United States International Trade Commission

Used Electronic Products:

An Examination of U.S. Exports

Investigation No. 332-528
USITC Publication 4379
February 2013

U.S. International Trade Commission

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Abstract

As the world's leading market for electronic products, the United States generates large quantities of used electronic products (UEPs) each year. UEPs are collected from consumers and businesses and evaluated for their value. They are classified as working electronic products and parts to be refurbished and resold, or as non-working goods to be recycled into scrap materials. Both working products and scrap materials may be resold in the United States or exported. These functions are performed by a diverse group of organizations including waste collectors, recyclers, original equipment manufacturers, retailers, brokers, and professional service firms such as equipment leasing companies and information technology (IT) asset management firms. The UEP supply chain is a complicated network of domestic sales and exports, which are likely to occur along each step in the chain. In 2011, total domestic sales of UEPs were valued at $19.2 billion, compared to U.S. UEP exports of $1.45 billion. This report, prepared at the request of the U.S. Trade Representative, estimates and describes (1) the type, volume, value, and foreign markets of significance for U.S. exports of UEPs; (2) the characteristics of UEPs exported from the United States; (3) the forms, activities, and characteristics of domestic enterprises exporting these products; (4) the forms and activities, with respect to UEPs, of enterprises receiving U.S. shipments; (5) the relative share of U.S. sales of UEPs that are exported; and (6) the factors affecting trade in UEPs. UEPs covered by this investigation include consumer and IT equipment such as audio and visual equipment, computers and peripheral equipment, digital imaging equipment, cell phones and other telecommunication equipment, and component parts of these products.

CONTENTS

CONTENTS—*Continued*

CONTENTS—*Continued*

CONTENTS—*Continued*

CONTENTS—*Continued*

CONTENTS—*Continued*

Page

Tables—*Continued*

CONTENTS—*Continued*

ACRONYMS

AUV	Average unit value
BAN	Basel Action Network
CEA	Consumer Electronics Association
CEC	Commission for Environmental Cooperation
CRT	Cathode-ray tube
EACR	East African Computer Recycling Company
EMS	Environmental Management Standard
EPA	U.S. Environmental Protection Administration
HTS	Harmonized Tariff Schedule
IDC	International Data Corporation
ISRI	Institute of Scrap Recycling Industries
IT	Information Technology
LCD	Liquid Crystal Display
LDCs	Less-developed countries
MIT	Massachusetts Institute of Technology
NAFTA	North American Free Trade Agreement
NAICS	North American Industry Classification System
NGO	Non-governmental organization
ODMs	Original device manufacturer
OECD	Organization for Economic Cooperation and Development
OEM	Original equipment manufacturer
PC	Personal computer
PCBs	Polychlorinated biphenyls
PCTs	Polychlorinated terphenyls
PBBs	Polybrominated biphenyl
PCC	Pollution Control Committee
R2	R2 Solutions – Responsible Recycling
RCRA	Resource Conservation & Recovery Act
RIOS	Recycling Industry Operating Standard
RSE	Relative Standard Error
SPCB	State Pollution Control Board
StEP	Solving the E-waste Problem
TV	Television
UEPs	Used electronic products
USTR	Office of the U.S. Trade Representative
WEEE	Waste electrical and electronic equipment

Executive Summary

The United States is the world's largest market for new electronic products, and therefore generates significant amounts of used electronic products (UEPs)[1] each year. U.S. collectors and processors reported $20.6 billion in sales of UEPs in 2011, including exports of $1.45 billion (7 percent). By value, most exports were products that were refurbished and resold as working computers, cell phones, and other used products. Measured by weight, most exports were scrap materials, which come from UEPs that are disassembled or recycled in the United States. Commodity metals, plastics, and glass are exported to be used in manufacturing processes overseas; circuit boards are exported to smelting facilities to recover gold and other precious metals. Only a small share of U.S. exports of UEPs was sent overseas for disposal.

The UEP supply chain is complex. UEPs are collected from consumers and businesses, evaluated for value as working goods or materials, repaired and cleaned or recycled, and resold in the United States or exported. These functions are performed by a diverse group of organizations, including waste collectors, recyclers, original equipment manufacturers, retailers, brokers, and professional service firms such as equipment leasing companies and information technology (IT) asset management firms. These products and actors form a complicated network generating domestic sales as well as exports, which are likely to occur along each step in the UEP supply chain, as illustrated in figure ES.1.

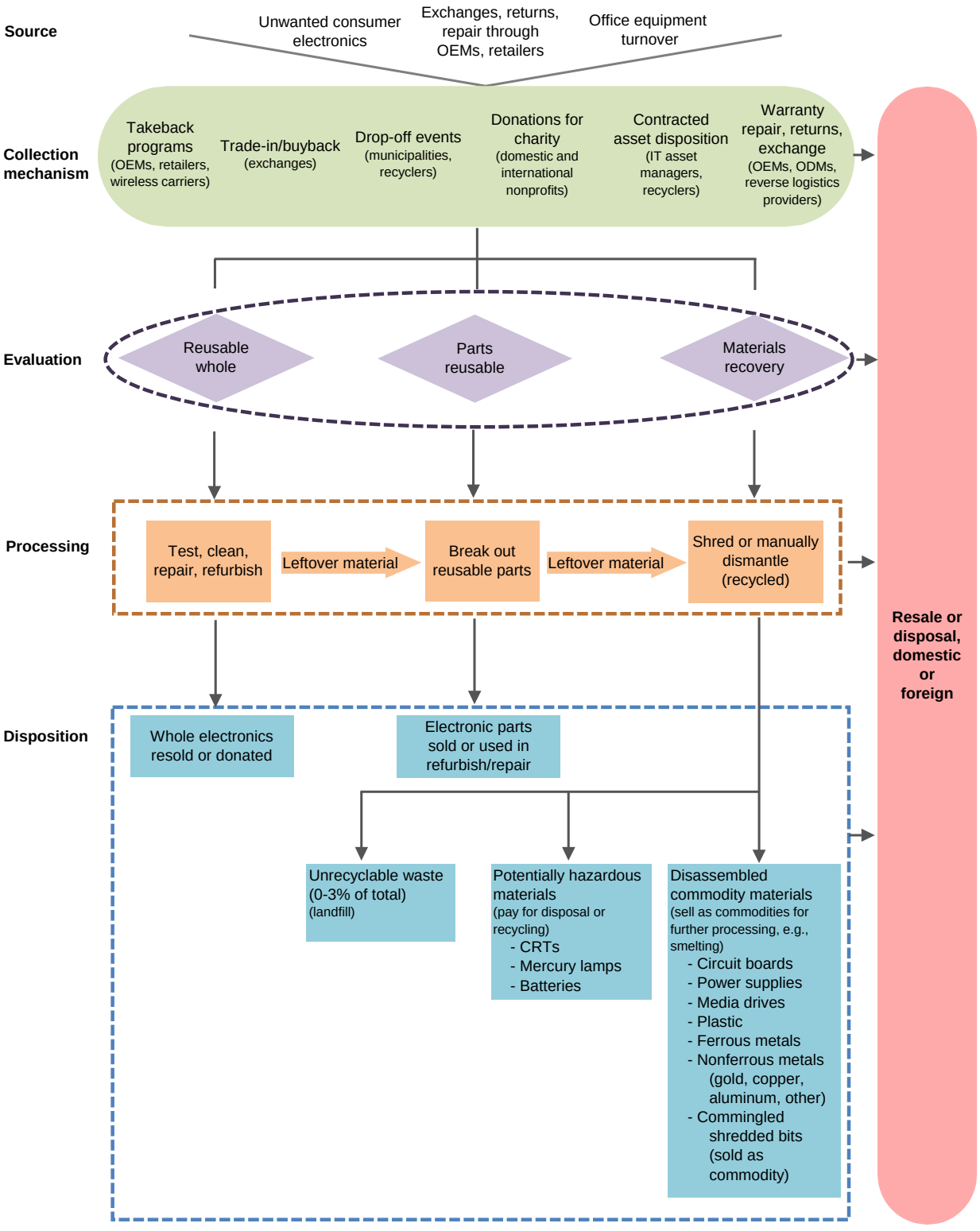
At the request of the U.S. Trade Representative, the Commission conducted an investigation to provide estimates of U.S. exports of UEPs in 2011 and to describe the actors and products involved.[2] This report is the first comprehensive attempt to quantify U.S. exports of UEPs from a diverse group of industries. There is very little published literature regarding the types and quantity of U.S. exports of UEPs. The results presented in the few existing studies are not directly comparable to the Commission's results, but are discussed in chapter 1 of the report.

This report provides estimates of domestic sales and U.S. exports of UEPs that are tested and working prior to export; UEPs that are intact but have not been tested; and UEPs that have been disassembled in the United States. The resulting exports consist of scrap materials from the disassembly process, as well as UEPs intended for disposal. The data for this report are largely drawn from responses to a Commission questionnaire sent to U.S. enterprises involved in the UEP industry. The weighted results of the questionnaire are presented throughout this report. These results represent domestic sales and exports of the following product groups: computers and parts; computer peripheral equipment; flat screen monitors; monitors and televisions containing cathode-ray tubes (CRTs); televisions and other audiovisual equipment not containing CRTs; mobile handsets (cell phones) and other telecommunications equipment; office imaging equipment; medical imaging equipment; whole printed circuit boards; shredded printed circuit boards; wires and cables; and commodity metals, plastics, and glass.

[1] For this investigation, the Commission defined used electronic products to include consumer electronics and IT equipment that have reached the end of their useful life with the original owner.

[2] A copy of the request letter is reproduced in appendix A, and a copy of the Commission's notice of investigation is reproduced in appendix B.

FIGURE ES.1 Used electronic products end-of-life cycle: Sales, including exports, may occur at any point along this complex chain



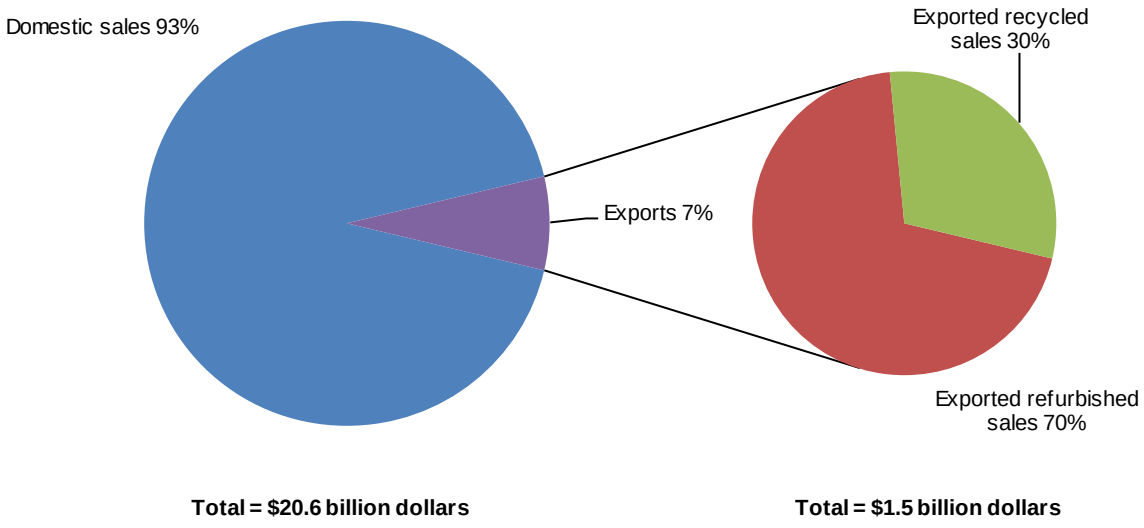
Source: Compiled by the Commission.

Key Findings and Observations

U.S. enterprises reported $20.6 billion in total sales of UEPs in 2011, composed of $19.2 billion of domestic sales and U.S. exports totaling $1.45 billion, or 7 percent of total sales (figure ES.2).

Refurbished UEPs accounted for the majority of U.S. domestic sales ($15.0 billion), compared with $4.3 billion in domestic sales of disassembled (recycled) UEPs. Exports of UEPs accounted for $1.0 billion of sales of repaired and refurbished products, and $439 million of sales of recycled UEPs in 2011 (table ES.1). About one-quarter of UEP handlers are directly engaged in exporting. Forty-one percent of UEP handlers (both direct exporters and non-exporters) reported that they were reasonably certain some portion of their UEP output was later exported by another organization.

FIGURE ES-2 Exports were 7% of UEP sales in 2011



Source: USITC calculations of weighted responses to the Commission questionnaire.

TABLE ES.1 U.S. domestic sales and exports of UEPs, 2011 (million $)

	Domestic sales	Exports	Total
Refurbished UEPs	14,920	1,012	15,932
Recycled UEPs	4,270	439	4,709
Total	19,190	1,451	20,641

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: Exports of UEPs for disposal are costs paid by the exporters, rather than revenues, so are not included here.

The top five destinations for U.S. exports of UEPs in 2011, accounting for 74 percent of exports, were Mexico, India, Hong Kong, China, and the group of other Asia-Pacific markets. Just over half of U.S. UEP exports were shipped to OECD countries.

Belgium, Sweden, Canada, and the group of Asia-Pacific markets excluding Hong Kong, China, and India (largely the Republic of Korea and Japan)[3] together accounted for 274,000 tons, or about 36 percent of U.S. exports by volume (table ES.2).[4] Large smelting facilities located in countries that are members of the Organisation for Economic Co-operation and Development (OECD) refine processed materials, particularly circuit boards, and recover metals that can be used in the manufacture of new products. The largest non-OECD destination countries were India, Hong Kong, and China, together receiving about 31 percent of U.S. exports of UEPs by weight in 2011. These countries are likely to have large secondary use markets for refurbished UEPs. In addition, China and to a lesser extent India, are important manufacturing centers for new electronic products, which drives demand in those countries for raw materials derived from UEPs for use as inputs into the manufacture of new products.

TABLE ES.2 Destination of U.S. exports of UEPs, 2011

Country	Short tons
Asia-Pacific markets other than Hong Kong, China, and India[b]	[a]198,638
Mexico	128,790
India	[a]98,506
Hong Kong	68,094
China	65,359
Canada	39,687
Sweden	[a]21,851
Belgium	18,212
Other European Union	9,770
Other Latin America	7,824
Other Middle East	6,926
Sub-Saharan Africa	78
All other and unknown	93,986
Total	757,721

Source: USITC calculations of weighted responses to the Commission questionnaire.

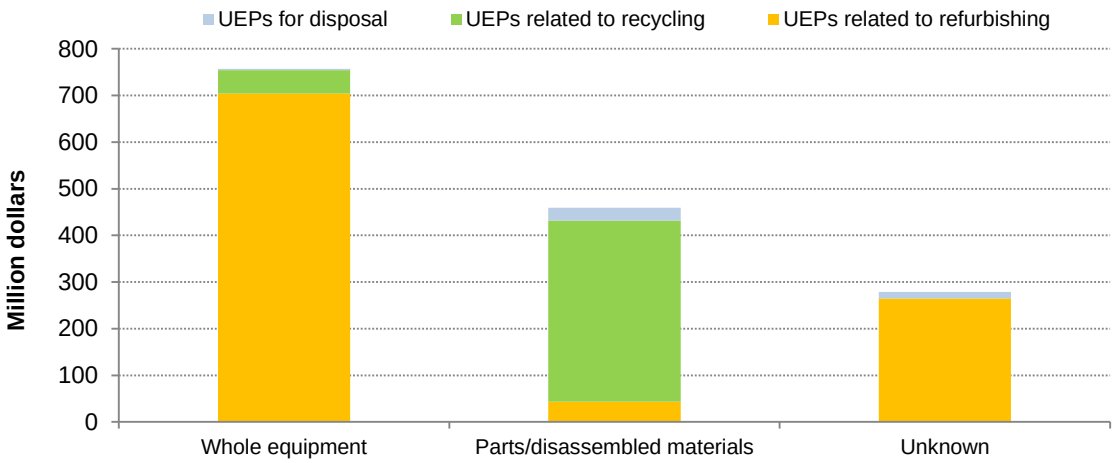
[a]Low-precision estimate, with RSE above 50 percent.
[b]Principally Korea and Japan; also includes Australia, Malaysia, New Zealand, Pakistan, the Philippines, Singapore, Taiwan, Thailand, and Vietnam.

Whole equipment for reuse accounted for the largest share of U.S. exports by value in 2011, while disassembled UEPs account for the largest share by volume (figure ES.3).

Whole products sold for reuse as working electronic products generally yield a larger payout than do whole products or components intended for recycling, because a functioning UEP is more valuable than the scrap value of its component parts. Accordingly, whole equipment intended for reuse, including computers, cell phones, and televisions, accounted for the majority, by value, ($762 million) of all U.S. exports of

[3] Cannot be individually distinguished because of prohibitions on disclosure of individual company information.
[4] Tons are short tons, equal to 2000 pounds.

FIGURE ES.3 Whole equipment accounted for the largest share of U.S. exports of UEPs in 2011, by value



Source: USITC calculations of weighted responses to the Commission questionnaire.

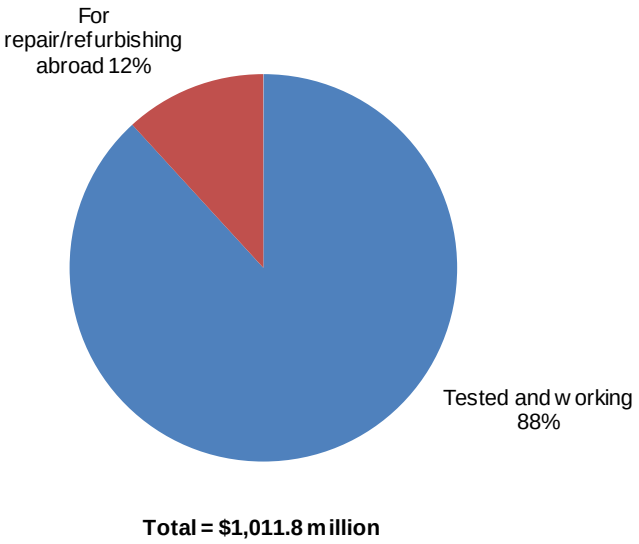
Note: It is not possible to compare exports of whole equipment to exports of disassembled materials by volume, since whole equipment is reported by number of units and disassembled materials are reported by weight.

repaired or refurbished UEPs in 2011. Though less valuable, commodity scrap materials from disassembled UEPs, primarily metals, plastics, and glass, along with parts not intended for reuse (such as whole and shredded printed circuit boards, wires and cables, and separated CRTs, mercury lamps, and batteries) are still in considerable demand. They made up the majority of total U.S. exports of disassembled UEPs in 2011 (91 percent) in terms of volume.

Tested and working products represented the majority of U.S. exports of whole UEPs.

Whole equipment consists of UEPs such as computers, televisions, and cell phones, which may or may not be in working condition at the time of export. UEPs shipped as "tested and working" have been powered on and tested prior to export to demonstrate that the unit can function as originally intended. Exported whole goods intended for refurbishment or repair abroad may be reused as working products, but may also be recycled or disposed of at the foreign destination if the UEPs do not find a ready market or are not repairable when they are inspected at the export destination (figure ES.4).

FIGURE ES.4 Most 2011 U.S. exports of repaired/refurbished UEPs were in tested and working condition



Source: USITC calculations of weighted responses to the Commission questionnaire.

Refurbishing and repair enterprises comprised the largest share of U.S. exporters of UEPs, followed by enterprises involved in wholesaling, brokering, or retailing.

About one-quarter of the UEP industry is directly engaged in exporting, and 27 percent of non-exporters are reasonably certain that at least some of their output is later exported by another organization. The propensity to export may be higher or lower depending on the entities' primary activity and other characteristics, such as size and certification status.

Larger entities are generally more likely to export UEPs; organizations holding an industry certification such as e-Stewards or R2 are less likely to export.

Forty-one percent of entities reporting exports in 2011 were primarily engaged in refurbishing and repair, followed by wholesaling, brokering, and retailing at 27 percent (table ES.3).

TABLE ES.3 Exporters, by primary activity, 2011

Primary UEP activity of exporter	Number of UEP exporting entities	Share of UEP exporting entities
		Percent
Refurbishing and repair	560	41
Wholesaling, brokering, and retailing	370	27
Collection and sorting	110	8
Disassembly	130	9
IT asset management and services	80	6
Metals recovery	10	1
Other	110	8
Total	1,370	100

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: Estimates rounded to the nearest 10 exporting entities.

By end use of the products, commodity materials intended for smelting or refining accounted for the largest share of U.S. exports by weight (43 percent) in 2011 (table ES.4).

Much smaller shares were intended for resale as working equipment not requiring any further processing, for resale following repair or refurbishing, and for disassembly or recycling of the parts or equipment. U.S. exports of UEPs as charitable donations were small relative to other end uses (less than 0.5 percent by weight), although testimony presented to the Commission noted the importance of providing personal computers and other electronic equipment to underserved communities both in the United States and abroad.[5] Only a very small percentage of all respondents that exported UEPs reported disposal as the intended end use.

TABLE ES.4 Estimated U.S. exports of UEPs, by end use, 2011

End use	Export weight	Percent
	Short tons	
Materials processing (smelting, refining, sorting)	323,772	42.7
Recycling or disassembly	[a]84,941	11.2
Resale of whole equipment or working parts with further processing (recycle, repair, refurbish, etc.)	[a]58,021	7.7
Resale of whole equipment or working parts without further processing (tested/working in the United States)	47,071	6.2
Final disposal	[a]5,768	0.8
Charitable donation (operational goods)	[a]27	([b])
Other	102,295	13.5
Unknown	135,826	17.9
Total	757,721	100

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: The data presented here represent exporters' estimates of the end use of their exported products at the export destination. These data are available only on the basis of weight, not value. Data presented elsewhere in the report, and in this executive summary, represent exporters' characterizations of their exported products. Totals and breakdowns from the two sets of data are not comparable.

[a]Low-precision estimates, with RSE above 50 percent.
[b]Less than 0.5 percent.

However, respondents did not know the intended final use of nearly 18 percent (by weight) of U.S. exports of UEPs.

The largest share (34 percent) of UEP exports in 2011 (by weight) went to foreign smelters and metal foundries. Enterprises engaged in reprocessing commodity plastics accounted for another 7 percent of exports derived from UEPs, for a total of more than 40 percent engaged in processing commodity materials (table ES.5).

In second place, approximately 29 percent of U.S. UEP exports, by weight, were shipped to enterprises engaged in refurbishing or remanufacturing of intact UEPs. About 5 percent was shipped to enterprises described as resellers or brokers. Respondents did not know the intended final use of nearly 13 percent of U.S. exports of UEPs.

[5] Testimony presented to the Commission described donations of used personal computers and other electronic equipment in the mix of U.S. exports of UEPs. See USITC, hearing transcript, May 15, 2012, 126–40 (testimony of Charles Brennick, Interconnection.org).

TABLE ES.5 Estimated U.S exports of UEPs, by type of receiving enterprise, 2011

Foreign enterprise type	Export weight	Percent
	Short tons	
Smelter/metal foundry	255,240	33.7
Refurbisher/remanufacturer	217,622	28.7
Plastics reprocessor	50,833	6.7
Recycler of used electronics	50,087	6.6
Reseller/broker	34,811	4.6
Original equipment manufacturer (OEM)/Original device manufacturer (ODM)	11,744	1.5
Nonprofit organization/charity	[a]29	([b])
Other	41,406	5.5
Unknown	[a]95,949	12.7
Total	757,721	100.0

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: The data presented here represent exporters' estimates of the type of enterprises that received their export shipments. These data are available only on the basis of weight, not value. Data presented elsewhere in the report, and in this executive summary, represent exporters' characterizations of their exported products. Totals and breakdowns from the two sets of data are not comparable.

[a]Low-precision estimates, with RSE above 50 percent.
[b]Less than 0.5 percent.

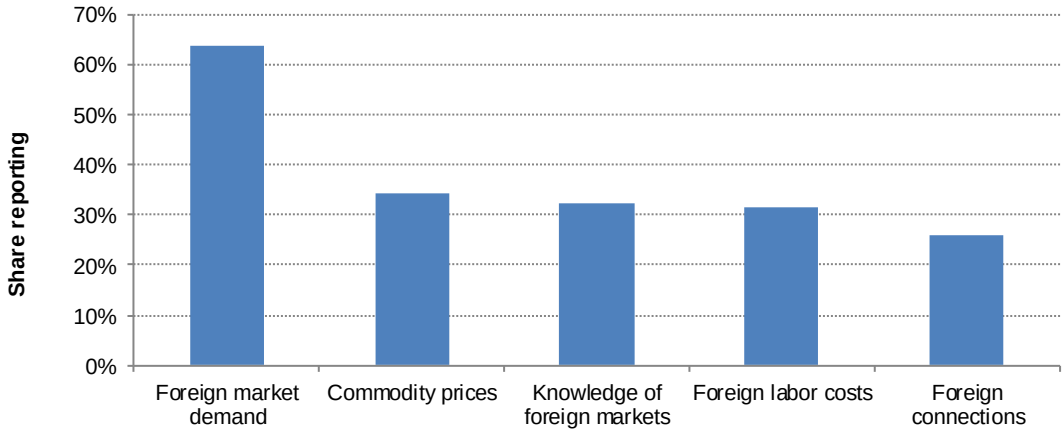
Informal and unregulated recycling of exported UEPs remains a concern within the industry. No quantitative data on this segment of the industry are available, but some descriptive information is included in this report.

At the Commission's hearing, through submissions by interested parties, and in the literature on the disposition of UEPs, informal processing in developing countries emerged as a significant concern for U.S. exporters of UEPs and others. Informal processing describes the disassembly of UEPs by individuals in unregulated, often impoverished, settings with little regard to health, safety, and the environment. The survey could not determine whether U.S. exports of UEPs bound for recycling or disposal in 2011 were sent to such facilities, nor could it capture ad hoc shipments of undeclared UEPs mixed in with exports of other items. Nonetheless, it is likely that some portion of U.S. UEP exports are processed in the "informal" recycling sector, either upon import or after a second or third useful life in the destination country.

Exporters and non-exporters reported different factors affecting their export decisions.

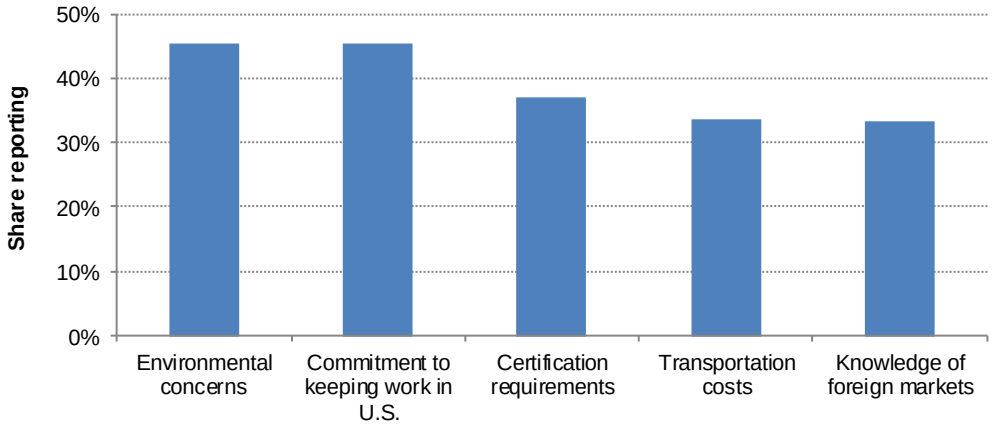
In the survey, about two-thirds of organizations that *did* export UEPs in 2011 reported that market demand for their products was a factor encouraging exports, far above any other factor. Other such factors were commodity prices, knowledge of foreign markets, and labor costs in foreign markets (figure ES.5). Organizations that *did not* export in 2011 most often cited environmental concerns and a general commitment to keeping work in the United States as factors discouraging exports, followed by requirements of certification programs (figure ES.6).

FIGURE ES.5 Share of exporters reporting that these factors encouraged exports



Source: USITC calculations of weighted responses to the Commission questionnaire.

FIGURE ES.6 Share of nonexporters reporting that these factors discouraged exports



Source: USITC calculations of weighted responses to the Commission questionnaire.

The United States has limited capacity to process UEPs in two segments of the industry—CRT glass and final smelting—creating incentives to export CRT monitors, CRT glass, and circuit boards destined for smelting to retrieve precious metals.

The world has few CRT processing facilities; most are in Mexico and India. U.S. entities that handle CRT glass either export it or, reportedly, stockpile it in the United States because U.S. processing is cost prohibitive. Both tightened regulations and the closure of foreign plants that recycle CRTs reduce legal export opportunities for CRT-containing products from the United States. Unlike other materials from disassembled electronic products that are easily exported, U.S. companies must pay for the recycling of CRTs and CRT glass. U.S. exports of CRTs are regulated by the U.S. Environmental Protection Agency (EPA). Companies must notify the EPA before exporting CRTs and must ensure that nonworking CRTs are exported only to appropriate and willing destination countries. There are no federal regulations governing the export of other UEPs, although such

legislation has been introduced in Congress. Circuit boards are primarily exported to one of six smelters located in OECD countries outside the United States.

U.S. regulations in place in 28 states generally depress exports by changing the cost structure of the local UEP industry.

State regulations do not directly affect exports of UEPs, but they do alter the cost structure and underlying economic conditions that companies face. These regulations follow four different structures: producer responsibility laws, consumer fee laws, landfill disposal fee laws, and disposal ban laws. However, even within these structures, states' regulations and requirements vary considerably with different rules, targets, processes, and product coverage. This variability creates inefficiencies and adds to compliance costs for organizations trying to create integrated, national UEP collection and recycling networks.

Certification programs have become a significant factor in the UEP industry, and likely serve to limit U.S. exports of UEPs.

The two most prevalent certification programs, R2 and e-Stewards, are voluntary industry efforts that promote industry best practices and also serve as marketing tools for firms in the industry. Since both programs permit exports of "tested and working" refurbished goods and of commodity materials from disassembled UEPs, compliance with either program should not affect export streams of those products. However, both programs likely limit exports of whole "nonworking" UEPs by requiring recyclers and others in the industry to carefully track their exports and submit to audits to verify their downstream processes. The certifications differ on their export requirements: e-Stewards bans exports of certain types of UEPs to non-OECD countries, while R2 permits such exports if the exporter carefully tracks the product to its final destination. (See Basel Convention discuss in next section.)

In developing countries, there is strong demand for UEPs exported from the United States, but the Basel Convention effectively limits such exports, and a number of developing-country signatories agree not to import nonworking UEPs from OECD member countries.

Demand for U.S. UEPs in developing countries takes several forms. Intact, working UEPs are resold in the secondary market, to both businesses and individuals. Nonworking products may be repaired and resold, or disassembled for scrap materials, sometimes in the informal recycling sector. Scrap materials become inputs for manufacturing operations, along with similar materials from products other than UEPs. However, the Basel Convention, which entered into force in 1992, partially limits cross-border trade of certain materials designated as hazardous waste, including lead and other materials found in UEPs, by establishing a prior notification and consent system for shipments. The United States is one of only three countries that have not ratified the Convention. In addition, the Ban Amendment to the Convention, which was adopted in 1995 but has not yet entered into force, will completely prohibit exports of all hazardous wastes covered by the Convention, including intact, non-tested UEPs, from members of the OECD, EC, and Liechtenstein to all other countries. In addition to or in support of the Basel Convention and the Ban Amendment, a number of countries have issued regulations limiting their imports of UEPs, which reduce U.S. exports to those countries.

U.S. Census Bureau export data add detail on U.S. exports of specific UEP product groups.

In addition to questionnaire results, the Commission obtained and analyzed non-public, shipment-level, monthly export data for 2011 from the U.S. Census Bureau for six product groupings: mobile phones, laptop computers, desktop computers, hard drives, flat screen monitors, and CRTs and products containing CRTs. Products were identified by their 10-digit Schedule B numbers. Schedule B codes do not distinguish between used and new products, so average unit values (AUVs) for each shipment were used as proxies to analyze U.S. export flows, under the assumption that lower-valued goods were more likely to be used products. For each product grouping, data were aggregated using the bottom 10th, 25th, and 50th percentiles based on AUV. Results showed that:

- *For cell phones:* Shipments of higher-value units (in the bottom 25th percentile AUV) were more likely to be sent to OECD countries (particularly Mexico). Shipments of phones with an AUV in the bottom 10th percentile, which represents only 6 percent of the value but nearly 29 percent of units, were overwhelmingly sent to non-OECD countries. Hong Kong was the most common destination for such shipments of cell phones, followed by Paraguay and Colombia.

- *For laptops:* Laptops had the highest number of shipments among the selected products. About one-third of U.S. exports of laptops fell below the 10th percentile AUV. Of these, 75 percent of shipments went to non-OECD countries. Hong Kong, the United Arab Emirates, and Mexico were the top three destinations for both the 10th and 25th percentile AUVs.

- *For desktops:* The bottom 10th percentile of AUV shipments were distributed fairly evenly between OECD and non-OECD countries, compared with other products. Mexico, Brazil, and Great Britain were the most common destinations for products in this percentile.

- *For CRTs and products containing CRTs:* Mexico was the predominant destination in terms of both the number of shipments and the number of units shipped.

- *For hard drives and flat-screen monitors*: These products were frequently referenced by questionnaire respondents. As with many of the other product groups analyzed, Mexico was the predominant export destination, which also explains why a high percentage of shipments of these products were destined for OECD countries.

