincerely,

W. P. Carrier

W. P. Carrier

cc: Robert Carr - ITC - 202-205-3161 - Fax

bcc: H. Johnson - EIA - 703-907-7501

7545 Rockville Road, Indianapolis, Indiana 46214-3073 U.S.A. Phone: (317) 273-0090 • FAX: (317) 273-2400
http://www.nacc-mallory.com

PORTER, WRIGHT, MORRIS & ARTHUR

Attorneys & Counselors at Law

1667 K Street, N.W.
Washington, D.C. 20006
Telephone: 202-778-3000
Facsimile: 202-778-3063
Nationwide: 800-456-7962

LESLIE A. GLICK
202-778-3022
lglick@porterwright.com

RECEIVED
OFC OF THE SECRETARY
US INT'L TRADE COMM
'97 MAR -7 P3:55

March 7, 1997

The Honorable Donna R. Koehnke
United States International Trade Commission
500 E Street, S.W.
Washington D.C. 20436

Re: Invest. No. 332-380, Advice Concerning Proposed Modification of Duties on Certain Information Technology Products

Dear Secretary Koehnke:

Pursuant to your notice of March 5, 1997, we are enclosing a submission on behalf of our client Vishay Intertechnology, Inc. for consideration by your staff in its report. We also request that it be included in full in your official report. Kemet Electronic has also reviewed the enclosed letter and attachments and endorses the views contained therein.

Very truly yours,

Leslie Alan Glick

Cincinnati • Cleveland • Columbus • Dayton • Naples, FL • Washington, DC

VISHAY INTERTECHNOLOGY INC 63 LINCOLN HIGHWAY PO BOX 4004/MALVERN PA 19355-0988
PHONE (610) 644-1300 FAX (610) 296-0657

VISHAY

March 6, 1997

Mr. John Carr
U.S. International Trade Commission
500 E. Street SW
Washington, D.C.

Dear Mr. Carr:

I am enclosing my response to certain questions that you posed relating to capacitors and resistors and to our companies. We would like our responses included in the official record of the investigation along with this letter. We are very disturbed by the method in which this investigation was commenced and carried out. The normal procedure would have been to publish a notice in the Federal Register, announce a reasonable comment period, hold hearings etc. so that true and meaningful public input could be obtained. Instead, your "information gathering" will be completed prior to even the publication of the notice. It does not appear that the goal of this investigation is to obtain relevant information in any organized and objective manner. The ITC is an independent, bi-partisan organization, and we are concerned that you are simply being used to rubber stamp an action already taken by the U.S. Trade Representative. For example, it is highly unusual for the entire investigation to be conducted through phone interviews without questionnaires. This is subject to misreporting, misinterpretation and there is no written record available to check to see if what was reported was really said. We insisted on receiving a written request and responding in writing, but we understand other companies are simply being telephoned. We certainly think your office had time to put together a questionnaire. We are very disappointed that the ITC, a n independent agency with a long history of integrity, thoroughness and independence is allowing itself to be used in this manner by the Office of the U.S. Trade Representative.

Concerning substantive points of this investigation, we would like the following information included in your record:

1. The Informational Technology Agreement does not help the U.S. capacitor and resistor industry in any way.

2. U.S. capacitor and resistor makers will benefit little from the "opening of the European market" since European duties are already quite low, and we are already well positioned to serve these markets.

3. The real winner in the ITA agreement is Japan. The duty on capacitors and resistors imported into Japan is already zero. In return the 9.6% U.S. duty on capacitors and the 6% duty on resistors is removed. Japan does not have to worry about duties in its home market since it has erected a complex and impenetrable system of non-tariff barriers that make it impossible for U.S. capacitor and resistor makers to sell there. The Japanese will occasionally buy some model that they do not make but otherwise the market is closed. Moreover, not only is the Japanese market itself closed, but Japanese companies in the U.S. will not by from us nor will Japanese joint ventures with non-Japanese companies in Japan, the U.S. and third world countries (even where the non-Japanese joint venturer may be a company that has previously bought from us and knows that quality of our product). The Japanese use a complex system of "specsmanship" to keep from buying from U.S. producers.

4. The Japanese penetration of the U.S. market is already very great (see attached exhibit A submitted for your official record). Removal of the duties under the ITA will further increase the Japanese penetration to the point that U.S. companies will have difficulty competing and being profitable unless they move more jobs offshore.

5. The production by Vishay of capacitors and resistors is vital to the national security. This has been attested to by the Chairman of the House Armed Services Committee (see attachment A). A list of vital military programs served by our products is also attached (see attachment B).

We also wish to note for the record that the U.S.T.R. did not consult with our industry and in fact misled our industry into believing that the capacitors would not be included. They did not follow the advisory committee process set out in the Trade Act of 1974. They relied on contacts with the Electronics Industry Association that was in fact a member of the ITAC group promoting the agreement and had a built in conflict of interest since most of its non-capacitor and resistor producing members supported the ITA.

Very truly yours,

VISHAY INTERTECHNOLOGY, INC.

Avi D. Eden
Vice Chairman of the Board

EUROPEAN PRODUCERS/MARKET

After talking with other industry representatives, we have discerned that Philips, Siemens/Matsushita, Vishay, Thompson, and AVX are major producers in Europe. Are there any others that we are not catching? Do these companies comprise the bulk of European production? Missing are - WIMA, Germany; ARCOTRONICS, Italy and Germany; EVOX/RIFA, Sweden and Finland; ISKRA, Slowenia

In regard to resistors, we understand that Philips and Vishay are major European producers. Do these companies comprise the majority or substantial share of European production? Are we missing any? Any companies in the United Kingdom for instance? BEYSCHLAG, Germany; WELWYN, UK, BECKMANN, UK; VITROHM

Is consumption in the European market any different from that in the U.S.? Any more oriented toward consumer electronics rather than computers or telecommunications, or visa versa? Telecom and automotive are very strong. Industrial and computer are medium sized markets consumer electronics is low.

Are there any competitive differences between U.S. industry and European industry? For example, does the European Community have quicker or slower capital equipment depreciation schedules? Are the labor forces comparable in education/skill/wage rates? Is there any difference in technology levels, if so, which country is the lead? Labor and technology are similar.

JAPAN/ASIA

We have been told that some of the major Japanese producers of capacitors include Matsushita (Panasonic), TDK, NEC, ROHM, KOA Speer, Murata, Nichicon, and Nippon Cherni-con. Do these companies make up the bulk of Japanese production? Are we missing any companies, and if so, who? Missing capacitor companies are Hitachi - AIC, Matsuo, Shizuki, and Kyocera.

We understand that major Japanese producers of resistors include Hokuriku, Murata, Matsushita, ROHM, KOA Speer, and Fujitsu. Do these companies comprise the majority of production, or are we missing some? Missing resistor companies are Kyocera and Susumu

Is consumption of caps and resistors any different in Japan than in the U.S., and if so, how? Any more or less oriented toward consumer electronics, industrial, computer, telecom? CAPS: Quantity - 70% consumer, 30% industrial - Dollars/Yen - 60% consumer, 40% industrial
RESISTORS: Quantity - 83% consumer, 17% industrial - Dollars/Yen - 72% consumer, 28% industrial

What if any competitive differences exist between U.S. and Japanese producers? Tax treatment? Capital equipment depreciation schedules? Are there any differences in labor force, skill, education, wage rates? Any technology gap between the two countries, and if so, who is in the lead? Through the imposition of non-tariff barriers, US producers of capacitors and resistors are denied access to Japanese markets (whether located in Japan or at Japanese owned companies elsewhere in the world). Only resistor and capacitor products not manufactured by Japanese companies or not otherwise available are given access to the Japanese market. No technological, tax, wage, labor, equipment, quality, service or cost differences exist which could justify such an exclusion.

Are there any other notable Asian producers of capacitors or resistors? Samsung, Lucky-Goldstar, Dae Woo

QUESTIONS FOR RESISTOR MANUFACTURERS:

What is the national affiliation/ownership of their company? USA

What was the approximate value of their U.S. production in 1995 or 1996 (resistor products only)? Over $100,000,000 approximately

Any production outside of the United States, and if so where (especially interested in Mexican production and/or production sharing)? Mexico; Israel

Approximately how many workers do they employ in the production of resistors in the United States (try to separate out resistor employment if the company produces other good)? Approximately 2300

Any employment outside of the United States? Yes

What type of resistors do they produce? Similar to those manufactured in U.S.

What are the major end markets/uses for their products (computers, industrial, etc.)? Military, Computers, Telecommunications, Industrial - essentially all market areas

Is their product a mature good (commodity good), what is the level of technology, is the technology widely available? Resistors are a variety of technologies - we have commodity, military, and niche product.

Who are their major competitors (U.S. market, and in Europe/Asia if they are involved in international trade)? Panasonic, Rohm, KOA, Kyocera, Phillips, IRC, CTS, Bourns Kamaya, TAD Components

How does their product compete (price, quality, technology, quickness to market, etc.)? They are strong competitors

Are they involved in international trade, and if so, where? Yes, on a worldwide basis

Do they have any cooperative agreements with other producers, especially foreign? They usually have stocking locations with little or no manufacturing in North America and Europe

Any problems selling abroad (tariff or non-tariff barriers)? Japan - non tariff barriers; Part of Asia - non tariff barrier

WORLD CAPACITOR MARKETS
CONSUMPTION OF ALL CAPACITORS

Percent of Area	Japan	Europe	North America US	Rest of World Far East ex Japan
Shipped from:				
Japan	94.5%	23.0%	23.5%	24.2%
Europe	0.9%	70.8%	2.2%	2.7%
North America	0.1%	2.0%	70.0%	3.5%
Rest of World	4.6%	4.2%	4.3%	69.6%
Totals	100.0%	100.0%	100.0%	100.0%

Source: 1996 World Capacitor Trade Statistics
Electronic Industries Association; January 10, 1997

WORLD CAPACITOR MARKETS
CONSUMPTION OF ALL CAPACITORS

Millions of $	Japan	Europe	North America US	Rest of World Far East ex Japan
Shipped from:				
Japan	2284	487	595	1907
Europe	21	1497	56	211
North America	2	42	1772	276
Rest of World	111	89	110	5478
Totals	$2,418	$2,115	$2,533	$7,872

Source: 1996 World Capacitor Trade Statistics
Electronic Industries Association; January 10, 1997

THE CENTER FOR SECURITY POLICY

DECISION BRIEF

DECISION BRIEF
For Immediate Release

No. 97-D 23
7 February 1997
(202) 466-0515

'HOLD EVERYTHING': BARSHEFSKY'S NEW INFO TECH TRADE DEAL PROMOTES TRADE AT EXPENSE OF U.S. SECURITY INTERESTS

(Washington, D.C.): Last December, the Acting U.S. Trade Representative, Ambassador Charlene Barshefsky, presided over the completion of a "Ministerial Declaration on Trade in Information Technology Products" by members of the World Trade Organization. This agreement was drafted with a view to reducing tariffs and thereby promoting trade in computers, telecommunications equipment, copiers, radio and video technology and related components. The result is widely expected to be that American businesses will benefit from increased access to foreign markets, and consumers will enjoy reduced costs for foreign-produced goods in these areas.

Unfortunately, as negotiated, Ambassador Barshefsky's info tech trade deal may have significant -- and highly deleterious -- implications for U.S. national security. This agreement **clears the way for foreign manufacturers of capacitors and resistors to have completely duty-free access to the U.S. market. This may translate into distinct competitive advantages for foreign firms anxious to *wipe out* the last remaining U.S.-owned and -based manufacturers of these products, items critical to virtually every modern weapon system in the American arsenal.**

An illustrative sample of the military programs that rely upon these components includes: the AEGIS air defense system, AMRAAM air-to-air missiles, Patriot anti-aircraft and anti-missile missiles, TOW anti-tank weapons, key communications systems such as MILSTAR and SINCGARS, the HARM anti-radar weapons and the Peacekeeper and Trident strategic missiles. **Should the United States lose the one or two American companies still available to supply the capacitors and resistors required for such systems, military readiness could be materially degraded.**

This is no abstract proposition. In Operation Desert Shield/Storm, U.S. officials were alarmed to discover that dependency on foreign suppliers for spare parts or replacement components of vital weapon systems could translate into unacceptable shortfalls in defense capabilities and/or serious strains in relations with allied nations. For example, Washington had to ask the Japanese government for its help in assuring supplies of display screens for U.S. weapon systems that were not available from U.S. manufacturers.

'What, Me Worry?'

It appears, however, that **no thought was given by Ambassador Barshefsky or her team to the national security implications of the information technology agreement.** Indeed, the decision to include capacitors seems to have been almost an afterthought as earlier drafts and USTR consultations with affected industries gave no indication that such components would be affected. Even after the agreement was initialed in Singapore on 13 December 1996 and a number of legislators -- including, notably, the Chairman of the Senate

- more -

1250 24th Street, N.W., Suite 350, Washington, D.C. 20037 (202) 466-0515 FAX (202) 466-0518
info@security-policy.org www.security-policy.org

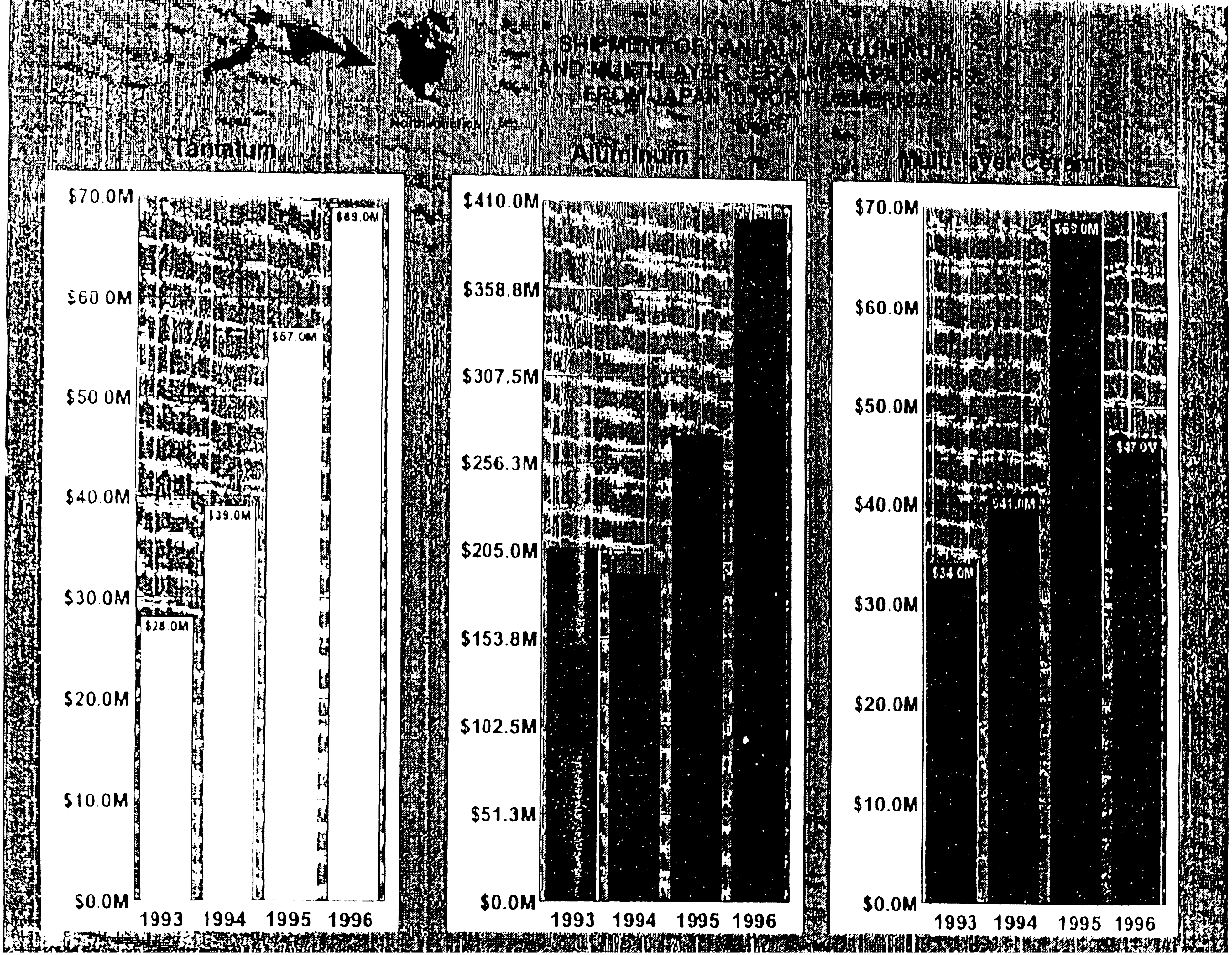
Armed Services Committee, Sen. Strom Thurmond -- began raising questions about the potential adverse repercussions of this agreement for U.S. security interests, **Mrs. Barshefsky has evinced little willingness to consider these repercussions or changes to the agreement that might be made to mitigate them.**

The Bottom Line

The good news for those concerned about the Clinton Administration's tendency to subordinate national security interests to the monomaniacal pursuit of trade opportunities is that Ambassador Barshefsky currently awaits Senate confirmation of her nomination to fill the post of U.S. Trade Representative on a permanent basis. What is more, because of her past lobbying activities on behalf of foreign entities, a waiver requiring the approval of *both houses* of Congress must precede Mrs. Barshefsky's confirmation by the Senate.