CHAPTER 1
Introduction

Overview

As the world's leading market for electronic products, the United States generates large quantities of used electronic products (UEPs).[1] When the original owner of a UEP is finished with it, the product can end up in a variety of destinations. Used computers, cell phones, and other UEPs may be resold or donated to charitable organizations as working products for new users; sent to U.S. firms for recovery of working parts or recycling into scrap materials, including metals, plastics, and glass; or sent to landfills for disposal. These products may also be exported as whole products, working or nonworking; functional parts; or disassembled scrap materials. By one estimate, discarded cell phones, televisions (TVs), computers, and computer peripherals (including printers, scanners, fax machines, mice, and keyboards) totaled 2.37 million tons[2] in 2009.[3] Approximately 25 percent of TVs, computer products, and cell phones that were ready for end-of-life management in 2009 were collected for processing; two-thirds of these came from commercial sources.[4] Collection rates as a share of total products ready for end-of-life management vary by product. In 2009, an estimated 38 percent of computers were recycled, compared to 8 percent of cell phones.[5]

Though the report does not address environmental issues, such concerns drive policies related to UEP end-of-life management. U.S. processors and handlers of UEPs divert streams of these products from landfills and create economic value. However, the materials and processes used for recovery present possible threats to the environment and health if not handled responsibly. In particular, in recent years, a number of organizations have drawn attention to informal electronics recycling taking place in developing countries—recycling that often does not meet commonly accepted environmental or safe labor standards.[6] This attention has led to increased monitoring of UEP exports to developing countries, as well as the emergence of industry certification programs for recyclers. These programs aim to curtail U.S. exports to recyclers operating in unsafe conditions. The U.S. Environmental Protection Agency (EPA) now encourages electronics refurbishers and recyclers to commit to sending 100 percent of the goods they collect to third-party certified downstream processors.[7]

This investigation examines the level of U.S. UEP exports in 2011 and the characteristics of those exported products. The investigation also examines the types of U.S. organizations that typically export UEPs, as well as the foreign enterprises that receive

[1] For this investigation, the Commission defined used electronic products to include consumer electronics and IT equipment that have reached the end of their useful life with the original owner.

[2] Throughout this study the term "tons" refers to short-tons, equal to 2000 pounds.

[3] EPA, "Wastes—Resource Conservation" (accessed October 19, 2012).

[4] End-of-life management refers to recycling and downstream processes for UEPs that will not be reused. Such activities include sorting, disassembly for materials recovery, or disposal.

[5] EPA, "Wastes—Resource Conservation" (accessed October 19, 2012). UEPs that are not collected most likely end up in landfills or remain, unused, in consumers' homes.

[6] Informal recycling is discussed in chapter 5.

[7] Crognale, "EPA Challenges E-Waste Recycling Industry," September 28, 2012.

U.S. exports. There are many challenges to examining U.S. exports of UEPs. First, no official trade data exist on U.S. exports of UEPs.[8] Further, the UEP industry is unusual in that environmental concerns have created significant pressure not to export UEPs from the United States—to developing countries in particular. Such exports are not illegal, but many countries refuse to accept UEP imports, and many firms prefer not to discuss their UEP exports. As a result, very little publicly available information exists. To address these information deficiencies, the Commission supplemented existing public information with new primary data from an industry questionnaire, extensive industry interviews, and data obtained from the U.S. Census Bureau (Census).

Objective

As requested by the Office of the U.S. Trade Representative (USTR), this report describes U.S. exports of UEPs in 2011. The USTR noted that one recommendation of the National Strategy for Electronics Stewardship (National Strategy) is to improve information on trade flows of UEPs.[9] In accordance with the request from the USTR, this report includes information for 2011 on the following: (1) the type, volume, value, and foreign markets of significance for U.S. exports of UEPs; (2) the forms and activities of enterprises receiving U.S. shipments of UEPs; (3) the characteristics of UEPs exported from the United States, including product condition, composition of shipments, and extent of processing prior to export; (4) the forms, activities, and characteristics of domestic enterprises exporting these products; (5) the relative share of U.S. sales of UEPs that is exported; and (6) the factors affecting trade in UEPs.

Scope

UEPs covered by this investigation include consumer and information technology (IT) equipment in the following categories: audio and visual equipment, computers and peripheral equipment, digital imaging equipment (both office machines and medical imaging equipment), cell phones and other telecommunication equipment, and component parts of these products (further discussed in chapter 2).[10] This report presents a single-year snapshot of the U.S. UEP industry in 2011, including data on repair, refurbishment, recycling, and sales of UEPs in the domestic market, and the extent to which those products are exported from the United States. Both the questionnaire and the report give special attention to certain component parts of UEPs, such as circuit boards and cathode-ray tubes (CRTs), that are designated as hazardous waste under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their

[8] Two major U.S. government publications classify U.S. trade: the Harmonized Tariff Schedule of the United States, used to classify U.S. imports, and the Statistical Classification of Domestic and Foreign Commodities Exported from the United States (also known as Schedule B), used to classify U.S. exports. Neither distinguishes between used and new electronic products. The U.S. export statistics are administered by the U.S. Census Bureau. http://www.census.gov/foreign-trade/schedules/b/.

[9] The National Strategy is the result of an U.S. government interagency task force to improve electronics stewardship. It presents four goals to enhance the management of electronics throughout the product life cycle. See http://www.epa.gov/osw/conserve/materials/ecycling/taskforce/docs/strategy.pdf.

[10] These broader groupings of UEPs were specifically identified in the USTR's request letter. The USTR invited the USITC to include other items where relevant. See appendix A.

Disposal (Basel Convention).[11] Box 1.1 addresses the differences in terminology used to discuss UEPs in various contexts.

BOX 1.1 What's in a name: Used electronic products, e-waste, and WEEE

Based on the USTR's request letter and relevant literature, for this report the Commission has adopted the following definition of UEPs: *electronic products, including consumer electronics and IT equipment, that have reached the end of their useful life with the original owner*. This follows the definition outlined by a workshop of the Solving the E-waste Problem (StEP) Initiative, which brought together stakeholders from academia, industry, nonprofit organizations, and U.S. government agencies. The workshop identified seven priority UEPs, including desktop computers, laptop computers, cathode-ray tubes, flat screen displays, printers, mobile phones, and circuit boards.[a] The Commission included additional products, such as digital imaging devices, in response to the request letter received from USTR (see appendix A).

Among processors and handlers of UEPs, products at the end of their useful life are often referred to as "e-waste," due to the risks posed by improper handling of the potentially hazardous materials that they contain. However, this term misleadingly implies that UEPs can only be disposed of. Following the National Strategy, for the purpose of this report, the Commission considers "e-waste" to be a subset of UEPs, which are also able to be reused, refurbished, or recycled for parts and commodity scrap materials.[b]

Within the U.S. and global electronics recycling industry, definitions of covered products and the scope of regulations vary widely. For example, European Union directives concerning waste electrical and electronic equipment (WEEE) cover broader categories of household appliances and electrical goods.[c] Such products were not included in this report because in the United States, they are typically managed in separate end-of-life streams.

[a] Miller et al., *Characterizing Transboundary Flows of Used Electronics, January 2012.*

[b] Interagency Task Force on Electronics Stewardship, *National Strategy for Electronics Stewardship,* July 20, 2011.

[c] Directive (EC) 2002/96 of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE), O.J. (L37/24) . Annex 1A, February 13, 2003.

Because of concerns surrounding U.S. exports of UEPs to developing countries, both industry practices and international regulations, such as the Basel Convention, take into account whether such products are exported to Organisation for Economic Co-operation and Development (OECD) member countries.[12] As a result, this report addresses the extent to which U.S. exports are sent to OECD versus non-OECD countries. Within those broad groups, where data are available, the report examines exports of specific types of electronic products to specific countries. Exporters include both U.S.-based firms and U.S. affiliates of foreign-based firms, and also include nonprofit organizations, a number of which are active in sending UEPs to charity recipients abroad. Detailed information on exporting entities appears in chapter 4.

This report does not provide data on trends in U.S. exports over time, but several factors suggest that exports of these products to developing countries may have declined over the last decade. First, nongovernmental organizations (NGOs), such as the Basel Action Network (BAN) and the Electronics Takeback Coalition, have publicized the potential environmental and health risks associated with informal processing of such exports. Second, and due in part to these publicity efforts, much of the industry has adopted one or

[11] The text of the Basel Convention can be found at http://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx. More information on the convention appears in chapter 6.

[12] Most OECD countries have relatively high incomes and are considered developed countries.

both of the R2 and e-Stewards certification programs, both of which were introduced in 2009 and have become powerful forces within the industry.[13] Under both of these programs, certified organizations submit to an auditing program that tracks the downstream supply chains of collectors and recyclers of UEPs, and agree to rules guiding exports of these products to non-OECD countries. Under the e-Stewards program, processors of UEPs commit to zero exports of intact, nonworking products to developing countries. These certification programs, and their effects, are addressed in greater detail in chapter 6.

Used Electronic Product Industry Background

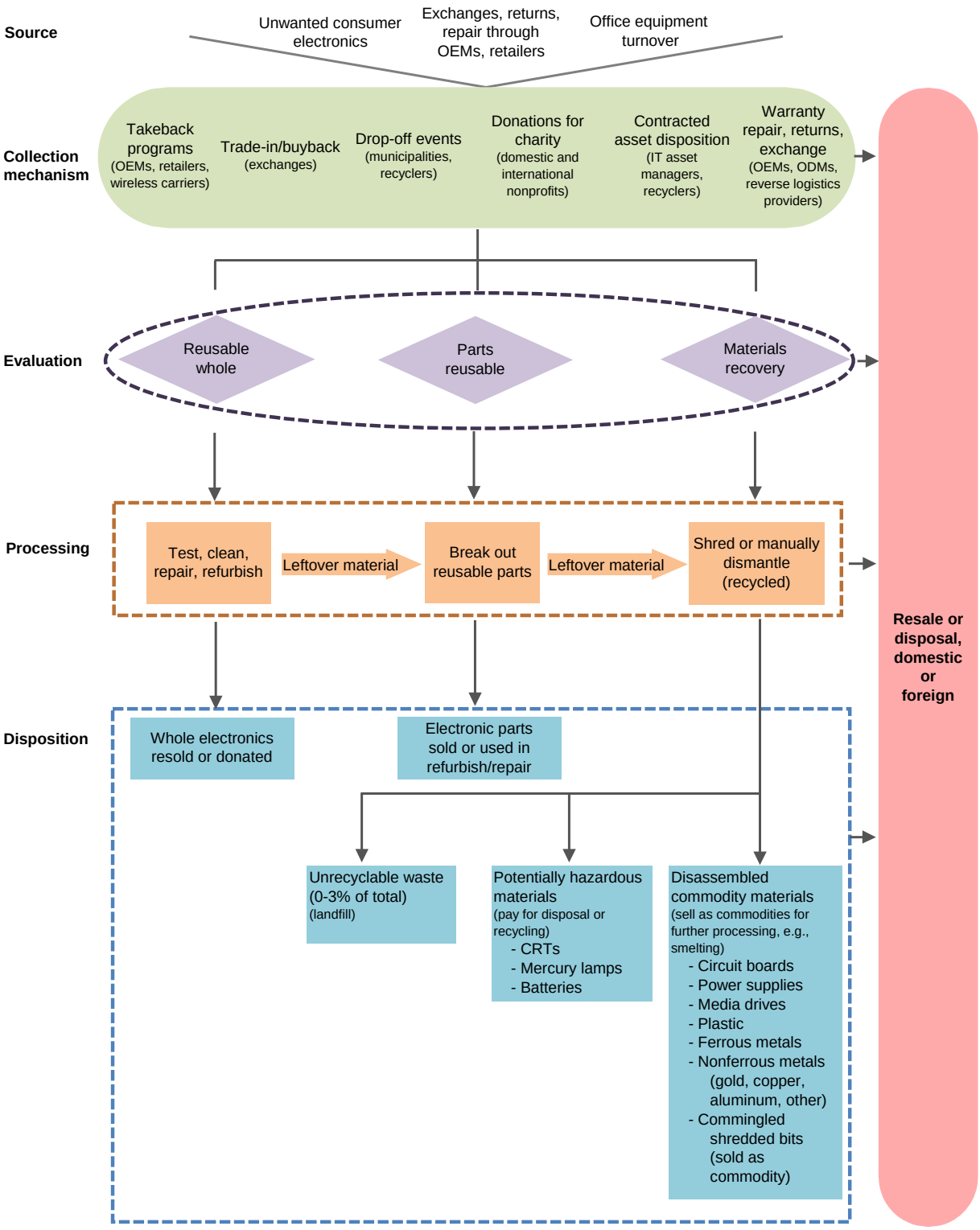
Unlike new products, which are shipped from manufacturers to retail and wholesale distribution outlets, used products must be collected from their original users before entering the UEP supply chain, either for resale as working electronic products or for recycling and materials recovery. As noted above, EPA estimates suggest that only 25 percent of UEPs ready for end-of-life management are collected,[14] and the Consumer Electronics Association (CEA) estimates that, among consumers that have gotten rid of a device, 48 percent donated it, 26 percent recycled it, and 12 percent disposed of it as waste.[15] CEA members reportedly collected 230 tons of UEPs in 2011.[16]

Figure 1.1 illustrates the UEP end-of-life cycle. As detailed in the figure, UEPs originate through various channels and follow a fairly complex supply chain. Industry representatives consistently suggested that exports can and do take place at any point along this supply chain.

The supply chain begins in various ways: with collections from individual consumers and businesses that have finished using a product; customer exchanges; and repairs and returns through original equipment manufacturers (OEMs) and retailers. Used equipment originating with consumers is often collected through municipal or charity collection events, or trade-in or buyback programs offered through retailers. Recent estimates suggest that only about one-third of UEPs collected for recycling or refurbishment originate with individual consumers, despite the fact that the consumer market is the largest market for new electronic products.[17] Equipment originating from businesses' technology upgrades is often handled by professional IT asset management firms due to data privacy concerns. These UEPs tend to be more valuable than consumer trade-ins, and are more likely to be refurbished and resold as working equipment for secondary users. OEM and retail exchanges, returns, and repairs are generally handled directly through the OEM or the retailer, or through reverse logistics service providers operating under contract with the OEMs and retailers.

[13] Industry representatives, interviews by USITC staff, April 16 and 17, 2012.
[14] EPA, "Wastes—Resource Conservation" (accessed October 19, 2012).
[15] CEA, "Executive Summary," September 18, 2012, 1.
[16] Rates of recycling and donation are likely higher for businesses than for consumers. eCycling Leadership Initiative, http://www.ce.org/ecycle (accessed October 3, 2012).
[17] EPA, "Electronics Waste Management in the United States," May 2011, 6.

FIGURE 1.1 Used electronic products end-of-life cycle: Sales, including exports, may occur at any point along this complex chain



Source: Compiled by the Commission.

Once UEPs are collected from any source, they undergo a triage process in which they are sorted according to their value for reuse versus recycling for materials recovery. Products that can be resold as working electronic products have the highest value, and are generally repaired or refurbished and then resold. In some cases, working parts are harvested from existing equipment, and the parts are refurbished and resold.

The industry makes a distinction between equipment that is refurbished and tested in the United States before export, and equipment that is exported whole, but not tested and working before export. [18] Tested and working UEPs are most likely to be used for each product's original purpose (e.g., as a computer or cell phone), rather than discarded or disassembled at the export destination. By contrast, whole equipment that is not tested before export is considered by many to pose a serious risk of being disassembled for materials recovery after export, often using methods that may harm the environment or endanger the workers. In addition, there are concerns that, while some untested equipment may be responsibly refurbished at the export destination, a significant share of such shipments may simply be discarded in unsuitable landfills and cause environmental harm in the destination countries.[19]

Older UEPs, or those not in good condition, are disassembled by hand or through a mechanical shredding process, and the metals, plastics, and other materials are recovered and resold. Once UEPs are directed towards disassembly and materials recovery, their value is no longer determined by the original product form (e.g., laptop, cell phone, television); instead, their value is based on the items' materials content (e.g., circuit boards, copper, aluminum, and plastics).

Materials recovered from UEPs that are disassembled in the United States are also frequently exported, as discussed further throughout the report. Metals, plastics, and glass obtained from disassembly operations are sold in large volumes, separated by commodity type.[20] Once disassembled from the original UEPs, a large share of circuit boards, either whole or shredded, is exported to one of a few high-tech smelting facilities in OECD countries that specialize in recovering gold, copper, and other valuable metals from the boards.[21] Chapter 6 provides more detailed information on the factors that affect trade in UEPs.

Brokers reportedly play an important role in facilitating the multiple transactions that can occur along the UEP supply chain within the U.S. market as well as overseas. Some brokers specialize in intact UEPs; others focus on metals, plastics, or materials resulting from disassembly; and still others handle both product streams. Brokers consolidate smaller quantities of UEPs into larger volumes that can meet the threshold—i.e., a full shipping container—required for export. They may also provide customer contacts in

[18] Products considered to be tested and working have been powered on and checked to ensure that all components are functional. Configuration information and product specifications are documented; however, there is no industry standard for "tested and working" products. USITC, hearing transcript, May 15, 2012, 120 (testimony of Lane Epperson, HiTech Assets, Inc.).

[19] Industry representatives, interviews by USITC staff, February 8 and 28, 2012.

[20] Throughout the report, disassembled materials are referred to as commodity materials, as these products are bought and sold in large volumes. However, the data do not necessarily represent shipments of pure metals or plastics.

[21] These smelters are currently operating in Sweden, Belgium, Japan, South Korea, and Canada, and observers agree that they operate to high environmental standards. As of 2012, no similar facility was operating in the United States.

foreign markets, or knowledge of foreign market structure and regulations.[22] Brokers in the UEP industry range from large recycling firms with global customer networks, to mid-size firms with contacts in one or two overseas markets, to one-person operations that approach small UEP recyclers with cash in hand to buy small loads of UEPs.[23] The multi-transactional nature of this industry, and the fact that brokers might never take physical or legal possession of the goods, complicates the task of tracking downstream sales and exports and collecting reliable data.

Approach

As requested by the USTR, the data in this report are largely based on the compilation and statistical analysis of primary data collected from responses by U.S. organizations to the Commission's questionnaire. This quantitative analysis is augmented by confidential, firm-level export data provided by Census and by qualitative information developed through a public hearing, written submissions, literature review, industry interviews, and site visits to U.S. processors and handlers of UEPs.

Commission Survey of U.S. Firms

In an effort to collect relevant data, the Commission developed a questionnaire that was sent to a stratified random sample of 5,200 firms identified as likely processors and handlers of UEPs. Based on public information about the industry and extensive interviews with industry representatives, the Commission identified six industry subsectors that are believed to account for the majority of UEP-related activity in the United States and are therefore potential exporters. The Commission then sent questionnaires to firms and nonprofit organizations in the following subsectors of the UEP industry:

- waste management and remediation;
- smelting of nonferrous materials;
- electronic products manufacturing;
- wholesaling and brokering of electronic products and of recyclable materials;
- repair and refurbishing of electronic products; and
- other services, such as IT asset management.[24]

The Commission's list of firms in these industry subsectors forms the basis of the Commission's sampling frame, which is an approximation of the U.S. population of all relevant firms.[25] By identifying these industry subsectors in advance and creating a sampling frame, the Commission was able to use statistical sampling techniques to extrapolate the results from the questionnaire to the entire U.S. population of likely handlers and/or exporters of UEPs (see box 1.2 for information on the precision of the Commission's estimates). More information on the sampling frame, response rates, and weighting of responses is presented in appendix E.

[22] Industry representative, meeting with USITC staff, March 7, 2012; industry representative, telephone interview by USITC staff, January 31, 2012; industry representative, telephone interview by USITC staff, February 27, 2012.

[23] Industry representative, meeting with USITC staff, February 24, 2012.

[24] These subsectors were matched to industry groupings under the North American Industry Classification System (NAICS).

[25] Firms with less than 10 employees were excluded from the survey in order to reduce the burden on small firms. For additional detail on the Commission's survey methodology and analysis, see appendix E.

BOX 1.2 Measuring precision using relative standard errors (RSEs)

Throughout this report, all estimates based on calculations of weighted responses to the Commission's questionnaire have been examined to determine their precision. The RSE is a measure of the precision of these estimates that describes how widely the estimates are distributed around a mean. More specifically, an RSE is defined as the standard error of a particular estimate divided by the estimate itself, expressed as a percentage. A smaller RSE indicates a more precise estimate. For example, if an estimate of an industry's revenues is $10 million and the standard error for that estimate is $1 million, then the RSE is 10 percent. Likewise, if another industry's revenues are estimated at $10 million, but the standard error for that estimate is $5 million, then the RSE is 50 percent. The first example (with a smaller RSE) implies that the estimate is a more precise measurement of industry revenues, whereas the second example (with a larger RSE) suggests that another sample might produce a result different from the current estimate.

Unless otherwise noted, estimates presented in this report have RSEs below 50 percent, which indicates that the standard error of the estimate is less than half of its magnitude. In cases where the survey produced an estimate that is particularly relevant to the reader but has less precision (i.e., a higher RSE), the RSE for that estimate was provided.[a]

[a] For a more detailed description of RSEs, see USDOC, Census, "How the Data Are Collected" (accessed August 22, 2012).

Using the questionnaire, the Commission was able to identify organizations that were actively involved in the UEP industry.[26] The questionnaire also asked organizations involved in the industry to report details of their collection, processing, and output of UEPs and related materials, along with details about exports of particular UEPs, for both weight and value. The full text of the questionnaire can be found in appendix F.

Questionnaires are a source of primary data, and the Commission has relied on the veracity of questionnaire respondents in compiling and presenting the data in this report. Some commented that a questionnaire might not be the best instrument to accurately estimate U.S. exports of UEPs because, due to industry pressure not to export, firms might not be forthcoming about U.S. exports of UEPs to developing countries.[27] Rather, these industry representatives preferred that the U.S. government track container shipments of UEPs and increase U.S. Customs inspections of containers at the loading port to obtain an accurate understanding of U.S. exports.[28]

Relying on survey data presented several challenges to the Commission's findings. The results of the Commission's questionnaire have been aggregated and weighted to provide estimates about a broader population, with results that may be skewed towards non-exporters or responsible exporters that responded to the questionnaire, as well as to larger firms, since very small firms were not surveyed. Finally, response rates were different for different parts of the questionnaire. The result, as discussed in chapter 5, is that data presented in chapters 2–4 are not directly comparable to those presented in chapter 5.

[26] The questionnaire asked respondents whether their organization did any of the following in 2011: acquire, refurbish, repair, resell, disassemble, recycle, export, or otherwise process UEPs. Respondents that answered yes were directed to complete the rest of the questionnaire. Respondents that answered no were directed to the end of the questionnaire, and their responses were used only to better understand the sample population.

[27] USITC, hearing transcript, May 15, 2012, 251; Electronics TakeBack Coalition, written submission to the USITC, May 22, 2012, 5; TransparentPlanet, written submission to the USITC, August 30, 2012, 3.

[28] USITC, hearing transcript, May 15, 2012, 252; TransparentPlanet, written submission to the USITC, August 30, 2012, 4.

Census Data

In addition to survey results, the Commission analyzed Census trade data on U.S. exports of mobile phones, laptop computers, desktop computers, CRTs, hard drives, and flat screen monitors classified under codes in chapters 84 and 85 of Schedule B.[29] Shipment-level monthly export data from 2011 were analyzed so that they could be compared with the questionnaire results, as well as to provide additional insight into UEP export flows from the United States. Since Schedule B codes do not distinguish between used and new products, average unit values for each shipment were used as proxies to analyze U.S. export flows, with the assumption that lower-valued goods were more likely to be used products. An analysis of the data for cell phones is found in chapter 2. Appendix H analyzes data for the remaining product groups.[30]

Other Information Sources

In addition to the data compiled from the questionnaire and Census, this report draws on extensive qualitative information from a public hearing, written submissions to the Commission, site visits to recycling facilities, and interviews with individuals and organizations involved in the industry. The Commission held a public hearing in Washington, DC on May 15, 2012 with 15 witnesses giving testimony. Witnesses included representatives of for-profit recyclers, refurbishers, global companies, industry associations, and NGOs.[31] In addition, the Commission received five written submissions for the record. Summaries of the testimony of each hearing witness and written submission are included in appendix D, and the full hearing testimony and all written submissions are available on the Commission website.[32]

The Commission also visited two recycling facilities and conducted interviews with representatives of 35 organizations, including large and small electronics recycling firms, IT asset disposition firms, for-profit and nonprofit refurbishers and resellers of UEPs, brokers, nonprofit organizations involved in collecting and exporting UEPs, OEMs and original device manufacturers (ODMs), industry associations, academic institutions, and U.S. government agencies. Finally, to gather qualitative information on the global markets for UEPs, the Commission sent information requests to U.S. embassies in 23 countries and received responses from 15.

Literature Review

As noted above, there is little publicly available data on U.S. exports of UEPs. Nonetheless, several published and ongoing studies provide additional insights into different areas of the UEP supply chain. Two studies in particular provided estimates of UEP exports from the United States. Neither addressed precisely the same industry and product mix as the Commission's investigation (table 1.1). The results are not directly comparable to Commission estimates presented in this report, but given the dearth of

[29] Aggregate data for these trade flows are publicly available through the Census Bureau. Under a National Interest Determination, USITC was able to obtain a shipment-level dataset, which include proprietary information and are not publicly available. The USITC requested and was granted access to confidential export data regarding U.S. exports of UEPs collected by Census in order to comply with statutory information requested by the USTR. These data were handled under the Commission's confidential data procedures, and results are only presented in the aggregate.

[30] The data and figures presented in this report have been aggregated such that they do not disclose any confidential information.

[31] For a list of witnesses, see appendix C.

[32] Materials can be found at https://edis.usitc.gov/ (free registration required).

public estimates of the level of UEP exports, they are included below in an effort to provide as broad a context for the Commission investigation as possible.

TABLE 1.1 Estimates of U.S. UEP exports

Study	Study specifics	Estimate of U.S. UEP exports
Used Electronic Products: An Examination of U.S. Exports (USITC, 2013)	A questionnaire surveyed a stratified random sample of firms with 10 employees or more in the waste management, smelting, manufacturing, wholesaling, repair, and asset management industries. Respondents were asked to account for both refurbished and disassembled UEPs and were legally required to respond.	In 2011, U.S. handlers and processors of UEPs exported $1.5 billion, or 7 percent of total sales. Twenty-six percent of U.S. firms that handled and/or processed UEPs in 2011 reported direct exports.
Miller, T.R. *Quantitative Characterization of Transboundary Flows of Used Electronics: A Case Study of the United States* (MIT, 2012)	Estimates refer only to laptops. Voluntary survey respondents.	Fifty to 100 percent of laptops collected for processing are subsequently exported to both OECD and non-OECD countries.
Daoud, David. *Inside the U.S. Electronics Recycling Industry* (IDC, 2011)	Survey respondents were recyclers only. 2010 data. Survey refers only to end-of-life items, not to refurbished UEPs. Voluntary survey respondents.	21 percent of recyclers' direct output is exported; of the remaining domestic sales, many of the commodity byproducts of recycling are eventually exported.
Puckett, Jim, et al. *Exporting Harm: The High-Tech Trashing of Asia* (BAN, 2002)	Refers only to end-of-life items, not to refurbished UEPs. Based on industry expert opinions in 2002, not a statistical estimate.	50 to 80 percent of "e-waste" collected in the United States is sent abroad for recycling.

Source: Compiled by USITC.

The Recycling Research Foundation and the Institute of Scrap Recycling Industries commissioned a report from the International Data Corporation (IDC)[33] to provide a profile of the U.S. recycling industry, including labor, revenue, and other firm profile information. Published in 2011, the IDC report focused on recyclers only and estimated the size of the U.S. recycling industry, sources of U.S. UEPs, organization size, years in the business, output by weight, and challenges to the industry. The survey found that roughly 79 percent of total recycling output was first sold within the United States.[34]

IDC's methodology differed from that of the Commission in several important ways. First, the IDC sample included small firms (i.e., less than 10 employees), which accounted for 51 percent of IDC's respondents. (To reduce the burden on small businesses, the Commission excluded organizations with less than 10 employees from its questionnaire sample frame). Further, the IDC surveyed scrap plastic and metals handlers that were not surveyed by the Commission. Finally, the IDC conducted a voluntary survey limited to recyclers; the Commission's mandatory questionnaire examined the

[33] Daoud, "Inside the U.S. Electronics Recycling Industry," September, 2011.

[34] While respondents indicated that most of the output was first sold in the United States, they also reported that much of the output was eventually sold in the global markets for scrap materials. Daoud, *Inside the U.S. Electronics Recycling Industry*, September 2011, 13.

industry more broadly, also surveying UEP brokers, collectors, smelters, IT asset management firms, and refurbishers.

Another study, from the Massachusetts Institute of Technology (MIT), employed published estimates of UEP generation and collection, coupled with a voluntary survey employing Bayesian Truth Serum methodology to estimate 2010 U.S. exports of used laptops, as well as U.S. export share for all whole UEPs.[35] This 2012 study estimated that between 50 and 100 percent of total U.S. UEPs collected for processing were eventually exported to both OECD and non-OECD countries. Using results from its survey, the MIT report estimated that in 2010, U.S. processors of UEPs exported between 6 million and 12 million laptop computers. The estimated share of U.S. UEPs that were exported was higher than IDC's estimate of 21 percent, which the authors tentatively attribute to the commonly cited figure of 50 to 80 percent given in a 2002 BAN report.[36] The authors tested their estimation techniques for a specific case study (laptops) and suggested that further research be completed for other product groupings.[37]

Organization of the Report

This report contains six chapters. Chapter 2 provides an overview of U.S. exports of UEPs in 2011, principally based on data from questionnaire results and Census. Chapter 3 discusses the characteristics of UEPs that are exported, including the condition of those products, the composition of shipments, and the extent to which exports are processed or remain intact before export. Chapter 4 provides information on the types of domestic exporters, including the types of business activities in which these firms and nonprofit organizations engaged during 2011 and the share of exports accounted for by different types of enterprises. Chapter 5 provides insight into the foreign importers that received U.S. shipments of UEPs in 2011. The chapter describes the forms and activities of those importers, the most common end uses of U.S. exports in foreign markets, and the extent of cross-border, intra-firm shipments within U.S. exports. Chapter 6 examines both the domestic and foreign factors affecting U.S. exports of used electronic products.

[35] Bayesian Truth Serum methodology is a "survey scoring method that provides truth telling incentives for respondents answering multiple-choice questions about intrinsically private matters: opinions, tastes, past behavior. The method requires respondents to supply not only their own answers, but also percentage estimates of others'answers." It enhances truth-telling and differentiates expert responses from popular responses. Miller, "Quantitative Characterization of Transboundary Flows," 2012, 79.

[36] The Commission includes a reference to the BAN report in an effort to include all publicly available estimates of UEP exports. However, the BAN estimates were not the result of a statistical analysis. Rather, the estimates came from a nonscientific survey of industry experts' opinions conducted over 10 years ago. As discussed in this report, there are strong reasons to believe that industry conditions have changed since that time, not least due to the efforts of the organizations that published the 2002 report. Puckett et al., "Exporting Harm," February 25, 2002.

[37] Miller, "Quantitative Characterization of Transboundary Flows," 2012, 106.

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Puckett, Jim, et al. *Exporting Harm: The High-Tech Trashing of Asia.* Seattle, WA: Basel Action Network, and San Jose, CA: Silicon Valley Toxics Coalition, February 25, 2002. http://www.ban.org/E-waste/technotrashfinalcomp.pdf.

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CHAPTER 2
Overview of U.S. Used Electronics Products Industry and Exports[1]

Overview

This chapter presents an overview of the U.S. industry dealing in used electronic products (UEPs), as well as its exports of UEPs, and summarizes the Commission's questionnaire responses. Based on these responses, the chapter estimates the total size of the UEP industry in the United States and the share of UEP exports, relative to total domestic sales of UEPs. This chapter also presents data bearing on the industry's sources of UEP inputs, specific product groups, and export destinations.

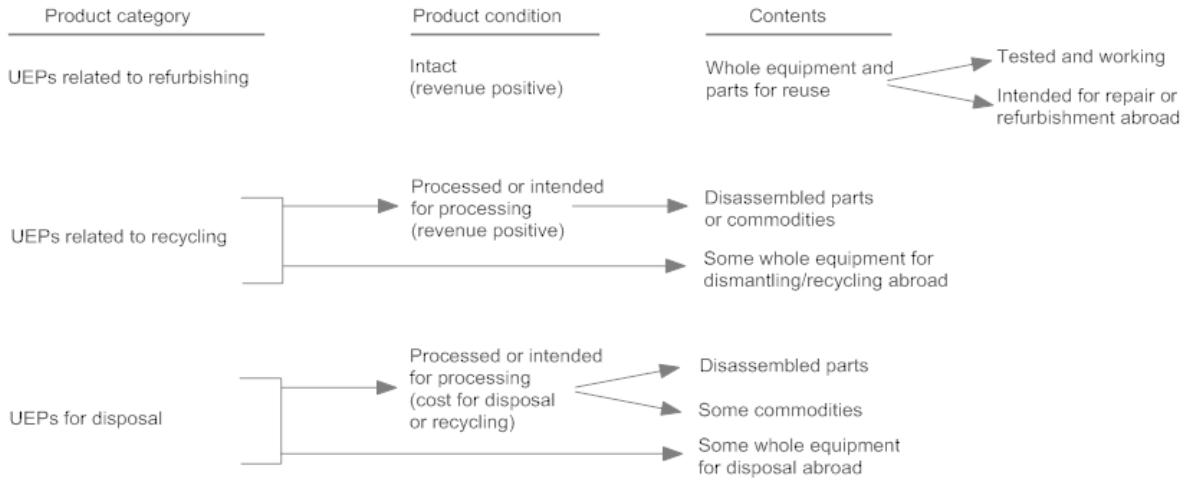
In addition to data from the questionnaire, the Commission analyzed Census export data reflecting individual shipments of cell phones, laptop computers, CRTs, and other electronic products. Census data do not distinguish between used and new products, but by focusing on shipments with the lowest average unit values (AUV) for selected product categories, the Commission provides a range of calculations for U.S. exports of UEPs. The results of this analysis with regard to cell phones are presented at the end of this chapter. Similar analysis of other products is presented in appendix H.

Summary of Products

For the purposes of this report, U.S. exports of UEPs are divided into three major product categories: repaired or refurbished UEPs, recycled UEPs, and UEPs for disposal (figure 2.1). **Repaired or refurbished UEPs,** consisting of whole equipment and parts for reuse, are exported intact. In this report, this product category includes already repaired or refurbished UEPs and those that are exported to be refurbished or repaired abroad. **Recycled UEPs,** consisting of disassembled parts or commodity-grade scrap materials suitable for reuse, are primarily exported in processed condition. However, some products in this category may be whole electronic products exported intact for disassembly outside the United States. Finally, **UEPs for disposal** are primarily non-reusable disassembled parts, but may also include commodities and whole equipment to be discarded.

[1] Unless otherwise noted, results presented throughout this chapter are based on USITC calculations of weighted responses to the Commission questionnaire. In order to reduce the burden on questionnaire respondents, the questionnaire did not survey organizations with less than 10 employees. The estimates presented in this report apply to the U.S. UEP industry for organizations composed of 10 or more employees only.

FIGURE 2.1 UEPs may be exported intact or in processed form



Source: Compiled by USITC staff.

Note: Exports related to refurbishing reflect section 4 of the questionnaire, exports related to recycling reflect section 5 of the questionnaire, and exports for disposal reflect section 6 of the questionnaire.

Refurbished or repaired UEP exports consist of end use UEPs, such as computers, TVs, and cell phones. Though intact, these products may not be in working condition. "Tested and working" applies to products that have been powered on and tested before export, to demonstrate that all components function and that the unit can operate as originally intended.[2] Tested and working products are generally intended to be resold for use without further modifications. Usually these are whole pieces of equipment; less commonly, intact parts, such as whole printed circuit boards, may be exported for reuse in new or refurbished end use equipment.[3]

Exports of goods intended for refurbishment or repair abroad may be in the form of either whole equipment or parts, but all need further processing abroad. The line between exports for repair and exports for recycling is ill defined, as the exporter has no way to guarantee that the necessary repairs will be completed abroad. If a product is not repairable once it reaches its export destination, it will likely be disassembled or disposed of.

The key difference between intact products and processed UEPs is that processed goods are not intended to be reused for their original purposes. UEPs slated for processing are broken down, stripped, shredded, or disassembled, either by hand or by machine. Processed UEPs fall into two categories: goods intended for recycling or materials

[2] The configuration information and specifications of the machine are also documented during this process. Tested and working equipment is labeled as such before export. USITC, hearing transcript, May 15, 2012, 119 (testimony of Lane Epperson, HiTech Assets).

[3] In 2011, U.S. exports of whole circuit boards accounted for an estimated 4 percent of total U.S. exports of repaired/refurbished UEPs, according to questionnaire responses. Most exported whole circuit boards are shredded and/or smelted, not reused.

recovery, and goods intended for disposal.[4] A key distinction between these two categories is that most recycled goods generate income, while entities must pay a fee to discard certain goods for disposal. The category of goods intended for disposal also includes goods that UEP recyclers must pay another firm to recycle. Goods intended for recycling or materials recovery may be exported as either disassembled parts or commodity remnants of whole equipment (including plastics, metals, and glass). When exported, they enter into the input stream for manufacturing or further recycling. Some goods may also be discarded.

As requested by the USTR, this report focuses on exports of the following categories of UEPs: audio and visual equipment, computers and peripheral equipment, digital imaging devices, and telecommunication equipment, including component parts of these products. Table 2.1 illustrates the product categories as defined for questionnaire respondents.

U.S. Domestic UEP Industry

In 2011, U.S. domestic sales of UEPs were an estimated $19.2 billion, by about 5,300 firms. By value, most domestic sales consisted of refurbished products ($14.9 billion), rather than recycled products ($4.3 billion). In addition, U.S. organizations incurred costs (as opposed to sales) of $44 million for disposal or recycling of UEPs outside the United States. In comparison, total disposal costs for the domestic market were $86 million. The majority of these costs were for UEPs containing environmentally hazardous products, particularly CRT TVs and monitors.

Summary of UEP industry sales (million $)

	Domestic sales
Refurbished	14,920
Recycled	4,270
Total	19,190

Source: USITC calculations of weighted responses to the Commission questionnaire.

It is important to note that these domestic sales figures reflect total sales, rather than total value. The questionnaire respondents were organizations placed throughout the UEP supply chain and intra-industry, so downstream sales are common. For this reason, the sales value presented here is likely greater than the value of UEP material collected within the United States, since it reflects the cumulative sales for organizations throughout the UEP supply chain.

U.S. Sources of UEPs

Recycling and refurbishing operations collect UEPs from many different sources, reporting collection of about 4.4 million short tons in 2011. Commercial collections and acquisitions accounted for 1.7 million tons of collected material in 2011, far larger than any other source (figure 2.2). The next largest source was material from OEMs, at

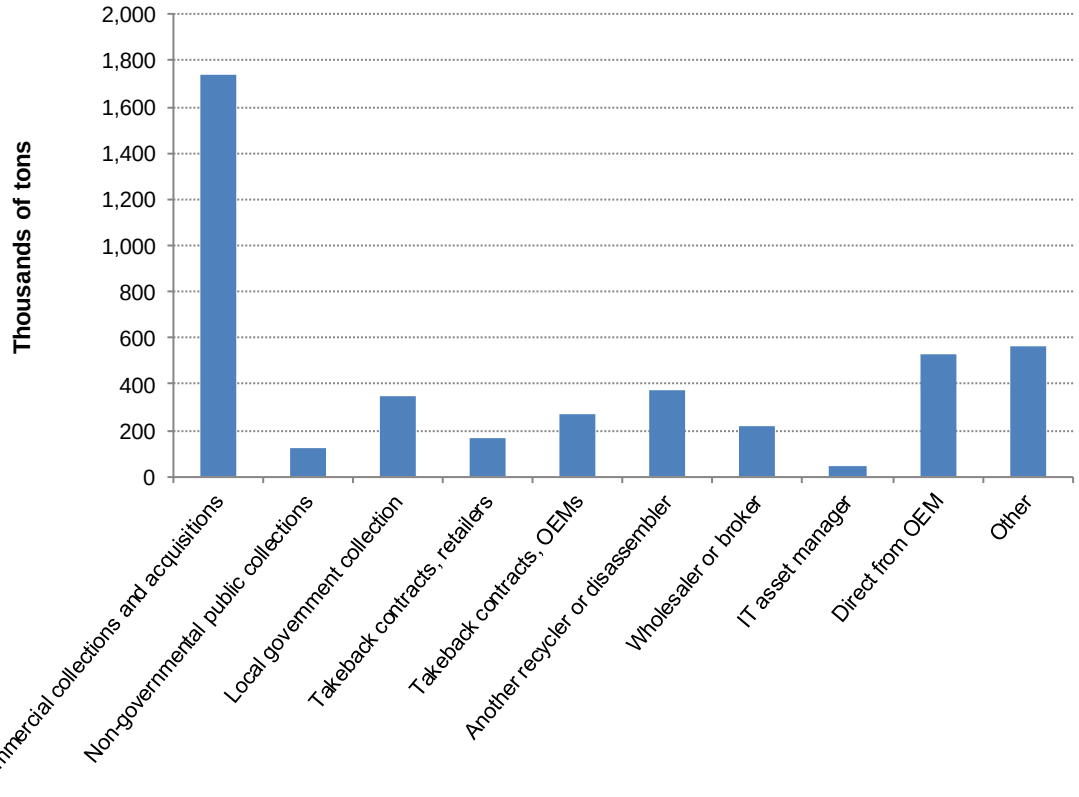
[4] There are a small number of goods that processors typically pay to have recycled by another firm. The most prominent example is CRTs, which most processors remove from TV and computer monitors but do not themselves recycle. Instead, they generally pay specialized firms to recycle CRTs, either overseas or in the United States. Some CRTs may also be exported to foreign destinations for disposal. See chapter 6 for a discussion of U.S. regulations on CRT exports.

TABLE 2.1 Description of surveyed product groupings

Product	Product examples
Computers and parts	Desktop computers, laptops, mainframes, servers, tablets, netbooks, and e-readers. Also includes parts integrated into computers, such as hard drives, motherboards, and internal modems. *Includes batteries integrated into laptops, but not batteries collected separately.*
Computer peripheral equipment	Equipment external to computers, such as external hard drives, keyboards, and mice.
Flat screen monitors	Non-CRT monitors used for computers or other electronic equipment, such as LED or LCD displays.
Monitors and televisions containing CRTs	Televisions and monitors used for computers and other electronic equipment that contain CRTs, or CRTs that have been removed from their original devices.
Televisions and other audio/visual equipment, not containing CRTs	Televisions, video game systems and accessories, still image cameras and camcorders (digital and analog), stereo systems, microphones, MP3 players, and other sound equipment with integrated video capabilities.
Mobile handsets and other telecommunications equipment	Cell phones, smartphones, mobile phone accessories, pagers, radios, personal digital assistants (PDAs), GPS navigation devices, routers, switches, modems, hubs, and other mobile communications equipment.
Office imaging equipment	Printers, copiers, fax machines, scanners, and multifunctional machines.
Medical imaging equipment	Scanning equipment for medical purposes, including but not limited to x-ray, MRI, and CT scan machines.
Whole printed circuit boards	Circuit boards from electronic products. These may be either populated with hardware (such as processors) and wiring or bare, but not shredded.
Shredded printed circuit boards	Circuit boards that have been mechanically disassembled and homogenized.
Wires and cables	Components of electronic products that were used to connect a device to a power supply or to other devices and that have been detached in the separation process.
Commodity metals, plastics, and glass	Materials from electronic products that have been separated and processed back into a condition allowing them to be used again in a manufacturing process. *Does not include CRT glass.*

Source: Definitions included in the Commission questionnaire.

FIGURE 2.2 Commercial collections were the largest source, by weight, of UEPs in 2011



Source: USITC calculations of weighted responses to the Commission questionnaire.

529,000 tons. These results suggest that most sales of UEPs are business-to-business transactions, rather than collections from individual consumers. Similar to the estimated value of domestic UEPs, these weights represent the cumulative weight of all UEPs collected, rather than the total weight of UEPs in the United States in 2011. The materials can be shipped several times between UEP firms, and the weight of those materials would be counted for each shipment.

There appear to be clear upstream-downstream relationships among certain segments of the industry. When broken down by organizations' primary business activities, commercial collections and acquisitions represent the largest source of UEPs for several industry segments, including recycling services; asset management, leasing, and professional services; disassembly and processing; and collection and sorting (table 2.2).

Operations that focus on refurbishing and parts recovery primarily source their materials directly from OEMs or commercial collections and acquisitions, with 10 percent sourced from "takeback" programs sponsored by both retailers and OEMs. Another source is municipalities and nonprofit organizations that have focused on consumer-level collections through local government initiatives. These collections appear to partner primarily with disassembly and processing operations, and to a lesser degree with collection and sorting organizations and recycling services organizations, in providing them a source of UEPs.

TABLE 2.2 Source of UEP collections, by primary activity of enterprise, 2011

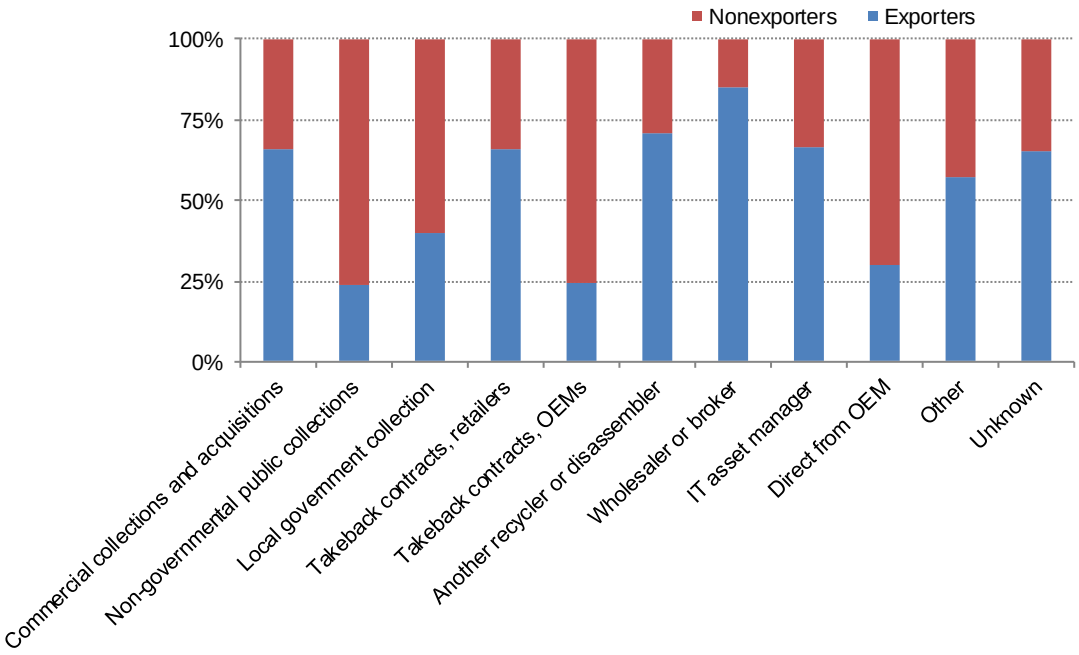
Source of collections	Recycling services, asset management, leasing, and professional services	Wholesale of parts, wholesale of scrap, and retail	Refurbishing, repairs under warranty, and parts recovery	Disassembly and processing	Collection and sorting	Metals recovery	Other (such as disposal)	Entities whose primary activity is not UEPs
				Short tons				
Commercial collections and acquisitions	157,539	69,416	160,186	609,351	91,200	8,754	2,415	639,546
Nongovernmental public collections	3,302	16,521	4,782	81,768	16,507	39	98	578
Local government collection	55,286	9,207	30,042	147,064	68,344	0	34,747	0
Takeback contracts, retailers	1,668	30,541	15,115	94,844	21,325	0	2,600	76
Takeback contracts, OEMs	1,033	31,190	70,811	159,456	5,908	0	698	35
Another recycler or disassembler	10,505	85,048	4,352	222,581	6,108	45,245	1,229	0
Wholesaler or broker	2,978	66,366	12,694	4,550	905	3,431	1	127,863
IT asset manager	9,764	1,721	169	27,769	1,348	0	12	0
Direct from OEM	13,420	52,583	370,391	91,425	732	116	599	36
Other	108,194	120,161	115,730	69,095	44,188	1	6,554	1,095
Unknown	17,414	354	10,882	39,831	18,374	14,676	12	333
Total	381,102	483,110	795,153	1,547,734	274,941	72,261	48,965	769,561

Source: USITC calculations of weighted responses to the Commission questionnaire.

For other industry segments, the upstream-downstream relationships are not clearly defined by sources of UEP materials. Responses to the questionnaire indicated that wholesalers of parts or scrap received UEPs from a wide variety of sources. This may imply that wholesaler operations rely upon a diverse portfolio of upstream suppliers, or that individual wholesalers serve niche markets aggregating certain types of UEP materials.

There also appears to be a relationship between an organization's source of UEPs and its decision to export. Non-exporters were much more likely to receive UEPs from OEMs, OEM takeback contracts, or public collection events (figure 2.3). Conversely, 65 percent of UEP material from commercial collections and acquisitions (and also the most significant source in terms of volume) was collected by companies that exported. Part of the explanation could simply be that larger organizations are more likely to export. UEPs sourced from commercial collections tend to be of higher quality, are of more recent vintage, and come in larger lots, making these products better candidates for export to foreign retail establishments. It may also be the case that OEMs (which tend to be concerned with brand awareness) and local governments (which are responsive to constituent concerns) have responded to negative publicity surrounding UEP exports by choosing to send their UEPs to companies that do not export.

FIGURE 2.3 Sources of UEPs, exporters vs. nonexporters, by weight, 2011



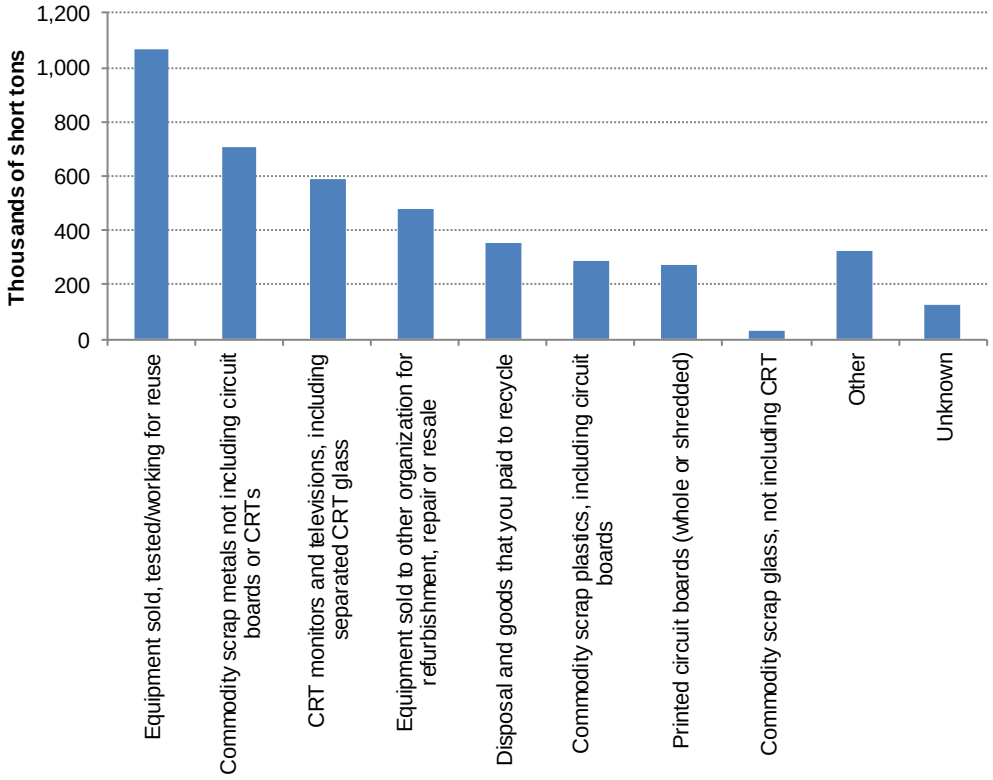
Source: USITC calculations of weighted responses to the Commission questionnaire.

Output of U.S. UEP Organizations

In 2011, the largest share of output from the UEP supply chain in the United States, by volume, was tested and working products sold for reuse (1.1 million tons) (figure 2.4). These are UEPs that entered the secondary market (either domestic or export) to be reused in their original forms. Commodity scrap metals represented the next-highest level of output of UEPs (about 710,000 tons). Commodity scrap materials are an important

component of U.S. UEP output. Typically, once products have been processed into commodity scrap materials, they no longer pose the same environmental and safety risks as most UEPs. Combining scrap metals with scrap plastics and glass, the total output for commodity scrap material was 1.0 million tons. In 2011, U.S. firms' domestic output of shredded circuit boards (112,000 short tons) exceeded the output of whole circuit boards (100,000 short tons). Shredded circuit boards accounted for 66 percent of the value of circuit boards ($649 million compared with $331 million for whole circuit boards).

FIGURE 2.4 UEPs for reuse were the largest share of output in 2011



Source: USITC calculations of weighted responses to the Commission questionnaire.

U.S. Exports of UEPs

U.S. exports of UEPs totaled $1.5 billion in 2011, accounting for 7 percent of total industry sales, as shown in the following tabulation and in figure 2.5. An estimated 1,370 firms exported UEPs in 2011. These estimates reflect U.S. exports of refurbished goods that are tested and working when sold, intact electronic products not tested and working when sold, and component parts and commodity materials derived from UEPs that have been disassembled in the United States.[5]

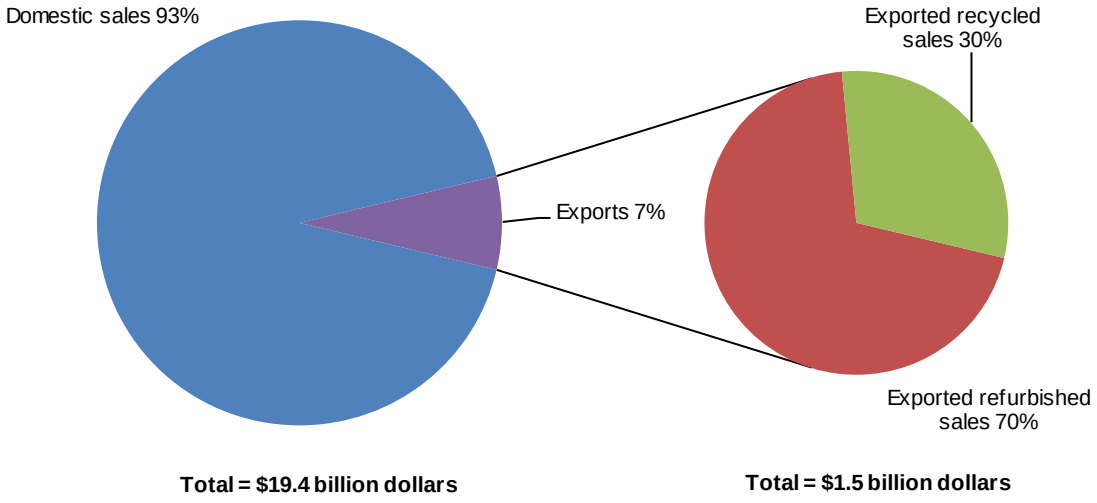
[5] UEPs exported for disposal are not included in this total, because those goods represent costs, rather than income for exporters.

Summary of UEP exports (million $)

	Exports
Refurbished	1,012
Recycled	439
Total	1,451

Source: USITC calculations of weighted responses to the Commission questionnaire.

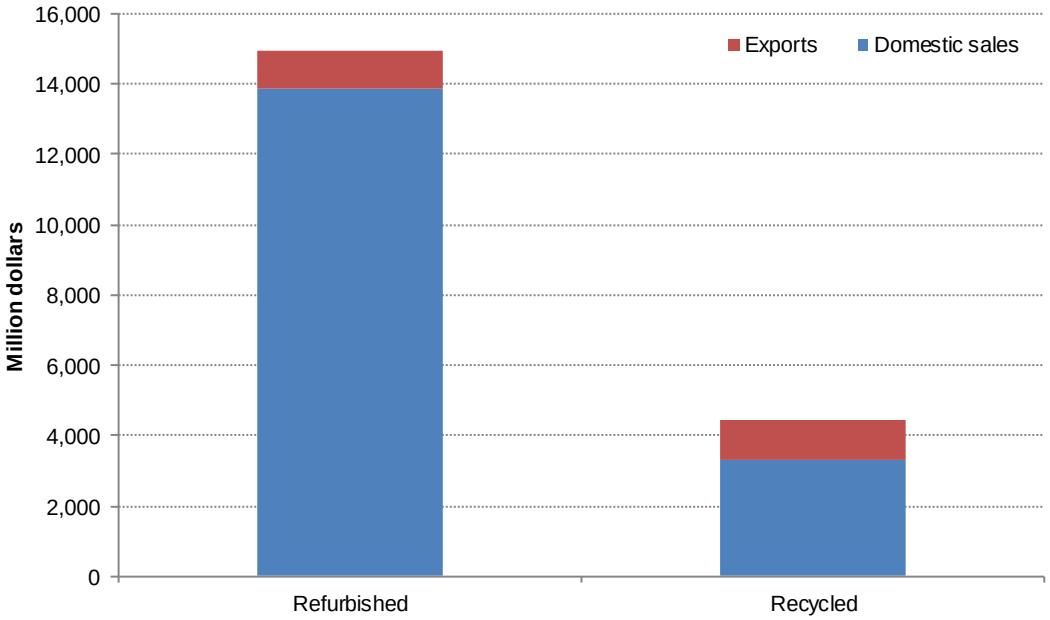
FIGURE 2.5 Exports were 7% of UEP sales in 2011



Source: USITC calculations of weighted responses to the Commission questionnaire.

In 2011, the United States exported $1.0 billion of refurbished UEPs and $439 million in recycled UEPs. Recycled products were heavily concentrated in commodity materials (metals, plastics, and non-CRT glass). Shredded circuit boards were the second-largest recycled product grouping by value. Together, those two product groups made up 81 percent of exported recycled UEPs by value, indicating that most exports of recycled UEPs have already been processed domestically to some degree. More than 88 percent of refurbished products are exported from the United States as tested and working. Figure 2.6 compares domestic sales of refurbished and recycled UEPs to exports. Chapter 3 provides additional detail on exports by product and on the condition of goods at the time of export.

FIGURE 2.6 Refurbished goods: The largest share of sales by value, 2011



Source: USITC calculations of weighted responses to the Commission questionnaire.

Electronics recyclers are able to sell most of their output, but some materials do not have a market, and UEP organizations must pay to dispose of them or to have them recycled by other organizations. U.S. exporters of UEPs reported export disposal costs of $44 million in 2011, much smaller than the value of exports of either refurbished or recycled UEPs. Separated CRTs, mercury lamps, and batteries accounted for $15 million of those disposal costs; $12 million was estimated to be "other" products not specified in the survey. Unlike most UEPs, CRT TVs and monitors generate little demand on the secondary market, and CRT glass is expensive to process. The consumer market for used CRTs, both original and secondary, has diminished in recent years as flat screen TVs and monitors have increased market share, so more CRTs need to be recycled.[6] Glass from CRTs contains high levels of lead and requires specialized handling and disposal procedures. There is limited capacity in the United States to safely process CRT glass, boosting the likelihood of export, as discussed in more detail in chapter 6.[7]

UEP Exports, by Primary Activity of Enterprise

In 2011, exports of UEPs were concentrated among a few segments of the industry (table 2.3). Organizations that primarily refurbish goods accounted for 66 percent of exported refurbished sales (figure 2.7). Exports of recycled goods were also highly concentrated, with nearly 90 percent of exports accounted for by organizations that disassemble and process UEPs.

[6]Industry representative, interview with USITC staff, Pennsylvania, March 7, 2012.
[7]Industry representative, interview with USITC staff, Massachusetts, February 24, 2012.

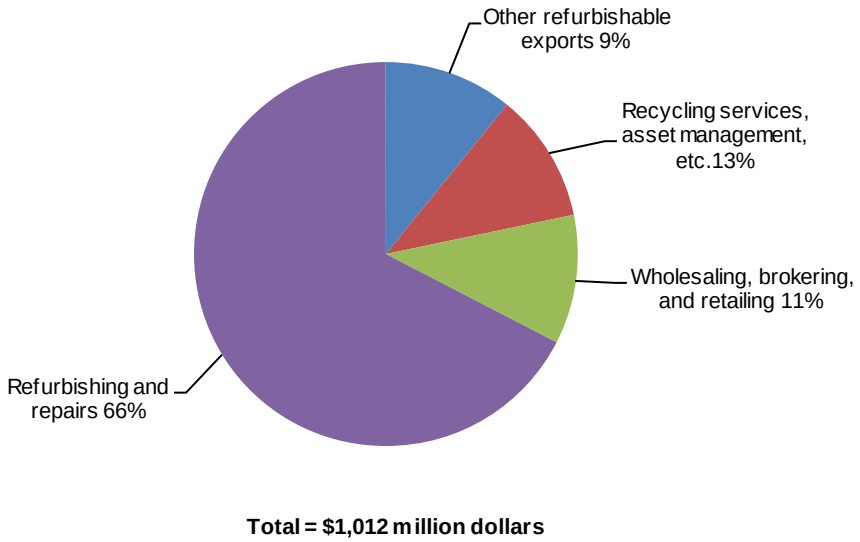
TABLE 2.3 Exports of UEPs by U.S. companies, 2011

	Refurbished sales	Recycled sales
	Millions of $	
Recycling services, asset management, leasing, and professional services	132	[a]3
Wholesale of parts, wholesale of scrap, and retail	107	[a]23
Refurbishing, repairs under warranty, and parts recovery	666	[a]9
Disassembly and processing	27	395
Collection and sorting	40	[a]9
Metal recovery	0	[a]1
Other (such as disposal)	6	0
Firms whose primary activity is not UEPs	[a]35	0
Totals	1,012	439

Source: USITC calculations of weighted responses to the Commission questionnaire.

[a]Low-precision estimate, with RSE above 50 percent.

FIGURE 2.7 Operations that primarily refurbish UEPs accounted for the majority of refurbished UEP exports in 2011

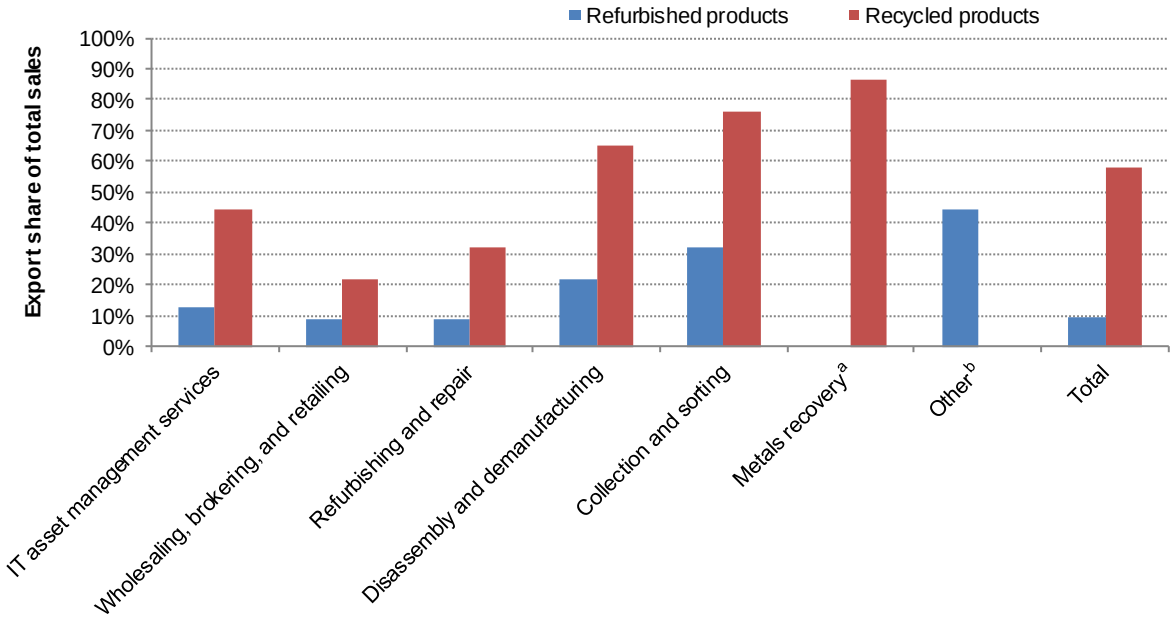


Source: USITC calculations of weighted responses to the Commission questionnaire.

Exports accounted for a greater share of total sales for exporters of recycled products, than they did for exporters of refurbished products. For organizations that exported in 2011, exports of recycled UEPs accounted for 58 percent of total sales. For organizations that exported refurbished products, however, exports accounted for only 9 percent. The reliance on export markets is particularly pronounced for metals recovery operations (which exported 86 percent[8] of their recycled products) and operations that primarily collect and sort recycled UEPs (which exported 32 percent of their refurbished and 76 percent[9] of their recycled goods) (figure 2.8). These particular segments are located at

[8] Low precision estimate, with RSE of 55 percent.
[9] Low precision estimate, with RSE of 54 percent.

FIGURE 2.8 UEP recyclers that export are reliant on foreign sales



Source: USITC calculations of weighted responses to the Commission questionnaire.

[a]Not available.
[b]No reporting of recycled products.

the beginning (collection and sorting) and end (disassembly and processing, metals recovery) of the UEP supply chain. In other words, the domestic industry captures either very little or most of the value contained within UEPs before sending them overseas.

Foreign Destinations for U.S Exports of UEPs

In 2011, U.S. organizations exported UEPs to diverse destinations. The largest destination for used electronic exports, by weight, was Asia-Pacific markets other than Hong Kong, China, and India (primarily the Republic of Korea [Korea] and Japan), with 199,000 tons (table 2.4). Mexico was next, receiving U.S. exports of 129,000 tons.[10] In total, about 53 percent of U.S. exports in 2011 were destined for OECD member countries, 35 percent went to non-OECD countries, and 12 percent went to unknown destinations. Both OECD and non-OECD destinations received a variety of UEPs and scrap materials (figure 2.9).

[10] Korea and Mexico are both members of the OECD.

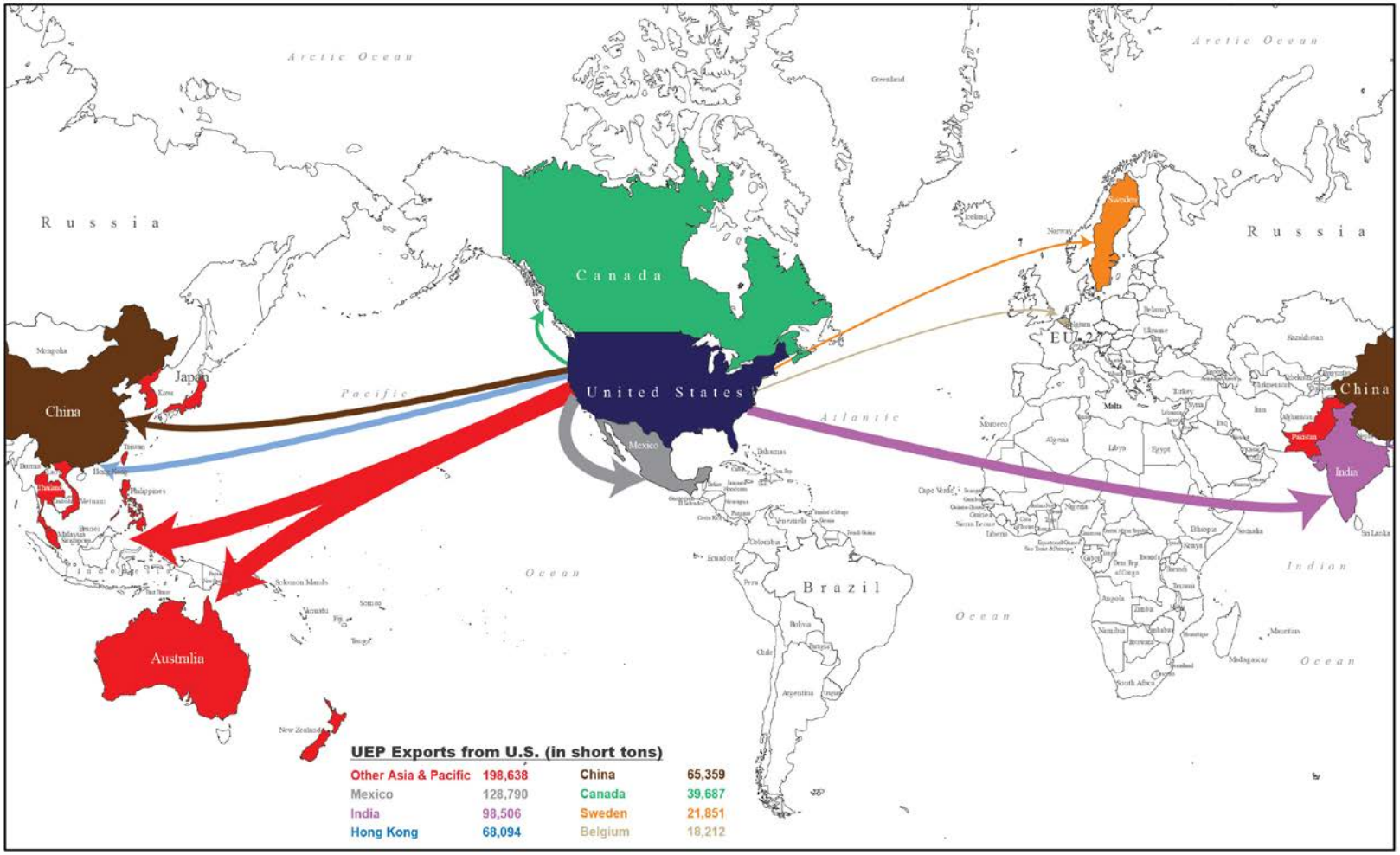
TABLE 2.4 Destination of U.S. exports of UEPs, 2011

Country	Tons
Asia-Pacific markets other than Hong Kong, China, and India[b]	[a]198,638
Mexico	128,790
India	[a]98,506
Hong Kong	68,094
China	65,359
Canada	39,687
Sweden	[a]21,851
Belgium	18,212
Other European Union	9,770
Other Latin America	7,824
Other Middle East	6,926
Sub-Saharan Africa	78
All other and unknown	93,986
Total	757,721

Source: USITC calculations of weighted responses to the Commission questionnaire.