There is, accordingly, ample opportunity for legislators determined to ensure that vital U.S. defense capabilities do not become unduly dependent upon potentially unreliable foreign suppliers to reason with Mrs. Barshefsky about the need to "perfect" her information technology agreement with regard to militarily-relevant capacitors and resistors. As it happens, Ambassador Barshefsky informed the Senate Finance Committee on the occasion of her nomination hearing on 29 January that the info tech agreement would be "finalized within the next few weeks." Accordingly, **there should also be an opportunity to effect the sorts of changes required *before* that diplomatic process is completed and work on her nomination is concluded.**

During that period, the Senate **may also wish to take up with the Administration its determination to exercise its right to advise and consent to the finished agreement** -- a constitutional role the Clinton team would like to prevent Senators from playing in this area (as in several others of import for the national security -- notably, changes to the Conventional Forces in Europe and Anti-Ballistic Missile Treaties). **Such a review could be an important starting point for a more fulsome examination of the larger question of the military implications of foreign dependency in what President Clinton likes to call the "global economy."**


Tantalum
$70.0M
$60.0M
$50.0M
$40.0M
$30.0M
$20.0M
$10.0M
$0.0M
$28.0M
$39.0M
$57.0M
$69.0M
1993
1994
1995
1996
Aluminum
$410.0M
$358.8M
$307.5M
$256.3M
$205.0M
$153.8M
$102.5M
$51.3M
$0.0M
1993
1994
1995
1996
$70.0M
$60.0M
$50.0M
$40.0M
$30.0M
$20.0M
$10.0M
$0.0M
$34.0M
$41.0M
$69.0M
1993
1994
1995
1996

THE CENTER FOR SECURITY POLICY

DECISION BRIEF
For Immediate Release

No. 97-D 23
7 February 1997
(202) 466-0515

DECISION BRIEF

'HOLD EVERYTHING': BARSHEFSKY'S NEW INFO TECH TRADE DEAL PROMOTES TRADE AT EXPENSE OF U.S. SECURITY INTERESTS

(Washington, D.C.): Last December, the Acting U.S. Trade Representative, Ambassador Charlene Barshefsky, presided over the completion of a "Ministerial Declaration on Trade in Information Technology Products" by members of the World Trade Organization. This agreement was drafted with a view to reducing tariffs and thereby promoting trade in computers, telecommunications equipment, copiers, radio and video technology and related components. The result is widely expected to be that American businesses will benefit from increased access to foreign markets, and consumers will enjoy reduced costs for foreign-produced goods in these areas.

Unfortunately, as negotiated, Ambassador Barshefsky's info tech trade deal may have significant -- and highly deleterious -- implications for U.S. national security. **This agreement clears the way for foreign manufacturers of capacitors and resistors to have completely duty-free access to the U.S. market. This may translate into distinct competitive advantages for foreign firms anxious to *wipe out* the last remaining U.S.-owned and -based manufacturers of these products, items critical to virtually every modern weapon system in the American arsenal.**

An illustrative sample of the military programs that rely upon these components includes: the AEGIS air defense system, AMRAAM air-to-air missiles, Patriot anti-aircraft and anti-missile missiles, TOW anti-tank weapons, key communications systems such as MILSTAR and SINCGARS, the HARM anti-radar weapons and the Peacekeeper and Trident strategic missiles. **Should the United States lose the one or two American companies still available to supply the capacitors and resistors required for such systems, military readiness could be materially degraded.**

This is no abstract proposition. In Operation Desert Shield/Storm, U.S. officials were alarmed to discover that dependency on foreign suppliers for spare parts or replacement components of vital weapon systems could translate into unacceptable shortfalls in defense capabilities and/or serious strains in relations with allied nations. For example, Washington had to ask the Japanese government for its help in assuring supplies of display screens for U.S. weapon systems that were not available from U.S. manufacturers.

'What, Me Worry?'

It appears, however, that **no thought was given by Ambassador Barshefsky or her team to the national security implications of the information technology agreement.** Indeed, the decision to include capacitors seems to have been almost an afterthought as earlier drafts and USTR consultations with affected industries gave no indication that such components would be affected. Even after the agreement was initialed in Singapore on 13 December 1996 and a number of legislators -- including, notably, the Chairman of the Senate

- more -

1250 24th Street, N.W., Suite 350, Washington, D.C. 20037 (202) 466-0515 FAX (202) 466-0518
info@security-policy.org www.security-policy.org

Armed Services Committee, Sen. Strom Thurmond -- began raising questions about the potential adverse repercussions of this agreement for U.S. security interests, Mrs. Barshefsky has evinced little **willingness to consider these repercussions or changes to the agreement that might be made to mitigate them.**

The Bottom Line

The good news for those concerned about the Clinton Administration's tendency to subordinate national security interests to the monomaniacal pursuit of trade opportunities is that Ambassador Barshefsky currently awaits Senate confirmation of her nomination to fill the post of U.S. Trade Representative on a permanent basis. What is more, because of her past lobbying activities on behalf of foreign entities, a waiver requiring the approval of *both houses* of Congress must precede Mrs. Barshefsky's confirmation by the Senate.

There is, accordingly, ample opportunity for legislators determined to ensure that vital U.S. defense capabilities do not become unduly dependent upon potentially unreliable foreign suppliers to reason with Mrs. Barshefsky about the need to "perfect" her information technology agreement with regard to militarily-relevant capacitors and resistors. As it happens, Ambassador Barshefsky informed the Senate Finance Committee on the occasion of her nomination hearing on 29 January that the info tech agreement would be "finalized within the next few weeks." **Accordingly, there should also be an opportunity to effect the sorts of changes required *before* that diplomatic process is completed and work on her nomination is concluded.**

During that period, **the Senate may also wish to take up with the Administration its determination to exercise its right to advise and consent to the finished agreement -- a** constitutional role the Clinton team would like to prevent Senators from playing in this area (as in several others of import for the national security -- notably, changes to the Conventional Forces in Europe and Anti-Ballistic Missile Treaties). **Such a review could be an important starting point for a more fulsome examination of the larger question of the military implications of foreign dependency in what President Clinton likes to call the "global economy."**

**BEFORE THE U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON WAYS AND MEANS
SUBCOMMITTEE ON TRADE
FEBRUARY 26, 1997**

**STATEMENT OF THE PASSIVE ELECTRONICS COALITION
IN OPPOSITION TO THE INFORMATION TECHNOLOGY AGREEMENT (ITA)
AS PRESENTLY CONSTITUTED AND IN FAVOR OF ELIMINATION
OF CAPACITORS AND RESISTORS FROM THE SCOPE OF THE ITA**

Mr. Chairman and members of the Subcommittee on Trade. My name is Don Poinsette, Vice President of Kemet Electronics located in Greenville, South Carolina with facilities also in North Carolina and Texas. We produce only two products, tantalum capacitors and multilayered dielectric ceramic capacitors. Also testifying today will be James Kaplan Jr. of Cornell Dubilier a small producer of mostly aluminum capacitors with plants in Liberty, South Carolina, Wayne, New Jersey, and New Bedford, Massachusetts. Also with me today but not at the witness table due to space restrictions is Jim Jerozal, Chief Financial Officer of Kemet, Joe Bstandig, Communications Manager of Vishay Intertechnology/Dale-located in Nebraska and South Dakota, Mike Ritter National Sales manager of Industrial Midwec Capacitor Corporation located in Rolling Meadows Illinois, in the 8th Congressional District; and our legal counsel, Mr. Les Glick of the law firm of Porter, Wright Morris and Arthur, Washington, D.C.

Our group, the Passive Electronics Coalition, includes numerous different companies that produce capacitors and resistors in 18 different states and 25 different congressional districts. We are all U.S. owned companies and all have a commonality of interest in preserving our U.S. jobs threatened by this Information Technology Agreement. A complete list of these companies is listed below:

Kemet Electronics Corporation, Greenville, South Carolina; Shelby, North Carolina; and Brownsville, Texas
Vishay Intertechnology, Inc. Malvern, Pennsylvania
Cornell Dubilier, Liberty, South Carolina; Wayne, New Jersey; New Bedford, Massachusetts
Magnetek Capacitors, Bridgeport, Connecticut
Industrial/Medwec Capacitor Corp., Rolling Meadows, Illinois (8th Congressional District)
Aerovox Corp., New Bedford, Massachusetts; Dartmouth, Massachusetts
Dale Electronics, Columbus, Nebraska; Norfolk, Nebraska; Tempe, Arizona; Yantron, South Dakota
Sprague Companies, Sanford, Maine; West Palm Beach, Florida; Concord, N.H.
Vitramon, Inc., Bridgeport, Connecticut; Roanoke, Virginia
Vishay Measurements Group, Inc., Raliegh, North Carolina
Techno, Inc., Van Nuys, California
Roederstein Electronics, Statesville, North Carolina
Angstrom Precision, Inc., Hagerstown, Maryland
York Capacitors, Winooski, Vermont
Barker Microfarad, Inc., Hillsville, Virginia
Ohmteck, Inc., Niagara Falls, New York
Ultronix, Junction, Colorado
Commonwealth Sprague Capacitors, North Adams, Massachusetts

Mr. Chairman our group is called the Passive Electronics Coalition because we produce passive electronics products--capacitors and resistors. These are products that do not store or transmit information. They are passive in the sense that they are used to reduce the flow of electrical current (in the case of resistors) or to store and release electrical energy in the case of capacitors. In the first place. Unlike chips or microprocessors, they have no memory or information storing functions. I point this out for two reasons. First so that you do not think that the use of the word passive in our name means that our coalition is in anyway passive or complacent about the ITA agreement. In fact, Mr. Chairman, we are a very angry and extremely motivated group due to what we consider a very grave injustice that has been done to us by the Acting U.S. Trade Representative in Negotiating the ITA agreement. Second, we strongly believe that our products, capacitors and resistors, generically have no place in any Information Technology Agreement. Unlike the many other included products, from word processing machines to calculators to machines for producing semiconductors, our products are not information products at all and have no place in this agreement. Some capacitors are as large as a tin can (show sample) and are used in refrigeration systems and having nothing whatsoever even to do with electronics. They couldn't even fit into a laptop computer or cellular phone. Others do go into computers and electronics devices but their functions do not relate to "information technology." Indeed the technology in capacitors and resistors is really very low. In short, we believe that generically these products have no place in this agreement.

What is interesting, but also the cause of our anger and frustration, is that apparently the Acting U.S. Trade Representative also agreed that capacitors did not belong in the ITA. They were not part of the U.S. offer or part of any draft of the agreement ever shown to the capacitor industry. In fact we were told , and we and our attorneys had many calls to USTR that capacitors were not part of the agreement. If we had been told otherwise, Mr. Chairman, we would have been here speaking to you a year ago in addition to today. But either purposely or inadvertently we were misinformed by the Acting U.S. Trade Representative concerning inclusion of capacitors in the ITA. We are particularly concerned because Acting Trade Representative Barshefsky is now telling members of Congress that she did not know of all the concerns and issues about capacitors. First this is not true, since as early as May 16, 1996 Senator Strom Thurmond, Chairman of the Armed Services Committee and Senator from the state where Kemet has its main plant, sent her a letter which stated in part about the ITA,"... It is my understanding that these negotiations are attempting to reduce the duties on various electronic products and that capacitors have been suggested as one item to be targeted. This could result in considerable injury to Kemet, particularly since any tariff removal or reduction given to the Europeans would also be extended to the Japanese. Furthermore, none of the companies which initiated these negotiations produce capacitors nor has Kemet had the opportunity to have formal input into this process." This letter was sent in May 1996. Ms Barshefsky never responded to Senator Thurmond so he wrote her again in on December 12, 1996, before the ITA was announced. Again, Acting Trade Representative Barshefsky did not respond to the letter. In fact, Senator Thurmond, had to make a personal call to our Acting Trade Representative before he could get an answer on this issue and was then told that there was not much she could do.

This Mr. Chairman is the issue that concerns us. Why our government and our acting trade representative have chosen to ignore the concerns of a major industry in the U.S., those companies that produce capacitors and resistors and in fact sacrifice us on the alter of expediency so it could announce with fanfare and glory this new ITA agreement as if it were some great accomplishment for all U.S. industries. This simply is not the case. The ITA may benefit some U.S. companies that produce consumer products like computers and cellular phones, but it will not benefit capacitor and resistor makers at all and in fact will severly injure us. These are the reasons why.

Reduction in the tariff on capacitors (currently 9.6%) and resistors (currently 6%) would devastate the U.S. producers and workers. This is already a very competitive business. These tariffs have intentionally been left high, much higher than the weighted average U.S. tariff, due to recognition that these are import sensitive industries and ones that are important to the national defense. The profit margins on these products are small. Japan is already very successful in the U.S. market even with these high duties in place. Removing them would be like turning over one of the last surviving U.S. electronics industries to the Japanese that already dominate or control most others. We don't have any more U.S. made televisions or radios. Do we want to have a situation where there are no more U.S. made capacitors. Attached to this statement is a bar graph illustrating the Japanese shipments of various capacitors to the U.S. It shows a tremendous growth. Particularly in Tantalum capacitors that are one of the mainstays of Kemet. Japan more than doubled their exports of these capacitors to the U.S. from 1993 to 1996. They also more than doubled their exports of aluminum capacitors during this period. The bottom line is that the Japanese do not need any more help in trying to take over the U.S. capacitor industry. Certainly not from the U.S. government. Why does our government want to make it easier for them by removing these duties? We ask the Committee this because it is a question we cannot answer. It is not the Europeans that really want this duty off but the Japanese. There are few independent European capacitor producers. This deal was struck because the Japanese who are part of the ITA quad group that was behind the negotiations wanted this U.S. industry and the Europeans went along and our Acting Trade Representative politely complied by handing it over on a silver platter. At stake are thousands of U.S. jobs many in small towns without many other industries. The 9.6% tariff on capacitors is what is preserving these U.S. jobs against the cheaper costs of producing these products abroad. After years of negotiations in the Uruguay Round of the GATT, the prior trade negotiators left this tariff. Now the current ones in one clandestine action in Singapore have destroyed the protection so carefully crafted by their predecessors who were concerned about this industry.