[a]Low-precision estimate, with RSE above 50 percent.
[b]Principally Korea and Japan; also includes Australia, Malaysia, New Zealand, Pakistan, the Philippines, Singapore, Taiwan, Thailand, and Vietnam.

FIGURE 2.9 Asia-Pacific markets other than Hong Kong, China, and India were the largest destination of U.S. exports of UEPs, in 2011



Source: USITC calculations of weighted responses to the Commission questionnaire.

The largest non-OECD destination markets were India, Hong Kong, and China, accounting for about 31 percent of total U.S. exports of UEPs by weight in 2011. These destinations are likely to have a large secondary use market for refurbished UEPs (see chapter 6). They are also important manufacturing centers for electronic products, with demand for used products and parts for remanufacturing, as well as for raw materials derived from UEPs that can be used to manufacture new products.

Large smelting facilities in Belgium, Sweden, Japan, Canada, and Korea refine processed materials, particularly circuit boards, and recover metals that can be used in the manufacture of new products. These smelters are described in greater detail in chapter 5. Belgium, Sweden, Canada, and Asian markets other than Hong Kong and China (largely Korea and Japan) together accounted for 278,000 short tons of UEPs. Although not all exports to these countries are necessarily destined for smelters, most of the materials shipped to these destinations came from processing operations.

UEP exports were also sent to Latin American countries other than Mexico (7,800 short tons), including the Caribbean, and to countries in the Middle East (6,900 short tons). The Dominican Republic, El Salvador, Brazil, and Colombia accounted for the majority of Latin American exports. Exports to the Middle East were primarily destined for Egypt, Jordan, or the United Arab Emirates.

Analysis of Trade Data from Census

In addition to questionnaire results, the Commission analyzed U.S. export data from Census for certain electronic products in chapters 84 and 85 of Schedule B.[11] Shipment-level, monthly export data from 2011 for certain Schedule B codes were analyzed so that data could be compared with the questionnaire results and to provide additional insight into export flows of UEPs from the United States. Products were identified by 10-digit Schedule B numbers. Selected Schedule B products were grouped and analyzed based on both their significance in the market for UEPs and the ease with which product definitions allowed f,or well-defined, homogenous products.

The analysis focuses on six product groupings: cell phones, laptop computers, desktop computers, hard drives, flat screen monitors, and CRTs. Exports of products containing CRTs were further broken out into four groups: CRT televisions, CRT monitors, CRTs with processing units, and CRTs without housings or attachments (“bare” CRTs). Unfortunately, Schedule B codes do not distinguish between used and new products. Since definitive information distinguishing used versus new products is not available, average unit values (AUVs) for each shipment were used as proxies to analyze U.S. export flows, with the assumption that lower-valued goods were more likely to be used products. For each product grouping, the 10th, 25th, and 50th percentiles of export shipments based on AUV proxies were determined. These results provide additional reference points in evaluating exports of UEPs from the United States. A summary of the export data for the cell phone grouping is presented below. An analysis of these data for the remaining selected products is presented in appendix H.

[11] Schedule B collects and classifies products that are exported from the United States in concurrence with the Harmonized System developed by the World Customs Organization. Aggregate data for these trade flows are publicly available through the Census Bureau. USITC was able to obtain shipment level data, which include proprietary information and are not publicly available.

The results of the analysis of Census data are not directly comparable with the results of the Commission questionnaire, but rather illustrate 2011 export flows of certain (presumably used) electronic products to certain destinations. For example, to reduce the burden on respondents, the Commission questionnaire included laptops and desktops together in a broader export category identified as "computers and parts." Similarly, cell phones were included in a broader category identified as "mobile handsets and other telecommunication equipment." Data grouped into these broader categories may show different characteristics from data grouped into the more specific product categories identified by the Schedule B codes used by Census.

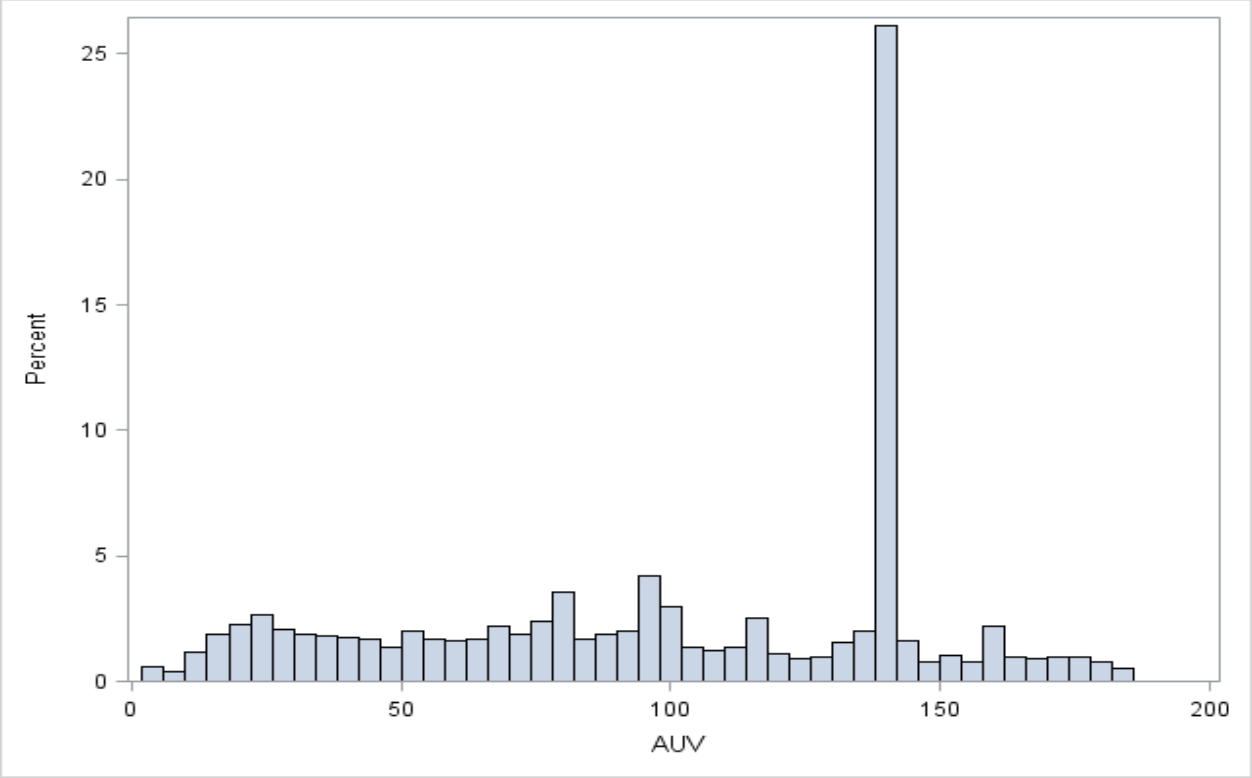
Cell Phones

Shipments of cell phones were the most valuable of the selected product groupings analyzed, in terms of both total trade and shipments for the lowest 50 percent of AUVs. Shipment AUVs were heavily skewed towards lower-value products, as the average price is well below the median. As the histogram shows, over 20 percent of all shipments were valued between $130 and $150 per unit (figure 2.10). This is at the top end or slightly above the 25th percentile of the AUV for the product group. This price point corresponds with U.S. retail prices seen for many old-model and refurbished cell phones and smart phones sold through online distributors, which would qualify as UEPs in the Commission's questionnaire. [12]

Table 2.5 summarizes the cell phone data from this analysis and tables 2.6–2.8 display detail by export destination. The share of shipments that were destined for OECD countries increased as AUV increased. Shipments of higher-value units were more likely to be exported to OECD countries and in particular to Mexico, which was the top destination by number of shipments when looking at the 25th and 50th percentiles (tables 2.7 and 2.8). Shipments of cell phones with an AUV in the lowest 10th percentile, which represented only 6 percent of the value but nearly 29 percent of units, were overwhelmingly sent to non-OECD countries (92 percent). Hong Kong was by far the most common destination for such shipments of cell phones, but low-value cell phone exports to a number of Latin American countries, including Venezuela, Paraguay, and Haiti, were also significant.

[12] Data are from online searches conducted by USITC on eBay and Google on September 26, 2012.

FIGURE 2.10 Cell phones, Schedule B codes 8517120020 and 8517120050: Percent distribution of shipments in the bottom 50th percentile based on average unit value



Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011.

TABLE 2.5 Summary of U.S. Census export data, cell phones

Schedule B export codes:		8517120020, 8517120050						
	Unit value		No. of shipments	No. of units	Value of shipments	% of total value	% shipments to OECD countries	% Shipments to non-OECD countries
			($)		($)			
Total exports	avg.	123.48	56,064	45,380,982	5,603,431,572	100	27.6	72.4
Lowest 50%	≤	184.06	28,032	38,463,820	3,012,934,130	54	37.0	63.0
Lowest 25%	≤	104.16	14,016	26,816,231	1,391,917,576	25	20.5	79.5
Lowest 10%	≤	50.00	5,631	13,331,185	321,898,803	6	8.0	92.0

Source: U.S. Census Bureau, unpublished export data, 2011.

TABLE 2.6 Cell phones: U.S. exports with unit values in lowest 10 percent of shipments, 2011[a]

	AUV	No. of units	No. of shipments	Export value (US $)	Share of total value (percent)
Hong Kong	17.32	3,492,517	1,265	60,495,597	19
Venezuela	34.09	1,049,706	172	35,781,308	11
Paraguay	30.31	1,161,230	776	35,196,305	11
Mexico	23.28	1,329,494	255	30,944,120	10
Haiti	19.10	1,308,554	102	24,992,331	8
El Salvador	25.49	488,538	167	12,453,270	4
Dominican Republic	35.26	348,058	176	12,271,154	4
Honduras	26.09	430,716	120	11,237,325	3
Jamaica	24.69	448,855	82	11,083,478	3
Philippines	(b)	(b)	(b)	(b)	(b)
All other	(b)	(b)	(b)	(b)	(b)
OECD countries	23.42	1,514,503	453	35,476,753	11
Developing countries	24.24	11,816,682	5,178	286,422,050	89
Total	24.15	13,331,185	5,631	321,898,803	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 8517120020 and 8517120050).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $50.00 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE 2.7 Cell phones: U.S. exports with unit values in lowest 25 percent of shipments, 2011[a]

	AUV	No. of units	No. of shipments	Export value (US $)	Share of total value (percent)
Mexico	66.52	6,328,716	2,336	421,002,603	30
China	90.94	2,833,538	985	257,681,531	19
Paraguay	55.32	2,873,545	1,983	158,958,974	11
Hong Kong	27.72	4,283,852	1,950	118,750,877	9
Venezuela	51.93	2,195,791	427	114,037,023	8
Peru	(b)	(b)	(b)	(b)	(b)
Colombia	47.26	619,751	780	29,290,019	2
Haiti	19.63	1,319,969	115	25,906,752	2
Philippines	(b)	(b)	(b)	(b)	(b)
El Salvador	30.08	547,765	265	16,476,410	1
All other	41.18	4,820,138	4,863	198,496,291	14
OECD countries	65.66	6,743,283	2,879	442,743,005	32
Developing countries	47.29	20,072,948	11,137	949,174,571	68
Total	51.91	26,816,231	14,016	1,391,917,576	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 8517120020 and 8517120050).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $104.16 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE 2.8 Cell phones: U.S. exports with unit values in lowest 50 percent of shipments, 2011[a]

	AUV	No. of units	No. of shipments	Export value (US $)	Share of total value (percent)
Mexico	100.90	11,650,838	8,347	1,175,574,557	39
China	(b)	(b)	(b)	(b)	(b)
Venezuela	77.42	3,104,280	896	240,317,926	8
Hong Kong	44.47	5,035,745	3,072	223,937,144	7
Paraguay	61.30	3,127,943	2,495	191,740,295	6
Peru	(b)	(b)	(b)	(b)	(b)
Colombia	68.82	808,990	1,221	55,677,806	2
United Arab Emirates	95.06	516,847	582	49,133,974	2
Belgium	(b)	(b)	(b)	(b)	(b)
Korea, Republic of	114.30	383,571	108	43,841,417	1
All other	59.28	8,764,012	9,290	519,511,160	17
OECD countries	103.53	13,434,444	10,369	1,390,802,199	46
Developing countries	64.81	25,029,376	17,663	1,622,131,931	54
Total	78.33	38,463,820	28,032	3,012,934,130	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 8517120020 and 8517120050).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $184.06 (see chapter 2).
[b]Data suppressed to protect confidentiality.

CHAPTER 3
Characteristics of U.S. Used Electronic Products Exports[1]

Overview

This chapter provides information on the product condition—whether processed or intact—of U.S. exports of used electronic products (UEPs) in three categories: exports related to repaired or refurbished UEPs, exports related to recycled UEPs, and UEPs exported for disposal. It also reports the characteristics of export shipments, by both product category and exporting entity. Data presented are primarily based on information drawn from questionnaire responses, hearing testimony, and interviews with industry representatives. While this chapter compares reported export values among the three product categories, totals by volume are not directly comparable for repaired and refurbished UEPs, which are reported in number of units, and recycled UEPs and UEPs for disposal, which are both reported in tons.[2]

Product Condition of U.S. Exports of UEPs by Product Category

The product condition of U.S. exports of UEPs depends on both the type of equipment and its intended destination market. However, because some products (such as computers and cell phones) have value as both refurbished goods for reuse and as scrap materials for recycling, it becomes difficult to track how they are being used once they reach the intended export market.[3] In practical terms, intact goods exported for refurbishing likely face a triage (sorting) process, as they would in the United States, with some UEPs being refurbished and resold as working products while the less valuable items in a shipment are slotted for either recycling or disposal at the export destination. Further, in the Schedule B documentation, exporters do not identify the intended use of UEPs in foreign markets, or whether the shipment consists of new or used equipment.

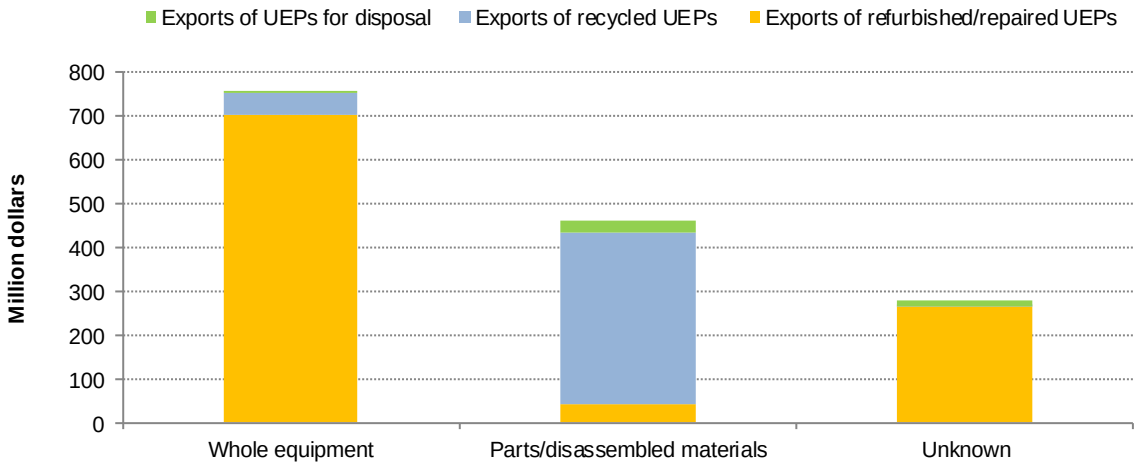
By value, exports of whole equipment (in working condition or for repair) led overall exports of UEPs in 2011 (figure 3.1). Over half of this equipment (53 percent) by value was UEPs intended for reuse, including computers, cell phones, and medical imaging equipment. Products resold for reuse as working electronic products generally yield a

[1] Unless otherwise noted, results presented throughout this chapter are based on USITC calculations of weighted responses to the Commission questionnaire. In order to reduce the burden on questionnaire respondents, the questionnaire did not survey organizations with less than 10 employees. The estimates presented in this report apply to the U.S. UEP industry for organizations composed of 10 or more employees only.

[2] Tons are short tons, equal to 2000 pounds.

[3] Industry representative, telephone interview by USITC staff, February 7, 2012.

FIGURE 3.1 Whole equipment accounted for the largest share of U.S. exports of UEPs in 2011



Source: USITC calculations of weighted responses to the Commission questionnaire.

larger payout than do components shipped for recycling, so products with resale value are unlikely to be recycled.[4]

Disassembled materials and parts from recycled products accounted for another large segment of U.S. exports of UEPs in 2011. In terms of value, commodity metals, plastics, and glass, along with parts not intended for reuse (such as whole and shredded printed circuit boards, wires and cables, and monitors and televisions containing CRTs), made up the majority (91 percent) of total U.S. exports of recycled UEPs in 2011. Many exports of commodities are directed to the world's primary manufacturing centers in China and India; U.S. demand for these raw materials is much lower.[5]

Though only a small share of all UEP exports consisted of UEPs intended for disposal, nearly two-thirds of such exports were commodity materials or parts. Some domestic OEMs reportedly require destruction of whole used equipment in the United States, either because of data security concerns or to avoid cannibalizing sales of new products on the market. This practice results in the recycling of some intact (and working) goods, and likely limits some exports of whole equipment for recycling or disposal.[6]

Some export shipments of refurbished or repaired UEPs are of mixed electronic products and likely contain both whole goods and reusable parts. Respondents may have reported the product category as "unknown" for these shipments. For recycled UEPs, exporters classified less than 1 percent of export shipments as "other" or "unknown."[7] However,

[4] Sometimes the margins are slim. For example, according to one industry source the scrap value of a computer monitor is approximately $6, while a monitor for reuse will fetch between $12 and $15. Industry representative, interview by USITC staff, February 24, 2012.

[5] USITC, hearing transcript, May 15, 2012, 58 (testimony of Renee St. Denis, Sims Recycling Solutions); USITC, hearing transcript, May 15, 2012, 26 (testimony of Dag Adamson, LifeSpan Recycling).

[6] USITC, hearing transcript, May 15, 2012, 66 (testimony of Gordon Scott, Forever Green Recycling).

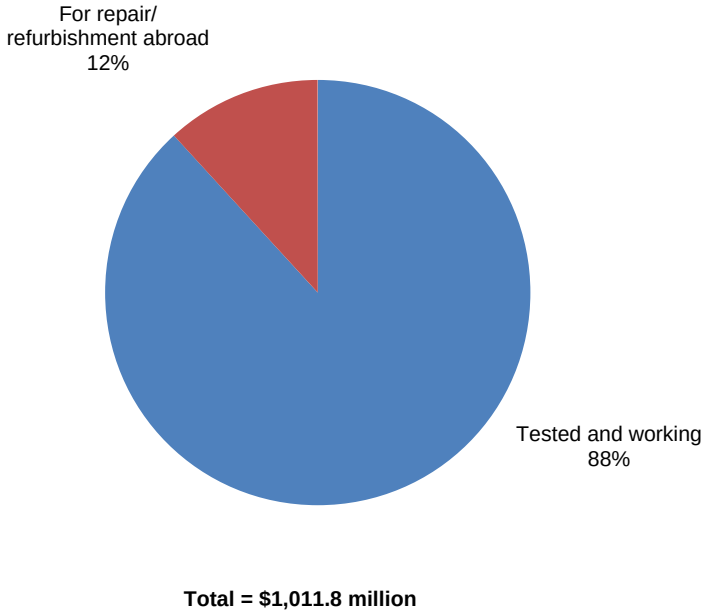
[7] On the questionnaire, respondents could specify "other" for products not listed, or "unknown" for shipments where the exporter did not know the types of products being exported.

this category accounted for one-quarter of exports of refurbished/repaired UEPs, and nearly one-third (26 percent) of UEPs for disposal.

U.S. Exports of Refurbished and Repaired UEPs

By value, nearly all (88 percent) of estimated 2011 U.S. exports of refurbished and repaired UEPs were in tested and working condition (figure 3.2). Though anecdotal information suggests widespread demand for nonworking UEPs to be repaired or refurbished abroad, the questionnaire responses alone did not confirm this. Several industry sources speculated that questionnaire data for tested and working products could be incomplete because there are no restrictions on exports of these goods, so many domestic firms do not track sales of tested and working equipment.[8] At least one domestic entity sells such goods to contractors that then resell the products on eBay, making it impossible to determine whether the goods ultimately end up in domestic or foreign markets.[9]

FIGURE 3.2 Most 2011 U.S. exports of repaired/refurbished UEPs were in tested and working condition



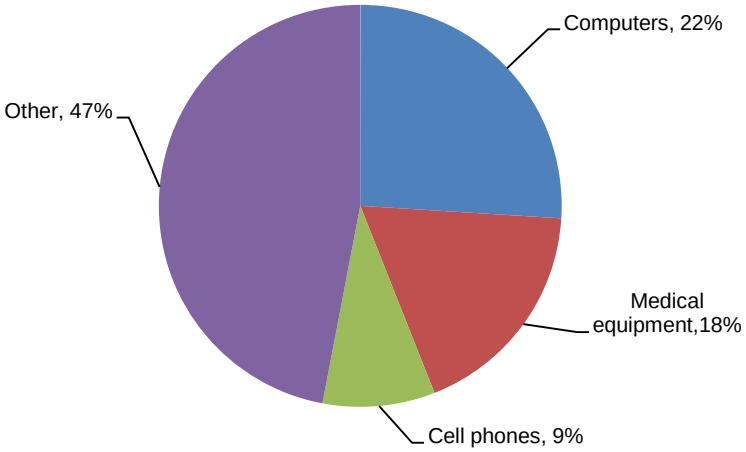
Source: USITC calculations of weighted responses to the Commission questionnaire.

The questionnaire asked U.S. exporters for data on products in tested and working condition as well as equipment intended for repair or refurbishment abroad. The disaggregated data could not be precisely estimated, so only combined exports are reported in table 3.1. In 2011, U.S. exports of computers accounted for an estimated 23 percent of the value of total U.S. exports of repaired/refurbished UEPs, while exports of medical equipment accounted for another 17 percent of the value of this category (table 3.1). In contrast, by number of units, cell phones and telecommunications

[8] Industry representative, telephone interview by USITC, February 15, 2012.
[9] Ibid.

equipment made up the largest product category, accounting for 9 percent of total U.S. exports of repaired/refurbished UEPs (figure 3.3).[10]

FIGURE 3.3 U.S. exports of tested and working equipment UEPs, by value, 2011



Total = $893.0 million

Source: USITC calculations of weighted responses to the Commission questionnnaire.

Note: Covers 88 percent of 2011 U.S. exports of refurblished/repaired UEPs.

TABLE 3.1 Estimated U.S. exports of refurbished and repaired UEPs, by product, 2011

Product	Value	Volume
	Million $	Million units
Computers	232.0	4.5
Medical imaging equipment	175.6	[b]
Cell phones and other telecommunications equipment	142.6	9.1
Computer peripheral equipment	77.8	[a]8.8
Whole printed circuit boards	43.4	0.3
Televisions and other video and audio equipment	40.7	[a]1.0
Flat screen monitors	21.3	[a]3.6
Office imaging equipment	12.4	[a]1.1
Monitors and televisions containing CRTs	[a] 1.8	[a]0.2
Other[c]	232.5	[a]54.9
Unknown	[a]31.9	[a]0.4
Total	1,011.8	83.9

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: Includes tested and working UEPs, and goods exported for repair and refurbishment overseas.

[a]Low-precision estimates, with RSE above 50 percent.
[b]Less than 0.1 million units.
[c]"Other" encompasses a wide range of varied producers that did not match the survey categories (e.g., spare parts, modules, networking equipment, and non-imaging medical equipment).

[10] Estimates for equipment in tested and working condition were generally robust, with RSEs lower than 50 percent, while RSEs for estimates for products intended to be repaired/refurbished abroad were larger than 50 percent for many products, with the exception of cell phones and other telecommunications equipment.

According to one U.S. computer refurbisher, new computing equipment sold in the United States is built to higher quality standards than new equipment marketed in many developing countries. This is primarily because U.S. consumers are willing to pay a premium for better quality. U.S. firms in data-intensive industries can justify replacing functional computing equipment every few years because productivity gains allow them to cover the replacement cost. Thus, used U.S. computing equipment in working condition commands high resale values in foreign markets.[11] An estimated 50 percent of the 30 million PCs refurbished domestically in the Microsoft refurbisher network are exported, mainly to Latin America.[12] While higher-value computers are more likely to be resold in the United States, industry sources reported that a refurbished laptop priced at $50 or lower has no domestic market and therefore will be exported.[13] One industry source estimated a failure rate of 2 to 3 percent for refurbished computers, which is reportedly comparable to failure rates of new equipment sold by OEMs.[14]

Though medical imaging equipment accounted for almost one-fifth of the value of total exports of UEPs in tested and working condition in 2011, by volume these machines made up less than 1 percent of total units exported. Resale values for such sophisticated and technologically complex machines are high, and salvage values are low. Repair expertise for this type of equipment is not yet diffused around the globe, as is the case for other types of electronic products; therefore, it is more common to sell these machines in working condition.

In 2011, cell phones amounted to 9 percent of U.S. exports of tested and working UEPs. While U.S. exports of used and new cell phones were formerly limited to North and South America, owing to differences in global wireless standards, now many U.S. phones work in markets around the globe.[15] Cell phones were also a major component of U.S. exports of UEPs for repair and refurbishment abroad in 2011. By value, cell phones and telecommunications equipment accounted for an estimated 54 percent of U.S. exports of such UEPs in 2011 ($64.2 million) and for 85 percent of the volume of such exports (7.8 million units).

Compared with exports of tested and working UEPs, computers accounted for very little of reported U.S. exports for repair/refurbishment abroad. While anecdotal data suggest that computers represent a significant portion of U.S. exports for both tested and working products and UEPs intended for repair or refurbishment,[16] questionnaire responses indicated that computers and parts for repair or refurbishment abroad accounted for only 2 percent of the total by value and by volume.

Demand for UEPs for refurbishment and repair is reportedly strong in Mexico and parts of Asia, especially India and China. These countries have established capacity in

[11] Industry representative, interview by USITC staff, February 28, 2012; written submission to the USITC, PC Rebuilders and Recyclers, May 15, 2012, 3.

[12] Industry representative, telephone interview by USITC staff, April 2, 2012. In 2010, Microsoft Corporation launched a program licensing the installation and use of its software in used personal computers. As of July 2012, the Microsoft Registered Refurbishers Program had 4,505 registered refurbishers in 100 countries; some 621of these refurbishers are located in developing countries. Microsoft website, www.microsoft.com/refurbishedpcs (accessed August 3, 2012).

[13] Industry representative, telephone interview by USITC staff, April 2, 2012.

[14] USITC, hearing transcript, May 15, 2012, 139 (testimony of Charles Brennick, InterConnection.org).

[15] Government representative, telephone interview by USITC staff, January 25, 2012.

[16] Industry representative, interview by USITC staff, February 8, 2012; government representative, telephone interview by USITC staff, January 25, 2012.

domestic industries that repair UEPs and resell products locally.[17] Based on questionnaire data, Mexico, India, and China received 17 percent, 13 percent,[18] and 9 percent of U.S. exports of UEPs by value, respectively, in 2011. Established industries for recycling UEPs were also reported in Bangladesh, Kenya, and Ghana, while refurbishing operations for UEPs are very active in Brazil.[19] However, judging from the Commission's questionnaire results, the United States is not an important source of the inputs for those repair industries, as most U.S. exports related to repaired and refurbished UEPs are in tested and working condition.

Resale of reusable parts from the latest generation of technology is profitable and the source of considerable global demand.[20] A U.S.-based OEM with global operations reported that U.S. exports of parts from UEPs are largely intended for repair facilities abroad, with some goods reimported into the United States after being repaired under warranty. The key factors in these exports are localized expertise and OEM corporate policy. As electronics become more technologically sophisticated, the parts are increasingly specialized. According to one industry source, every domestic OEM likely exports some UEPs as part of its repair supply chain.[21] Repair, refurbishing, and testing processes for mass market, consumer-oriented products are consolidated for efficiency.[22] These companies likely perform more repairs in the destination markets for their new products to save on transportation costs.[23] However, such exports were not a significant component of U.S. exports of UEPs for refurbishment or repair in 2011; less than 6 percent of these UEPs were expected to return to the United States after being repaired abroad. This is consistent with the small share of U.S. exports of UEPs for repair or refurbishment overseas as a proportion of all U.S. exports of repaired or refurbished UEPs.

U.S. Exports of Recycled UEPs

U.S. companies that exported a significant share of processed materials reported that commodity-grade scrap materials represented the majority of their export volume (box 3.1).[24] Consistent with these statements, 2011 U.S. exports of recycled UEPs primarily consisted of commodity materials (an estimated 64 percent of total tonnage) (table 3.2). While the questionnaire did not ask respondents to detail the composition of the recycled commodities, one industry source estimated the general content of

[17] USITC, hearing transcript, May 15, 2012, 159–60 (testimony of Kyle Wiens, iFixit); government representative, telephone interview by USITC staff, January 25, 2012; Kakkar, "Scrap to Silver," September 29, 2010. Chapters 2 and 5 of this report give more information on the destinations of U.S. exports, as reported in the questionnaire.

[18] Low-precision estimate, with RSE equal to 57 percent. These shares are based on questionnaire data.

[19] USITC, hearing transcript, May 15, 2012, 96 (testimony of Renee St. Denis, Sims Recycling Solutions); USITC, hearing transcript, May 15, 2012, 159–60 (testimony of Kyle Wiens, iFixit); Lepawsky and Billah, "Making Chains That (Un)make Things," 2011, 121–39.

[20] One U.S. recycler reported holding parts from newer technologies for resale for up to 36 months. Industry representative, interview by USITC staff, February 24, 2012.

[21] Industry representative, telephone interview by USITC staff, April 25, 2012.

[22] For example, mass market, lower valued goods such as cell phones, DVD players, or personal computers are sent by consumers to repair facilities for service under warranty, whereas higher value electronic products, such as network servers or MRI machines, would be serviced in-person.

[23] Industry representative, telephone interview by USITC staff, April 25, 2012.

[24] Industry representative, telephone interview by USITC staff, February 7, 2012; industry representative, telephone interview by USITC staff, February 24, 2012.

BOX 3.1 A shift from domestic refurbishing toward recycling

While the questionnaire covers only one year, 2011, and therefore does not address industry trends, industry representatives have observed a shift from domestic refurbishing toward recycling of UEPs. Rising commodity prices, declining technology costs, and new state-level recycling laws have all contributed to the change. Over the last three years in particular, many commodity prices have almost doubled, driving a dramatic rise in the manual disassembly industry in the United States.[a] Dismantling electronics equipment by hand reportedly preserves more economic value for recyclers because it allows more complete separation of the materials, resulting in higher resale values.[b] For example, while all copper removed during the dismantling process is valuable, copper from stripped wires has the highest value. Manually stripping the wires yields a high-grade product, whereas mechanical shredding melts all of a product's copper together, diluting the value of the higher-grade copper.[c]

The reuse market in developed countries is also changing due to declining product costs and more rapid software updates.[d] The arbitrage value between new and used electronic products has shrunk considerably since the 1980s, so that the cost of the component is minimal and the real cost to reuse a broken UEP is the labor involved in fixing it. For example, an LCD monitor may have originally cost $200, but a new replacement costs only $60, so paying a technician $20 or $30 per hour to repair it does not make economic sense. And once the PC is in working order, the latest generation of software may not run smoothly on the older hardware. As a result, the spread between the value of refurbished equipment and new equipment is being compressed dramatically, thus creating more incentives to recycle rather than export UEPs.[e] Finally, the recent enactment of many state-level recycling laws reportedly has created incentives for U.S. recyclers to dismantle used products for their materials value rather than export whole products for reuse.[f] (Chapter 6 provides further discussion on the impact of state-level recycling laws on UEP processing.)

[a] One U.S. recycler explained that in the 1990s, with gold prices at $275 per ounce, dismantling used goods by hand in the United States was cost prohibitive. Now that gold commands more than $1,750 per ounce, it is profitable to pay U.S. workers to disassemble electronics by hand. Industry representative, interview by USITC staff, February 24, 2012; industry representative, telephone interview by USITC staff, February, 15, 2012.
[b] Issues related to labor costs are addressed in more detail in chapter 6. USITC, hearing transcript, May 15, 2012, 211–12 (testimony of Willie Cade, PC Rebuilders & Recyclers).
[c] Industry representative, telephone interview by USITC staff, February 7, 2012.
[d] Industry representative, telephone interview by USITC staff, February 2, 2012.
[e] USITC, hearing transcript, May 15, 2012, 116 (testimony of Renee St. Denis, Sims Recycling Solutions).
[f] Academic representative, telephone interview by USITC staff.

TABLE 3.2 Estimated U.S. exports of recycled UEPs, 2011

Product	Value	Volume
	Million $	Tons
Commodity metals, plastics, and glass (not including CRTs)	216.1	209,197
Shredded printed circuit boards	[a]140.3	39,685
Monitors and televisions containing CRTs	[a]12.0	[a]18,516
Whole printed circuit boards	27.3	16,966
Computers	6.0	9,418
Cell phones and other telecommunication equipment	[a]20.3	[a]8,163
Computer peripheral equipment	8.0	7,622
Office imaging equipment	[a]2.1	[a]6,849
Wires and cables from any electronic product	5.0	6,740
Flat screen monitors	[a]1.2	[a]1,655
Televisions and other video and audio equipment	[a]0.4	[a]602
Medical imaging equipment	[a]0.1	[a]130
Separated CRTs, mercury lamps, and batteries	[(b)]	[a]8
Unknown	[a]0.3	[a]180
Other	[a]0.3	[a]2
Total	439.3	325,733

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: Totals may not add due to rounding. Since data on weights and values are not precise, they do not allow comparisons of value per ton for different products.

[a]Low-precision estimates, with RSE above 50 percent.
[b]Less than $0.1 million.

commodity materials from UEPs to be 50–55 percent steel, 30 percent plastics, 10–12 percent aluminum, and 5–6 percent circuit boards bearing precious metals.[25]

Exports of monitors and televisions containing CRTs represented only 6 percent[26] of the total volume (and 3 percent[27] of total value) of recycled UEP exports, but, consistent with anecdotal information, these were the most commonly exported whole goods for dismantling and recycling abroad.[28] Together, shredded and whole circuit boards accounted for 17 percent of the total volume of recycled exports of UEPs in 2011, but made up 38 percent of the total value of such exports, likely owing to their relatively high precious metals content. As discussed in chapter 5, most circuit boards are exported to large secondary smelters in OECD countries.[29]

In 2011, estimated U.S. exports of shredded circuit boards for recycling totaled nearly 40,000 tons, while such exports of whole circuit boards amounted to just under 17,000 tons. The recycling value of circuit boards varies, depending on their precious metal content, which in turn depends on the machine they originate from. A distinction is made between high-grade boards (found in servers, cell phones, and PCs) and low-grade boards(found in printers, copiers, and other digital imaging equipment). High-grade boards contain more concentrated amounts of precious metals and are therefore more valuable.

Industry practice is to export high-grade circuit boards to secondary smelters whole, while lower-grade circuit boards may be shredded domestically and then exported. High-grade boards are not shredded domestically for two reasons: (1) domestic shredders do not allow a perfect separation of the precious metal elements, so domestic shredding would dilute their value, and (2) some dust containing precious metals could be lost during processing and shipment of shredded boards.[30]

It is more difficult to determine the final value of lower-grade circuit boards, so U.S. companies are likely to shred and sample the material domestically to determine the value of precious metals before exporting to a larger smelter. There are no domestic secondary smelters that can process circuit boards completely, at least not on a large scale.[31] The start-up costs for such a facility are reportedly around $2 billion.[32]

[25] Industry representative, telephone interview by USITC staff, February 28, 2012.

[26] Low precision estimate; RSE equal to 64 percent.

[27] Low precision estimate; RSE equal to 65 percent.

[28] Industry representative, telephone interview by USITC staff, February 24, 2012.

[29] According to industry sources, these large smelters can recover up to 20 precious elements from circuit boards while U.S. smelters recover between 8 and 12. Government representative, telephone interview by USITC staff, January 25, 2012.

[30] Industry representative, telephone interview by USITC staff, April 27, 2012.

[31] At least three U.S. companies reportedly break down circuit boards to successfully remove precious metals, but they are not secondary smelters. For final processing, as noted earlier, circuit boards are typically sent to secondary copper smelters in OECD countries (Japan, Belgium, Sweden, Canada, and Korea). Industry representative, telephone interview by USITC staff, February 18, 2012; industry representative, telephone interview by USITC staff, February 2, 2012; USITC, hearing transcript, May 15, 2012, 76–77, 96 (testimony of Renee St. Denis, Sims Recycling Solutions).

[32] Government representative, telephone interview by USITC staff, January 25, 2012.

U.S. Exports of UEPs for Disposal[33]

Several industry representatives indicated that U.S. exports for disposal are driven by a lack of domestic processing capacity and were likely to include used CRTs and batteries.[34] Estimates for disposal based on the questionnaire data, while imprecise, support this anecdotal information. CRTs, mercury lamps, and batteries accounted for the highest volume and costs of disposal of all U.S. exports of UEPs for disposal in 2011 (table 3.3). Other products with large shares by value or weight included commodity materials and circuit boards. As previously discussed, the value of printed circuit boards is driven by their high precious-metal content, and these circuit boards are likely destined for secondary smelters in OECD countries.

TABLE 3.3 Estimated U.S. exports of UEPs for disposal, 2011

Product	Cost	Volume
	Million $	Tons
Separated CRTs, mercury lamps, and batteries	15.5	[a]139,958
Commodity metals, plastics, and glass (not including CRTs)	[a]3.0	[a]58,948
Shredded printed circuit boards	[a]8.3	[a]12,723
Televisions and other video and audio equipment	[a]1.6	[a]6,562
Cell phones and other telecommunication equipment	[a]1.5	[a]2,049
Wires and cables from any electronic product	[a]0.5	[a]1,014
Whole printed circuit boards	[a]0.2	[a]133
Monitors and televisions containing CRTs	[a]0.0	[a]47
Computers	0	[a]23
Office imaging equipment	0	[a]8
Medical imaging equipment	0	[a]7
Flat screen monitors	0	[a]5
Computer peripheral equipment	0	0
Other	[a]12.1	[a]19,802
Unknown	[a]1.8	0
Total	44.3	241,279

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: Totals may not add due to rounding. Since data on weights and values are not precise, they do not allow for comparisons of value per ton for different products with any confidence.

[a]Low-precision estimates, with RSE above 50 percent.
[b]Less than $0.1 million.
[c]"Other" encompasses a wide range of varied products that did not precisely match the survey categories (e.g., parts and mixed electronics).

The widespread popularity of flat screen TVs and monitors has curtailed global demand for CRT glass.[35] As a result, most used CRTs are reportedly recycled, rather than reused. Furnaces to manufacture CRT glass are scarce; reportedly, there are no remaining facilities in developed countries.[36] Industry sources indicated that several processors for recycling of used CRT glass exist in the United States (box 3.2). Still, the limited domestic capacity for recycling CRTs, compounded by firms' stockpiling in order to avoid paying disposal costs, has ensured continued U.S. exports of CRTs for recycling.[37]

[33] Disposal is defined in the questionnaire as "end-of-life disposition of used electronic products that a recycler or disassembler pays to dispose of rather than products that bring in income because they are sold as the output of a recycling process."
[34] Industry representative, telephone interview by USITC staff, February 2, 2012.
[35] USITC, hearing transcript, May 15, 2012, 74 (testimony of Gordon Scott, Forever Green Recycling).
[36] Cauchi, presentation at ISRI Conference, April 10, 2012.
[37] Resource Recycling, "CRT Glass Headed to CA Landfills," September 27, 2012.

BOX 3.2 CRT processors in the United States

Entities across the United States reportedly remove the lead from the old CRT glass in televisions and computer monitors to produce lead ingots and clean glass. Dlubak Glass Company is one firm which processes glass from various industries; CRTs account for approximately 10 percent of the 270,000-pound annual capacity of its Ohio and Arizona plants. In February 2012, Dlubak partnered with Regency Technologies in Ohio to offer complete breakdown, dismantling, and recycling of CRT glass into separate recyclable materials.[a] Closed Loop Refining and Recovery processes whole, intact CRT tubes and mixed broken CRT glass into lead ingots for batteries and glass for new glass-to-glass markets in its Phoenix, AZ, facility.[b]

Several other companies, including Universal Recycling Technologies and ECS Refining, are e-Stewards-certified domestic glass processors (see chapter 6 for a more detailed discussion of e-Stewards). Universal Recycling Technologies is headquartered in Wisconsin and owns five recycling facilities located throughout the country.[c] ECS Refining, which characterizes itself as "one of the few complete domestic solutions for CRT devices," has four processing centers located in California and Texas.[d]

In addition, Comp Two Computer in Chicago can process colored glass from CRTs into clean colored glass.[e] Another global company reported that its U.S. operations are currently investing in furnaces to break CRTs down to silica and glass.[f]

[a] Dlubak Glass Company website, http://www.dlubak.com (accessed August 10, 2012); Regency Technologies, "Regency Technologies Announces New CRT Glass Recycling Facility," February 15, 2012.
[b] Closed Loop Refining and Recovery website, http://www.cirrusa.com/ (accessed August 10, 2012).
[c] Universal Recycling Technologies website, http://universalrecyclers.com (accessed August 10, 2012).
[d] ECS Refining website, http://www.ecsrefining.com/services-and-markets/products-and-services/crt-glass-processing (accessed August 10, 2012).
[e] Cauchi, presentation at ISRI Conference, April 10, 2012; USITC, hearing transcript, May 15, 2012, 15 (testiomony of Gordon Scott, Forever Green Recycling).
[f] Industry representative, telephone interview by USITC staff, February 14, 2012.

Some CRTs are exported to large plants in Mexico, where they are reportedly washed and readied for further processing, and Canada, where the lead is removed.[38] According to one industry source, it is likely that future U.S. exports of CRTs for recycling will end up in India, as the only other glass-to-glass furnaces in the world (in China and Malaysia) are scheduled to close by 2013.[39]

Despite the transition away from the use of CRTs in most developing countries, there is reportedly limited reuse of CRTs by Asian and African consumers. According to one source, Kenyan consumers developed strong demand for digital-capable televisions after the analog-to-digital conversion was recently completed. CRT monitors from old computers are imported and combined with circuit boards to become functioning televisions.[40] Another source remarked that CRT computer monitors will likely continue to enjoy popularity in developing countries because they are reportedly more reliable than flat screen monitors in humid climates without air conditioning.[41]

[38] Industry representative, telephone interview by USITC staff, January 31, 2012; industry representative, telephone interview by USITC staff, July 26, 2012.
[39] Industry representative, telephone interview by USITC staff, February 15, 2012; Cauchi, presentation at ISRI conference, April 10, 2012.
[40] USITC, hearing transcript, May 15, 2012, 194 (testimony of Kyle Wiens, iFixit).
[41] Industry representative, interview by USITC staff, May 16, 2012.

Shipment Characteristics and Product Mix

U.S. export shipments of UEPs take one of the following forms: homogenous groups of identical products, mixed UEPs, or UEPs mixed with other goods (not electronic products). The composition of shipments depends primarily on the intended use of the product and its destination market. Most UEPs are shipped by sea in gaylords (large, pallet-sized containers used for shipping in bulk quantities), although some products are shipped by air (likely high-value repairs under warranty or for re-import), and shipments to Canada or Mexico may be transported by truck.[42] Industry sources report that a wide variety of Schedule B codes are used to classify shipments of used UEPs, ranging from basic codes for commodities (e.g., aluminum and copper scrap), to whole goods (e.g., computers), to component parts of whole equipment (e.g., electronic integrated circuits).[43]

Shipping by Sea

Official shipment data for UEPs are limited; Schedule B codes do not distinguish between exports of new goods and used goods. Bills of lading submitted at U.S. ports may be inaccurate, or may not fully reflect the true inventory of the export container, either because exporters do not know it or because they are grouping UEPs with other types of goods. Or, bills of lading might also be prepared to circumvent foreign laws that prohibit importation of hazardous goods, as has been reported for some interdicted shipments through Hong Kong, a major shipping hub for exports to Asian countries.[44] Anecdotal information from the industry suggests that nonfunctional goods and parts may be packed together with working equipment for shipment. In these cases, when the container arrives at a foreign port, the working equipment is separated out for resale while the rest may be repaired and resold, disassembled for scrap materials, or disposed of at little or no cost to the importer.[45] In other cases, shipments of used electronics may be labeled as other unrelated goods or included with household products, such as furniture or auto parts.[46] Anecdotal information suggests that the contents of a shipping container may be reliably inferred from its sales price. An industry representative reported that if a container is valued at $30,000 or more, those goods are likely to be reused as working UEPs, while a container valued at $10,000 or less is probably full of scrap materials. Full containers of UEPs do not generally sell for prices between $10,000 and $30,000.[47]

Electronic products and parts with substantial bulk and weight, such as PCs and computer monitors, are likely to be shipped by sea.[48] The commodity outputs from disassembling

[42] In addition, some nonprofits may employ travelers to personally carry equipment with them to foreign markets. USITC, hearing transcript, May 15, 2012, 139 (testimony of James Brennick, InterConnection.org).

[43] The U.S. Bureau of the Census administers Schedule B numbers, which are used to classify exported products into predetermined product categories.

[44] Government representative, telephone interview by USITC staff, February 28, 2012.

[45] Industry representative, telephone interview by USITC staff, February 8, 2012.

[46] Industry representatives, interview by USITC staff, March 30, 2012; government representative, interview by USITC staff, February 28, 2012; USITC, hearing transcript, May 15, 2012, 254 (testimony of Wendy Neu, CAER).

[47] Industry representative, interview by USITC staff, February 28, 2012.

[48] USITC, hearing transcript, May 15, 2012, 87 (testimony of Lane Epperson, HiTech Assets).

UEPs (including metals, plastics, and glass) are also likely to be shipped by sea to manufacturing centers in Asia.[49] Very large product volumes are required to fill a shipping container.[50] Several U.S. recyclers reported that their operations alone do not generate enough volume to justify the cost of exporting; in fact, the UEP industry consists of many small companies, so it is unlikely that most single companies can achieve this scale.[51] Other firms (brokers) serve as intermediaries, consolidating shipments from many companies to fill an entire shipping container. One company remarked that while all of its direct sales are to other U.S. companies, their outputs are likely consolidated with similar items from other recyclers and then exported.[52] A scarcity of data arising from the small size of some brokerage firms and the closed nature of the industry makes it difficult to assess the prevalence of this practice.

Product Mix of Shipments

The questionnaire asked exporters to report the most common type of export shipment (whether single product, mixed electronics, or mixed with other products) for all three product categories (refurbished or repaired UEPs, recycled UEPs, and UEPs for disposal). While some sources suggest that shipment type depends at least in part on the intended export market, the questionnaire did not gather data for export shipment characteristics together with export markets.

It is widely reported that the contents of export containers with UEPs vary. CRTs in particular are reportedly exported in a wide range of conditions, from working products pristinely packaged to broken units inserted into a gaylord[53] containing other reusable products.[54] For example, the UK Environment Agency reportedly has found containers of CRTs mixed with other kinds of non-electronic goods.[55] According to one industry representative, this practice would allow U.S. exporters to avoid paying disposal costs, and the importer may dump the CRTs at no cost when they arrive at the foreign port.[56] Because the exporter pays by container, an incentive exists to maximize the amount of goods in each container. Sometimes shipments may contain harmful materials (box 3.3).

Single Product Type

U.S. exporters of UEPs indicated that products intended for disposal were more likely to be shipped as single (unmixed) products than were the other two product categories (figure 3.4). As noted earlier, a substantial share of UEPs for disposal were exported as commodity materials (24 percent by weight),[57] which likely explains some of the single

[49] USITC, hearing transcript, May 15, 2012, 88 (testimony of Renee St. Denis, Sims Recycling).

[50] According to one U.S. recycler, it takes between 750 and 900 CRTs to fill a gaylord for shipping to a foreign port. USITC, hearing transcript, May 15, 2012, 89 (testimony of Gordon Scott, Forever Green Recycling).

[51] Industry representative, telephone interview by USITC staff, February 15, 2012; industry representative, interview by USITC staff, February 24, 2012.

[52] Industry representative, telephone interview by USITC staff, February 15, 2012.

[53] A gaylord is a large box used for shipping bulk quantities.

[54] Industry representative, telephone interview by USITC, February 8, 2012; industry representative, telephone interview by USITC, February 28, 2012.

[55] Industry representative, telephone interview by USITC staff, March 30, 2012; government representative, telephone interview by USITC, February 28, 2012.

[56] Industry representative, telephone interview by USITC, February 8, 2012.

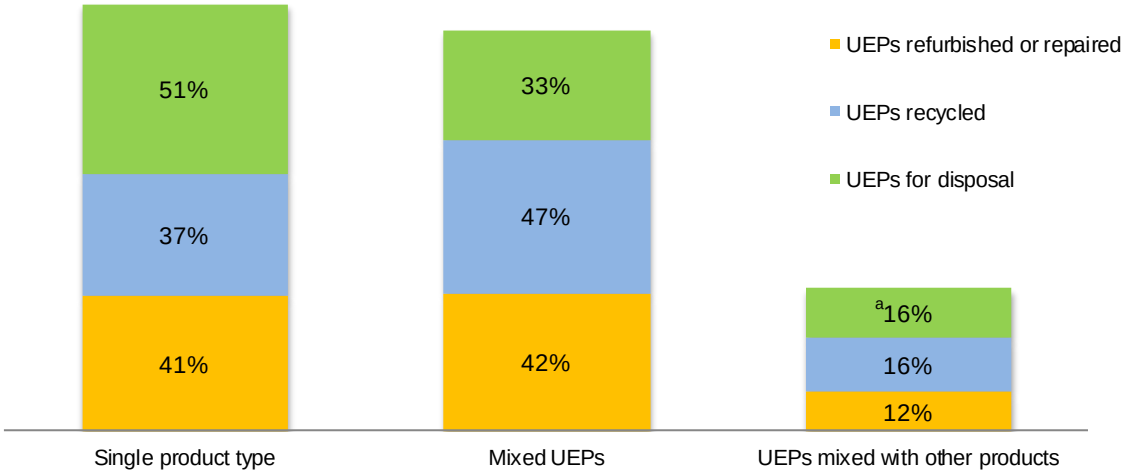
[57] Low-precision estimate, with an RSE equal to 62 percent.

BOX 3.3 Disagreements regarding reported export shipments

While opinions differ among parties in the used electronics industry on a number of topics, one of the most serious disputes concerns what is shipped and where it eventually ends up. For example, a Seattle-based NGO, the Basel Action Network (BAN), is currently engaged in legal proceedings with Intercon Solutions, an electronics recycling company based in Illinois. Press reports are inconclusive but highlight two contrasting stories. In 2011, Intercon reportedly approached BAN to submit to an audit in order to become certified under the organization's e-Stewards program (see chapter 6 for more discussion on industry certification programs). In the course of its audit, BAN alleged that Intercon initiated an illegal shipment of UEPs containing harmful materials to China, and made this information public. Intercon CEO Brian Brundage denied the allegations, and Intercon filed a defamation lawsuit against BAN in Illinois state court in June 2012.[a] BAN filed a federal counterclaim seeking declaratory relief for its reputation in September 2012.[b]

[a] Paicely, "Protecting the Earth or Just Pretending?" September 17, 2012.
[b] Basel Action Network, "BAN Denies Defamation Allegations," September 4, 2012.

FIGURE 3.4 2011 U.S. exports of UEPs, reported shipment characteristics by container content



Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: Total shipments by container type add up to 100% for each product category, except refurbished or repaired, which sums to 95%. The remaining 5% of such shipments were intended for repair overseas and expected to be shipped back to the United States after repair.

product shipments, as commodities are generally separated from whole products. Also, many firms may be shipping entire gaylords of CRTs for disposal to a single destination. There was little difference in the shares of recycled UEPs and repaired/refurbished UEPs shipped as single products.

Mixed UEPs

While recycled UEPs were slightly more likely than repaired/refurbished UEPs to be shipped with mixed electronic products, both product categories had a greater share of shipments with other electronics than did UEPs for disposal. As was the case with single product shipments, similar shares of mixed UEP shipments were likely for both exports of recycled UEPs and refurbished/repaired UEPs.

Occasionally, shipments of mixed electronic products allow the U.S. exporter flexibility. For example, shipments of working computers from noncommercial refurbishers may contain surplus parts and systems in case of accidental breakage. Because warranties on such exports are not viable, this method allows companies to ensure that they deliver goods in fully working condition.[58] Shipments of mixed electronic products sometimes reflect the method of collection. The types of UEPs collected from consumers or by municipalities are likely to be obsolete and destined for recycling or disposal, rather than reuse. For example, at a county collection drive, a large export container will often be waiting in a parking lot and all products will be mixed together as the container is loaded, without sorting.[59] By contrast, commercial collections are more valuable, both due to the larger scale and the lower age of the equipment, and are more likely to be carefully packaged for shipment and reuse.[60]

UEPs Mixed with Other Products

Overall, exports of UEPs in each of the three product categories were more likely to be shipped together with electronic products than with other types of goods. Compared with U.S. exports of recycled UEPs and those intended for disposal abroad, repaired or refurbished UEPs were estimated to be slightly less likely to be shipped with other non-electronic products.[61]

Product Mix by Type of Exporter

Among the different types of domestic UEP organizations, based on their primary activities, recyclers, refurbishers, and collectors reported mostly single-product UEP export shipments (table 3.4). In contrast, wholesalers and disassemblers primarily exported mixed UEPs. The disassemblers also reported substantial exports of single product shipments. For metal recovery entities, export shipments were almost evenly divided between single products and mixed UEPs.

Shipping by Air

One U.S. firm reported that all of its international shipments of remanufactured or repaired parts are by air. These parts are viewed as time sensitive and high value. While

[58] TechSoup, written submission to the USITC, April 15, 2012, 2.

[59] Industry representative, telephone interview by USITC staff, January 31, 2012.

[60] USITC, hearing transcript, May 15, 2012, 171 (testimony of Charles Brennick, InterConnection.org); industry representative, interview by USITC staff, February 28, 2012.

[61] The estimated 16 percent of UEPs for disposal in shipments of UEPs with other products is a low-precision estimate, with RSE equal to 79 percent.

TABLE 3.4 U.S. exports of UEPs, by container content of shipments and exporting firm's primary activity, 2011

Container content	Primary activity							
	Recyclers	Wholesalers	Refurbishers	Disassemblers	Collectors	Metal recovery	Other	Not used electronics[c]
	Percent							
Single UEPs	49	27	44	40	46	[a]40	[a]42	[a]5
Mixed UEPs	[a]22	60	38	48	25	[a]46	[a]44	[a]63
With other products	0	[a]11	15	[a]12	[a]14	[a]13	0	[a]32
For repair overseas[b]	[a]29	2	3	0	[a]15	0	[a]13	0
Total	100	100	100	100	100	100	100	100

Source: USITC calculations of weighted responses to the Commission questionnaire.

[a]Low precision estimate, with an RSE above 50 percent.
[b]Goods expected to be shipped back to the United States.
[c]These businesses are involved in the UEP industry, but used electronics processing is not a core function.

shipping by sea can reportedly take up to three or four weeks, shipping by air occurs in an average of four days. Because technology prices are constantly declining, this firm sees a sense of urgency in delivering used goods for reuse, rather than for recycling.[62] According to another industry source, UEPs shipped by air freight generally consist of smaller, lighter devices such as laptops or cell phones.[63]

Shipping by Land

As discussed in chapters 2 and 5, both Mexico and Canada are major hubs of UEP processing, attracting significant exports from the United States. In 2011, Mexico was the second-largest market for U.S. exports of UEPs, while Canada was the sixth-largest export destination. Many of these exports likely move by truck.[64]

Mexico is home to a thriving refurbishing and repair industry for UEPs.[65] Local companies reportedly dismantle UEPs by hand. Some of these products are repaired or refurbished for reuse and returned to the United States for resale. Others are resold as working goods in Mexico, while still others enter the global recycling stream.[66]

Canada has a major secondary smelting industry. Sims, one of the world's largest electronics and metal recycling companies, has a very high technology processing plant in Canada where the company processes CRTs from the United States.[67] In addition, Quebec is home to a major secondary smelter, Xstrata, with copper smelting and refining capacity.[68]

[62] USITC, hearing transcript, May 15, 2012, 87 (testimony of Lane Epperson, HiTech Assets).
[63] Industry representative, telephone interview by USITC staff, April 25, 2012.
[64] The questionnaire did not solicit data on this method of transport, so a comparison of anecdotal data and questionnaire responses for U.S. exports of UEP by truck is not possible.
[65] Government representative, telephone interview by USITC staff, January 25, 2012; Retroworks website, http://www.retroworks.net/retroworksofmexico.html (accessed October 12, 2012).
[66] USITC hearing transcript, May 15, 2012, 186-87 (testimony of Robin Ingenthron, Retroworks). Retroworks website, http://www.retroworks.net/retroworksofmexico.html (accessed October 12, 2012).
[67] USITC, hearing transcript, May 15, 2012, 122 (testimony of Renee St. Denis, Sims Recycling Solutions).
[68] Xstrata website, http://xstratarecycling.com (accessed October 8, 2012).

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CHAPTER 4
Domestic Exporting Entities[1]

Overview

This chapter provides information on the characteristics and forms of U.S. entities exporting used electronic products (UEPs). Information is drawn from questionnaire data, hearing testimony, submissions to the Commission, and interviews with industry officials. In these interviews, one commonly expressed view was that "everyone exports—from all parts of the supply chain."[2] As discussed in chapter 1, the used electronics supply chain comprises the processes and channels through which UEPs travel (see figure 1.1).[3] It is likely that some UEPs are exported at each stage of the supply chain, creating a broad spectrum of entities and motivations for exporting.[4]

Exporters include firms that collect, disassemble, refine, refurbish, repair, and resell or donate UEPs, components, and commodity materials. As noted earlier, firms conducting such activities range widely in size and include diverse organizations such as OEMs, IT asset managers, reverse logistics providers,[5] recyclers, and nonprofits.

Characteristics of Exporting Entities

This section relies on Commission questionnaire data to examine the characteristics of exporters. More than a quarter of the organizations active in the UEP industry are directly engaged in exporting, and an additional 27 percent are reasonably certain that at least some of their output is later exported by another organization. The propensity to export is likely related to both an entity's primary activity and other characteristics, such as certification status.

[1] Unless otherwise noted, the data presented throughout this chapter are based on Commission calculations of weighted responses to the Commission questionnaire. In order to reduce the burden on questionnaire respondents, the questionnaire did not survey organizations with less than 10 employees. The estimates presented in this report apply to the U.S. UEP industry for organizations composed of 10 or more employees only.

[2] Industry representatives, telephone interviews by USITC staff, January 25 and 31, 2012. The Sims representative emphasized the complexity of the recycling supply chain and the sheer number of its participants, noting that the products may cross international borders more than once as they are recycled. USITC, hearing transcript, May 15, 2012, 41 (testimony of Renee St. Denis, Sims Recycling Solutions).

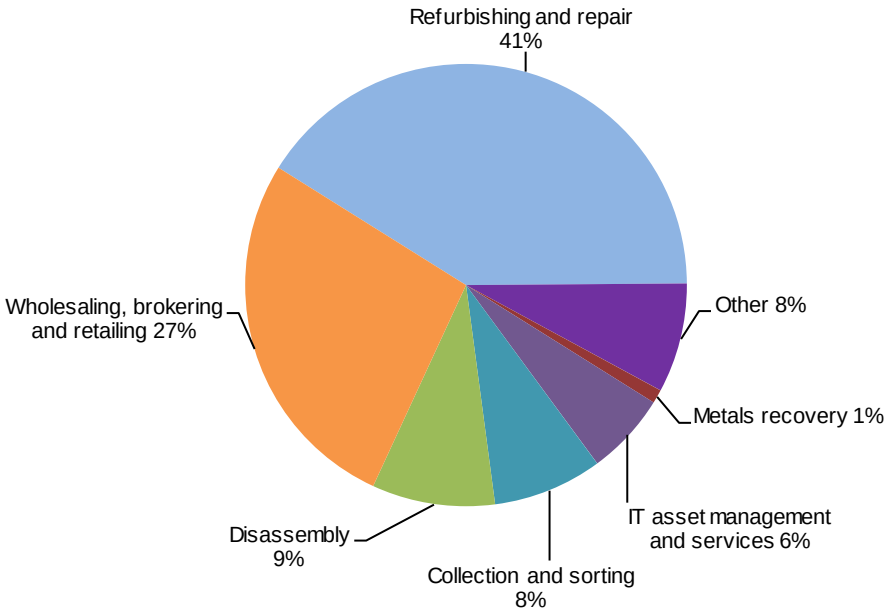
[3] These activities of OEMs and retailers are referred to as their "reverse supply chain" and may also include management of inventory in retail outlets that is not yet sold to the end customer but that is damaged, defective, or otherwise returned to the OEM. Such products are also considered "used."

[4] For example, industry participants may export whole products before disassembling them, or may export component materials after disassembly, which entails different cost considerations and export destinations. See chapter 2 for a discussion of the types of UEPs being exported.

[5] Reverse logistics firms provide services to electronics OEMs and retailers—managing returned or recalled products, and repairing products under warranty. These aftermarket services are often offered by original design manufacturers (ODMs) or contract manufacturers.

Forty-one percent of entities reporting exports in 2011 were primarily engaged in refurbishing and repair, followed by wholesaling, brokering, and retailing at 27 percent (figure 4.1).[6]

FIGURE 4.1 Share of UEP-exporting entities by primary activity, 2011



Source: USITC calculations of weighted responses to the Commission questionnaire.

Exporters According to Form of UEP Exports

The Commission collected data on U.S. exports of three different sets of UEPs—that is, on sales related to refurbished and repaired goods, sales related to recycling, and payments for recycling or disposal. [7] Note that these forms of U.S. exports are distinct from the primary activity of the exporter, although the data show a logical correlation.[8] The data indicate that by volume, entities primarily engaged in refurbishing and repair accounted for the majority of exports related to refurbishing.[9] Similarly, entities whose primary activity was disassembly accounted for most of the exports of UEPs related to

[6] Many UEP firms are engaged in more than one of these activities. However, the questionnaire required each responding organization to identify one as their primary activity.

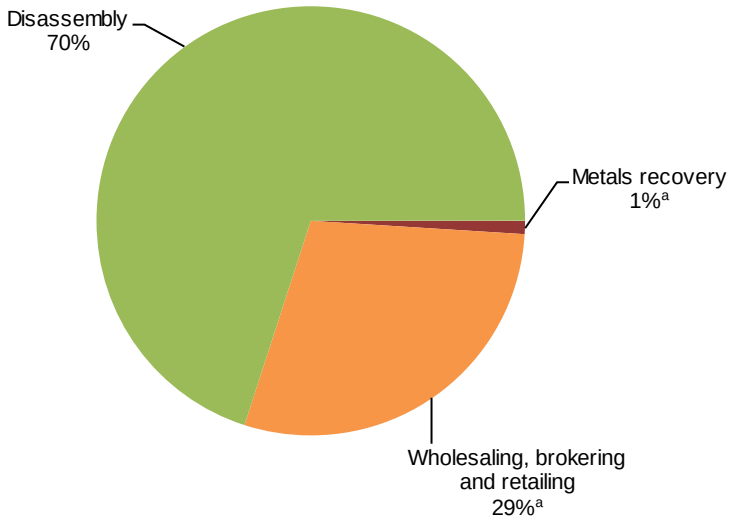
[7] The volume of these UEPs cannot be aggregated because they were reported in different forms—units for refurbished goods, and weight for materials slated for recycling and disposal.

[8] For example, an entity that reports its primary activity as refurbishing and repair may nonetheless export some recycled UEPs. In fact, exporting entities are likely to be engaged in multiple UEP activities and may export UEPs in more than one form.

[9] In completing the questionnaire, entities reported their exports of UEPs sold tested and working (already refurbished) as well as of UEPs sold not tested/working to an organization outside the United States for refurbishing and repair (refurbishable). Together, these refurbished and refurbishable UEP exports are referred to in this chapter as UEPs related to refurbishing.

recycling.[10] Entities primarily engaged in disassembly were also most likely to have paid another organization to recycle or dispose of UEPs abroad (figure 4.2). Appendix G contains additional detailed data related to export volume by primary activity.

FIGURE 4.2 UEP export weight by primary activity of exporters, that entities paid to recycle or dispose of, 2011



Source: USITC calculations of weighted responses to the Commission questionnaire.

[a]Low precision estimate, with RSE above 50 percent.

All types of entities were involved to some extent in exporting whole UEPs and disassembled parts and materials (table 4.1). The primary activities of entities exporting CRT monitors or televisions included IT asset management and services,[11] refurbishing and repair, disassembly and wholesaling, brokering, and retailing.

Propensity to Export among U.S. Handlers and Processors of UEPs

Twenty-six percent of all UEP handlers were directly engaged in exporting. The propensity to export was roughly similar across primary activities, with the exception of entities engaged in metals recovery and in collection and sorting, which had smaller shares of exporters (table 4.2). Breaking down the primary activity groupings to their more specific components reveals that the primary activities with the highest shares of

[10] Entities reported their exports of recycled materials (already disassembled or processed UEPs) as well as UEPs sold for recycling outside the United States (whole products or parts destined for disassembly or further metals processing). Together, these UEP exports are referred to in this chapter as UEPs related to recycling.

[11] Low-precision estimate, with an RSE of 62 percent.

TABLE 4.1 Percentage of exporting entities indicating export of specified products, by primary activity, 2011

Primary activity of exporter	Refurbished or repaired UEPs, sold tested and working	UEPs, not tested/ working	CRT monitors or televisions	Whole or shredded circuit boards	Commodity-grade scrap from UEPs	Wires and cables from UEPs
Collection and sorting	43	71	0	14	[a]9	[a]14
IT asset management and services	68	46	[a]15	26	31	26
Refurbishing and repair	96	15	4	9	3	82
Disassembly and dismantling	20	[a]17	31	54	67	68
Metals recovery	[a]13	0	0	87	[a]27	[a]13
Wholesaling, brokering, and retailing	54	30	4	8	[a]10	28

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: The shares indicate the percentage of firms reporting exports. The percentages will not sum to 100, since exporters were able to select all products that applied.