American capacitor makers get little in return for surrendering our market to the Japanese capacitor invasion. In Japan , Kemet has not been able to even sell one capacitor. This is not only to Japanese companies in Japan but even Japanese companies located in other countries. We were told by some U.S./Japanese joint ventures where we already supply the same capacitor to the U.S. partner and they know our product; and that they were interested in our products but when we tried to make a sale we were given insurmountable bureaucratic obstacles. The game the Japanese play is called "specsmanship" or the "art of delay." They tell us that we cannot meet their spec even though Kemet and Vishay are the U.S. leaders in technology. Our products are good enough for Hewlett Packard and Compaq and for the Patriot Missile but the Japanese say we don't meet their specs. They tell us the specs are in Japanese and they don't have time to translate it. If we offer to translate it our self they say these translations are not acceptable or must be submitted to them for refinement. When we approach these companies were are told "they buy from Oki" or some other Japanese company. In short, their is a close knit club in Japan that the Japanese suppliers and customers have no interest or desire to break. In short, Japan has an institutionalized non tariff barrier that is keeping out U.S. capacitors and resistors. Vishay has had the same experience.

Thus ITA results in the following situation for our industry.

1. The Japanese have complete duty free access to our market that is an open and competitive one.

2. We have no market access to the Japanese market although the duties are not an issue, non-tariff barriers make sales impossible. Duty wise we are receiving nothing since the Japanese duty is already zero. They can afford to keep it at zero due to their complex system of non-tariff barriers that makes sales impossible, not only in Japan but even to Japanese companies based in the U.S. and third countries.

3. The ITA does not address non tariff barriers in Japan which makes it a flawed and incomplete agreement.

4. The supposed opening of the European market is a meaningless gesture since the duties there are already very low, around 2.6% so that we gain very little by the trade off. We were already competing very well in Europe and did not ask for nor do we need the alleged benefits of this agreement.

5. Concerning reduction of duties in other countries, other than Japan this means very little. In a meeting we had the representatives of the USTR thought we should be happy that we would face lower duties in places like Australia. This is very nice but the amount of capacitors and resistors that are bought there are insignificant. The agreement has opened no markets for us that we were not already able to sell in.

In short, our Acting Trade Representative made a very bad negotiation for capacitors and resistors. We gave up high duties that have been helping the industry meet the already voracious Japanese appetite for our market. In return we got no access to Japan due to the fact that the agreement did not cover non tariff barriers. We got about a 3% reduction in the European tariff that means little competitively and more substantial reductions in tariffs from other countries where there is little demand for capacitors and resistors. If the U.S. Trade Representative is proud of such a negotiation , this pride was earned at the expense of our industry and thousands of potential jobs. Simply put, it was a bad deal for the U.S. capacitor and resistor industry.

What makes this situation even more outrageous is that we were never consulted. Although the trade act talks about a consultive process and the use of advisory committees there were none at least for capacitors. There was an advocacy group called the International Technology Agreement Coalition (ITAC) that consisted mostly of computer and electronics equipment manufacturers that wanted the agreement. No capacitor maker was a member. We tried to participate and were told we could not. We were told that our rights were represented through the Electronics Industries Association (EIA) that was a member even though the EIA's members included the very same computer and equipment makers who were pushing the agreement and whose interests were different and adverse to ours. The U.S. Trade Representatives office regularly met and consulted with this ITAC group even though it was a one sided advocacy group that included many European and Japanese owned companies which we feel is improper. USTR did not once call a meeting to discuss any issues with any capacitor or resistor manufactures. We had to call them and what we got were assurances that at least for capacitors, "they were not in the agreement ".

There is a very clear legislative history and intent of the Trade Act of 1974 as well as the Trade Reform Acts of 1973 and 1974 which was its predecessor to have a private sector advisory committee consultation process before any major trade negotiations . In this regard I might quote from the Committee Report of the Senate Finance Committee on the Trade Reform Act of 1974. HR 10710 which ultimately was enacted as the Trade Act 1974 that stated

ADVICE FROM THE PRIVATE SECTOR

(Section 135)

> . . . the need for the Government to seek information and advice from the private sector is more important than ever before. The purposes of this section are to establish the institutional framework to assure that the representative elements form the private sector have the opportunity to make known their views to U.S. negotiators and to provide the latter a formal mechanism through which to seek information and advice from the private sector with respect to U.S. negotiating objectives and bargaining positions before and during . . . the multilateral trade negotiations.
>
> This section would provide for the creation of three general types of advisory committees and in addition would require the President to provide opportunity for the submission of information and recommendations on an information basis by other private organizations or groups. . . the requirement that the president also establish advisory committees for particular product sectors to be representative, so far as practicable, of all industry, labor or agricultural interests in such sector reflects the Committee's concern that in the past trade negotiations there have not been adequate input from U.S. producers who are in the best position to assess the effects of removing U.S. and foreign trade barriers. (Emphasis added).

(See Senate Report No 93-129S) at 101

Clearly Congress was aware how important input was from the actual producers of a product which the USTR may be negotiating about, but incredibly the USTR has chosen to ignore this. Their meetings have been with the ITAC advocacy group, many of whose members are foreign owned and dominated companies such as Ericcson. Why weren't they setting up meetings with capacitor and resistor producers. The fact is that USTR has tried to do an end run around our industry. They belatedly (I believe in November) informally asked the ITC to check with capacitor producers about how they felt within the industry and some calls were made on a very informal unscientific way. The ITC apparently reported to USTR that the industry was divided, having spoken to many of the Japanese and European owned or controlled capacitor producers in the U.S. such as Phillips, which we all know is a huge European owned company and AVX (which is owned by one of the largest Japanese Capacitors producers). Belatedly now, that the criticism has been made the USTR has been apparently asking the ITC to do more of an investigation, apparently to cover its tracks. However, we have received reports that this is not in good faith and is only a gesture to go through the motions. For example, in an article in the February 17, 1995 issue of the Electronics Buyers News, it was reported as follows:

> A capacitor industry analysis firm the Paumanok Group Apex, N.C. was asked by the United States Trade Representative and the International Trade Commission to supply capacitor data for the subcommittee hearings but declined said the firms president, Dennis Zogbi. He said that the requests were politically motivated". At page 116.

What the USTR should have done, many months ago was to set up an advisory committee of capacitor and resistor makers and talk to us. If they wanted advice from the International Trade Commission, which may have been appropriate, it should not have been a last minute hurry up job to support what they already did but a comprehensive Section 332 investigation where all the facts could have been developed.

Instead Mr. Chairman, Our acting trade representative, ignored our concerns, and 10,000 miles away, in Singapore, out of the sight and scrutiny of the U.S. taxpayers, capacitors were added the last minute to the agreement without any advance knowledge or consultation with our industry. In fact we had to read about this in the New York Times, a rather sad turn of events. It appears that our negotiators seemed more concerned with what Sir Leon Brittan, head EU negotiator felt than the U.S. industries back home. In the December 11, 1997 issue of the New York Times, we read a quote from Augusto Fantuzzi the trade minister of Italy where he was quoted as saying that "the draft accord included tariff cuts on capacitors, fiber optic cables and digital photocopiers -- all products that Washington had wanted excluded from an accord But he noted that graphic display tubes and optic fibers would be excluded as hoped for by the United States." Thus apparently the U.S. fought to save some of these other products while sacrificing capacitors. There was a picture in the article of acting USTR Barshefsky toasting Sir Leon Brittan of the EU with both of them smiling. Mr. Chairman, I can't tell you how sick that photo made me and members of my industry. Our own trade representative celebrating after the betrayal of our industry.

Mr. Chairman, I do not use the word "betrayal" lightly. The word "betrayal" is defined as a "break of faith," or to "lead astray" (Webster's New World Dictionary, Second College Edition). This is what happened to the U.S. capacitor industry in Singapore. Now when we try to talk to the U.S. Trade Representative, they are spending their time trying to cover their tracks and find ways to attack or discredit our industry instead of trying to help us. We have had several meetings at the level of the Assistant USTR (the acting trade representative herself has not been willing to meet with us) and we are told, "we are sorry there is nothing we can do". We are told that we should be happy that we have a four year phase out of the duty when the Europeans would like to accelerate our phase out. This does not make us feel any better. What we want, is the duties removed, or at the minimum a phase out of maybe 8 or 9 years at 1 percent a year so we can have the maximum time needed to adjust.

Mr. Chairman, there is one other very important reason for this duty to remain and that is for the national defense and to protect the mobilization base. The Defense Production Act requires the maintenance of a mobilization base. Tantalum and multilayer dielectric ceramic capacitors have many uses in military applications.

There are only two surviving U.S. owned and based producers of these products. Kemet and Vishay. These products are used in the Patriot missile, the , the Trident and Peacekeeper missiles the TOW anti tank weapon system, HARM anti radar systems and the MILSTAR communications systems to name a few. I would like to quote from a Decision Brief prepared by the Center for Security Policy directed by a former Deputy Secretary of Defense from the February 7, 1997 issue. (Attached) The article was entitled "Hold Everything Barshefsky's New Infotech Trade Deal Promotes Trade at Expense of U.S. Security Interests" and is attached in full to our Statement. The article notes that "Should the United States lose the one or two American companies still available to supply capacitors and resistors required for such system, military readiness could be materially degraded."

The newsletter goes on to say that "this is no abstract proposition. In Operation Desert Shield/Storm, the U.S. officials were alarmed to discover that dependency on foreign suppliers for spare parts or replacement components of vital weapon systems could translate into unacceptable shortfalls in defense capacities and or serious strains in relations with allied nations. For example, Washington had to ask the Japanese government for its help in assuring supplies of display screens for U.S. weapon systems that were not available from U.S. manufactures." Mr. Chairman, we have raised these concerns with the Armed Services committees in both houses and hopefully you and Acting Trade Representative Barshefsky will be hearing from them soon. We ask you, if it came to national emergency and we were relying on our Patriot missiles for defense against enemy attack and spare capacitors were needed as replacement parts, if you would want our country to have to go to Japan to ask them for these, perhaps to be told that this was a lower priority than their computer or cellular phone makers. This could happen if capacitors and resistors are not removed from the ITA. Our industry will go the way of the television and radio manufacturers, U.S. names but no U.S. production. One of the largest

Japanese capacitor makers has already bought AVX, formerly one of the largest U.S. owned capacitor producers. Kemet and Vishay are all that stands between a totally Japanese owned U.S. production base for tantalum and multilayered dielectric ceramic capacitors.

Mr Chairman, I would now like to turn the microphone over to Jim Kaplan, Jr. of Cornell Dubilier.

Thank you Mr. Chairman, my name is Jim Kaplan, Jr. and I am a Vice President of Cornell Dubilier. We employ 270 people in making electrolytic capacitors in Liberty South Carolina and also have distribution and corporate facilities in New Bedford, Massachusetts and Wayne, New Jersey that together employ another 80 people. Compared to Kemet and Vishay we are a small company. One of our main products that is over half our sales is aluminum electrolytic capacitors. We are competing with Japan and Europe for a total domestic market of about 250 million. We have about 10% of this market. We do not understand why aluminum capacitors are even in this Information Technology Agreement. None of our capacitors are used in computers or information devices. and they don't belong at all in this ITA agreement. Moreover, we are completely clueless as to why we want to give any breaks to the Japanese manufacturers who will not buy any of our capacitors. They will only buy from Japan. Even the Japanese companies in the U.S. won't answer our phone calls. For example Toshiba buys all its aluminum capacitors for Hitachi in Japan and pay 20% over what they can buy them for here. We have been in business for 11 years and only started making money last year. Another company that produces aluminum-capacitors is Aerovox, part of our coalition and they lost 3 million last year. The other company in this aluminum capacitor business is Phillips a European owned company that we understand is also testifying. Phillips' facility has been on the market for several years and we believe their strategy is to become an importer instead of a producer thus eliminating many U.S. production jobs. We hope the Committee will remember that even though Phillips may be a member of groups like the Electronic Industries Association they are not an American owned or controlled company and they produce almost nothing in the U.S. They sold their tantalum capacitor production facility to Vishay and their resistor facility went out of business and Vishay purchased the machinery. Essentially they are importers from Europe and the Far East with minor U.S. production of a few specialty products. Yet they are allowed to testify here as a U.S. industry--which they are not. We are attaching to this statement a position paper on this issue from Aerovox that indicates that their capacitors are also not utilized in PC's monitors or electronic equipment but in household appliances such as washers and room air conditioners. They are also puzzled by what "information technology" is furthered by including their product. In another letter we received from coalition member Commonwealth Sprague Capacitor in Greenwich, Connecticut they state, "none of our capacitors have applications in computer or telecommunication products" are tariffs on air conditioners being eliminated. If not why eliminate the tariffs on a component only used in a air conditioners". I think this is a very good questions

WASHINGTON/27114 01

BEFORE THE U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON WAYS AND MEANS
SUBCOMMITTEE ON TRADE
FEBRUARY 26, 1997

STATEMENT OF THE PASSIVE ELECTRONICS COALITION IN OPPOSITION TO THE INFORMATION TECHNOLOGY AGREEMENT (ITA) AS PRESENTLY CONSTITUTED AND IN FAVOR OF ELIMINATION OF CAPACITORS AND RESISTORS FROM THE SCOPE OF THE ITA.

Mr. Chairman and members of the Subcommittee on Trade, my name is Don Poinsette, Vice President of KEMET Corporation located in Greenville, South Carolina, with facilities also in North Carolina and Texas. Sitting to my left and also testifying today is James Kaplan Jr., Vice President of Cornell Dubelier Corp., a producer of aluminum capacitors with plants in South Carolina, New Jersey, and Massachusetts. Also with us today but not at the witness table are my colleague, James Jerozal, Chief Financial Officer of KEMET; Mike Ritter, National Sales Manager of Industrial Midwec Corp located in Rolling Meadows, Illinois, which is in the Chairman's congressional district; Joe Bstandig, Communications Manager for Vishay Intertechnologies Inc. with facilities in 14 states; and Mr. Les Glick of the law firm of Porter, Wright, Morris, and Arthur here in Washington, DC.

We represent the newly formed Passive Electronics Coalition that includes numerous companies producing capacitors and resistors in 18 different states and 25 congressional districts. We share a commonality of interest in preserving our companies, preserving our technologies, and protecting the more than 20,000 jobs threatened by this Information Technology Agreement. A complete list of these companies is in our written statement filed Monday and which we request be included in full in the hearing record.

Mr. Chairman, I will begin by saying that the word "passive" in our name should not mislead you. The word defines our products, but not our members.

Mr. Chairman, we are a very angry and extremely motivated group due to what we consider has been a grave injustice perpetrated on us, on our industry, and perhaps even on the very security of these United States themselves, by the US. Trade Representative in negotiating the ITA.

That negotiation took place without a single consultation with any company in our part of the electronics industry. It took place without regard for the federal statutes which require that consultation. It took place in spite of two letters sent by Senator Strom Thurmond in May and December of last year, neither of which were even acknowledged by the USTR. And, it took place in spite of repeated assurances from the USTR itself that capacitors were not included in the agreement. The latest of these assurances was made when the USTR was meeting with other country representatives in Singapore, far from the communications channels in Washington. Once again both we and our attorneys were told that capacitors were not included. Then, in the

December 11th issue of the New York Times, we were stunned to read that capacitors had been included in the ITA.

Mr. Chairman, by definition, successful negotiations are supposed to result in win/win situations for the parties involved. In this ITA, as far as passive electronic components are concerned, it is all win/ win for everyone outside the United States and total lose/lose for the American companies inside the United States. The Europeans win, the Koreans win, even Iceland can win if they want to... but the BIG winner, one more time, is the Japanese. And the Japanese give up absolutely nothing, I repeat, absolutely nothing, in order to get these huge concessions. This is because their tariff is already zero. They use a complex system of non-tariff barriers in Japan which make it impossible for our companies to sell there.

So what do we get in the ITA as currently written? In a word, we get had. To whit:

Number 1) The Japanese finally get that which they have wanted for a very long time - totally duty free access to an already open and competitive market in the USA.

Number 2) American companies get no additional access to the totally closed Japanese markets since duties have never been an issue there.

Number 3) While we are told that Europe has been insisting on the inclusion of passive devices in the ITA, we know for a fact that the EU has been heavily influenced by Japanese companies already located there.

Number 4) True, we get a duty reduction of duties in countries such as Australia, Canada, and Norway. It is also true that such reductions make absolutely no difference to any of us in this room. The simple reason is that no capacitors and few resistors are produced in those countries. We were already competing quite well there

Number 5) And this may be the single most important point of all, our own USTR has handed to the other countries, again most notably to the Japanese, a 9.4% reduction in their cost of doing business in the USA! Mr. Chairman, I assure you and the members of your committee that a near 10% reduction in costs in this already extremely competitive and low margin business can only be compared to a gift from God.

Finally, as if protecting American companies, technologies, and 20,000 jobs was not sufficient, we would respectfully draw your attention to the national security. I would like to quote from a decision brief prepared by the Center for Security Policy directed by a former Deputy Secretary of Defense from the February 7, 1997 issue. The article was entitled "Hold Everything. Barshefsky's New Info Tech Trade Deal Promotes Trade At Expense of U.S. Security Interest" and is attached in full to our statement. The article notes that "should the United States lose the one or two American companies still available to supply capacitors and resistors required for such systems, military readiness could be materially degraded". The newsletter goes on to say that "this is no abstract proposition. In operation Desert Shield/Storm the U.S. officials were alarmed to discover that dependency on foreign suppliers for spare parts or replacement components of vital weapon systems could translate into unacceptable short falls in defense capacities and/or serious strains in relations with allied nations. For example, Washington had to ask the Japanese government for its help in supplying supplies of display screens for U.S. weapons systems that were not available from U.S. manufacturers". Mr. Chairman, we have raised these concerns with the armed services committees in both houses and hopefully you and acting trade representative Barshefsky will be hearing from them soon. Gentlemen, the simple fact is that not a single Integrated Circuit, not a single microprocessor, will work without having many of our type products right alongside them. Our best estimates are that today, on average, every Integrated Circuit has five tantalum capacitors, 100 ceramic capacitors, and an equal number of resistors arrayed around it. Not only does that allow your TV to work, your VCR to work, the engine in your car to run, the security system in your home to work, but it also permits the Patriot missile to work, it permits Trident to work, it permits TOW anti-tank weapon systems to work, and it permits our space shuttles to make their way back and forth with the ease with which they do. In short, Mr. Chairman, every single electronic circuit must, I repeat must, have our products in them before they will function.

KEMET Corporation and Vishay are the two lone surviving American companies manufacturing these two capacitor products. The rest of the world is supplied, for all practical purposes, by the Japanese. Except for the presence and continued success of these two American companies, Japan can control the world markets of Europe, South America, Asia, China, NAFTA, and of course Japan itself. If our own government, this time the USTR, persists in destroying every competitive advantage we might have in the United States, then all we have to look forward to is being held hostage by foreign suppliers and/or to foreign manufacturing operations. Shuttering domestic facilities and/ or possibly selling out to one foreign interest or another may be the only avenues open over time. Like so many products before us, there may be an American name on the product, but it won't be manufactured here - and the company may not be owned by Americans.

Finally, Mr. Chairman, it should be clear. These products are <u>not, repeat not</u>, related in any way to information technology. They do not store nor do they transmit information. These are functioning electronic components necessary to building an electronic circuit. Nothing more. They do <u>not</u> belong in an Information Technology Agreement. If there is anyone among us who really thinks that these components belong in information technology products then we challenge that person to explain why steel, glass, plastic, screws, paint, nuts and bolts are not in it.

So, Mr. Chairman, what does our coalition want? Do we ask that the ITA be destroyed? No. But what we <u>do</u> ask is that you and your committee with all urgency insist that the USTR <u>remove</u> passive components from this agreement. <u>Our best estimates are that these components make up less than one half of one percent of the value of the agreement.</u> It cannot possibly harm the agreement to have them removed. Please help us preserve our companies, our jobs, and our very ability to compete. We ask you please to not be a party to giving away another vital industry to overseas interests as has happened too many times before.

I would now like to turn the microphone over to Jim Kaplan Jr. .

....

Mr. Chairman, that concludes our testimony. Thank you.

IPC

2215 Sanders Road
Northbrook, Illinois
60062-6135

Tel 847 509 9700
Fax 847 509 9798
URL http://www.ipc.org

March 19, 1997

'97 MAR 20 P12:45

The Honorable Donna R. Koehnke
Secretary, U.S. International Trade Commission
500 E Street, SW
Washington, D.C. 20436

Dear Secretary Koehnke: 332-380

As the President of the Institute for Interconnecting and Packaging Electronic Circuits (IPC), I am writing to express the U.S. interconnection industry's qualified support for the recently-concluded Information Technology Agreement (ITA).

The IPC's 2,200 members represent a vast majority of the companies and other interests that make up the U.S. interconnection industry, a $22-billion segment of the U.S. economy that employs over 200,000 Americans. Our core members are companies that produce bare printed wiring boards (PWBs), and printed wiring assemblies (PWAs) by attaching electronic components to the bare PWBs. IPC members also include suppliers to the industry as well as major original equipment manufacturers (OEMs) that use PWBs in their own products or rely on electronics manufacturing services industry companies to provide assembly services. In addition, the IPC membership includes over 100 representatives from government and academia with vital interests in this critical technology.

In general, the IPC supports tariff elimination on information technology products through the ITA. We believe that the elimination of duties on the export and sale of our products is essential to the health and future growth of our industry. With the elimination of tariffs on these products, we now look forward to working toward the goal of eliminating non-tariff barriers in order to ensure a level playing field between the U.S. industry and our competitors overseas.

We have serious concerns, however, that the final ITA product landscape was incomplete and does not adequately represent the full spectrum of the U.S. information technology industry. In particular, we were disappointed that equipment and materials used in the manufacture and assembly of printed wiring boards were omitted from the ITA product landscape. We are aware of the circumstances under which the ITA was negotiated and accept that USTR negotiators reluctantly removed these items from the ITA product landscape in order to achieve the broadest agreement possible. Nonetheless, the U.S. electronic equipment and materials industry is struggling to increase its sales, especially in the burgeoning markets of Asia where duties on these products range from 5 to 15 percent.

The IPC is also concerned with, and strenuously objects to, requests by signatories to the ITA for a decelerated tariff elimination schedule for their products. We believe that all signatories to the ITA have highly competitive and, in some cases, very aggressive IT sectors. Special considerations in this regard are anathema to the spirit of the ITA and perpetuate the uneven playing field that we are seeking to eliminate.

The IPC appreciates this opportunity to comment on the Information Technology Agreement. As work continues on implementing and expanding the ITA, and as the future trade agreements are negotiated, we commend the efforts of the U.S. government in seeking fair and free trade.

Sincerely,

Thomas J. Dammrich
President
Institute for Interconnecting and Packaging Electronic Circuits

TJD/pb

BARNES, RICHARDSON & COLBURN

ATTORNEYS & COUNSELLORS AT LAW

1225 EYE STREET, N.W.
SUITE 1150
WASHINGTON, D.C. 20005
TELEPHONE: (202) 457-0300
FACSIMILE (202) 331-8746

JAMES H. LUNDQUIST, P.C.
JAMES S. O'KELLY
RUFUS E. JARMAN, JR.
DAVID O. ELLIOTT
GUNTER VON CONRAD
ROBERT E. BURKE
DONALD J. UNGER
MATTHEW T. McGRATH
SANDRA LISS FRIEDMAN*
BRIAN F. WALSH*

CINDY H. CHAN*
MICHAEL J. CHESSLER*
DAVID M. DUNBAR*
LAWRENCE M. FRIEDMAN*
JESSE M. GERSON*
ALAN GOGGINS
MATTHEW A. GOLDSTEIN
LAWRENCE W. HANSON*
KAZUMUNE V. KANO*
CHRISTOPHER E. PEY*
FREDERIC D. VAN ARNAM, JR.*

475 PARK AVENUE SOUTH
NEW YORK, N.Y. 10016
TEL. (212) 725-0200
FACSIMILE (212) 889-4135

200 EAST RANDOLPH DRIVE
SUITE 7920
CHICAGO, ILLINOIS 60601
TEL. (312) 565-2000
FACSIMILE (312) 565-1782

TEXAS COMMERCE TOWER
600 TRAVIS-SUITE 1925
HOUSTON, TEXAS 77002
TEL. (713) 224-3400
FACSIMILE (713) 224-4001

SPECIAL COUNSEL
ANSIS M. HELMANIS*

OF COUNSEL
E. THOMAS HONEY
ANDREW P. VANCE
NORMAN KATZ*
ROBERT H. SCHOR*

*NOT ADMITTED IN D.C.

March 21, 1997

PUBLIC DOCUMENT

The Honorable Donna R. Koehnke
Secretary
U.S. International Trade Commission
500 E Street, S.W.
Washington, D.C. 20436

Re: Inv. No. 332-380; Advice Concerning the Proposed Modifications of Duties on Certain Information Technology Products and Distilled Spirits

Dear Ms. Koehnke:

Pursuant to the Commission's notice, published in the Federal Register at 62 Fed. Reg. 11,222 (Mar. 11, 1997), we hereby file a Written Statement on behalf of Leica, Inc. in the above-referenced investigation. Enclosed are fourteen copies per the Commission's rules at 19 C.F.R. § 201.8(d). Please contact us if you have any questions concerning this submission.

Respectfully submitted,

Robert Burke

Robert E. Burke
Counsel to Leica, Inc.

BEFORE THE:
UNITED STATES INTERNATIONAL TRADE COMMISSION

In the Matter of:	:	
Advice Concerning the Proposed Modifications of Duties on Certain Information Technology Products and Distilled Spirits	: : :	Investigation 332-380

WRITTEN STATEMENT
LEICA, INC.

In Support of Clarification of Certain Descriptions of Information Technology Products

BARNES, RICHARDSON & COLBURN
200 East Randolph Drive, Suite 7920
Chicago, IL 60601
(312)565-2000
Robert E. Burke, Attorney
Amy H. Warlick, International Trade Analyst

BEFORE THE:
UNITED STATES INTERNATIONAL TRADE COMMISSION

In the Matter of:	:	
Advice Concerning the Proposed Modifications of Duties on Certain Information Technology Products and Distilled Spirits	:	Investigation 332-380
	:	
	:	

WRITTEN STATEMENT
LEICA, INC.

Introduction

This statement is filed on behalf of Leica, Inc. of Deerfield, Illinois ("Leica"), pursuant to a notice published in the Federal Register of March 5, 1997, inviting participation by interested parties in the subject investigation. Leica is a subsidiary of Leica PLC Holdings, in St. Gallen, Switzerland, a long-standing, worldwide producer and distributor of optical and non-optical instruments. Leica has two affiliated manufacturing plants in the United States, including a plant in Allendale, New Jersey that produces certain products involved in this investigation. Leica's affiliated United States plants export products to destinations outside the United States.

Leica imports and distributes in the United States optical and electron beam instruments, and instrument systems and parts, designed for the inspection, measurement, analysis and manufacturing of semiconductor wafers and devices, the masks and reticles used in semiconductor manufacturing, printed circuit boards and assemblies, liquid crystal displays, and magnetic storage devices. The products referred to in the previous sentence will, hereafter, be referred to as "Leica's subject products."

Leica supports the world-wide elimination of all tariffs on products and parts thereof imported under the international *Harmonized Tariff Schedule* (HTS) subheadings in chapter 90, which are designed for use in inspecting, measuring, analyzing and/or manufacturing semiconductor wafers and devices, the masks and reticles used in semiconductor manufacturing, printed circuit boards and assemblies, liquid crystal displays, magnetic storage devices, and/or all other products included in Attachment B to the Ministerial Declaration on Trade in Information Technology Products (Declaration).

Background and Summary

The end users of Leica's subject products are companies engaged in the manufacture of semiconductors, semiconductor devices, printed circuit boards and assemblies, and other microelectronic products. Leica's subject products play a critical role in the manufacturing processes of these end-users. While the applications vary among Leica's subject products, in general, the optical instruments and systems designed for semiconductor manufacturing, which make up a significant portion of Leica's subject products, enable manufacturers to inspect the line widths and spacings of the patterns on semiconductor wafers, masks, and reticles, as well as the depth of the etching processes and the film thickness of patterned layers.

The global microelectronics manufacturing industry has expanded exponentially during the past 2 decades. In the United States alone, shipments of semiconductors and semiconductor devices grew by 236 percent between 1988 and 1995,[1] largely on account of growing exports to Japan. Since Leica's subject products are essential to the manufacturing of these products, the demand for Leica's subject products has grown in direct response to this rise in global production.

The elimination of duties on Leica's subject products would lower the costs associated with the manufacture of semiconductor devices and other microelectronic products, encourage the advancement of microelectronic manufacturing technology and, thereby, assist the development of the global information technology industry. Leica is in favor of rapid, worldwide duty elimination on their subject products, and supports the inclusion in Attachment A of the Declaration of the products in headings 9010, 9011, 9012, 9017, 9030, and 9031 to the extent that they are for one or more of the products listed in Attachment B. Attachment B includes "printed circuit assemblies," and defines them as consisting of:

> one or more printed circuits of heading 8534 with one or more active elements assembled thereon.... "Active elements" means diodes, transistors, and similar semiconductor devices, whether or not photosensitive, of heading 8541, and integrated circuits and micro assemblies of heading 8542.

Leica is concerned, however, about the technical details of the potential Agreement on Trade in Information Technology Products (ITA) that are currently being worked out through the verification of participants' draft *Harmonized Tariff Schedules* in Geneva. More specifically, Leica is concerned that the new international HTS subheadings that are being broken out in order to reflect participants' tariff commitments will incorporate article descriptions, derived from Attachment A to the Declaration, which are too narrowly defined. For instance, the article description listed for HTS subheading 9011.10,

> Optical stereoscopic microscopic microscopes fitted with equipment specifically designed for the handling and transport of semiconductor wafers or reticles....for Attachment B

would appear to exclude products that are identical in description and in terms of their design for use

[1] "Current Industrial Report: Semiconductors, Printed Circuit Boards, and Related Equipment," Bureau of the Census, Oct. 1996.

in Attachment B, *except* that they are not fitted with handlers, even though they are fitted with semiconductor transport equipment, and even though handlers may be fitted to them after importation. There are several other article descriptions in Attachment A that are too narrowly defined to include products that are designed for information technology products and that are, otherwise, intended to be covered by the ITA.

In addition, Leica is concerned that the new international HTS subheadings will incorporate article descriptions which impose burdensome paperwork requirements by various Customs authorities. For instance, if the article descriptions are interpreted as requiring "actual use," paperwork proving "actual use" may have to be submitted with each entry. These burdensome requirements could prevent Leica from the full benefits of the duty eliminations declared in Singapore. Instead, Leica favors the more expansive article description "designed for" inspecting, measuring, analyzing and/or manufacturing any product included in Attachment B to the Declaration. Leica also encourages the United States to include in the ITA all instruments and instrument systems and parts in HTS Chapter 90 designed for inspecting, measuring, analyzing and/or manufacturing semiconductor wafers and devices, the masks and reticles used in semiconductor manufacturing, printed circuit boards and assemblies, liquid crystal displays, magnetic storage devices, and/or all other products included in Attachment B to the Declaration.