[a]Low-precision estimates, with RSEs higher than 50 percent.

TABLE 4.2 Share of UEP handlers who export, by primary activity, 2011

Primary activity grouping	Number of entities handling UEPs	Number of exporting entities	Share of UEP handlers who export (percent)
Collection and sorting	1,060	110	10
IT asset management and services	320	80	24
Refurbishing and repair	1,770	560	32
Disassembly	450	130	29
Metals recovery	70	10	11
Wholesaling, brokering, and retailing	1,120	370	33
Other	520	110	21
Total UEP handlers	5,320	1,370	26

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: Estimates have been rounded to the nearest 10 entities; percentages are based on actual estimates. Estimates understate the total number of participants in the UEP industry, as they do not include companies with 10 employees or less.

exporters were wholesaling or brokering of equipment and parts (48 percent) and wholesaling or brokering of commodity scrap materials (50 percent).[12]

Twenty-seven percent of UEP handlers do not export directly but believe that some portion of their UEP output was later exported by another organization (table 4.3). This figure was highest for entities whose primary activity was metals recovery (54 percent) and disassembly and dismantling (49 percent) (table 4.3). The prevalence of these indirect exports reflects the complexity of the UEP supply chain and the variety of entities that play a role prior to export. Even organizations that do not directly export understand that some of their output will likely be exported by another entity, either as a whole electronic product or as commodity scrap derived from disassembled UEPs. Particularly for products destined for disassembly for parts and metals recovery, exporting is likely to happen at some later point in the UEP supply chain, as a large share of these products are reused in manufacturing new products outside the United States.

[12] The reported primary activity groupings referred to throughout the text are based on aggregated questionnaire responses within which even more specific activities could be selected. Appendix G lists the primary activity questionnaire responses that were used to form the more general primary activity groupings. These groupings are helpful for discussing the data and improving statistical significance, but in some cases the more granular results may present a more nuanced picture of the industry.

TABLE 4.3 Nonexporting UEP handlers engaged in indirect export, by primary activity, 2011

Primary activity	Share of total UEP industry made up of nonexporters that believe some portion of their output is exported by another organization (percent)
Metals recovery	54
Disassembly	49
IT asset management and services	37
Collection and sorting	36
Wholesaling, brokering, and retailing	25
Refurbishing and repair	20
All nonexporting UEP handlers	27

Source: USITC calculations of weighted responses to the Commission questionnaire.

Foreign-Invested Entities[13]

Foreign-invested entities accounted for 10 percent of participants in the UEP supply chain in 2011, and for 19 percent of U.S. UEP exporters. Of these foreign-invested exporters, an estimated two-thirds have activities related to UEPs in countries other than the United States. The most common investing country was Japan. See chapter 5 for a discussion of exports by U.S. entities with foreign affiliates.

Certification

Some exporters are certified to one or more of several standards attesting to the rigor of their due diligence and downstream monitoring of their UEP sales. Twenty-seven percent of UEP exporters had some type of certification, compared to 15 percent of nonexporting UEP handlers, indicating a higher likelihood to export if an entity has a certification. In order to acquire most certifications, parties must have their domestic and export processes audited by a third party. Entities with certifications thus may have been more forthcoming in responding to the questionnaire and reporting U.S. export data, thereby producing an exaggerated picture of the difference between those with and without a certification. Alternatively, the higher prevalence of certifications among exporters may indicate that certifications are becoming more important to companies that are already exporting because it conveys a third party's approval of their activities. For a more thorough discussion of the two major certification programs, and of the factors motivating exporters, see chapter 6.

Types of Exporting Entities

As discussed above, entities along the UEP supply chain are all potential exporters. This section will examine the role of each type of exporter—collector, IT asset manager, refurbisher, recycler, metals processor, and reseller—as well as the nature of participation by manufacturers and nonprofits.

Many entities participate in multiple stages of the UEP supply chain. The questionnaire asked each organization to choose one primary activity; those data are reflected here, even though many firms engage in more than one of these activities.[14] For example,

[13] Defined in the questionnaire as U.S. companies with foreign ownership interest of 10 percent or greater.

[14] The questionnaire showed that entities whose primary activity was IT asset management and services or disassembly on average engaged in six different activities.

many refurbishers also engage in materials recovery. Similarly, both refurbishers and recyclers will likely separate out tested and working assets for resale, the hallmark activity of an IT asset manager.[15] Table 4.4 describes the types of entities that export UEPs. OEMs and nonprofits are also forms of entities that can be involved in collection, recycling, reselling, and refurbishing. Though not broken out as specific industry segments, their roles are discussed throughout the section below.

The results of key comparisons among the different types of exporting entities are summarized in table 4.5 and are mentioned in the discussions of each type of exporting entity during the remainder of this chapter.

Collectors[16]

UEP collectors take a variety of forms, including state and local governments, charities, large retail companies, and OEMs. Ten percent of all domestic UEP collectors were involved in direct exporting, and an additional 36 percent were reasonably certain some of their output was exported by another organization. Collectors represent an estimated 8 percent of all UEP exporting entities, and they are the exporting entity most likely to export UEPs that are not tested and working (table 4.1). Collectors exported an estimated 6.6 million units of UEPs related to refurbishment and repair in 2011,[17] 20 percent of which were exported to be refurbished or repaired at a foreign destination.[18] Similarly, collectors exported 3,100 tons of UEPs related to recycling,[19] nearly 80 percent of which was exported to be recycled abroad. [20] This relatively large portion of exports destined for disassembly abroad rather than in the United States supports the idea, expressed by industry representatives, that some UEPs may be exported immediately upon collection, before undergoing any processing in the United States. [21]

Roughly half of collectors who exported held a certification, compared to only 8 percent of collectors not engaged in exporting. To the extent that large retail outlets or OEMs manage drop-off programs and would be considered collectors, they are more likely to look for certifications in the downstream recyclers they contract with than to hold a certification themselves. Because large retail outlets' or OEMs' UEP collections are generally managed through contracts with third parties, these firms are unlikely to engage in direct export of the UEPs collected through their consumer drop-off programs.

[15] For example, Forever Green, which considers itself an electronics recycler and whose primary activity is manually dismantling used electronics, also has a reuse store where it sells tested and refurbished equipment. USITC, hearing transcript, May 15, 2012, 19 (testimony of Gordon Scott, Forever Green). Regency Technologies, an asset manager, also maintains its own team of repair technicians to refurbish used computer equipment. USITC, hearing transcript, May 15, 2012, 32 (testimony of Jim Levine, Regency Technologies).

[16] For the purposes of this report, respondents indicating their primary UEP-related activity as collection or sorting of incoming UEPs are referred to as "collectors."

[17] Low-precision estimate, with an RSE of 73 percent.

[18] Low-precision estimate, with an RSE of 61 percent.

[19] Low-precision estimate, with an RSE of 58 percent.

[20] Low-precision estimate, with an RSE of 60 percent.

[21] Industry representative, telephone interview by USITC staff, January 31, 2012.

TABLE 4.4 Types of exporters of UEPs, 2011

Entity (based on primary activity)	Description of activity and forms of participating entities
Collectors	• For-profit or nonprofit organizations collect UEPs from their original users. • Used household electronics are collected through takeback programs and drop-off events hosted by entities such as recycling companies, retail outlets (including those of telecom service providers), electronics manufacturers, and nonprofits such as charities, schools, and municipalities. • Collection of UEPs from commercial sources is likely to be performed by IT asset managers who are able to assure accountability and data security.
IT asset managers and related service providers	• These firms contract with businesses to handle the disposition of their used IT equipment and manage technology upgrades; may offer additional services such as data security and destruction or environmentally responsible disposal. • Some IT asset managers engage in the actual recycling and refurbishing of products, while others primarily manage the process and contract with downstream parties. Reverse logistics firms provide a related service to electronics OEMs and retailers—managing the reverse supply chain and coordinating recycling or repair. These aftermarket services are often offered by original design manufacturers (ODMs) or contract manufacturers.
Refurbishers	• These repair, refurbish, or remanufacture UEPs for resale, donation, or return to customers under warranty—their work includes fixing cosmetic damage, upgrading software, upgrading memory, testing, cleaning, and prepping the used product for resale. • Refurbished products may be resold individually (highest value products) or sold in bulk to secondhand retailers (such as prepaid wireless phone companies). • Firms include nonprofits, which may donate or resell discounted refurbished products in an effort to bridge the digital divide, both domestically and abroad. • Reverse logistics companies, electronics manufacturing service providers, and OEMs with global operations also repair UEPs returned under warranty.
Recyclers	• These firms dismantle and disassemble UEPs manually or mechanically, depending on size and capability. • Some nonprofits participate in disassembly of UEPs, including those specializing in providing training and employment to disadvantaged populations.
Metals Processors	• Commodity parts and scrap materials from UEPs may undergo chemical or heat treatments to extract precious and nonprecious metal content, after being manually or mechanically disassembled. • Most metals processors in the U.S. export their processed output to a limited number of lead and copper smelters around the world capable of extracting and separating metals into an even purer form.
Resellers	• Individuals or organizations buy used electronics (whole or disassembled) to facilitate resale to a domestic or foreign buyer. • Brokers and wholesalers specialize in consolidating smaller shipments of UEPs in order to resell them domestically or abroad for further processing or reuse. A whole container load is usually required for exporting, so many companies sell to brokers rather than export directly. Retailers include OEMs, nonprofits, chain retail stores, or online outlets that offer used electronic products, usually refurbished and in working condition. Some entities retail on a large scale and only a portion of their sales are UEPs, while others specialize specifically in used goods. Other resellers specialize in consumer trade-ins of used electronics.

Source: USITC questionnaire and industry interviews by USITC staff.

TABLE 4.5 Overview of key metrics for UEP exporters, 2011

	Share of UEP handlers directly exporting (%)	Share of UEP handlers that did not directly export but believed some UEPs exported indirectly (%)	Primary activity of exporting entities (%)	Value of exports related to refurbishing and recycling (million $)	Volume of exports related to refurbishing (million units)	Volume of exports related to recycling (tons)
Collection and sorting	10	36	8	49	6.6	3,107
IT asset management and services	24	37	6	134	10.8	1,757
Refurbishing and repair	32	20	41	675	60.2	6,167
Disassembly	29	49	10	421	2.3	279,415
Metals recovery	11	54	1	[a]1	0.0	21,385
Wholesaling, brokering, and retailing	33	25	27	130	3.5	13,902

Source: USITC calculations of weighted responses to the Commission questionnaire.

[a]Low-precision estimate, with RSE above 50 percent.

IT Asset Managers [22]

IT asset managers typically contract directly with a business to advise on and manage the disposition of outdated technology assets, which could include PCs, laptops, monitors, printers, servers, and networking equipment. Twenty-four percent of all domestic IT asset managers were involved in direct exporting, and an additional 37 percent were reasonably certain some of their output was eventually exported by another organization. Representing an estimated 6 percent of all UEP exporting entities, IT asset managers exported an estimated 10.8 million units of UEPs related to refurbishment and repair, representing 13 percent of such exports in 2011. About half of these exports were not tested/working, but destined for refurbishment outside the United States.[23]

On average, exporting IT asset managers exported 10 percent of their total UEP sales, distinguishing them from exporting recyclers, who exported 57 percent of their UEP sales. IT asset managers separate out assets that can be resold, both domestically and overseas, before the remainder is sent for dismantling and materials recovery (box 4.1).[24] One IT asset manager reported that the U.S. reuse market was strong for business infrastructure equipment such as servers, switches, and routers, while more consumer-oriented UEPs such as PCs and laptops were more heavily resold in international markets.[25]

Tested and working assets can be exported through various channels, including to an individual end user through online retail services (like eBay or Amazon) or in bulk to a foreign wholesaler or broker.[26] The IT asset manager can then either recycle or refurbish the remaining nonworking assets itself, contract with a third-party recycler or refurbisher, or sell them to a broker. These nonworking or obsolete assets may be exported as

[22] In discussing questionnaire results, this study uses the term "IT asset managers" in referring to companies indicating their primary activity as IT asset management or asset disposition services; recycling services for businesses; or logistics or consulting services.

[23] Low-precision estimate, with an RSE of 62 percent.

[24] USITC, hearing transcript, May 15, 2012, 7–8 (testimony of Lane Epperson, HiTech Assets).

[25] USITC, hearing transcript, May 15, 2012, 54 (testimony of Lane Epperson, HiTech Assets).

[26] USITC, hearing transcript, May 15, 2012, 23 (testimony of Dag Adamson, LifeSpan Recycling). Similarly, Regency Technologies noted three sales channels for resale of working used electronics—dealer, corporations, and e-commerce—some of which represent exports. USITC, hearing transcript, May 15, 2012, 32 (testimony of Jim Levine, Regency Technologies).

BOX 4.1 IT asset managers—collect, sort, resell, recycle

Some IT asset managers operate on a consignment business model, where they share profits from resold assets with the original owner of the asset. The enterprise contracting with the IT asset manager will pay for services like data destruction and inventory management, but will also receive a percentage of the sale price of items successfully resold. The emphasis of IT asset managers tends to be on reselling assets for reuse, as this is more profitable than selling UEPs for raw materials.

HiTech Assets, an IT asset manager, testified to the Commission that about 91 percent of the company's revenue comes from reuse, compared to 2 percent from the sale of obsolete UEPs and scrap for materials recovery. This Oklahoma-based asset manager sells tested/working items both in the United States and internationally, while processing the nonworking or obsolete assets in the United States. The company exported around 300 tons of used electronic assets for reuse in 2011, primarily to non-OECD countries. HiTech Assets testified that more than 40 percent of its items sold for reuse were exported. [a]

Another IT asset manager, LifeSpan, processes around 5,000 tons of UEPs per year, about 70 percent of which is reused; the other 30 percent is disassembled into commodities. LifeSpan reports higher value in reselling assets and parts for reuse than in disassembling and selling commodity materials. It states that less than 10 percent of its material is exported directly, but the other 90 percent is indirectly exported into the global commodities market. [b]

[a] USITC, hearing transcript, May 15, 2012 (testimony of Lane Epperson, HiTech Assets).
[b] USITC, hearing transcript, May 15, 2012, 26 (testimony of Dag Adamson, LifeSpan Recycling); Adamson, written testimony to the USITC, May 15, 2012.

commodity scrap or exported for further processing overseas. [27] According to questionnaire results, IT asset managers exported approximately 1,800 tons of such UEPs related to recycling in 2011, less than 1 percent of all exports of this form.[28]

A related service is provided by companies that focus on handling reverse logistics and supply chain management for OEMs and retailers. These companies provide services such as IT asset disposition, but may also manage customer returns, lease returns, inventory, spare parts, and repair, all of which involve used electronics. This may include sending returned, like-new products back to the original supplier or directing products in need of repair to the proper facility, both of which may involve exporting to an OEM or contracted facility abroad. [29] For example, estimates indicate that 10 to 20 percent of all new computer equipment is returned by consumers to the manufacturer or retail outlet; one-third of these returns are directly exported.[30]

Refurbishers[31]

Refurbishers are companies that prepare UEPs for foreign and domestic reuse. A refurbisher may clean the device, install better software, upgrade the memory, replace parts, conduct repairs under warranty, or make cosmetic repairs to ready the product for donation or resale to a new consumer.

[27] One IT asset manager, LifeSpan Recycling, also disassembles UEPs not suitable for refurbishment or resale. The resulting commodity flows are exported globally, albeit indirectly. USITC, hearing transcript, May 15, 2012, 26 (testimony of Dag Adamson, LifeSpan Recycling).
[28] Low-precision estimate, with an RSE of 63 percent.
[29] USITC, hearing transcript, May 15, 2012, 22–23 (testimony of Dag Adamson, Lifespan Recycling).
[30] USITC, hearing transcript, May 15, 2012, 27 (testimony of Dag Adamson, Lifespan Recycling).
[31] For the purposes of discussing questionnaire results, those companies indicating their primary activity as refurbishing, remanufacturing, or repairing for resale or donation or parts recovery and reused are referred to as "refurbishers."

Thirty-two percent of U.S. UEP refurbishers were involved in direct exporting, and another 20 percent were reasonably certain some of their output was eventually exported by another organization. Refurbishers represented an estimated 41 percent of all UEP exporting entities, more than any other type of entity. Consistent with their primary activity, refurbishers accounted for the largest portion of UEP exports related to refurbishment and repair in 2011—72 percent by volume, or 60.2 million units.[32] The vast majority of these exports were of tested and working equipment, as opposed to UEPs being exported to an organization outside the U.S. for refurbishing or repair.

Anecdotally, industry representatives have reported several instances for which export of nontested/working UEPs for refurbishment is common. First, U.S. refurbishers may export "refurbishable" UEPs to developing countries where refurbishing is an established local industry. For example, at the Commission's hearing, InterConnection cited an instance where the organization shipped semi-refurbished UEP equipment to a Chilean nongovernmental organization (NGO) that had a program in place to install software and complete the refurbishing.[33] Similarly, PC Rebuilders & Recyclers and American Retroworks are R2-certified refurbishers that report exporting both refurbished and refurbishable PCs.[34] Second, some OEMs, retailers, or their agents service goods under warranty through repair services abroad.[35] One industry representative suggested that repair is likely to be done near the site of original manufacture, because that is where the product expertise is concentrated; such sites are often outside the United States.[36] Companies that provide consumers independent warranties on electronic products often locate their repair facilities overseas, requiring export of the damaged UEP to the repair site. Finally, some refurbishers may be large enough to locate various parts of their operations in the most cost-effective sites throughout the world. Recellular, a large refurbisher of cell phones, reportedly repairs and refurbishes phones collected in the United States in Mexico, China, Hong Kong, and Vietnam. See box 4.4 later in this chapter.

U.S. refurbishers also exported approximately 6,200 tons of UEPs related to recycling, or 2 percent of this type of export.[37] Several refurbishers have reported that although refurbishing UEPs is more profitable than disassembling them, only a fraction of their UEPs are refurbished and resold, while a larger portion are disassembled into commodity materials.[38] On average, exporting refurbishers exported only 9 percent of their total UEP sales, suggesting a strong domestic demand for refurbished electronic products. According to InterConnection, a 501(c)(3) nonprofit organization that recycles over one million pounds of electronic products per year at its facility in Seattle, WA. About 20 percent of its computers are refurbished, and a small share of those are exported.[39]

[32] Low-precision estimate, with an RSE of 83 percent.

[33] USITC hearing transcript, May 15, 2012, 184–185 (testimony of Charles Brennick, InterConnection).

[34] Cade, written testimony to the USITC, May 15, 2012, 7; USITC hearing transcript, May 15, 2012, 183 (testimony of Robin Ingenthron, American Retroworks).

[35] It is unclear whether companies exporting goods for repairs under warranty would have identified their primary UEP-related activity as refurbishing and repair in this questionnaire.

[36] Kyle Weins of iFixit testified that some repair of iPhones occurs in Vietnam, requiring nonfunctional units to be exported there. He suggested that refurbishers not acting as agents of OEMs may be using leaked circuit schematics from local factories. USITC hearing transcript, May 15, 2012, 185. 189–90.

[37] Low-precision estimate, with RSE estimated at 66 percent.

[38] Retroworks testified that although the company dismantles 75 percent of its UEP material, it emphasizes the 25 percent that is refurbished because it has the highest value. USITC hearing transcript, May 15, 2012, 186 (testimony of Robin Ingenthron, Retroworks).

[39] Industry representative, email message to USITC staff, December 31, 2012.

Some refurbishers operate as nonprofits, providing technical and vocational training services by teaching individuals how to repair computers and other electronic products, both in the United States and abroad.[40] Others specialize in providing refurbished technology to disadvantaged populations both domestically and abroad. InterConnection does both, bringing low-income and unemployed people into its facility to teach them how to refurbish used computers. InterConnection testified at the Commission that even though most of its refurbished computers remain in the United States it has shipped over 30,000 computers to 40 different countries.[41] Microsoft runs a program through which it offers discounted licensing for its software to refurbishers of PCs and laptops. Roughly 30 percent of Microsoft's Registered Refurbishers are nonprofits, which include charities, schools, and government programs.[42] These software licenses are key to the business model of organizations selling refurbished computers, as the discounted licenses allowing them to sell ready-to-use computers to users at much lower prices.

Recyclers[43]

Twenty-nine percent of all U.S. UEP recyclers were involved in direct exporting, and an additional 49 percent were reasonably certain that some of their output was exported by another organization. Recyclers represent an estimated 9 percent of all UEP exporting entities, less than half the estimated number of exporting collectors, refurbishers, or resellers. Consistent with their primary activity, recyclers accounted for the majority of UEP exports related to recycling in 2011—86 percent, or 279,400 tons. Ninety-seven percent of these U.S. exports were recycled materials, meaning products disassembled to a point where they no longer perform their original functions, as opposed to UEPs destined for recycling outside the United States.[44]

Recyclers also exported 169,500 tons of UEPs through contracts with other firms for disposal or recycling, which represented 70 percent of such U.S. exports in 2011. This is consistent with the idea that recyclers are primarily engaged in dismantling UEPs and therefore are the entities most likely to deal with hazardous disassembled materials that are expensive to dispose of properly, sometimes prompting payment to other entities to handle these materials in a safe and environmentally sound way. Recyclers also had the highest proportion of exporters with certifications, at 67 percent of recycling firms.

Recyclers' capabilities vary dramatically, from those using manual labor to dismantle UEPs to companies with sophisticated shredding and separation equipment (box 4.2).

Recyclers produce commodity materials such as plastic, copper, aluminum, and steel, as well as subassemblies that require further disassembly, but nonetheless are bought and sold like commodities. These commodity parts, which would include copper yokes, CRTs, wire bundles, power supplies, memory cards, and circuit boards, are valuable because of the materials they are composed of, but require processing beyond what some

[40] USITC, hearing transcript, May 15, 2012, 138 (testimony of Charles Brennick, InterConnection).
[41] USITC, hearing transcript, May 15, 2012, 134 (testimony of Charles Brennick, InterConnection).
[42] In FY2010 500,000 PCs were refurbished by nonprofits. Industry representative, telephone interview by USITC staff, April 2, 2012.
[43] For the purposes of discussing questionnaire results, "recyclers" are those companies who indicated their primary activity as mechanical processing or manual demanufacturing or disassembly. Although these companies may collect, evaluate, and engage in refurbishing as well, their primary activity is shredding or manually dismantling UEPs into various commodity parts and scrap materials.
[44] Because recyclers engage in dismantling used electronic equipment, they are unlikely to export whole equipment to be dismantled overseas.

BOX 4.2 Recyclers large and small

Recyclers range broadly in size in terms of employment, from large multinationals to small "mom and pop" organizations.[a] The Commission did not survey companies with less than 10 employees, but another survey found that the electronics recycling industry comprises a relatively large number of small recyclers, with more than 50 percent employing 10 workers or less.[b]

Sims Recycling Solutions ("Sims"), a subsidiary of Sims Metal Management, operates 50 recycling facilities around the world. Fourteen of its plants are in the United States, employing 700 workers.[c] Sims has invested in shredders and separation technology to mechanize parts of the disassembly process, which allow it to process large amounts of material at low unit costs.[d]

By contrast, companies lacking the scale or capital to invest in shredding technology will disassemble UEPs manually. Forever Green, located in Chantilly, VA, is a small recycling company that employs about 8 workers and reports dismantling UEPs by hand, using hammers and screwdrivers.[e]

Reportedly, manual disassembly produces purer outputs of commodity materials and higher recovery percentages of precious metals as compared to shredding, though it may be costly due to the labor required.[f] Even companies with advanced technology often use manual disassembly for parts of their recycling process.[g]

[a] Scott, written testimony to the USITC, May 15, 2012; St. Denis, prehearing submission to the USITC, April 30, 2012.
[b] Daoud, *Inside the U.S. Electronics Recycling Industry,* September 2011.
[c] USITC, hearing transcript, May 15, 2012, 36 (testimony of Renee St. Denis, Sims Recycling Solutions).
[d] USITC, hearing transcript, May 15, 2012, 98–100 (testimony of Renee St. Denis, Sims Recycling Solutions).
[e] USITC, hearing transcript, May 15, 2012, 67 (testimony of Gordon Scott, Forever Green).
[f] USITC, hearing transcript, May 15, 2012, 100 (testimony of Renee St. Denis, Sims Recycling Solutions).
[g] USITC, hearing transcript, May 15, 2012, 102–4 (testimony of Dag Adamson, Lifespan Recycling, and Jim Levine, Regency Technologies).

small recyclers are capable of or can afford to do safely. These commodity streams may be sold to domestic companies with more sophisticated processing capabilities, or may be exported.[45] Those exports may go to entities with sophisticated processing capabilities abroad, or may go to entities with very little formal processing capacity. Circuit boards in particular are typically exported to smelters in developed countries for precious metal recovery,[46] while other commodities are exported to countries where the precious metals may be recovered through informal—and often unsafe—processes like burning or acid dipping. See chapter 5 for a more detailed analysis of foreign entities that import UEPs and components from the United States.

Metals Processors[47]

Eleven percent of U.S. metals processors handling UEPs were involved in direct exporting, though an additional 54 percent were reasonably certain some of their output was exported by another organization. Metals processors did not report any exports related to refurbishing, nor did they pay for disposal or recycling outside the United

[45] For example, small recycler Forever Green sends some of its materials to a smelter in Chicago. USITC, hearing transcript, May 15, 2012, 17 (testimony of Gordon Scott, Forever Green).
[46] USITC, hearing transcript, May 15, 2012, 247 (testimony of John Bullock, International Precious Metals Institute).
[47] For the purposes of discussing questionnaire results, "metals processors" are those companies whose primary activity was metals recovery, smelting, or refining.

States. They did export an estimated 21,400 tons of recycled material in 2011[48]—only 7 percent of recycling-related exports, but the largest amount after recyclers.

Questionnaire data show that metals processors represent only an estimated 1 percent of UEP exporting entities. This is in keeping with the testimony of industry representatives as to the relatively limited U.S. capability for refining metals from UEPs. There are no secondary smelters capable of fully processing and extracting the complete range of precious metals in the United States.[49] Reportedly, the United States is home to a handful of specialty smelters, which are capable of smelting material such as circuit boards and reducing it to a copper-based alloy. These alloys must then be exported to the five major secondary copper smelters around the world for precious metal extraction (see chapter 5).[50] The U.S. industry is, however, in the process of developing some domestic capacity for extracting precious metals from circuit boards. Wistron, a Taiwan-headquartered company, is opening a facility in Texas that will use hydrometallurgical technology involving liquids and acids, rather than the typical pyrometallurgical, or heat-based, process used by smelters to refine precious metals like gold from circuit boards (box 4.3).[51]

The output of these processors is almost exclusively commodities that are typically exported.[52] For U.S. metals processors engaged in exporting, 86 percent of their UEP sales were exports, the highest proportion of exports of any type of exporter.[53] For example, at the Commission's hearing Sims Recycling Solutions testified that much of the steel they produce in their recycling processes is purchased by a metals company (their parent company) that exports the steel into the global market, together with steel from other sources.[54]

Wholesalers, Brokers, and Retailers[55]

Thirty-three percent of U.S. UEP wholesalers, brokers, and retailers (resellers) were involved in direct exporting, and an estimated additional 25 percent were reasonably certain some of their output was exported by another organization. Questionnaire data show that resellers represent 27 percent of all UEP exporters, the second-largest exporting group. Resellers exported around 3.5 million units[56] of refurbished related UEPs in 2011, more than half of which was exported in order to be refurbished outside of

[48] Low-precision estimate, with an RSE of 75 percent.

[49] Industry representative, telephone interview by USITC staff, April 27, 2012; USITC hearing transcript, May 15, 2012, 77 (testimony of Renee St. Denis, Sims Recycling Solutions).

[50] USITC hearing transcript, May 15, 2012, 77, 245-46 (testimony of Renee St. Denis, Sims Recycling Solutions, and John Bullock, International Precious Metals Institute). See chapter 5 for additional detail on these secondary smelters.

[51] Joyce, "Wistron E-recycling Facility Planned for Dallas Area," October 7, 2011.

[52] USITC, hearing transcript, May 15, 2012, 43, 70 (testimony of Renee St. Denis, Sims Recycling Solutions).

[53] Low-precision estimate, with an RSE of 54 percent.

[54] USITC, hearing transcript, May 15, 2012, 44 (testimony of Renee St. Denis, Sims Recycling Solutions). Pyrometallurgical processes use heat to separate various types of metals.

[55] The resellers discussed in this section are entities whose primary activity includes electronics retailing, wholesaling or brokering equipment and parts, or wholesaling or brokering commodity scrap material.

[56] Low-precision estimate, with an RSE of 52 percent.

BOX 4.3 Wistron—Repair, recycle, refine

Wistron is a Taiwan-headquartered original design manufacturer (ODM), which designs, manufactures, repairs, and recycles electronic products such as laptops, televisions, and servers. Wistron has repair and recycling facilities in Grapevine, Texas, where it repairs branded products that the company manufactures for its OEM customers, and dismantles electronics that can't be repaired or refurbished. [a]

Wistron has expanded its recycling capabilities and is establishing precious-metal refining capabilities at two facilities in Texas. The resulting subsidiary, Wistron GreenTech (Texas) Corporation, provides asset management services such as data destruction, repair, refurbishment, remarketing, and dismantling at one facility, and will provide circuit board refining at another. These facilities are R2 certified and collect UEPs from a variety of sources, not limited to Wistron's OEM customers. [b]

The new refining facility is planned for McKinney, Texas, and targets components derived from disassembly and separation of UEPs that can no longer be refurbished. Wistron GreenTech plans to refine printed circuit boards, batteries, and display panels in the United States, with the circuit board refining operations expected to begin by the beginning of 2013. [c]

Wistron GreenTech's refining operations are part of the company's strategy to provide recycling services to the customers it manufactures for, and will eventually help Wistron procure material required for manufacturing new electronic products. The plant will employ a hydrometallurgical process (using acids and liquids) to recover metals such as copper, gold, silver, platinum, and palladium. This is reportedly the first facility of its kind in the United States and is planned to have a capacity of 10 million pounds of circuit boards per year, providing an alternative to exporting circuit boards to foreign copper smelters.[d]

[a] Wistron, GreenTech, written submission to USITC, September 11, 2012; Wistron Corporate website, http://www.wistron.com/service/program_planning.htm (accessed October 17, 2012); Joyce, "Wistron E-recycling Facility Planned for Dallas Area," October 5, 2011.
[b] TIA E-cycling Central website, http://www.ecyclingcentral.com/recycler/program_details.php?ID=3989&state=TX (last updated June 6, 2012).
[c] Wistron, *2011 Corporate Sustainability and Social Responsibility Report,* 97–98; Carlisle, "Wistron Bringing $21 M Plant to McKinney," October 19, 2012.
[d] Joyce, "Wistron E-recycling Facility Planned for Dallas Area," October 5, 2011.

the United States. In addition, these entities exported approximately 13,900 tons of recycling-related UEPs, only 3 percent of which had not already been processed to some extent in the United States prior to export. [57] Resellers also exported 69,700 million pounds of UEPs for which they paid for recycling or disposal, accounting for 29 percent of exports of this form. [58]

Resellers were one of the least likely of all exporters to hold a certification. Seventeen percent of resellers engaged in exporting were certified, indicating a certification is not seen as a business imperative to the same extent as for many other entities in the industry.[59]

[57] Low-precision estimate, with an RSE of 57 percent.
[58] Low-precision estimate, with an RSE of 82 percent.
[59] This is likely the case for several reasons. First, some certifications like RIOS address manufacturing processes, which would not be applicable to entities whose primary activity is buying and selling. Second, some resellers may be individuals acting as brokers for whom a certification is too expensive or the process too burdensome. Furthermore, small brokers may work predominantly with customers who do not require them to be certified or are less concerned with what happens to their material after it leaves the premises.

Brokers

In the UEP industry, brokers are firms or individuals who act as middlemen between UEP handlers and the final purchasers of those products. These entities match sellers with buyers to facilitate transactions or consolidate products into larger shipments, often including export. The term "broker" can apply to exporters of both whole products and parts, as well as to large metals or plastics exporters who deal exclusively in commodity scrap and circuit boards being exported for smelting.

According to one industry representative, nearly all recyclers rely on brokers for exporting because U.S. recyclers rarely have direct relationships with foreign scrapyards or processing facilities.[60] Brokers are also more likely to be familiar with foreign markets, rules, and regulations.[61] In addition, many small recyclers may lack the volume to export a full shipping container and are restricted by their limited cash flow. A broker can solve both problems, consolidating material from multiple smaller recyclers and often paying cash on the spot.[62] Ten years ago, the vast majority of UEP exports from recyclers would have gone through such brokers. The practice has diminished to some extent today, because many of the largest used electronics recyclers have developed the product volume and foreign contacts to arrange transactions without brokers.[63] Certifications also discourage firms from selling to just any broker, as certified companies must track certain downstream sales. One firm reported that it sells to fewer customers following its R2 certification.[64]

Some brokers come to the United States on a temporary basis, tour scrapyards and recycling facilities, distribute their contact information, make deals to buy UEPs, and then return to their home country.[65] Alternatively, brokers may be based in the United States but retain strong ties to a foreign country to which they arrange exports. According to one industry representative, many brokers are Chinese-American and have family ties to people who own recycling operations in China.[66] There are also reports of small quantities of refurbished equipment, such as laptops, being purchased by foreign nationals and taken back to their home country for resale or reuse.[67] However, large recycling firms might also act as brokers, buying and selling materials within the UEP industry.

Retailers

There is a small but growing group of entities that specialize in trade-ins of consumer electronics, which can then be resold for reuse. The most prominent of these firms focus on cell phones and tablets. These companies buy UEPs, paying cash in exchange for a customer's old phone or tablet. These business models tend to focus on buying relatively new and high-end technology that can easily be resold. They have focused primarily on smartphones and tablets to date, because the rapid turnover in these products as technology advances means the displaced product itself is valuable in the second-hand

[60] Industry representative, telephone interview by USITC staff, April 27, 2012.
[61] USITC hearing transcript, May 15, 2012, 56 (testimony of Gordon Scott, Forever Green).
[62] Industry representative, interview with USITC, February 24, 2012; government official, telephone interview by USITC staff, February 28, 2011 (EPA, Lance Ehrig); USITC hearing transcript, May 15, 2012, 73 (testimony of Jim Levine, Regency Technologies).
[63] USITC hearing transcript, May 15, 2012, 59–60 (testimony of Dag Adamson, LifeSpan Recycling).
[64] Industry representative, interview by USITC staff, March 7, 2012.
[65] Industry representative, telephone interview by USITC staff, April 27, 2012.
[66] Industry representative, telephone interview by USITC staff, January 31, 2012.
[67] USITC hearing transcript, May 15, 2012, 55–56 (testimony of Gordon Scott, Forever Green).

market (box 4.4). Trade-in or buyback programs are distinct from municipal collection or drop-off events, or commercial takeback programs, which do not offer anything in exchange for UEPs and may even charge for disposal. [68]

Gazelle is an example of a company that focuses exclusively on resalable items and will not freely accept any unwanted UEPs. Other companies accept a wider variety of electronics and then resell the highest-value items, recycling the rest. The resold items may be sold in small volumes to individual consumers online (eBay, Amazon, reseller websites), or they may be sold in bulk to second-tier wireless carriers. These trade-in resellers have been contracting with retailers and nonprofits to facilitate or manage trade-in programs, on behalf of the retailer or nonprofit, which offer either cash or credit against future purchases in exchange for a consumer's UEPs. For example, Walmart has teamed with CExchange to allow its customers to earn a Walmart gift card when they trade in their UEPs. [69] Another large reseller and refurbisher of used cell phones, Recellular, partners with charitable organizations in a model that allows consumers who trade in UEPs to designate a particular charity to receive some of the proceeds (box 4.4).

BOX 4.4 Recellular—Resell, recycle, refurbish

Recellular is active in multiple aspects of the UEP supply chain, most notably as a reseller of used cell phones. Through its online trade-in website, Secure Trade-In, customers are able to receive a payment for their used cell phones of a certain quality—only cell phones with a trade-in value are accepted. According to its website, the company receives more than 400,000 devices every month.[a]

Recellular also collects used cell phones from telecom carriers, OEMs, retail returns, enterprises, and charities. Those that are in good condition are cleaned and prepared for resale. Those that need more significant repair are exported to Vietnam, Hong Kong, China, or Mexico, where they are refurbished. Those not worth repairing are dismantled and recycled. Recellular sells the cleaned and refurbished phones to customers domestically and in more than 40 countries abroad.[b] Phones are sold directly to consumers online, to retail stores, or to telecom carriers.

[a] Recellular Secure Trade-In website, (accessed October 23, 2012). http://www.securetradein.com/home/faq.aspx.

[b] Recellular Secure Trade-In website, (accessed October 23, 2012). http://www.recellular.com/home/overview#.

[68] Takeback programs are generally consumer programs hosted by manufacturers, wireless carriers, and retailers to accept the old, used, or obsolete electronics of their own consumers. These programs allow consumers to return particular branded equipment free of charge, rather than simply throwing it away. For example, AT&T's Reuse and Recycle Program allows consumers to bring unwanted cell phones and accessories to participating stores, regardless of manufacturer or carriers, free of charge. Similarly, Best Buy will accept and recycle a variety of consumer electronics for free, regardless of where they were originally purchased. Sometimes there will be fees for products notoriously difficult to safely dispose of (CRTs) or for off-brand electronics. LG Electronics offers free takeback and recycling of all LG-branded products.

Trade-in or buyback programs offer either cash or credit against future purchases in exchange for a consumer's used electronics. These programs are particularly relevant for cell phones, where there is a high turnover as technology advances, yet the displaced product itself is valuable in the secondhand market. Some online trade-in resellers specialize in these types of programs, though they are becoming more prevalent among OEMs and retailers as well.

[69] Walmart website, http://www.walmartstores.com/Sustainability/8787.aspx (accessed November 2, 2012).

Other large retailers, including telecom service providers, may also engage in exports related to consumer returns or repair, similar to that described for OEMs.[70] Additionally, these same entities may sell used or refurbished products directly to consumers, both domestically and abroad. For example, both Verizon and AT&T sell refurbished preowned phones on their websites and in stores.[71] Online retailers like Amazon and eBay, which are not specifically devoted to electronics, are also forums for selling UEPs. For example, Amazon sells both "used" and "refurbished" cell phones for many of the same models it sells new. [72] These used products are offered for sale by individuals, businesses, and Amazon itself. [73] Tiger Direct is an online retailer selling UEPs with varying levels of use, including products returned after limited use, products that had been opened by the customer and returned, and fully refurbished products. [74]

[70] USITC hearing transcript, May 15, 2012, 42 (testimony of Renee St. Denis, Sims Recycling Solutions).

[71] See AT&T website, http://www.att.com/shop/wireless/devices/refurbishedphones.html, and Verizon website, http://www.verizonwireless.com/b2c/splash/preowned.jsp (both accessed November 2, 2012).

[72] A search for "used cell phones" on www.amazon.com produced 169,844 results; "used laptops" produced 14,607 results. Amazon website http://www.amazon.com/s/ref=nb_sb_noss?url=search-alias%3Dmobile&field-keywords=used+cell+phones (accessed October 26, 2012).

[73] Amazon offers "warehouse deals." This label indicates that Amazon received the product, ensured it was in working order, and determined its quality level. http://www.amazon.com/gp/browse.html?ie=UTF8&marketplaceID=ATVPDKIKX0DER&me=A2L77EE7U53NWQ (accessed December 12, 2012).

[74] Tiger Direct website http://www.tigerdirect.com/ (accessed October 26, 2012).

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CHAPTER 5
End Uses and Foreign Buyers of UEPs[1]

Overview

This chapter examines the most common end uses of U.S. exports of used electronic products (UEPs) and the types and activities of foreign buyers engaged in importing these products. Information is drawn from the Commission's questionnaire, Commission hearing testimony, submissions to the Commission, Census export data, and published studies. The exports involve both working (and repairable) UEPs and nonworking UEPs and components; the latter group includes circuit boards as well as commodity materials (plastics, metals, and glass) intended for reuse or recycling. Exports of UEPs for disposal are briefly discussed. In addition, this chapter discusses the practice of informal recycling as one potentially significant destination for U.S. UEP exports.

The data presented in this chapter are based largely on U.S. exporters' estimates of the quantity of their exports (1) by end use at the exports' destination and (2) by the type of enterprise of the importer.[2] The questionnaire results show that the intended end use of the exported products and the nature of the businesses receiving U.S. exports of UEPs are closely aligned. A large share—43 percent by weight—of U.S. UEP exports in 2011 consisted of disassembled materials intended for further processing at foreign smelting or refining facilities, consistent with data presented in previous chapters. Similarly, approximately 40 percent of U.S. UEP exports by weight were shipped to enterprises such as smelters, metal foundries, and plastics recyclers engaged in processing these types of materials.

Most Common End Uses of U.S. UEP Exports

Upon arrival at their destination, U.S. UEP exports fall into two primary categories: working UEPs for sale in a secondary market, and nonworking equipment. Nonworking equipment can be equipment or disassembled products for repair (and resale), recycling, or another type of further processing; or it can be commodity material from disassembled products that is for sale. The largest share by weight—324,000 tons or 43 percent—of all

[1] Unless otherwise noted, data presented throughout this chapter are based on USITC calculations of weighted responses to the Commission questionnaire. In order to reduce the burden on questionnaire respondents, the questionnaire did not survey organizations with less than 10 employees. The estimates presented in this report apply to the U.S. UEP industry for organizations composed of 10 or more employees only.

[2] Earlier chapters of this study rely primarily on responses to sections of the questionnaire in which exporters described their own products and primary activities. This chapter relies on responses in which U.S. exporters were asked to describe the activities and enterprises of their trading partners abroad. Not all respondents answered all sections of the questionnaire, and some respondents did not provide consistent totals in all sections. Therefore, the data totals and related information reported in this chapter may not match the data reported in other sections of the report. In addition, the terminology used to describe particular UEP activities and enterprises was not quite the same as used in other sections of the questionnaire, in order to reduce the burden on questionnaire respondents, so the terminology used in this chapter may not exactly match descriptions in earlier chapters. For the text of the questionnaire, see appendix F.

U.S. exports of UEPs in 2011 consisted of commodity materials intended for materials processing—that is, for smelting or refining.[3] Some 105,000 tons of U.S. UEP exports in 2011 (14 percent) were destined for resale as working equipment not requiring any further processing or for resale following repair or refurbishing. Another 85,000 tons (11 percent)[4] were shipped specifically for disassembly or recycling of the parts or equipment at the export destination (table 5.1).

TABLE 5.1 End uses of exported UEPs, 2011

End use	Export weight	Percent
	Short tons	
Materials processing (smelting, refining, sorting)	323,772	42.7
Recycling or disassembly	[a]84,941	11.2
Resale of whole equipment or working parts with further processing (recycle, repair, refurbish, etc.)	58,021	7.7
Resale of whole equipment or working parts without further processing (tested/working in the United States)	47,071	6.2
Final disposal	[a]5,768	0.8
Charitable donation (operational goods)	[a]27	([b])
Other	102,295	13.5
Unknown	135,826	17.9
Total	757,721	100

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: The data presented here represent exporters' estimates of the end use of their exported products at the export destination. These data are available only on the basis of weight, not value. Data presented in earlier chapters represent exporters' characterizations of their exported products. Totals and breakdowns from the two sets of data may not match.

[a]Low-precision estimate, with RSE above 50 percent.
[b]Less than 0.5 percent.

In 2011, U.S. exports of UEPs as charitable donations were quite small compared with commercial transactions (less than 0.5 percent[5] by weight).[6] However, testimony presented to the Commission highlighted the work of charities that are active in providing personal computers and other electronic equipment to underserved communities both in the United States and abroad.[7] For example, InterConnection.org has shipped over 30,000 computers to schools and other organizations in 40 developing countries.[8]

According to responses to the Commission's questionnaire, only a very small percentage of total exports (less than 1 percent[9] by weight) had disposal as the intended end use. While respondents noted "other" end uses for 14 percent of exports, the vast majority of

[3] These data on commodity materials include feedstock that will go directly into new manufacturing (e.g., copper ingots) and items that require additional sorting, smelting, and/or refining (e.g., copper wires) before reuse in manufacturing.
[4] Low-precision estimate, with RSE estimated at 62 percent.
[5] Low-precision estimate, with RSE estimated at 80 percent.
[6] As discussed in chapter 3, exports of working equipment and parts include personal computers donated by nonprofit organizations to schools and other organizations in developing countries.
[7] USITC, hearing transcript, May 15, 2012, 126–40 (testimony of Jim Lynch, TechSoup Global, and Charles Brennick, InterConnection.org).
[8] USITC, hearing transcript, May 15, 2012, 134 (testimony of Charles Brennick, InterConnection.org).
[9] Low-precision estimate, with RSE estimated at 62 percent.

those were described as exports destined for redistribution, repair, or recycling through specific channels (such as through warranty programs, tracked distribution networks, or other known channels for recycling activities). However, exporting entities did not know the intended use of nearly 18 percent of U.S. exports of UEPs.

End Uses of Working U.S. UEP Exports

An estimated 60 percent of U.S. UEP exports (by value) were exported in tested, working condition in 2011.[10] While it is not always clear whether whole goods shipped to developing countries are intended for resale or recycling, available information suggests that they are most likely resold in working condition where possible, because most working UEPs (particularly more recent models) have a higher resale value than the recoverable materials they contain. According to one study, for example, nearly 90 percent of used personal computers being imported into Peru are resold rather than dismantled for recycling or raw materials, largely because their sales value intact surpassed that of their component materials.[11] Similarly, in Ghana, 90 percent of UEP imports in 2009 were either in working condition (70 percent) or repairable to be resold (20 percent) (box 5.1).[12] Thus, the end use for most working and repairable personal computers, cell phones, and other UEPs that are exported is initially a secondhand market.

BOX 5.1 U.S. exports of UEPs to Africa

Very few U.S. exports of UEPs are shipped to Africa—less than 1 percent of total U.S. exports. Other research suggests that most of the UEPs entering Africa come from Europe, not from the United States. For example, in studies prepared for the Basel Convention Secretariat, North America (mainly the United States) accounted for only about 5 percent of observed UEP imports into Nigeria and 8 percent of those into Ghana.[a] In part, this is because it costs more to ship from the United States to Africa than to East Asia.[b] The trading relationships between Europe and Africa are also better established.

The research also suggests that both U.S. and European exports of UEPs to Africa are primarily intended for reuse.[c] In Ghana, the Basel Convention study estimated that 30 percent of electronics imports were new and 70 percent were used.[d] Of the latter, nearly two-thirds (64 percent) were resold working, 20 percent were repaired and resold, and 15 percent were imported as broken.[e] While the United States accounted for only a small share of all Ghanaian UEP imports, the ratio of working to nonworking imports found by the study is illustrative of UEP markets in many developing countries. An estimated 10 percent of electronics imports into Ghana arrive through individual travelers; cell phones represent the largest share of such imports.[f] There is very little formal recycling in Ghana or Nigeria, but repair and resale by small operators is common and supports significant employment.[g]

[a] Amoyaw-Osei et al., *Ghana e-Waste Country Assessment,* 2011, 64.

[b] GAO, *Electronic Waste,* August 2008, 21. One recycler reported to GAO that shipping costs to Africa range from $4,000 to $7,000 for a 20' container, compared with $750 for a 40' container going to East Asia.

[c] Basel Convention Secretariat, *Where Are WEee in Africa?* December 2011, 10–11. Most imported UEPs enter Africa through Nigeria and Ghana.

[d] Amoyaw-Osei et al., *Ghana e-Waste Country Assessment,* 2011, 16. The majority of imports arrive through the port of Tema and flow through the area in and around Accra.

[e] Amoyaw-Osei et al., *Ghana e-Waste Country Assessment,* 2011, 64.

[f] Amoyaw-Osei et al., *Ghana e-Waste Country Assessment,* 2011, 64.

[g] Basel Convention Secretariat, "Where Are WEee in Africa?" December 2011, 21. In both Nigeria and Ghana, well-organized enterprises involved with the repair and refurbishing of used electronics employ as many as 30,000 workers.

[10] U.S. exports of UEPs in working and tested condition were estimated at $893 million (see figure 3.3). Total U.S. exports of UEPs were valued at $1.5 billion (figure 2.5).

[11] Kahhat and Williams, "Product or Waste?" 2009, 6010.

[12] Amoyaw-Osei et al., *Ghana e-Waste Country Assessment,* 2011, 25.

A common practice for refurbishers, recyclers, and brokers located in developing countries is to purchase large volumes of used, working electronic goods from the United States and other countries, and then resell most of the goods to small retail establishments which, in turn, resell them to individual consumers. Industry sources also note that a significant volume of working UEPs is sold directly from the United States to both domestic and foreign buyers through Internet sales.[13]

Exported UEPs may also enter a regional or global resale market through small trading enterprises that operate in major port cities. For example, Hong Kong is a major trading hub for all of East Asia and an important transfer point for shipments into southern China. U.S. UEPs exported to Hong Kong may well be sold in retail locations throughout East Asia. Demand for inexpensive secondhand products is strong in the region, and used-electronics malls are common in major Asian cities.[14] Similarly, Dubai reportedly serves as a hub for transshipments of refurbished UEPs to markets throughout the Middle East and Asia.[15] Mexico and, to a lesser extent, other countries in Latin America are also major markets for U.S. exports of working UEPs.[16]

Separate Census export data suggest that for some types of electronic products, such as cell phones, a high proportion of U.S. low-value exports are shipped to Hong Kong (presumably for distribution and resale throughout Asia) and to Latin American countries including Mexico, Haiti, Paraguay, and Venezuela. [17] Exports of low-value cell phones to these four countries are likely to be used and in working condition for the secondhand market.

End Uses of Nonworking U.S. UEP Exports and Commodity Materials

The disposition of U.S. exports of nonworking electronic equipment and parts depends largely on how they are first collected and processed in the United States. For example, circuit boards that have been disassembled from electronic devices are likely to be shipped to metal recovery smelters in OECD countries (see discussion on p. 5-11), while intact pieces of used equipment is likely to be shipped for recovery and recycling to developing countries. [18] Questionnaire data were not specific enough to identify the countries receiving U.S. exports specifically for further processing or recycling, but the types of recycling activities in developing countries are known to vary widely. They include both highly sophisticated sorting and processing facilities operated by multinational companies and low-tech, informal workshops.[19]

Some U.S. companies operate recycling facilities in Mexico. These include plants that disassemble and resell components from U.S. exports, as well as CRT glass recovery

[13] Industry representative, interview by USITC staff, Washington, DC, May 16, 2012.

[14] RILO, *Evaluation Report on Project Sky-Hole-Patching,* October 2007, 17.

[15] USITC, hearing transcript, May 15, 2012, 226–77 (testimony of Robin Ingenthron, American Retroworks).

[16] Mexico accounted for about 17 percent of U.S. UEP exports by weight in 2011; other Latin American countries, for about 1 percent (see chapter 2, table 2.4).

[17] See appendix H, tables H-H3.

[18] Industry representative, telephone interview by USITC staff, February 7, 2012; USITC, hearing transcript, May 15, 2012, 100 (testimony of Renee St. Denis, Sims Recycling Solutions); 216 (Robin Ingenthron, American Retroworks); 239 (testimony of Holly Chapell, Umicore USA); and 247 (testimony of John Bullock, International Precious Metals Institute).

[19] Examples of multinational companies with sophisticated (and certified) recycling operations are Tes-Amm, with recycling centers in Singapore, Malaysia, India, and China, and AER Worldwide, with operations in India and Malaysia. Industry representative, email message to USITC staff, July 27, 2012.

facilities. Among the reasons cited for establishing a recycling subsidiary in Mexico are that labor availability and lower average wages makes it possible to disassemble electronic components more completely than is generally the case in the United States.[20] Some U.S. UEPs are also shipped to repair facilities in Mexico for eventual return to customers in the United States, and some are transshipped through Mexico to other countries.[21]

Commodity metals, plastics, and glass from UEPs that are pre-separated in the United States typically enter the flow of scrap metals and plastics that are derived from wide-ranging sources, including discarded automobiles, building materials, appliances, and many other types of products. Exporters that primarily shipped commodity metals, plastics, and glass (not including CRTs) derived from UEPs sent the majority of those products to China, Hong Kong, India, and other Asian countries (primarily Korea and Japan). Wires and cables from electronic products (typically with copper content) were most commonly shipped to China. As a regulated commodity, CRT glass is treated differently, and will be addressed separately.

In addition to questionnaire responses, the Commission drew on publicly available Census data on U.S. exports of selected scrap materials, which include materials from the disassembly of UEPs; these data are also informative and largely consistent with the Commission's survey data.[22] For example, while the vast majority of scrap exports come from sources other than UEPs, questionnaire data suggest that the flow of exported scrap materials generated from disassembly and recycling of UEPs is similar to overall export flows of these materials. Figures 5.1 and 5.2 display Census data on U.S. exports for selected categories of copper and plastic scrap. Copper is selected here because it is the most abundant of the valuable metals found in end-of-life electronic products.[23] Census data confirm that most scrap copper is exported to China. Canada—which ranked sixth as an export destination for UEPs in the questionnaire—is the second-largest U.S. export market for copper scrap from all sources. Similarly, as the Census data show, plastics are most commonly exported to China and Hong Kong, as well as to Canada, India, and Mexico.

Chinese imports of plastics derived from UEPs tend to be sorted by resin type to be recycled into new products.[24] Plastics recovered from disassembly of computers and other electronic products are of mixed formulations and thus must be sorted and/or tested to determine their reusability and value. Some U.S. recyclers separate plastics by type or color prior to sale. More often, plastics are sold and shipped in mixed loads to a consolidator or broker for export. The type of plastic and what it might contain determines its recyclability and ultimate reuse potential. For example, plastics with flame retardants have more limited recyclability than plastics not containing those chemicals. In China and other developing countries with relatively low wage rates, plastics can be

[20] USITC, hearing transcript, May 15, 2012, 186–87 (testimony of Robin Ingenthron, American Retroworks, Inc.); industry representative, e-mail communication to Commission staff, December 12, 2012.

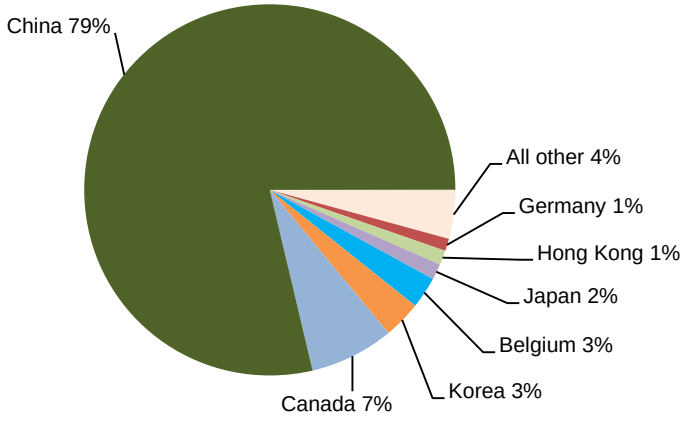
[21] CRT glass, in particular, is reportedly shipped to Mexico for recycling and/or transshipment to Indian recycling plants.

[22] These exports are reported by the U.S. Census Bureau using Schedule B classification numbers. Neither the international Harmonized System nor Schedule B include separate classifications for "used" electronics products, so export data combine both new and used goods.

[23] In circuit boards, for example, copper makes up 20 percent of the metal content, more than any other metal. Copper is also the principal metal used in wires and cables, motors, and collars of CRTs.

[24] Industry representative, telephone interview by USITC staff, February 15, 2012.

FIGURE 5.1 Most 2011 exports of copper scrap went to China

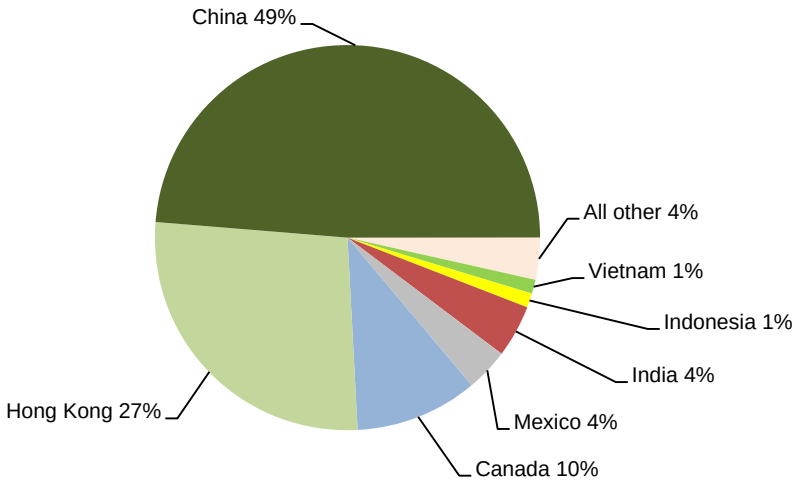


Total = 453 million tons

Source: USITC, DataWeb/USDOC (accessed October 1, 2012).

Note: Includes data from the following Schedule B codes: 7404.00.0025, 7404.00.0030, and 7404.00.0085.

FIGURE 5.2 The largest share of plastic scrap exports went to China in 2011



Total = 1.7 billion tons

Source: USITC, DataWeb/USDOC (accessed October 1, 2012).

Note: Includes data from the following Schedule B codes: 3903.30.0000, 3906.10.0000, 3915.10.0000, and 3915.90.0090.

manually separated. The burning of plastics to determine their type is reportedly a common (and unhealthy) activity in informal processing.[25] However, by volume, most U.S. exports of plastics originating from UEP recyclers are sold in bulk shipments to manufacturers that recycle the material into new products.[26] Typically, recycled plastic is used in manufacturing non-electronic products such as lawn furniture, toys, and wood composites.[27]

Forms and Activities of Enterprises Receiving U.S. Shipments

Consistent with the large share of U.S. UEP exports composed of commodity scrap materials (metals, plastics, glass, and circuit boards), the enterprises that process those materials—smelters, metal foundries, and plastics reprocessors—accounted for the largest share of enterprises receiving U.S. exports in 2011 (table 5.2).

TABLE 5.2 Estimated U.S exports of UEPs, by type of receiving enterprise, 2011

Foreign enterprise type	Export weight	Percent
	Short tons	
Smelter/metal foundry	255,240	33.7
Refurbisher/remanufacturer	217,622	28.7
Plastics reprocessor	50,833	6.7
Recycler of used electronics	50,087	6.6
Reseller/broker	34,811	4.6
OEM or original device manufacturer (ODM)	11,744	1.5
Nonprofit organization/charity	[a]29	([b])
Other	41,406	5.5
Unknown	[a]95,949	12.7
Total	757,721	100

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: The data shown here represent exporters' estimates of the types of enterprises that received their export shipments. These data are available only on the basis of weight, not value. Data presented in earlier chapters represent exporters' characterizations of the products they export and of their primary UEP-related activities. Totals and breakdowns from the two sets of data may not match.

[a]Low-precision estimate, with RSE above 50 percent.
[b]Less than 0.5 percent.

The types of enterprises receiving U.S. UEPs underscore the large volume of commodity materials derived from disassembled products that are exported, as well as the large share of UEPs exported for repair or reuse. Approximately 41 percent of U.S. UEP exports by weight in 2011 were shipped to enterprises such as smelters, metal foundries, and plastics reprocessors. Firms engaged in refurbishing or remanufacturing received another 29 percent of the total, and about 5 percent of exports were shipped directly to resellers or brokers. The balance was shipped to recyclers and a mix of "other" types of enterprises,

[25] Industry representative, telephone interview by USITC staff, June 6, 2012.
[26] Industry representative, telephone interview by USITC staff, February 15, 2012.
[27] Ibid.

including manufacturers and direct Internet purchasers. However, 13 percent[28] of U.S. UEP exports were shipped to unknown enterprise types. The unknown category likely includes various types of trading companies, such as brokers and resellers unknown to the exporter. Industry interviews strongly suggest that trading companies or brokers, many of which are relatively small, account for a significant share of the trade in UEPs, both as exporters of merchandise from the United States and as importers in destination countries.[29] Trading companies operating in destination countries in turn sell used equipment into the wholesale and retail markets, or directly to end users. The involvement of such trading firms in the UEP industry often makes it difficult to identify the final end use of these products.

Foreign Smelters and Refiners Receiving U.S. UEP Exports

U.S. electronics recyclers generate large volumes of circuit boards and other components from disassembling or shredding end-of-life goods. These materials are largely exported to one of six recognized smelting facilities in OECD countries (table 5.3).[30] This is because the United States' smelting and refining capacity is reportedly limited to a few facilities that can recover copper from UEPs. Of those U.S. firms for which whole or shredded circuit boards are a leading export product, most shipped those products to European Union countries where major smelters are located. Each of the companies in table 5.3 has an active electronics recycling segment that recovers precious and other metals from UEPs for sale into global commodity markets. Some focus only on specific metals such as gold, lead, or copper. Others are able to recover a wider assortment of elements from UEPs, including nickel, silver, platinum, rare earths, and others.[31]

Overseas smelting and refining capacity for recovering usable metals and other commodities from UEPs appears to be growing. The European companies in particular have been expanding their facilities.[32] Recently, the recovery of rare earth minerals from used electronics, batteries, and other discarded products has received increased interest and attention because of China's near-monopoly on the supply of rare earths.[33]

Foreign Processors of CRTs

Exports of CRTs and CRT glass are of particular environmental concern due to the product's high lead content. However, because the processing of CRT glass requires specialized facilities, and only a few exist in the United States, there is an incentive to

[28] Low-precision estimate, with RSE estimated at 52 percent.

[29] Searches of websites such as alibaba.com, brokerbin.com, and tradeloop.com list numerous brokers dealing in UEPs. The extensive involvement of small and medium-sized brokers in the trade of UEPs was a common observation made by many industry representatives in interviews by USITC staff.

[30] Industry representative, email message to USITC staff, August 7, 2012; company websites (see table 5.1).

[31] While each of these companies uses proprietary processes to extract specific metals from the raw material inputs, the procedure typically begins with an assay of the raw material, followed by a series of steps involving heating, leaching, chemical washing, and electromagnetic extraction targeted at each recoverable element.

[32] Buchert et al., *Recycling Critical Raw Materials,* 2012, 59. Aurubis expanded its copper-recycling capacity in Germany by nearly 30 percent in 2011, and Boliden is in the process of expanding its Swedish recycling capacities by two and half times.

[33] Buchert et al., *Recycling Critical Raw Materials,* 2012, 39. Rare earths are a group of 17 elements used in the production of a number of electronic devices, including magnets, electronic motors, liquid-crystal display screens, and semiconductors. While their value in electronic scrap is significantly less than that of precious metals, it has increased substantially over the past decade, largely due to limited supplies. China currently accounts for 95 percent of the world's production of rare earth metals, and it imposes export restraints on rare earths that are being challenged at the WTO.

TABLE 5.3 Major smelting and refining companies that purchased U.S. UEPs for metal recovery in 2011

Country	Company	Profile
Canada	Xstrata Recycling	Swiss-based company with a copper smelter and refinery in Ontario and a lead smelter in New Brunswick; takes in an assortment of electronic components to recover copper and other metals. Recycles CRT glass.
Belgium	Umicore	Belgium-based company with a smelter and refinery that can recover 20 precious and other non-ferrous metals from a wide range of input materials, including electronic scrap, mobile phones, and laptops.
Germany	Aurubis	Copper company that refines copper containing materials from the waste management sector, including electrical and electronic materials.
Sweden, Norway, and Finland	Boliden	Company has three smelters and refineries in Europe that recover copper and precious metals. A new plant was completed in 2011 that expanded the company's electronic scrap recycling capacity to 120,000 tons per year and made its Rönnskär, Sweden plant the world's largest electronic scrap recycling facility.
Japan	Dowa	A major Japanese metal and mining company with a smelter that specializes in recovery of rare earths from used electronics.
Korea	LS-Nikko Copper	Specializes in producing electrolytic copper cathodes used in various materials, including semi-conductors, electrical wire, and parts. Metal recycling is one of its four major business areas. In addition to copper, its facilities recover gold, silver, selenium, platinum, and palladium. Operates Recytech Korea, a subsidiary that specializes in the recovery of copper and other metals from scrap and used electronics.

Source: Company websites, annual reports, and USITC staff interviews with industry representatives. See also *Recycling International*, "Boliden Boosts Its Electronics Recycling Presence," June 19, 2012; *Recycling International*, "Rhodia Expands Rare Earth Recycling Reach," October 12, 2011.

Note: Although not operational in 2011, the Solvay Group opened a recycling plant in France in 2012 to recover rare earths from industrial magnets and certain kinds of batteries. Solvay Group website, http://www.solvay.com/EN/NewsPress/20120927_Coleopterre.aspx (accessed October 12, 2012).

export CRTs. As discussed in chapter 6, exporters of CRTs for both reuse and recycling must register with the EPA. As of September 2012, six U.S. exporters had EPA approval to export CRTs and CRT glass for recycling to facilities in Canada and Mexico.[34] Some portion of CRT exports to Mexico are reportedly processed and then transshipped to India through subsidiaries or affiliates.[35]

Export opportunities for CRT-containing products from the United States are increasingly limited by tightened regulations in the United States and foreign countries, as well as the closure of foreign plants that recycle CRTs.[36] The questionnaire data indicate that 2011 U.S. exports of "separated CRTs, mercury lamps, and batteries" for recycling or disposal were approximately 140,000 tons,[37] an amount fairly consistent with the quantities stated on the 2011 EPA notifications required to export CRT-containing products.[38] The EPA

[34] EPA website, http://www.epa.gov/osw/hazard/international/crts/recycling.htm (accessed November 15, 2012).

[35] Industry representative, telephone interview by USITC staff, July 27, 2012.

[36] Gibbs et al., "Conservation Criminology," 2011, 274. An examination of 2007 EPA and California data showed U.S. exports of regulated CRT-containing products and glass going to Malaysia, Brazil, Korea, China, and Vietnam in addition to Mexico, India, and China. However, those shipments have stopped, as most of the glass furnaces in those destination countries are no longer operating.

[37] See tables 3.2 and 3.3. This is a low-precision estimate, with an RSE over 50 percent.

[38] A more detailed discussion of EPA rules as they affect exports of UEPs and CRTs in particular is provided in chapter 6. California also requires notifications and approvals for exporting certain kinds of electronic waste and electronic devices.

data indicate that eight U.S. companies had EPA approvals in 2011 to export approximately 150,000 tons of broken CRTs and CRT glass to recycling facilities in Belgium, Mexico, and Canada.[39] However, EPA notifications do not necessarily reflect the volume of CRT-containing products actually exported; exports may be less than the amount for which a company seeks approval. According to a separate published analysis, the amount of broken CRTs and glass in 2011 EPA notifications represented a steep decline from 2009, when EPA notifications totaled about 661,000 tons.[40]

Most of the CRT glass exported to Canada and Mexico for recycling currently goes to two companies: Technologies Displays Mexicana, S.A. de C.V. (a subsidiary of Cali Resources, Inc.) in Mexicali, Mexico, and Xstrata in New Brunswick, Canada.[41] In California, Cali Resources' facility separates, cleans, and processes CRT glass, which is then shipped to Mexico and then to India for reuse in new displays. India reportedly has the only CRT glass recovery furnaces still in operation that are capable of recycling old CRT glass into new CRT glass, and for that reason some U.S. exports are likely shipped there through Mexico.[42] The Xstrata facility is a lead smelter that removes and recycles the lead content from the CRT glass. Both firms typically charge U.S. companies for providing the glass recycling service, rather than pay for CRT glass as an input.[43]

Illegal exports of CRTs have also been reported, including a number of cases that were prosecuted prior to 2011.[44] Observers suggest that exports of CRT-containing products and glass are likely underestimated because of undetected illegal shipments of CRTs or shipments that illegally include CRTs packed with other items, such as used automobiles or furniture.[45]

U.S. Firms and Foreign Affiliates

In some cases, U.S. companies handling or processing UEPs have direct investment links with foreign enterprises involved in trade. Of the 1,370 U.S. firms that exported UEPs, 291 firms (21 percent) exported to foreign affiliates. This intra-firm trade represented about 17 percent of all U.S. exports of UEPs by weight.