Respectfully Submitted

Leica, Inc.
By Barnes, Richardson & Colburn

Robert Burke

Robert E. Burke

Amy H. Warlick, International Trade Analyst
Date: March 21, 1997

Collier, Shannon, Rill & Scott, PLLC
Attorneys-at-Law
3050 K Street, N.W.
Suite 400
Washington, D.C. 20007

Paul C. Rosenthal
(202) 342-8485
Internet: pcr@colshan.com

Tel.: (202) 342-8400
Fax: (202) 342-8451

10 Barrack Street
Level 12
Sydney, NSW 2000, Australia
Tel.: 61-2-262-6700
Fax: 61-2-262-3263

'97 MAR 21 PM 5:10

March 21, 1997

Ms. Donna R. Koehnke
Secretary
U.S. International Trade Commission
500 E Street, SW
Washington, DC 20436

Re: Proposed Modification of Duties on Certain Information Technology Products

Dear Ms. Koehnke:

On behalf of Planar Systems, Inc. ("Planar") of Beaverton, Oregon, we submit this letter concerning the proposed modification of duties on certain information technology products pursuant to the ITC's March 11, 1997 request for comments, 62 Fed. Reg. 11,222. Planar is the leading U.S. producer of high information content flat panel displays, which are used in automatic data processing ("ADP") machines for many different applications. As one of the petitioners in the Commission's investigation of Certain High-Information Flat Panel Displays and Display Glass Therefor From Japan, Inv. 731-TA-469, USITC Pub. No. 2413 (August 1991), Planar has supported enforcement of the U.S. trade laws. While Planar opposes unfair trade, the company strongly believes in lowering tariff and non-tariff barriers. Accordingly, Planar supports the Information Technology Agreement ("ITA" or "the Agreement"). Indeed, because Planar supplements its U.S. production by importing certain displays from its facility in Finland and imports certain parts from the Far East, Planar urged the Office of the United States Trade Representative ("USTR") to ensure that electroluminescent flat panel displays were included in the ITA. Unfortunately, the U.S. Customs Service appears to be undermining the goals of the ITA by raising the tariffs on some of the same products that are scheduled to receive duty-free treatment under the ITA. If Customs continues to work at cross-purposes to the ITA, the Agreement may not be properly implemented, undermining its value to U.S. companies such as Planar.

The purpose of the ITA is to reduce tariffs on technology products. EL displays "for products falling within this Agreement," "wherever they are classified in the HS," are specifically included in the ITA. All of Planar's EL displays can be, and are, used with products covered by the Agreement and therefore should be covered by the Agreement themselves. In contrast to the ITA negotiations that will phase out duties on flat panel displays, Customs recently has reversed its long-standing practice of classifying EL displays under Chapter 84 of the tariff schedule, duty free, and instead has begun to classify these displays and their parts under Chapters 85, which carries a higher duty rate. Customs' approach to classification of flat panel displays is inconsistent with the goal of the ITA to eliminate tariffs on imported information technology products. Customs' position also makes the United States vulnerable to charges of hypocrisy given the U.S. government's allegations that the European Union has changed the tariff classification of certain technology goods in order to avoid granting them duty-free treatment.

Planar believes that the goals of the ITA are worthy and that the U.S. government should continue to pursue the completion of this important Agreement. In order for the United States to effectively implement the ITA, however, it is important that the various government agencies involved act in a coordinated fashion. The ITA should be interpreted and implemented in a way that effectuates its intent, and does not permit the Customs Service to undermine that intent.

Sincerely,

Paul Rosenthal

PAUL C. ROSENTHAL

Counsel to Planar Systems, Inc.

DISTILLED
SPIRITS
COUNCIL
OF THE
UNITED
STATES

March 17, 1997

Ms. Donna R. Koehnke
Secretary
U.S. International Trade Commission
500 E Street, S.W.
Washington, D.C. 20436

Re: Investigation 332-380

Dear Ms. Koehnke:

I am writing to you on behalf of the Distilled Spirits Council of the United States, Inc. (DISCUS) in response to your request for comments regarding the proposed modification of duties on distilled spirits (62 Fed. Reg. 11222, dated March 11, 1997). DISCUS is the trade association representing U.S. producers, importers, and exporters of distilled spirits.

DISCUS Position

A key achievement of the WTO Ministerial Conference in Singapore was the conclusion of tariff elimination agreements in the information technology and distilled spirits sectors. DISCUS strongly supports the agreement on distilled spirits, announced at the Singapore conference by the United States and the European Union, to eliminate tariffs on distilled spirits by the year 2000. The final agreement, announced March 13, 1997, provides for the elimination of tariffs on so-called "white spirits," including vodka, gin, and liqueurs by no later than January 1, 2000. Under the agreement, the United States and the European Union will also eliminate tariffs on whisky and brandy by January 1, 2000, four years earlier than scheduled. The two parties also agreed to eliminate tariffs on certain types of rum by the year 2003.

The U.S.-EU accord on tariff elimination is an important step toward global free trade in the distilled spirits sector, and one which will substantially benefit the U.S. distilled spirits industry. Faced with declining sales of distilled spirits in the United States, expanding exports holds the key to the future well-being of U.S. distilled spirits companies. This newly gained duty-free access to the European Union -- the leading export market for U.S. distilled spirits, including Bourbon, Tennessee Whiskey and Puerto Rican rum -- will generate increased U.S. export sales and additional production and jobs within the U.S. distilled spirits industry.

DISCUS • 1250 Eye Street, N.W. • Suite 900 • Washington, D.C. 20005-3998 202/628-3544 • FAX: 202/682-8888

The U.S.-EU agreement also establishes an important precedent for gaining duty-free access to additional foreign markets. With the principle of tariff elimination for all distilled spirits established, the United States is in a stronger position to pursue similar commitments from other countries in the context of WTO negotiations, in regional initiatives such as the Free Trade Agreement for the Americas (FTAA) and the Asia-Pacific Economic Cooperation dialogue, and with countries seeking to accede to the WTO, such as Russia, China, and Taiwan.

DISCUS Objectives

Over the past decade, DISCUS has supported the efforts of the United States to lower global trade barriers. In no area has this been more important for the U.S. distilled spirits industry than in the case of tariff concessions. DISCUS actively worked with the U.S. government during the GATT Uruguay Round negotiations to eliminate tariffs in the distilled spirits sector. This "zero for zero" initiative produced an agreement among the "Quad" countries to eliminate tariffs on whisky and brandy over a period of ten years and to substantially reduce tariffs on all other distilled spirits. Unfortunately, the agreement failed to provide for the elimination of tariffs on "white spirits" and liqueurs, due to the strong opposition of Japan at that time.

In order to complete the process of tariff elimination, the Congress provided authority and a direct mandate for further negotiations covering the distilled spirits sector in the 1994 Uruguay Round Agreements Act and the accompanying Statement of Administrative Action. Since then, we have worked closely with U.S. negotiators and the Congress to advance the objective of tariff elimination for all distilled spirits in key U.S. export markets. The U.S.-EU agreement reached at Singapore is a significant step in that direction and it is imperative that we build upon this success. Accordingly, we urge the Administration and the Congress to endorse the U.S.-EU agreement and support its full implementation.

Objectives of the U.S.-EU Accord on Spirits Tariffs

The elimination of European tariffs on distilled spirits will substantially benefit U.S. producers and exporters of distilled spirits. The European Union is the largest export market for U.S. distilled spirits. In 1995, U.S. sales totaled nearly $160 million -- approximately 35 percent of total U.S. exports to the world. Exports of Bourbon and Tennessee Whiskey account for the largest amount, with vodka, rum and liqueurs accounting for an important and growing share of the total. In 1995, sales of these products alone were valued at $12 million.

In addition to being the leading U.S. export market for distilled spirits, the European Union also is the largest export market in which most U.S. distilled spirits still face tariffs. Moreover, in all categories of distilled spirits, EU tariffs are measurably higher than those of the United States. Thus, the agreement will allow U.S. distilled spirits companies to gain duty-free access to their largest export market and to secure a proportionally larger reduction in tariff barriers than that offered by the United States on European products. In this regard, we estimate that U.S. distilled spirits exporters will save approximately $18.7 million in EU tariffs as a result of the distilled spirits agreement (see enclosure).

The U.S.-EU agreement also will benefit U.S. importers and marketers of distilled spirits. In addition to exporting, a number of U.S. distilled spirits producers also import and market European distilled spirits on the U.S. market. The elimination of U.S. tariffs on these products will enable our members to strengthen their competitive position in the U.S. market, while providing U.S. consumers with access to the widest variety of distilled spirits produced in the world. This in turn will enable them to compete more effectively on world markets.

Product Coverage of the U.S.-EU Accord on Spirits Tariffs

In the global marketplace, all distilled spirits compete directly with one another for consumer preference, market share, and brand loyalty. U.S. distilled spirits companies produce and market all types of distilled spirits -- ranging from Kentucky Bourbon to Puerto Rican rum. Accordingly, DISCUS has pressed since early in the Uruguay Round negotiations for the inclusion of all distilled spirits in any tariff elimination agreement. The agreement reached at Singapore ensures, for the first time, that U.S. producers of vodka, gin and liqueurs also will benefit from tariff elimination -- like U.S. producers of whisky and brandy -- in competing for a larger share of the European distilled spirits market.

We commend U.S. trade negotiators for their skill and persistence in crafting an agreement which promotes the interests of U.S. distilled spirits exporters while accommodating the concerns of Caribbean rum producers. Though mindful of these concerns, we believe that all distilled spirits producers should benefit from duty-free trade, including Puerto Rican rum producers. Caribbean producers -- principally in Jamaica, Barbados and Trinidad -- have enjoyed duty-free access for their rum to the U.S. market since 1983 under the Caribbean Basin Initiative (CBI). They also have enjoyed duty-free access to the European Union for a number of years under the so-called Lomé Agreement, while maintaining substantial tariff barriers on imports of all spirits into their own markets. In sharp contrast, Puerto Rican rum producers face significant tariffs on their shipments to the European Union.

The EU represents a large and growing export market for Puerto Rican rum, with export sales valued at $3.7 million in 1996. Expanding exports from Puerto Rico to the EU will have a beneficial effect on the island's economy through expansion of production and the creation of additional jobs. The rum industry in Puerto Rico currently generates over 2,600 jobs and comprises over 5% of the island's economy. (Most of these totals are accounted for by Bacardi Corporation the leading rum producer in Puerto Rico, which fully supports the U.S.-EU agreement.) The elimination of EU tariffs will allow Puerto Rican rum producers to compete for a larger share of the EU market on an equal footing with their competitors in the Caribbean.

Maintaining tariff protection in the rum sector beyond the year 2000 is unfair and potentially harmful to U.S. rum producers. They would continue to face a competitive disadvantage *vis-a-vis* Caribbean suppliers of rum in their largest export market. Moreover, they would be placed at a competitive disadvantage in relation to all other distilled spirits, such whisky, vodka, and gin, since these products would have duty-free access to U.S. and EU markets by the year 2000. In addition, maintaining tariff protection for rum establishes an extremely undesirable precedent for future bilateral and multilateral negotiations intended to secure duty-free access for U.S. distilled spirits in other markets.

Conclusion

Over the past decade, DISCUS has strongly supported the efforts of the United States to lower global trade and tariff barriers. The Uruguay Round negotiations produced significant benefits for the U.S. distilled spirits industry, including substantial reductions in foreign tariff barriers. Similarly, the agreement announced at the WTO Ministerial Conference in Singapore, which provides for the elimination of U.S. and EU tariffs on most spirits by January 1, 2000 is a further important step in that direction.

As noted in the enclosed correspondence to Ambassador Charlene Barshefsky, DISCUS and our industry colleagues in the European Union and Canada strongly support the elimination of tariffs on global trade in distilled spirits. Accordingly, we urge the Administration and the Congress to strongly support the elimination of tariffs in the distilled spirits sector and to fully endorse the U.S.-EU agreement on spirits tariffs.

If you have any questions with regard to this matter, please feel free to contact Mark Orr at (202) 682-8826, or by fax at (202) 682-8832.

Thank you very much for your consideration.

Sincerely,

Fred A. Meister
President/CEO

FAM:sas

Enclosures

U.S.-EU ACCORD ON SPIRITS TARIFFS

CUMULATIVE EU DUTY SAVINGS
(Based on 1996 U.S. Export Volume)

STAGE	WHISKY	VODKA	RUM	BRANDY	LIQUEURS	GIN	TOTAL
1997	$379,059	$285,818	$66,573	$51,721	$44,960	$32,549	$860,680
1998	$1,516,234	$1,143,272	$267,900	$206,882	$179,841	$130,197	$3,444,326
1999	$2,274,350	$1,714,908	$401,850	$310,322	$269,762	$195,296	$5,166,488
2000	$3,032,467	$2,286,544	$535,800	$413,763	$359,782	$260,394	$6,888,650
2001	0	0	$669,750	0	0	0	$669,750
2002	0	0	$803,699	0	0	0	$803,699
2003	0	0	$937,648	0	0	0	$937,648
TOTAL	$7,202,110	$5,430,542	$3,683,220	$982,688	$854,245	$618,436	$18,771,241

Note Information based on U S Customs Service data prepared by the U S Census Bureau

Prepared by: DISCUS International Issues & Trade Division

U.S.-EU ACCORD ON SPIRITS TARIFFS

PROJECTED EU DUTY PAYMENTS[1]
(Based on 1996 U.S. Export Volume)

STAGE	WHISKY	VODKA	RUM[2]	BRANDY	LIQUEURS	GIN	TOTAL
1996	$3,032,467	$2,286,544	$937,648	$413,763	$359,682	$260,394	$7,290,498
1997	$2,653,409	$2,000,726	$871,075	$362,043	$314,722	$227,845	$6,429,820
1998	$1,516,234	$1,143,272	$669,748	$206,882	$179,841	$130,197	$3,846,174
1999	$758,117	$571,636	$535,798	$103,441	$89,920	$65,098	$2,124,008
2000	0	0	$401,848	0	0	0	$401,848
2001	0	0	$267,898	0	0	0	$267,898
2002	0	0	$133,949	0	0	0	$133,949
2003	0	0	0	0	0	0	0

Note Information based on U S Customs Service data prepared by the U S Census Bureau.

[1] Calculated on 100 proof spirits

[2] Based on U.S. exports valued over EU price breaks and within tariff rate quota

Prepared by: DISCUS International Issues & Trade Division

DISTILLED
SPIRITS
COUNCIL
OF THE
UNITED
STATES

December 4, 1996

Ambassador Charlene Barshefsky
Acting United States Trade Representative
600 17th Street, NW.
Washington, D.C. 20508
USA

RE: "Zero for Zero" -- Distilled Spirits Tariff Elimination

Dear Ambassador Barshefsky:

The distilled spirits industries of the United States, Canada, and the European Union have strongly supported the elimination of tariffs on global trade in distilled spirits. We welcomed the Uruguay Round agreement to eliminate tariffs on whisky and brandy as a significant step toward this goal. Unfortunately, however, that agreement did not cover other distilled spirits, such as vodka, gin and rum, and liqueurs, and is to be implemented over an extended period of ten years.

We remain keenly interested in extending the elimination of tariffs to these products, and in accelerating the ten year schedule for eliminating tariffs on whisky and brandy. We therefore urge you to utilize the upcoming WTO Ministerial Conference, and the likely conclusion of a tariff elimination agreement in the information technology sector, to secure the agreement of other key WTO member countries, including in particular Japan, to complete the Uruguay Round distilled spirits "zero for zero" agreement in this manner.

Should it not prove possible to secure the agreement of other WTO members to such action at Singapore, we urge the United States, Canada, and the European Union to agree to proceed together to eliminate tariffs on vodka, gin, rum and liqueurs and to accelerate the ten year schedule for eliminating tariffs on whisky and brandy. Such action would be of significant benefit to our respective industries, as the United States, Canada, and the European Union are each other's largest export markets for distilled spirits. In addition, it would establish a strong basis for pursuing tariff elimination for distilled spirits on a broader scale within the WTO in the future.

DISCUS • 1250 Eye Street, N.W. • Suite 900 • Washington, D.C. 20005-3998 202 628-3544 • FAX 202 682-8888

An agreement by the United States, Canada and the European Union to additional tariff elimination in the distilled spirits sector would send a clear and unmistakable signal that the opposition of any one country should not prevent other WTO members from moving forward with trade liberalization initiatives of mutual benefit. Please be assured that such an agreement would have our full and enthusiastic support when presented for domestic consideration.

We are addressing identical letters to your Canadian and European counterparts, Minister of Trade Eggleton and European Commission Vice President Brittan.

Thank you very much for your consideration.

Sincerely,

Fred A. Meister
President/CEO
Distilled Spirits Council
of the United States

Ronald B. Veilleux
President /CEO
Association of Canadian
Distillers

Gillian Darley
Director General
Confederation of European
Spirits Producers

NABI

NATIONAL ASSOCIATION OF BEVERAGE IMPORTERS, INC.

1025 VERMONT AVENUE, N.W. · WASHINGTON, D.C. 20005 · (202) 638-1617

0000011

March 21, 1997

'97 MAR 21 P12:24

OFC. US ITC

Secretary
United States International Trade Commission
500 E Street, S.W.
Washington, D.C. 20436

Re: Investigation No. 332-380

Dear Mrs. Koehnke:

The National Association of Beverage Importers, Inc., (NABI) represents importers of beer, wine and distilled spirits. NABI members are responsible for the importation of a significant amount of the alcohol beverages imported into the United States.

The majority of NABI members are in complete agreement with the comments submitted by the Distilled Spirits Council of the United States (DISCUS). While NABI members are principally importers, and would, therefore, welcome the elimination of U.S. tariffs, we also believe the U.S./EU agreement will also benefit U.S. exporters of distilled spirits since the European Union is the largest market for U.S. distilled spirits. One NABI member company would prefer the status quo on rum. That company will be commenting in its own name. In addition, we would like to see the zero-to-zero tariff initiative applied to malt beverages also.

We believe the U.S./EU agreement is an important step for the elimination of tariffs worldwide. It is an important precedent for the elimination of tariffs on distilled spirits in other free trade agreements such as the Free Trade Agreement for the Americas (FTAA) and with other countries seeking to accede to the WTO.

We appreciate the opportunity to comment on this agreement and look forward to its timely implementation.

Sincerely,

Robert J. Maxwell
President

ROBERT J. MAXWELL
PRESIDENT

WINE-SPIRITS-BEER

CABLE ADDRESS: NAABI
TELEX: 904059 WSH

Presidents' Forum

of the Beverage Alcohol Industry

March 21, 1997

1110029

332-380

'97 MAR 20 P3:55

Secretary
U.S. International Trade Commission
500 E Street SW
Washington, DC 20436

Dear Madam Secretary:

The Presidents' Forum of the Beverage Alcohol Industry is a coalition of chief executive officers of companies in the United States that produce or import beer, wine and distilled spirits for sale to independent wholesalers throughout the United States, and for export of these products throughout the world. A current list of members is enclosed for your information.

The members of the Presidents' Forum strongly support the agreement reached at the World Trade Organization Ministerial Conference at Singapore in December, 1996, between the United States and the European Union for the elimination of tariffs on most distilled spirits. We believe unrestricted trade with the European Market is in the best interests of U.S. exporters and importers of distilled spirits, and that the agreement is an important first step toward worldwide adoption of the zero for zero initiative for these products.

The Presidents' Forum looks forward to action by the Office of the United States Trade Representative in using the U.S.-EU agreement as a precedent for seeking zero distilled spirits tariffs in negotiations with countries not presently covered by the agreement.

We appreciate the opportunity to offer these comments in furtherance of your investigation.

Sincerely,

Rex D. Davis

Rex D. Davis
Executive Director

Enclosure:

Rex D. Davis
Executive Director

311 Tenth Street, S.E.
Washington, D.C. 20003

Tel: (202) 546-3070
Fax: (202) 546-1448

Members of the Presidents' Forum of the Beverage Alcohol Industry

Mr. Harvey Allen
President
M.S. Walker, Inc.

Mr. Derek H. Anderson
President
William Grant & Sons, Inc.

Mr. Michel Bord
President
Austin Nichols & Co., Inc.

Mr. Peter W.H. Bordeaux
President
Sazerac Co., Inc.

Mr. Harvey Chaplin
President
Shaw-Ross International Importers

Mr. John R. Frank
Executive Vice President
Sidney Frank Importing Co.

Mr. Russell A. French
President
McCormick Distilling Co.

Mr. Larrie W. Laird
President
Laird & Company

Mr. Paul Lux
President
David Sherman Corporation

Mr. Duane H. Maas
President
U.S. Distilled Products Co.

Mr. Carl Mullen
President
Hood River Distilleries, Inc.

Mr. A. Kenneth Pincourt, Jr.
President
Todhunter International, Inc.

Mr. Michel Roux
President
Carillon Importers, Inc.

Mr. Marvin Sands
Chairman
Canandaigua Wine Co., Inc.

Mr. Max L. Shapira
Executive Vice President
Heaven Hill Distilleries, Inc.

Mr. Allen C. Shoup
President
Stimson-Lane Wine & Spirits, Ltd.

Mr. Hubert Surville
President
Marie Brizard Wine & Spirits, U.S.A.

Executive Director
Rex D. Davis
311 Tenth Street, S.E.
Washington, D.C. 20003
Tel. (202) 546-3070

Counsel
Buchman & O'Brien
10 E. 40th Street
New York, NY 10016
Tel. (212) 953-0440

10/14/96

REMY AMERIQUE, INC.

200002

March 19, 1997

'97 MAR 21 A9:43

Secretary
United States International Trade Commission
500 "E" Street, N.W.
Washington, D.C. 20436

Re: Investigation No. 332-380

Dear Secretary:

Remy Amerique, Inc. is a United States corporation which imports and distributes fine wines and spirits throughout the United States. We are ultimately owned by a French wine and spirits manufacturer and distribution company, and therefore believe we can comment on the benefits, from both a United States and a European perspective, of the "zero for zero" initiative which leads to the elimination of tariffs on distilled spirits.

We support this initiative and welcome the elimination of United States and European tariffs for distilled spirits.

We do believe, however, that the provisions of the Caribbean Basin Initiative ("CBI") should not be altered. The circumstances under which the United States agreed that it was necessary to provide some protection to certain countries still exist. The U.S.T.R. and the I.T.C. apparently agree with this since it has been proposed not to alter this provision of the initiative. Therefore, in order for the CBI to have any effect, the tariffs that exist on all other rums should also be maintained, regardless of the price.

We appreciate the opportunity to comment on this agreement.

Sincerely,

REMY AMERIQUE, INC.

By: Julie M. Kinch
Vice President-General Counsel

Rémy Amérique, Inc., 1350 Avenue of the Americas, New York, NY 10019
Tel.: 212 399 4200 - Fax: 212 399 6909

REMY·COINTREAU

U.S.A. SUBSIDIARY OF
WILLIAM GRANT & SONS. LTD
PHOENIX CRESCENT
STRATHCLYDE BUSINESS PARK
MOTHERWELL. ML4 3AN SCOTLAND

LONDON OFFICE
INDEPENDENCE HOUSE
84 LOWER MORTLAKE ROAD
RICHMOND. SURREY. TW9 2HS

NEW YORK OFFICE
1271 AVENUE OF THE AMERICAS
SUITE 4341
NEW YORK, NY 10020

FLORIDA OFFICE
TWO ALHAMBRA PLAZA SUITE 1102
CORAL GABLES. FLORIDA 33134

GLENFIDDICH
STAND FAST

William Grant & Sons, Inc.

130 FIELDCREST AVENUE • RARITAN CENTER
EDISON. NEW JERSEY 08837
TELEPHONE (908) 225 - 9000

PROPRIETORS OF
THE GLENFIDDICH DISTILLERY
BALVENIE DISTILLERY &
KININVIE DISTILLERY
DUFFTOWN BANFFSHIRE
THE LADYBURN & GIRVAN DISTILLERIES
GIRVAN. AYRSHIRE

ESTABLISHED 1887

March 12, 1997

'97 MAR 20 P4:04

Mrs. Koehnke
Secretary
U.S. International Trade Commission
500 E Street, S.W.
Washington, DC 20436

Re: Investigation No. 332-380

1100031

Dear Mrs. Koehnke::

We would just like to take this opportunity of indicating our total support of the elimination of tariffs on distilled spirits as proposed by the above investigation.

Yours,

Derek H Anderson

Derek H. Anderson
President

cc: B. Maxwell - NABI

TELEX RCA 219028 GRANT UR/FAX: (908) 225-0950

INFORMATION TECHNOLOGY INDUSTRY COUNCIL

March 21, 1997

Ms. Donna R. Koehnke
Secretary
U.S. International Trade Commission
500 E Street, SW
Washington, DC 20436

Ref: Investigation No. 332.380, Advice Concerning the Proposed Modification of Duties on Certain Information Technology Products and Distilled Spirits

Dear Ms. Koehnke:

This letter is in response to your notice of March 5, 1997 requesting comments on the elimination of duties on information technology products under the Information Technology Agreement. This agreement will eliminate tariffs on information technology products by January 2000.

The Information Technology Industry Council (ITI) represents the leading U.S. providers of information technology products and services. Its members had worldwide revenue of $381 billion in 1995. ITI has been leading the effort on the ITA for the past two and a half years and worked closely with USTR as the ITA evolved.

Ambassador Barshefsky and her negotiating team did an outstanding job in convincing our global trading partners of the benefits of an ITA. The elimination of tariffs on information technology products will both expand the IT market and help put the tools of the information society in the hands of more businesses and consumers around the world. The ITA is essentially a multibillion dollar tax cut for consumers.

We have included in our submission a copy of Mr. Aaron Cross's February 26 testimony on the ITA before the House Ways and Means Subcommittee on Trade. We believe this agreement is a giant boost for expanding those technologies considered critical to the economic success of all into the next century.

Sincerely,

Rhett B. Dawson
President

Enclosure

The association of leading IT companies
1250 EYE STREET, NW ■ SUITE 200 ■ WASHINGTON, DC 20005
(202) 737-8888 ■ FAX (202) 638-4922

ITI Public Policy Documents

Written Submission of
Aaron W. Cross
House Ways & Means Subcommittee on Trade
February 26, 1997

I am Aaron Cross, Public Policy Director in IBM's Governmental Programs Office in Washington, DC. Today, I appear on behalf of the Information Technology Industry Council. As chair of ITI's International Committee, I also have served as chairman of the Information Technology Agreement Coalition -- the industry group that developed a global industry consensus to promote the ITA and that worked daily with USTR and other government representatives around the world to arrive at an acceptable agreement. It was also my privilege, as a member of the Industry Functional Advisory Committee on Customs, to participate in the Singapore WTO Ministerial meeting as a member of the United States delegation.

Our evaluation of the Singapore Ministerial outcome:

> The ITA is a landmark trade agreement -- revolutionary in its scope and approach. It's a model for how industry and governments around the world can work cooperatively to achieve common goals. The basic aim of these negotiations was exceeded in almost every respect. That aim-To significantly enhance the degree to which the benefits of the Global Information Infrastructure will be made available quickly and less expensively to information technology (IT) users worldwide. The members of this subcommittee and the Administration -- especially Ambassador Barshefsky and her team-merit our sincerest gratitude for their foresight, hard work, and cooperation from the time of the ITA 's inception to its negotiation in Singapore.

The Challenges Behind the ITA

The ITA's origins stem from the conclusion of the Uruguay Round. The implementing legislation for the Round provided residual authority for USTR to negotiate tariffs on product sectors that had been included in the U.S. zero-for-zero package. That was very helpful, but we had to find a new vehicle. Fortunately, one was available -- the WTO.

As we looked at the situation, we knew that we would have to do things differently--First, to find a way to work within the new WTO framework; second, to do this on a sectoral basis; third, to use USTR's residual negotiating authority; and finally, to work on a global industry basis rather than from a national one.

The ITA 's Product Coverage

From our Uruguay Round experience, we knew already that computer companies throughout the Quad countries had supported the idea of zero-for-zero on computers. So, our first thought was to target only computers. We had known that during the Uruguay Round, European semiconductor and telecommunications companies had opposed tariff elimination. But as ITI went to our sister associations in Europe and Japan, we found that in the brief year that had elapsed since the conclusion of the Round, those attitudes had changed.

We therefore broadened our proposal to encompass computer hardware and software, semiconductors, semiconductor manufacturing and test equipment, telecommunications products, and other high technology instruments. That early outline of proposed product coverage formed the basis for the joint U.S. Government and industry ITA strategy and remained intact all the way through Singapore.

As ITI and AEA formed the ITA Coalition, we encouraged any association or company with operations in the U.S. to join our efforts.[1] We quickly found that some of our members wanted broader product coverage. As we evaluated their requests to add products to our suggested coverage list, we developed one guideline for considering their requests. Unless we had consensus among the Coalition members on a product's inclusion, we would not suggest it for ITA inclusion.

I go into this, because the subcommittee staff has asked that I address the question of capacitor coverage under the agreement. Early our work on product coverage, two of our member associations -- AEA and the Electronic Industries Association -- advised the Coalition that two of their companies -- Kemet and Vishay -- opposed including capacitors. They told us as well, however, that several of their other members supported capacitor coverage.

These opposing views led the Coalition to take a neutral position on the capacitor coverage issue, and we informed USTR of that position. Nevertheless, this was a critical issue, because the EU negotiators -- in response to their own industry -- were insisting that capacitors be included. I know, from my time in Singapore, that Ambassador Barshefsky and her team spent long hours with their EU counterparts on this issue. Frankly, the U.S. was alone among the Quad parties in holding out against the inclusion of capacitors. The EU was joined by Canada and Japan. In the final outcome, capacitors and other passive components were included in the ITA.

The coalition regrets that Kemet and Vishay are unhappy with the agreement. My own company -- and virtually every other coalition member company -- regard both companies as valued suppliers. They, like we, are in a highly competitive industry, and we need a vital passive components industry.

"Keeping an eye on the Big Picture"

Throughout the negotiations, USTR and we kept pressing home the message that this is a global initiative aimed at putting the power of computers, telecommunications, and related products into the hands of users of the GII. We knew from the start that without the Quad countries' support, the ITA would never take root as a WTO plurilateral agreement. That's why we spent so much time focusing on the advanced economies. But in truth, with a handful of exceptions, the tariff rates of the Quad countries were relatively low.

The real benefits of the ITA would be realized if we were to secure the participation of countries outside the Quad, where the tariffs in many countries are high. The Agreement negotiated in Singapore contains a provision that in order for the ITA to take effect on its July 1, 1997 target date, 90 percent of the world's trade volume in IT products must be accounted for by the signatory countries. The original 28 signatories accounted for about 84 percent, so our target has been to get as many other countries to sign up as possible.

These countries primarily fall into the advanced developing economy and other developing country categories. Again, a number of these have higher tariffs on IT products than do the Quad countries.

Still, we believe it very likely that the 90 percent target will be met and exceeded. The reason? It goes back to this government/industry view that the ITA's overriding intent is to focus on greater access to IT technology. We have cited a couple of case histories where bringing high tariffs down has worked greatly to increase the productivity and export competitiveness of countries like India and Malaysia. These case histories have shown that high tariff barriers only keep more productive segments of an economy -- such as software developers -- from having access to the tools that will make them more productive. Lowering those tariffs have direct and measurable impact on increasing productivity.

So, when we consider the question of "balance", the ITA's real innovation is that it levels the playing field for all sectors of the global economy in terms of access to this productivity tool. The ITA will have a major impact on narrowing the gap between the world's information "have's" and "have-nots". We see a growing acceptance of this new thinking among the world's trading partners. And it is for that reason that we are confident that the 90 percent target under the ITA will be exceeded.

"A Total Greater than the Sum of Its Parts"

The ITA goes well beyond the immediate cost savings to manufacturers and customers in ways that may not be well appreciated

- It will help to resolve customs classification disputes between the U.S. and other countries, as computer and telecommunications technologies continue to converge. With no tariff differential to exploit for self-advantage, there will be no incentive for any government to manipulate classification rules.

- Similarly, customs valuation cases are likely to disappear in many areas. The most obvious beneficiary in this area is the American software industry. Software companies need no longer be concerned that governments who belong to the agreement will try to impose tariffs on the value of the content of software, as opposed to the medium of the software itself. Valuation is not as important when there is no tariff rate to apply.

- Rules of origin similarly will cease to be an area of exposure to manipulation by countries who belong to the ITA.

- There will be a number of additional administrative efficiencies that accrue to IT companies. As the members of this subcommittee well know, customs compliance procedures, while much better than they used to be since the enactment of the Mod Act, are nevertheless expensive. When a company like mine sees over one million part numbers cross international frontiers in a given year, some of these areas -- like classification, valuation, and origin determination -- can be costly to determine. We will still have to do the work -- but for statistical reporting reasons, not in terms of ensuring against the loss of revenue for the U.S. Government.

Implications for U.S. Trade Policy

Mr. Chairman, this has been one of the most successful negotiations in U.S. trade history. We ought to consider what happened here in the ITA, because we stand much to gain if we can apply the lessons we have learned from the process.

- First and most importantly, the ITA departed from the traditional approach of trade talks in that it placed the focus of the outcome where it rightly should belong -on the consumers and users of products that were being discussed, not on the exporters and importers.

- Second, the ITA points to the paramount need for ensuring that the U.S. Government has qualified people who have the capacity to "think outside the box." In her support for the ITA -- and, again with the recently concluded talks on Global Basic Telecommunications -- Ambassador Barshefsky proved persuasively that USTR can do this. It is for that reason that ITI supports her confirmation as U.S. Trade Representative.

- Third, the WTO as an institution proved itself to be a worthy, and much more flexible organization than its predecessor, the GATT. Director General Ruggiero spoke forcefully in Singapore about the need for agreement on the ITA. You could sense it in his remarks -- if the ITA were to fail, then perhaps the future of the WTO as an institution would be at risk. If it were to succeed, then the WTO would have put its mark on the map.

- Fourth, the ITA points to the importance of industry/government cooperation on trade issues. We saw it manifest itself in several ways:

    1. USTR worked very closely with the Coalition throughout the negotiation process. We

exchanged very useful information, and by the time our negotiators went to Singapore, or Manila during the APEC meeting leading up to Singapore, or any of countless other negotiations, the U.S. negotiators were the best briefed and prepared delegation.

2. The industry advisory system in U.S. law also helped. I was impressed with Ambassador Lang' s daily briefings for the U. S. private sector advisors and found it gratifying that the U.S. negotiators went out of their way to ensure that at each step along the way, they had the latest thinking from these advisors. The private sector advisory system we have in U.S. law clearly gives us a leg up.

- Fifth, we can expect more of the same in the future, and we need your support. During the Trans Atlantic Business Dialogue meetings in Chicago last October, Sir Leon Brittan said in his concluding remarks that he is going to start referring to what he calls the "ITA Formula", explaining that he expects industry-led initiatives to proliferate in the future that should pave the way to plurilateral WTO agreements. In this regard, ITI wants to stress to the members of the subcommittee our strongest support for expanding the negotiating authority for USTR through fast track this year.

- Finally, we want to use this negotiating authority because the ITA will not cease its forward momentum when it goes into effect on July 1. There is a broader agenda that we intend to pursue. In October, ITA members will start to what some are referring to as "ITA II". These are negotiations provided for in the agreement to consider additional tariff elimination measures for ITA coverage, and to start consideration of non-tariff measures. I am confident that our industry coalition will have much to offer in terms of our ideas, advice, and support for this next round.

Mr. Chairman, on behalf of the Information Technology Industry Council, we appreciate very much this opportunity to appear. We appreciate very much your strong statement of support for the ITA when you announced these hearings. I will be pleased to answer any of your questions.

ITA COALITION

Association Members

ITI - Information Technology Industry Council - U.S. Co-Chair
AEA - American Electronics Association - European Co-Chair

AIA - Analytical Instrument Association
BSA - Business Software Alliance
CCIA - Computer & Communications Industry Association
EIA - Electronic Industries Association
EACC - European American Chamber of Commerce
IPC - Institute for Interconnecting & Packaging Electronic Circuits
OIDA - Optoelectronics Industry Development Association
SEMI - Semiconductor Equipment Manufacturers International
SIA - Semiconductor Industry Association
SPA - Software Publishers Association
TIA - Telecommunications Industry Association

Corporate Members

Adobe Systems
EDS
Motorola

Advanced Micro Devices
Amdahl
Analog Devices
AVX Corporation
Bay Networks
Cabletron
Cascade
Cisco Systems
Compaq Computer
Dallas Semiconductor
Dell Computer
Digital Equipment Corporation
Ericcson
Harris Corporation
Hewlett-Packard
Honeywell
IBM Corporation
Intel Corporation
International Rectifier
Kodak
LSI Logic
Lucent Technologies
Madge Networks
Micron Technologies
Microsoft
National Semiconductor
Northern Telecom
Oracle
Quality Technologies
Siemens Corporation
Silicon Graphics
Sun Microsystems
Tektronix
3Com
Uniden
Varian
Xerox

APPENDIX G

GATT BOUND TARIFF RATES FOR PRODUCTS COVERED BY ITA FOR ITA PARTICIPANTS

The following table contains the final Uruguay Round bound rates of duty for IT products, by 6-digit HS number, for WTO members that either are signatories to the ITA or have made commitments to the ITA as of March 1, 1997.[1] The table also contains rates of duty for IT products, by 6-digit HS number, for non-WTO members based on U.S. Department of Commerce working papers. These rates are believed to be accurate based on the best information available.

[1] GATT Secretariat, *Legal Instruments Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations Done at Marrakesh on 15 April 1995* (GATT: Geneva), 1994, various volumes.

Commodity	Australia	Canada	Costa Rica	Estonia	EU(15)	Hong Kong	Iceland	India
3818.00	10	6.5	(1)	0	6.5	(1)	10	40
8469.11	5	0	(1)	0	2.3	0	24	(1)
8470.10	7.5	0	(1)	0	6	0	24	(1)
8470.21	7.5	0	(1)	0	6	0	24	(1)
8470.29	7.5	0	(1)	0	6	0	24	(1)
8470.30	7.5	0	(1)	0	2	0	24	(1)
8470.40	7.5	0	(1)	0	2	0	24	(1)
8470.50	5	0	(1)	0	2	0	24	(1)
8470.90	7.5	0	(1)	0	2	0	24	(1)
8471.10	6	0	(1)	0	0-2.5	0	0	40
8471.30	6	0	(1)	0	0-2.5	0	0	40
8471.41	6	0	(1)	0	0-2.5	0	0	40
8471.49	6	0	(1)	0	0-2.5	0	0	40
8471.50	6	0	(1)	0	0-2.5	0	0	40
8471.60	6	0	(1)	0	0	0	0	40
8471.70	6	0	(1)	0	0	0	0	40
8471.80	6	0	(1)	0	0	0	0	40
8471.90	6	0	(1)	0	0	0	0	40
8472.90	5	2.6	(1)	0	2.2	0	24	(1)
8473.21	7.5	0	(1)	0	0-3	0	24	40
8473.29	7.5	0	(1)	0	0-3	0	24	40
8473.30	7.5	0	(1)	0	0-2	0	0	40

Commodity	Australia	Canada	Costa Rica	Estonia	EU(15)	Hong Kong	Iceland	India
8473.50	7.5	0	(1)	0	0-2	0	0	40
8504.40	19	6.7-11.3	(1)	0	0-3.3	(3)	24	25
8504.50	23	0-5.9	(1)	0	0-3.7	(3)	24	40
8517.11	15	0	(1)	0	0	0	(1)	(1)
8517.19	15	0	(1)	0	0	0	(1)	(1)
8517.21	15	(1)	(1)	0	3.6	0	(1)	(1)
8517.22	15	0	(1)	0	3.6	0	(1)	(1)
8517.30	15	0	(1)	0	3.6	0	(1)	(1)
8517.50	15	0	(1)	0	3.6	0	(1)	(1)
8517.80	15	0	(1)	0	3.6	0	(1)	(1)
8517.90	15	0-8.7	(1)	0	3	0	(1)	(1)
8518.10	15	3.7	(1)	0	2.5	0	(1)	(1)
8518.29	15	6.5	(1)	0	3	0	(1)	(1)
8518.30	15	6.8	(1)	0	2	0	30	(1)
8518.40	15	6.5	(1)	0	3	0	(1)	(1)
8518.90	15	6.5	(1)	0	2	0	30	(1)
8520.20	15	0	(1)	0	4	0	30	(1)
8523.11	15	4.6	(1)	0	2	0	18-35	(1)
8523.12	15	4.6	(1)	0	3.5	0	18-35	(1)
8523.13	15	4.6	(1)	0	3.5	0	18-35	(1)
8523.20	15	0	(1)	0	0-3.5	0	18-35	(1)
8523.90	15	8.9	(1)	0	3.5	0	18-35	(1)

Commodity	Australia	Canada	Costa Rica	Estonia	EU(15)	Hong Kong	Iceland	India
8524.31	0	6.3	(1)	0	3.5	0	16-29	(1)
8524.39	0	6.3	(1)	0	3.5	0	16-29	(1)
8524.40	7	7.4	(1)	0	0	0	18	(1)
8524.91	0	0	(1)	0	0	0	16-29	(1)
8524.99	0	0	(1)	0	3.5	0	16-29	(1)
8525.10	15	0	(1)	0	3.6	0	24	(1)
8525.20	15	0	(1)	0	6.5	0	24	(1)
8527.90	15	6.3	(1)	0	8	0	30	40
8529.10	15	0	(1)	0	3.6	0	30	(1)
8529.90	15	0	(1)	0	3-5	0	4	(1)
8531.20	10	0-6.8	(1)	0	2.2-4	(1)	24	(1)
8531.80	10	6.8	(1)	0	2.2	0	24	(1)
8531.90	10	0	(1)	0	2.2-4	0	15	(1)
8532.10	17	0	(1)	0	2.7	0	(1)	40
8532.21	15	5.1	(1)	0	3.7	0	(1)	40
8532.22	17	5.1	(1)	0	3.7	0	(1)	40
8532.23	17	5.1	(1)	0	2.7	0	(1)	40
8532.24	17	5.1	(1)	0	2.7	0	(1)	40
8532.25	17	5.1	(1)	0	2.7	0	(1)	40
8532.29	17	5.1	(1)	0	2.7	0	(1)	40
8532.30	17	5.1	(1)	0	3.7	0	(1)	40
8532.90	17	5.1	(1)	0	3.7	0	(1)	40

Commodity	Australia	Canada	Costa Rica	Estonia	EU(15)	Hong Kong	Iceland	India
8533.10	15	0	([1])	0	2.7	0	([1])	40
8533.21	15	0	([1])	0	2.7	0	([1])	40
8533.29	15	0	([1])	0	2.7	0	([1])	40
8533.31	15	0	([1])	0	2.7	0	([1])	40
8533.39	15	0	([1])	0	2.7	0	([1])	40
8533.40	15	0	([1])	0	2.7	0	([1])	40
8533.90	15	0	([1])	0	2.7	0	([1])	40
8534 (all)	17	0	([1])	0	4.5	0	([1])	40
8541.10	1	0	([1])	0	7	0	0	40
8541.21	1	0	([1])	0	7	0	0	40
8541.29	1	0	([1])	0	7	0	0	40
8541.30	1	0	([1])	0	7	0	0	40
8541.40	1-15	0	([1])	0	0-7	0	0	40
8541.50	1	0	([1])	0	7	0	0	40
8541.60	15	0	([1])	0	4	0	0	40
8541.90	1-15	0	([1])	0	2.9	0	0	40
8542.12	([1])	0	([1])	0	14	0	0	40
8542.13	([1])	0	([1])	0	0-7	0	0	40
8542.14	([1])	0	([1])	0	0-7	0	0	40
8542.19	([1])	0	([1])	0	0-7	0	0	40
8542.30	([1])	0	([1])	0	7	0	0	40
8542.40	([1])	0	([1])	0	7	0	0	40

Commodity	Australia	Canada	Costa Rica	Estonia	EU(15)	Hong Kong	Iceland	India
8542.50	([1])	0	([1])	0	7	0	0	40
8542.90	([1])	0	([1])	0	2.9	0	0	40
8543.81	([1])	([1])	([1])	0	([1])	0	([1])	40
8543.89	([1])	([1])	([1])	0	([1])	([1])	([1])	40
8544.41	0	5.1	([1])	0	3.3	0	18-24	40
8544.49	10	6.7	([1])	0	3.7	0	18-24	40
8544.51	15	5.1	([1])	0	3.3	0	18-24	40
8544.70	15	6.7	([1])	0	5.2	0	24-35	40
9009.11	0	0	([1])	0	6	0	35	40
9009.21	1	0	([1])	0	6	0	35	40
9009.90	0	0	([1])	0	3-6	0	35	40
9026.10	0-16	0-3.2	([1])	0	0-3.2	0	5	40
9026.20	0-16	0-3	([1])	0	0-3.2	0	5	40
9026.80	0-16	0-3.2	([1])	0	0-3.2	0	5	25
9026.90	0-10	0-4	([1])	0	0-2.1	0	5	40
9027.20	0	0-3	([1])	0	2.5	0	0	25
9027.30	0-5	0-4	([1])	0	2.5	0	0	25
9027.50	0	0	([1])	0	2.5	0	0	25
9027.80	0-5	0-4	([1])	0	2.5	0	0	25
9027.90	0-5	0-3.7	([1])	0	2.5	0	0	25
9030.40	5	0-5.1	([1])	0	0-4.2	0	5	40

Commodity	Indonesia	Israel	Japan	Korea	Macau	Malaysia	New Zealand	Norway
3818.00	([1])	5	0	6.5	([1])	([1])	8	6
8469.11	40	([1])	0	13	([1])	30	0	2
8470.10	40	10	0	5	([1])	5	0	3
8470.21	40	10	0	5	([1])	5	0	3
8470.29	40	10	0	5	([1])	5	0	3
8470.30	40	10	0	13	([1])	5	0	2
8470.40	40	10	0	13	([1])	5	0	3
8470.50	40	10	0	13	([1])	5	5	3
8470.90	40	10	0	13	([1])	5	10	2-3
8471.10	40	([1])	0	13	([1])	0	0	2
8471.30	40	([1])	0	0	([1])	0	0	2
8471.41	40	([1])	0	0	([1])	0	0	2
8471.49	40	([1])	0	0	([1])	0	0	0-2
8471.50	40	([1])	0	0	([1])	0	0	2
8471.60	40	([1])	0	0	([1])	0	0	0
8471.70	40	([1])	0	0	([1])	0	0	0
8471.80	40	([1])	0	0	([1])	0	0	0
8471.90	40	([1])	0	0	([1])	0	0	0
8472.90	40	16	0	13	([1])	5	0	3
8473.21	40	5	0	5	([1])	5	0-10	2
8473.29	40	5	0	13	([1])	5	0	3
8473.30	40	([1])	0	13-20	([1])	0	0	1.5

Commodity	Indonesia	Israel	Japan	Korea	Macau	Malaysia	New Zealand	Norway
8473.50	40	([1])	0	13-20	([1])	0	0	1.5
8504.40	40	8-10.5	0	13	([1])	5	10-25	2-3
8504.50	40	3-14	0	13	([1])	5	25	4
8517.11	40	6	0	13	0	25	17.5	0
8517.19	40	6	0	13	0	25	17.5	0
8517.21	40	6	0	13	0	5	0	0
8517.22	40	6	0	13	0	5	0	0
8517.30	40	6	0	13	0	5-25	17.5	0
8517.50	40	6	0	13	0	5	([1])	0
8517.80	40	6	0	13	0	20	30	0
8517.90	40	6	0	13	0	5	0-17.5	0
8518.10	40	5	0	16	0	25	0	2
8518.29	40	6	0	16	0	25	30	5
8518.30	40	6	0	16	0	25	0-30	2
8518.40	40	6	0	16	0	25	30	5
8518.90	40	6	0	16	0	5	0-30	2
8520.20	40	6	0	16	0	5	10	5
8523.11	40	12-8+.35 per thousand units	0	13	0	5-10	10	0
8523.12	40	12-8+.35 per thousand units	0	13	0	5-10	0-20	0
8523.13	40	12	0	13	0	5-10	0-20	0
8523.20	40	20	0	13	0	5	0	0

Commodity	Indonesia	Israel	Japan	Korea	Macau	Malaysia	New Zealand	Norway
8523.90	40	6-10	0	13	0	5-20	0	0
8524.31	40	12	0	13	0	5	5	0
8524.39	40	12	0	13	0	5	5	0
8524.40	40	12	0	13	0	5	5-10	0
8524.91	40	12	0	13	0	5-10	5	0
8524.99	40	12	0	13	0	5-10	5	0
8525.10	40	6	0	13	0	20	10	2.5
8525.20	40	6	0	13	0	20	0-30	3
8527.90	40	5	0	13	0	20	0-35	4.4
8529.10	40	16	0	13	0	20	0-30	2
8529.90	40	16	0	13	0	5	0-30	4
8531.20	([1])	([1])	0	13	([1])	0	20	3
8531.80	40	5	0	13	0	0	30	3
8531.90	40	5	0	13	([1])	0	20-30	3
8532.10	40	5-12	0	13	0	30	30	3
8532.21	40	12	0	13	0	0	30	3
8532.22	40	5-12	0	13	0	0	30	3
8532.23	40	5-12	0	13	0	5	30	3
8532.24	40	5-12	0	13	0	0	30	3
8532.25	40	5-12	0	13	0	5	30	3
8532.29	40	5-12	0	13	0	30	30	3
8532.30	40	5	0	13	0	0	30	3

Commodity	Indonesia	Israel	Japan	Korea	Macau	Malaysia	New Zealand	Norway
8532.90	40	5	0	13	0	0	30	3
8533.10	40	([1])	0	13	0	0	25	3
8533.21	40	([1])	0	13	0	0	25	3
8533.29	40	([1])	0	13	0	0	25	3
8533.31	40	([1])	0	13	0	0	0-25	3
8533.39	40	([1])	0	13	0	0	0-25	3
8533.40	40	([1])	0	13	0	0	0-25	3
8533.90	40	([1])	0	13	0	0	0-25	3
8534 (all)	40	10	0	8	0	5	30	3
8541.10	40	0	0	0	0	0	0	9
8541.21	40	0	0	0	0	0	0	7
8541.29	40	0	0	0	0	0	0	2.5
8541.30	40	0	0	0	0	0	0	3
8541.40	40	0	0	0	0	0	0	3
8541.50	40	0	0	0	0	0	0	1.5
8541.60	40	0	0	0	0	0	5-20	3
8541.90	40	0	0	0	0	0	0	0-3
8542.12	40	([1])	0	0	0	0	0	0.1
8542.13	40	([1])	0	0	0	0	0	0.1
8542.14	40	([1])	0	0	0	0	0	0.1
8542.19	40	([1])	0	0	0	0	0	0.1
8542.30	40	([1])	0	0	0	0	0	0.1

Commodity	Indonesia	Israel	Japan	Korea	Macau	Malaysia	New Zealand	Norway
8542.40	40	([1])	0	0	0	0	0	0.1
8542.50	40	([1])	0	0	0	0	0	0.1
8542.90	40	([1])	0	0	0	0	0	1.36
8543.81	([1])	5	([1])	([1])	([1])	([1])	([1])	([1])
8543.89	([1])	([1])	([1])	([1])	([1])	([1])	([1])	([1])
8544.41	40	10.5	4.8	13	0	30	25	0
8544.49	40	10.5	4.8	13	0	30	25	0
8544.51	40	10.5	4.8	13	0	30	25	0
8544.70	40	5.6	0	([1])	0	([1])	25	0
9009.11	40	0	0	13	0	20	10	0
9009.21	40	0	0	13	0	20	0	0
9009.90	40	0	0	13	0	10	0-16.5	0
9026.10	([1])	6-8	0	8	0	0	25	([1])
9026.20	([1])	6-12	0	8	0	0	25	([1])
9026.80	([1])	6-8	0	8	0	0	25	([1])
9026.90	([1])	5-6	0	8	0	5	([1])	([1])
9027.20	([1])	5.6	0	8	0	0	0	([1])
9027.30	([1])	5.6	0	8	0	0	0	([1])
9027.50	([1])	5.6-16	0	8	0	([1])	0	([1])
9027.80	([1])	5.6-12	0	8	0	5	0	([1])
9027.90	([1])	5.6	0	8	0	0	0	([1])
9030.40	([1])	5	0	13	0	5	25	([1])

Commodity	Romania[2]	Singapore	Switzerland[3] Swiss francs per 100 kilograms	Switzerland[3] Ad Valorem	Taiwan[4]	Thailand	Turkey	United States
3818.00	0.5	6.5	1.5	0.1	([1])	([1])	([1])	0
8469.11	35	10	91	1.9	5	30	7.8	0
8470.10	35	10	210	2.6	5.75	30	([1])	1.8
8470.21	35	10	210	4.8	5.75	30	([1])	1.8
8470.29	35	10	210	2.5	5.75	30	([1])	1.8
8470.30	35	10	213	2	5.75	30	7.6	1.8
8470.40	35	10	213	1.6	7.5	30	7.6	0
8470.50	35	10	27	0.4	7	30	7.6	0
8470.90	35	0-10	122-197	3.1-3.5	0	30	7.6	1.9
8471.10	0-35	0	47	0.3	5	20	6-8	0-2.4
8471.30	0-35	0	47	0.3	5	20	6-8	0-1.9
8471.41	0-35	0	47	0.3	5	20	6-8	0-1.9
8471.49	0-35	0-10	47	0.2-0.7	5-7.5	20	6-8	0-1.9
8471.50	0-35	0	47	0.3	5	20	6-8	0-1.9
8471.60	0-35	0-10	47	0.7	7.5	20	6-8	0
8471.70	0-35	0-10	47	0.3	7.5	20	6-8	0
8471.80	35	0	47	0.2	7.5	20	6-8	0
8471.90	35	10	47	0.2	5-7.5	20	8	0
8472.90	35	10	17	0.4	3	30	7.8	1.8
8473.21	35	10	133	0.6	2	30	8.5	1.9

Commodity	Romania[2]	Singapore	Switzerland[3] Swiss francs per 100 kilograms	Switzerland[3] Ad Valorem	Taiwan[4]	Thailand	Turkey	United States
8473.29	35	10	95	0.9	3	30	7.6	1.9
8473.30	15	0	95	0.4	5	20	7.6	0
8473.50	15	0	95	0.4	5	20	7.6	0
8504.40	0-35	10	8.4-17	0.2-0.3	7.5-12.5	([1])	12-14.6	0-1.5
8504.50	0-35	10	8.4-17	0.2-1.1	3-5	([1])	13.4	0-3
8517.11	35	10	57	0.6	7.5	30	13.8	4.2
8517.19	([1])	10	57	0.6	7.5	30	13.8	4.2
8517.21	35	10	57	0.6	10	30	([1])	2.3
8517.22	35	10	57	0.6	7.5	30	([1])	2.3
8517.30	35	10	57	0.3	7.5	30	([1])	2.3-8.5
8517.50	35	0	41	0.1	7.5	30	([1])	0-2.3
8517.80	35	10	41	0.2	7.5	30	([1])	4.2
8517.90	35	10	57-33	0.2	1.25-5	30	13.8	4.2
8518.10	0-35	10	60	0.4	7.5	30	14	0-4.9
8518.29	0-35	10	58	2.9	5	30	14	0-4.9
8518.30	0-35	10	65	0.7	3-7.5	30	13.6	4.3
8518.40	0-35	10	59	1.6	10	30	([1])	0-4.9
8518.90	35	10	59-65	0.3-1.8	1.25	30	12.8	4.3
8520.20	42	([1])	84	1.4	15	30	16.4	0
8523.11	25	0-10	38	1.7	5-12.5	30	([1])	0

Commodity	Romania[2]	Singapore	Switzerland[3] Swiss francs per 100 kilograms	Switzerland[3] Ad Valorem	Taiwan[4]	Thailand	Turkey	United States
8523.12	25	0	27	0.7	5-15	30	([1])	0
8523.13	25	0-10	38	1.9	5-12.5	30	([1])	0
8523.20	25	0	27	0.4	5-12.5	30	([1])	0
8523.90	25	0-10	27	0.6	7.5-12.5	30	([1])	0
8524.31	25	0-10	27	0.2	5	30	([1])	0
8524.39	25	0-10	27	0.2	5	30	([1])	0
8524.40	25	0-10	38	0.2-0.6	5	30	([1])	4.8¢-sqr.mtr.
8524.91	25	0-10	27	0.2	5	30	([1])	0
8524.99	25	0-10	27	0.2	5	30	([1])	0
8525.10	0-35	10	66	0.3	7.5	5	30-32	0-3
8525.20	0-35	10	47	0.2	7.5	5	30-32	3
8527.90	0-35	10	47	0.1	7.5	30	30-35.6	0-3
8529.10	0-35	10	66	1.1	2.5-7.5	30	15-17.9	0-3
8529.90	0-35	10	66	0.4	2.5-7.5	30	15-17.9	0-3.2
8531.20	0.5	25	29	0.1	5	30	([1])	1.3
8531.80	0-35	10	29	0.2	0-7.5	30	([1])	0
8531.90	35	0	21	0.2	2.5	30	([1])	1.3
8532.10	35	10	33-99	1.2-0.6	12.5	([1])	8	9
8532.21	35	10	100	0.3	3	([1])	8	9
8532.22	35	10	98	0.2	3	([1])	8	9

Commodity	Romania[2]	Singapore	Switzerland[3] Swiss francs per 100 kilograms	Switzerland[3] Ad Valorem	Taiwan[4]	Thailand	Turkey	United States
8532.23	35	10	99	0.7	3	([1])	8	9
8532.24	35	10	100	1.2	3	([1])	8	9
8532.25	35	10	33-98	0.3-1.1	3	([1])	8	9
8532.29	35	10	33-99	0.2-0.7	3	([1])	8	9
8532.30	35	10	34-100	0.2-0.2	3	([1])	8	9
8532.90	35	10	33-98	1.3-1.2	1.25	([1])	8	3.5
8533.10	35	10	90	1.4	3	([1])	14.1	6
8533.21	35	10	91	0.7	3	([1])	14.1	6
8533.29	35	10	27-91	0.4-2.7	3	([1])	14.1	3
8533.31	35	10	65-91	0.3-0.4	3	([1])	14.1	6
8533.39	35	10	33-91	0.4-1.7	3	([1])	14.1	3
8533.40	35	10	31-92	0.1-0.3	3	([1])	14.1	0-4.8
8533.90	35	10	27	0.1	1.25	([1])	14.1	6
8534 (all)	35	10	55-80	0.1-0.3	7.5	([1])	14.5	2.7
8541.10	35	10	25	0.1	0-1	30	([1])	0
8541.21	35	10	25	0.1	1	30	([1])	0
8541.29	35	10	25	0.1	0-1	30	([1])	0
8541.30	35	10	25	0.1	1	30	([1])	0
8541.40	35	10	25	0.1	0-1	30	([1])	0
8541.50	35	10	25	0.1	1	30	([1])	0

Commodity	Romania[2]	Singapore	Switzerland[3] Swiss francs per 100 kilograms	Switzerland[3] Ad Valorem	Taiwan[4]	Thailand	Turkey	United States
8541.60	35	10	25	0.1	1	30	([1])	0
8541.90	35	10	25	0.1	1-2	30	([1])	0
8542.12	35	10	25	0.1	([1])	([1])	([1])	0
8542.13	35	10	25	0.1	1	([1])	([1])	0
8542.14	35	10	25	0.1	1	([1])	([1])	0
8542.19	35	10	25	0.1	1	([1])	([1])	0
8542.30	35	10	25	0.1	1	([1])	([1])	0
8542.40	35	10	25	0.1	1	([1])	([1])	0
8542.50	35	10	25	0.1	1	([1])	([1])	0
8542.90	35	10	25	0.1	1	([1])	([1])	0
8543.81	([1])	([1])	([1])	([1])	([1])	([1])	([1])	([1])
8543.89	([1])	([1])	([1])	([1])	7.5	([1])	([1])	([1])
8544.41	35	0-10	60.9	1.7	7.5	30	([1])	2.6
8544.49	35	0-10	24	1.3	7.5	30	32.6	3.5
8544.51	35	0-10	67	2.1	7.5	30	([1])	2.6
8544.70	35	0	70	0.3	10	([1])	8	8.4
9009.11	18	10	49	1.2	7.5	30	([1])	1.8
9009.21	18	([1])	49	1.2	7.5	30	([1])	1.8
9009.90	18	10	49	0.8	7.5	30	([1])	0-1.8
9026.10	0-35	0	33	0.2	5-12.5	30	([1])	0-2.7

Commodity	Romania[2]	Singapore	Switzerland[3] Swiss francs per 100 kilograms	Switzerland[3] Ad Valorem	Taiwan[4]	Thailand	Turkey	United States
9026.20	0-5	0	33	0.2	5-12.5	30	([1])	0-1.7
9026.80	0-35	0	33	0.2	5	30	([1])	0-2.6
9026.90	0-35	0	33	0.2	2.5	30	([1])	0-3.2
9027.20	0-5	0	40	0.1	0	30	([1])	1.7-2.2
9027.30	0-5	0	35	0.2	0	30	([1])	1.7-3.5
9027.50	0-5	0	35	0.1	0	30	([1])	1.7-3.5
9027.80	0-5	0	35	0.1	0	30	([1])	1.7-2.2
9027.90	0-5	0	35	0.1	0	30	([1])	1.7-3.5
9030.40	0-35	0	40	0.1	5	30	([1])	0-1.7

[1] Not available.
[2] Romania adds an additional 0.5 percent "duties and additional charges" on all imports.
[3] While Switzerland traditionally has assessed tariffs based on product weight (Swiss francs per 100 kg., column a), it is in the process of changing to ad valorum rates (column b) to be in accordance with the practices of other WTO member countries. According to Swiss officials, Switzerland has not yet decided when the official change to ad valorum rates will occur, and most products currently entering Switzerland are assessed tariffs from column a.
[4] Taiwan has not yet acceded to the WTO. Tariff rates are based on U.S. Department of Commerce documents showing 1992 unbound rates.