The survey data show in particular that a large number of U.S. exporters whose primary activity is refurbishing or repair activities have investment or affiliate links with foreign firms. Firms engaged in refurbishing services represented 61 percent of the number of

[39] USITC calculations based on EPA, email message to USITC staff, October 1, 2012.

[40] Gibbs et al., "Conservation Criminology," 2011, 273. The authors conclude that, based upon EPA notifications, CRT-containing exports had increased from a range of 88,000–110,000 tons in 2008 to around 661,000 tons in 2009.

[41] Industry representative, telephone interview by USITC staff, July 27, 2012.

[42] EPA staff, interview by USITC staff, Washington, D.C., January 31, 2012. China reportedly has the capacity to manufacture new or refurbished CRTs from old units, but China prohibits the importation of used CRTs. Because EPA's CRT rule requires permission from the receiving country and facility, the only legal export destination for CRT glass currently is India. The two Indian companies with glass furnaces for recycling CRT glass are Thompson Displays—now Videocon Industries—and Samtel Glass Limited. However, EPA did not have any 2011 notifications on file for exports to India of broken CRTs or CRT glass.

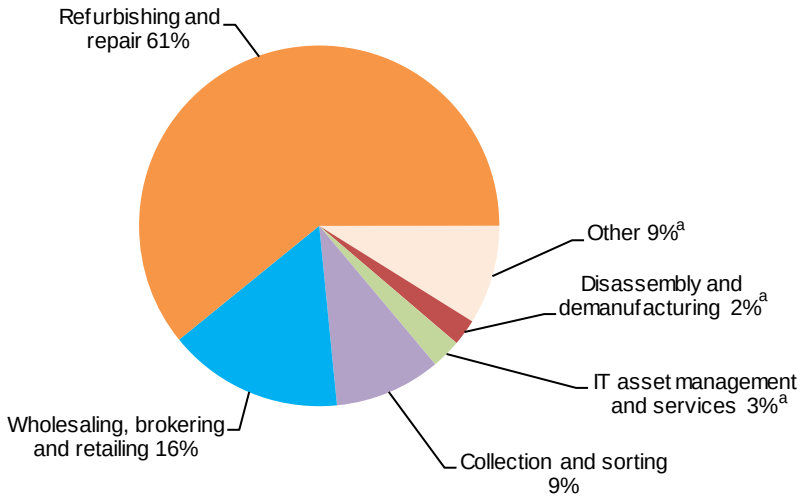
[43] Industry representative, telephone interview by USITC staff, February 14, 2012.

[44] Gibbs et al., "Conservation Criminology," 2011, 274–75. GAO, *Electronic Waste: EPA Needs to Better Control Harmful U.S. Exports*, 26, which reports that Hong Kong authorities interdicted 26 shipments of illegal shipments from the United States in 2007. See also RILO, *Evaluation Report on Project Sky-Hole-Patching*, October 2007, 13. According to this report, RILO documented 24 Hong Kong seizures of U.S. shipments over a seven-month period in 2007.

[45] Gibbs et al., "Transnational White Collar Crime and Risk," 2010, 548. See also Interpol, *Electronic Waste and Organized Crime*, 2009, 2.

U.S. firms exporting to foreign affiliates. Some form of wholesaling or brokering was the primary activity of another 16 percent of U.S. firms shipping to foreign affiliates (figure 5.3).

FIGURE 5.3 Share of firms exporting to foreign affiliates



Source: USITC calculations of weighted responses to the Commission questionnaire.

Informal Recycling Markets as an End Use for U.S. UEPs

U.S. UEPs and Informal Recycling

Testimony presented at the Commission's hearing, submissions from interested parties, and the literature on the disposition of used electronics all identified informal processing in developing countries as a significant and important concern for U.S. exporters of UEPs and others. Informal processing describes the disassembly of UEPs by individuals in unregulated settings, often with little regard to health, safety, and the environment. Multiple NGO and academic reports have documented environmental and health problems associated with informal recycling and recovery activities in developing countries.[46] Among the regions and communities that have been the subject of heavy media and NGO attention in this connection are southern Guangdong Province (Guiyu) in China; the Accra region of Ghana; Delhi and Bangalore in India; and Dhaka, Bangladesh.[47] In these settings, primitive acid baths and open burning are often used to separate recoverable (and valuable) commodities from electronics components, often in

[46] Much of the attention given to proper collection, recycling, and disposal of used electronics, particularly with respect to e-waste, is largely due to the activities of environmental NGOs. Several have publicized the environmental problems and unsafe labor conditions associated with recovery of materials and disposal of used electronics in China, India, and other developing countries. Among the most active of the organizations have been the Basel Action Network (BAN) and the Silicon Valley Toxics Coalition.

[47] See 60 Minutes, "Following the Trail of Toxic E-Waste," broadcast November 9, 2008 and August 27, 2009; Carroll, "High-Tech Trash," January 2008; BAN, *The Digital Dump*, October 24, 2005; BAN and Silicon Valley Toxics Coalition, *Exporting Harm*, February 25, 2002.

conjunction with the dumping of toxic waste. UEPs frequently contain harmful chemicals such as lead, mercury, cadmium, brominated flame retardants (BFRs), and polyvinyl chloride (PVC). Residues containing these chemicals are left over from the extraction process and are oftentimes dumped into nearby fields, irrigation channels, or streams. High pollution levels have been confirmed in a number of communities where this informal UEP processing takes place, and some reports indicate that children involved in the informal recycling of materials are placed at significant health risk.[48]

The questionnaire did not ask whether 2011 U.S. UEP exports bound for recycling, disposal, or unknown end uses were sent to facilities that have adequate equipment and safety procedures in place to protect human health and the environment, versus those that do not.[49] The questionnaire also did not capture ad hoc shipments of UEP exports that were misclassified and/or shipped together with exports of other miscellaneous items. Nonetheless, given the multiple sales a UEP may undergo, the complex nature of the UEP value chain, and the fact that informal recycling sites tend to be located in or near port cities, it is likely that some portion of U.S. UEP exports are processed in the informal recycling sector, either upon import or after a second or third useful life in the destination country.

Trends Affecting Informal Recycling and Other End Uses of U.S. Exports

There is disagreement among industry participants and environmental activists about the relative extent of informal recycling of UEPs of U.S. origin. Used electronics that flow into the informal processing stream are sourced from many countries and, in the case of Guiyu, the Chinese community at the center of attention for informal processing, increasingly from domestic and other Asian sources. By some estimates, China is now the second-largest producer of UEPs for disposal, generating 2.3 million tons annually.[50] In fact, UEPs from the United States appear to be declining in Guiyu, to the disappointment of many Chinese processors; these processors regret the trend because U.S. UEPs reportedly offer more and better recoverable materials than electronics manufactured for the Asian market.[51]

Other market participants argue that U.S. exports continue to end up in informal processing centers where dismantling occurs in unsafe and polluting conditions. Among other things, they point to the practice by unscrupulous brokers of including "junk electronics" in shipments with valuable equipment in order to dispose of it, a practice described as "sending toxics along for the ride." The "junk" is assumed to be retrieved and unsafely processed by impoverished workers or discarded, also unsafely, upon arrival at the export destination. [52]

Since concerns about informal recycling were initially raised in the early 2000s, there have been significant changes in both U.S. and foreign practices involving electronics recycling and exports. For example, the number of plants and the capacity to sort and disassemble UEPs is increasing, both in the United States and abroad. Additionally, new recycling technologies and facilities are improving the efficiency and recovery of more

[48] Li et al., "E-Waste Recycling," 2011, 2529. The authors estimate that 20 million workers are engaged in recycling-related activities in China.

[49] Respondents were not likely to be able to provide that information.

[50] Xinzhen, "Answering the E-Waste Question," July 23, 2012.

[51] Industry representative, email message to USITC staff, May 11, 2012.

[52] USITC, hearing transcript, May 15, 2012, 254 (testimony of Wendy Neu, Coalition of American Electronics Recycling).

types of materials, including rare earth elements.[53] Several of the smelters in foreign countries that purchase U.S. exports of nonworking and used electronic components have expanded or are in the process of expanding capacity.[54] Capacity for recycling nonworking UEPs is also increasing in China and other developing countries. In the past five years, new recycling centers have been constructed in various Chinese cities, diverting some material away from informal recycling.[55] Moreover, as previously noted, an increasing share of material flowing into the informal processing sector in developing countries appears to be locally or regionally sourced, with less originating in the United States.

The attention given to environmental concerns and regulatory enforcement, both in the United States and abroad, is reportedly making it more difficult to export UEPs as compared with several years ago. Voluntary certification programs that track and monitor the disposition of UEPs are becoming increasingly prevalent, particularly among the largest handlers of used equipment (as discussed in chapter 6). Based on news reports, China appears to be paying more attention to illegal UEP imports by tightening enforcement, even as the volume of domestically produced UEPs increases. In other Asian countries, efforts have been launched to better manage end-of-life electronics, including those ultimately derived from imported used equipment. A recent example is India, where new regulations on managing UEPs took effect in 2012.[56]

Major OEMs, including Lenovo, Dell, and HP, have instituted recycling services not just in the United States, but in their major markets in Europe and Asia. Malaysia has begun a pilot project whereby consumers are given vouchers for returning e-waste to retail collection points. According to its Department of Environment, Malaysia has 155 e-waste recovery facilities with a total capacity to handle 24,000 metric tons of e-waste per month.[57] While these facilities mainly handle UEPs generated locally or regionally, some materials of U.S. origin are also likely to be included.

As electronic devices proliferate and as users update to the latest technology, the quantity of end-of-life (or end-of-first life) electronic products continues to increase. However, the characteristics of UEPs are also changing. In interviews and testimony to the Commission, industry participants observed that electronic devices (and thus UEPs) are becoming lighter and smaller. The difference in the size and weight of CRTs, which are being phased out, when compared with LCD/LED flat screen monitors is substantial, and the weight and size of personal computers continue to shrink. Some manufacturers are also making it more difficult to disassemble electronic products for repair or for recovery of parts or scrap materials.[58] Thus, some new smart phones and tablets are more easily shredded when no longer working rather than repaired or exploited for reusable parts. All of these trends will likely have an impact on the end uses of U.S. exports of UEPs and the types of foreign importers to which they are shipped.

[53] Buchert et al., *Recycling Critical Raw Materials*, 2012, 39.

[54] See table 5.3. Aurubis, Solvay, and Boliden, among others, have expanded their capacity for processing end-of- life electronic products and related materials.

[55] According to a recent news report, 84 government-approved electronics disassembly and disposal plants were operating in China at the end of 2011, more than half of which were foreign funded or privately owned. See Xinzhen, "Answering the E-Waste Question," July 23, 2012.

[56] Ganeash, "Trying to Rule Out E-Waste," 2012.

[57] *New Strait Times*, "Good Response to e-Waste Project," July 24, 2012.

[58] Industry representative, interview by USITC staff, Washington, DC, May 16, 2012.

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CHAPTER 6
Factors Affecting Trade in UEPs[1]

Overview

This chapter assesses supply, demand, and other factors affecting U.S. trade in used electronic products (UEPs). Domestic efforts to collect and process UEPs determine the supply of such products available for refurbishment and resale, or for disassembly and recycling into commodity materials. State and federal regulations and 2008 that recent introduced industry certification programs also affect the total U.S. supply, and thus U.S. exports. The difference between domestic and foreign labor costs is also a factor. The foreign demand for UEPs originating in the United States is strong, encompassing demand for working goods, whole goods that are not working but might be refurbished and reused overseas, and commodity materials extracted from recycling of UEPs. On the other hand, foreign and international regulations, such as the Basel Convention,[2] reduce total foreign demand, especially in developing countries.

The Commission requested that exporting and nonexporting organizations indicate whether certain factors encouraged or discouraged their own organization's likelihood of exporting. For all organizations (both exporters and nonexporters), the most frequent factors that "encouraged exporting" were demand in foreign markets, commodity prices, and labor costs. Factors that were seen as discouraging UEP exports were a commitment to keeping work in the United States and environmental concerns (figure 6.1).

For organizations that *did* export UEPs in 2011, about two-thirds (64 percent) reported that market demand for their products was a factor encouraging exports, far above any other factor (figure 6.2). Several other factors were cited by about one-third of the industry, including commodity prices (35 percent), knowledge of foreign markets (32 percent) and labor costs in foreign markets (32 percent).[3]

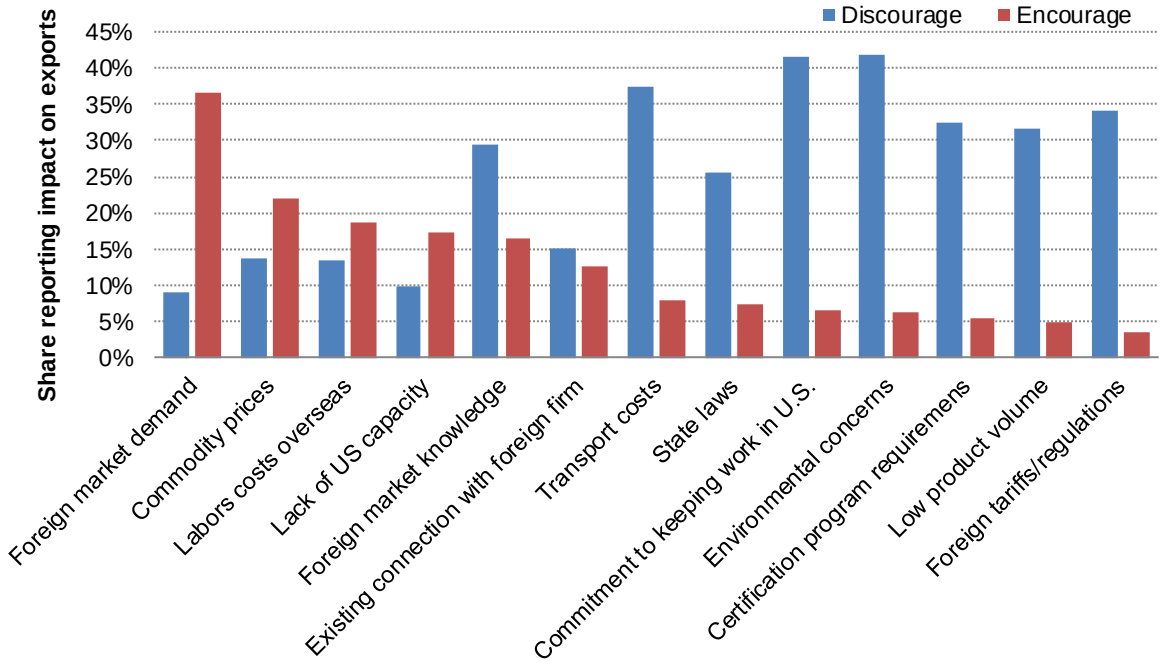
For organizations that *did not* export in 2011, environmental concerns and a general commitment to keeping work in the United States were cited most often as factors discouraging exports (by 46 and 45 percent of respondents, respectively), followed by requirements of certification programs (37 percent) (figure 6.3). Other factors discouraging exports, cited by more than 30 percent of the UEP industry, were transportation costs, knowledge of foreign markets, foreign tariffs and taxes, and state laws.

[1] Unless otherwise noted, data presented throughout this chapter are based on USITC calculations of weighted responses to the Commission questionnaire. In order to reduce the burden on questionnaire respondents, the questionnaire did not survey organizations with less than 10 employees. The estimates presented in this report apply to the U.S. UEP industry for organizations composed of 10 or more employees only.

[2] The full name is The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

[3] Organizations were not limited in the number of factors they could choose, and the factors were not ranked.

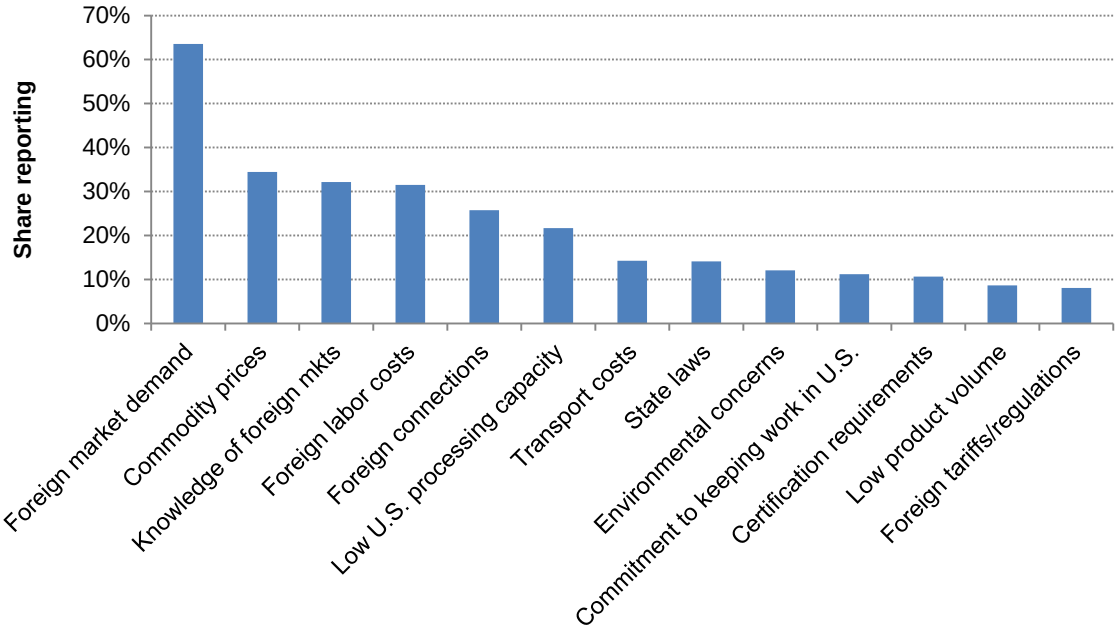
FIGURE 6.1 Certain factors encourage exporting, but more discourage it



Source: USITC calculations of weighted responses to the Commission questionnaire.

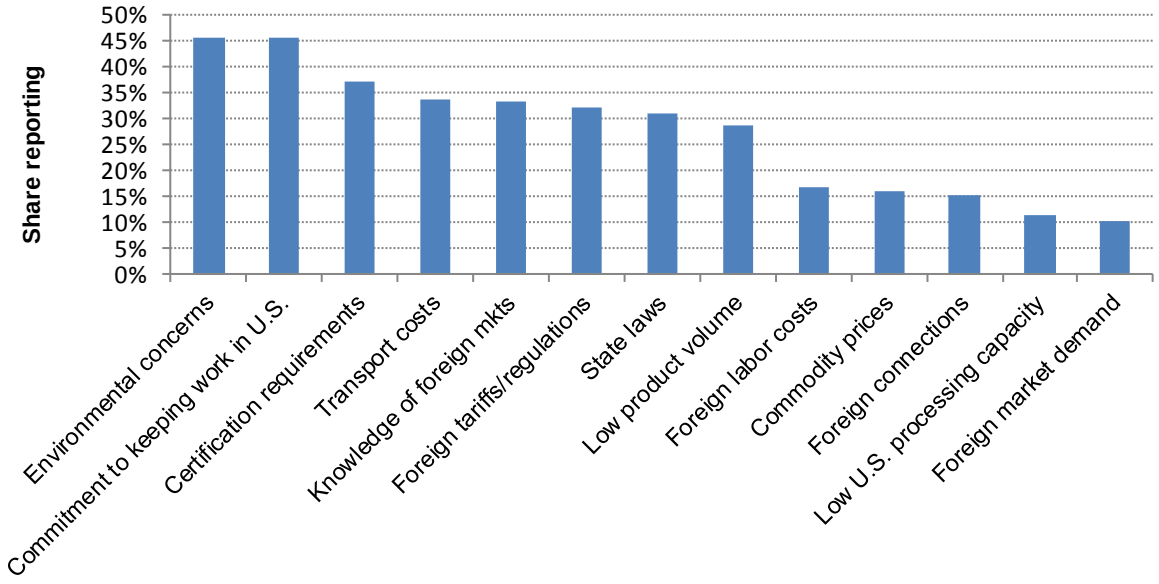
Note: Includes all responding entities (exporters and nonexporters).

FIGURE 6.2 Share of exporters for which these factors encouraged exports



Source: USITC calculations of weighted responses to the Commission questionnaire.

FIGURE 6.3 Share of nonexporters for which these factors discouraged exports



Source: USITC calculations of weighted responses to the Commission questionnaire.

Domestic Factors: Supply of UEPs for Export

U.S. exports of UEPs are particularly affected by several domestic factors. First, the greater the domestic capacity to collect, triage, process, and ultimately recycle, refurbish or discard UEPs and materials, the smaller will be the supply of U.S. UEPs available for export. Additionally, at least 28 state-level laws and regulations impact recycling activities and the cost structure of the industry. Finally, beginning in 2008, industry groups have implemented two separate industry certification programs that have imposed standards on certified companies' and nonprofit organizations' handling and processing of UEPs, with rules that address exports.

Domestic Processing Capacity for UEPs

The most important factor affecting the supply of U.S. UEP exports is the capacity within the United States to collect and process UEPs for refurbishment or recycling. As discussed in chapter 1, the UEP supply chain encompasses a variety of activities. U.S. capacity is a factor determining whether UEPs are processed in the United States versus overseas.

A lack of recycling capacity was one factor that encouraged UEP exports in 2011, according to questionnaire responses. This was particularly true for disassemblers and processors, collection and sorting facilities, and recycling service organizations.[4] Many companies in the refurbishing and recycling industries have increased production in the past decade. Collection of UEPs increased 38 percent from 2006 to 2010 in the United States, by weight. Even with that growth, however, it was estimated that only 27 percent

[4] As noted above, the most significant areas for which the U.S. industry lacks capacity are smelting facilities for circuit boards and CRT processing facilities.

of electronic products that were ready for end-of-life management were collected in 2010.[5] Additional investment in UEP processing capacity is expected in the coming years, as more products enter the UEP market and efforts to increase collection rates from households and businesses continue.[6] The lack of handling capacity can be challenging for policymakers as well. For example, in California, state regulations prohibiting disposal of CRTs in landfills have been relaxed, as the surge of CRTs has outstripped the state's capacity to process the material.[7]

The strong U.S. market for new electronic products creates a large U.S. supply of UEPs for the recycling industry, but there is not an equivalent U.S. demand for raw materials reclaimed in the recycling process. Instead, it is the large manufacturing centers, such as China, Korea, and India, that demand raw material inputs for their manufacturing industries.[8] Other economic factors, such as rising commodity prices and market values for particular electronic components, affect the economic feasibility of certain recycling operations and processes. For example, as mentioned in chapter 3, the relative profitability of manual disassembly versus mechanical shredding of UEPs changes as commodity prices change.[9] Manual disassembly extracts and segregates materials in a way that often generates a price premium, because it separates different commodities cleanly.[10] However, that premium must exceed the premium offered by the lower labor costs of the mechanical shredding process to tip the scales in favor of the manual process.

As noted earlier, shredded circuit boards sent to large smelting and metals recovery facilities represent a significant U.S. export stream. Domestic capacity for secondary smelting is very limited or nonexistent for UEPs. Additionally, new investment in the United States for large-scale secondary smelting plants that can use UEPs as input is unlikely, due to the substantial capital needed to build such a plant, the high costs of meeting accepted environmental and metallurgical standards, and, as of 2012, the adequate global capacity provided by several large-scale smelters in OECD countries.[11] However, as noted in chapter 4, there is at least one company investing in the United States in a final processing facility using different, less expensive technology for recovering metals from UEPs.[12] But even with this new facility, U.S. exports of UEPs to large, secondary smelters abroad are likely to be significant.

[5] EPA, Office of Resource Conservation and Recovery, *Electronics Waste Management*, May 2011.

[6] USITC, hearing transcript, May 15, 2012, 51, 278 (testimony of Wendy Neu, Coalition of American Electronics Recycling); USITC, hearing transcript, May 15, 2012, 81 (testimony Of Renee St. Denis, Sims Recycling Solutions).

[7] "CRT Glass Headed to CA Landfills," *Resource Recycling*, September 2012.

[8] USITC questionnaire results; USITC, hearing transcript, May 15, 2012, 58 (testimony of Renee St. Denis, Sims Recycling Solutions); USITC, hearing transcript, May 15, 2012, 49–51 (testimony of Dag Adamson, LifeSpan Recycling Company).

[9] USITC, hearing transcript, May 15, 2012, 212 (testimony of Willie Cade, PCRR Rebuilders and Recyclers).

[10] USITC, hearing transcript, May 15, 2012, 100 (testimony of Renee St. Denis, Sims Recycling Solutions).

[11] USITC, hearing transcript, May 15, 2012, 246–47, 281–82 (testimony of John Bullock, International Precious Metals Institute).

[12] The company, Wistron GreenTech, is investing in a new processing facility in Texas. For more information, see box 4.3.

U.S. State Regulations and the Availability of Domestic UEPs for Export

According to industry representatives, state legislation is a primary driver of residential and many commercial collection programs for UEPs.[13] As of October 2012, 28 states have passed some form of legislation regulating UEPs, e-waste, and certain materials found in electronic products, beginning with California in 2003.[14] Individual state laws can be broadly classified into four types: producer responsibility laws, which are the most common; consumer fee laws, as established in California; landfill disposal fee laws, found in Arkansas; and disposal bans or "no e-waste" laws, such as in Massachusetts and New Hampshire (table 6.1).

TABLE 6.1 State laws regulating UEPs and materials

Type of law	States that have implemented such laws	Example of provisions
Producer responsibility laws	CT, HI, IL, IN, ME, MD, MI, MN, MO, NJ, NY, NC, OK, OR, PA, RI, SC, TX, UT, VT, VA, WA, WV, WI	Requires manufacturers and retailers to develop or fund programs to support UEP recycling capacity and infrastructure.
Consumer fee laws	CA	Fee is assessed on new electronic products at the point of purchase based on the product's display size.
Landfill disposal fee laws	AR	Fees are imposed on all solid waste to support an electronic equipment recycling program.
Disposal bans/no e-waste laws	MA, NH	Bans disposal, incineration, or transfer for disposal of CRT glass in the state.

Source: Electronics Recycling Coordination Clearinghouse.

A large challenge for the UEP industry is that the patchwork of state laws does not easily allow for an integrated national collection and processing network of UEPs, which has contributed to the fragmented structure of the recycling industry.[15] Even when states' policies have similar frameworks, specific requirements are often different. These differences can substantially affect the operation of organizations, depending on which state they are located in. This presents particular challenges for organizations that operate in more than one state.

Producer responsibility laws, the most common type of state regulation, require producers, such as original equipment manufacturers (OEMs) and in some cases retailers, to provide or fund responsible disposal options for customers.[16] Most state laws require manufacturers or retailers of covered electronic products to register with the state environmental agency and pay a fee to sell their products in the state. Different states have different requirements for producers, but generally they must either provide a collection program for customers or help fund a state-run program.[17]

[13] Industry representative, telephone interview by USITC staff, Washington, DC, February 3, 2012.
[14] ERCC "Map of States with Legislation," (accessed on October 23, 2012).
[15] GAO, *Electronic Waste*, July 2010, 1424.
[16] ERCC, "Map of States with Legislation" (accessed April 25, 2012).
[17] ERCC, "Map of States with Legislation" (accessed April 25, 2012).

Some states have specific benchmarks. For example, Indiana requires manufacturers to collect and recycle a weight equal to 60 percent of the previous year's sales within the state, or be subject to additional fees. Other states have specific stipulations for the programs. Michigan, for example, requires manufacturers' collection programs to be convenient and free of charge to consumers. In Connecticut, companies pay for the costs of recycling their branded products by financing the state's electronic product recycling system. In addition, the state requires that municipalities provide collection programs, as well as develop education and outreach to make the collection programs accessible to households within the municipalities.[18]

California's law, passed in 2003, is a consumer fee regulatory framework. California is the only state that has instituted such a consumer fee.[19] Sellers of electronic products collect a fee at the point of purchase from buyers of new devices with video displays (such as televisions, cell phones, monitors, and laptop or tablet computers). Fees are set according to screen size, ranging from $6 for a product with a screen between 4 inches and 15 inches to $10 for an item with a screen larger than 35 inches.[20] The collected fees are then distributed to UEP recyclers in the state.[21]

Part of the revenue generated goes to state-approved collection and recycling operations that receive a per-pound fixed-rate reimbursement for all materials collected and recycled. However, in order to qualify for the reimbursement, products must have documentation that they were sourced from a California household.[22] The program has experienced instances of fraud, with out-of-state products being claimed for reimbursement and operations filing for reimbursement without performing recycling services. While state agencies are expected to monitor claims, California has recently pursued legal action in several cases where organizations improperly collected reimbursements.[23]

Lastly, California regulations require waste handlers exporting any CRTs to comply with federal regulations (discussed below). In addition, they must separately notify the California Department of Toxic Substances of the details of all export shipments that include CRTs. For export shipments destined for non-OECD countries, the notification must also include details of other covered electronic devices or waste.[24]

Arkansas, Massachusetts, and New Hampshire all have regulations regarding e-waste and used electronics, although none is as comprehensive as the producer responsibility or consumer fee laws described above.[25] Arkansas collects a landfill disposal fee from all solid waste collectors, which helps support a computer and electronic equipment recycling program.[26] New Hampshire bans most video imaging devices from landfills,

[18] Connecticut Department of Energy and Environmental Protection, "Municipal Guidance for Compliance with Connecticut's E-Waste Recycling Law: CGS Section 22a-629-640." http://www.ct.gov/dep/cwp/view.asp?a=2714&q=397488&depNav_GID=1645 (accessed April 25, 2012).

[19] California State Board of Equalization, "Electronic Waste Recycling Fee," Publication 95, December 2010.

[20] These rates were lowered in 2011. In 2009 and 2010, fees ranged from $8 to $25.

[21] CalRecycle, "Electronic Waste Recycling Act of 2003: Covered Electronic Waste Payment System (SB 20/SB 50)" (accessed on April 25, 2012); GAO, *Electronic Waste*, July 2010, 45.

[22] Inform, Inc. "A Review," February 2007.

[23] California Environmental Protection Agency, Department of Toxic Substances, "State Announces First Criminal Plea Argument," August 3, 2012.

[24] 22 CCR §66273.40.

[25] ERCC, "Maps of States with Legislation," (accessed on April 25, 2012).

[26] Solid Waste Management and Recycling Fund, Arkansas Code § 8-6-605 (2007).

making landfill operators accountable for any improper disposal.[27] Massachusetts's regulations ban CRTs from solid waste disposal facilities.[28] As a result, all CRTs in Massachusetts must be sent to recycling organizations, which the Department of Environmental Protection helps promote.[29] These regulations ultimately affect consumers' options for disposing of UEPs, either by increasing the cost or by eliminating certain facilities from disposal options.

According to questionnaire respondents, state regulations discourage exports, particularly for processors, metals processing facilities, and recycling services organizations. State regulations do not directly affect exports of UEPs, but they do alter the cost structure and underlying economic conditions that companies face. Existing state laws have different rules, targets, processes, and product coverage, which create inefficiencies and additional compliance costs for organizations trying to create integrated national networks.[30]

U.S. Federal Regulation

Although not as extensive as state and local regulation, federal regulations in place for certain covered UEPs also impact recycling and exports. Related federal legislation was introduced in the 112th Congress (box 6.1). Most importantly, since 2003, under certain conditions, CRTs have qualified as hazardous waste under the federal Resource Conservation and Recovery Act (RCRA), which is enforced by the EPA.[31] Under EPA regulations, exports of these materials are restricted (but remain legal) and exporters must follow certain administrative procedures.

Under EPA's CRT rule, exporters of used, intact CRTs for reuse must submit a one-time notification to the appropriate EPA regional office and maintain records for three years demonstrating that each shipment will be reused. Exporters of used, broken CRTs and unprocessed CRT glass for recycling must pre-notify EPA's national Office of Enforcement and Compliance Assistance of intended shipments and receive written permission from the regulatory authority in the destination country prior to shipment.[32] In practice, as discussed in chapter 5, there is a gray market of illegal shipments that manage to avoid enforcement of these regulations.[33] Destinations for U.S. exports of CRTs and CRT glass are discussed in chapter 3.

[27] New Hampshire Department of Environmental Services, "State Law Prohibits Landfilling or Incineration," May 26, 2006; New Hampshire House Bill 1455-FN-A (May 24, 2006).

[28] ERCC, "Maps of States with Legislation," (accessed on April 25, 2012).

[29] Massachusetts Department of Environmental Protection, "Cathode Ray Tube (CRT) Reuse and Recycling" (accessed October 2, 2012).

[30] GAO, *Electronic Waste*, July 2010, 14–24.

[31] EPA, Wastes—Hazardous Wastes, "Final Rules on Cathode Ray Tubes and Discarded Mercury-Containing Equipment," http://www.epa.gov/epawaste/hazard/recycling/electron/index.htm#crts (accessed April 20, 2012); GAO, *Electronic Waste*, July 2010, 8–11.

[32] The rule requires notification of an intended shipment 60 days before the shipment and may cover exports extending over 12 months or less.

[33] Industry representative, telephone interview by USITC staff, Washington, DC, February 28, 2012; GAO, *Electronic Waste*, July 2010, 9. Examples include providing false information on the bill of lading or mixing and hiding CRTs for recycling with CRTs for reuse/refurbishing. Chinese and Hong Kong regulations do not allow the imports of CRTs of any kind; however, strong demand there reportedly facilitates such gray-market behavior.

BOX 6.1 Responsible Electronics Recycling Act (HR 2284/S 1270)

Aside from the RCRA provisions that cover CRTs and bulbs and batteries containing mercury, no U.S. federal regulation currently covers the export of most UEPs or material from UEPs. However, a bill introduced in the 112th Congress—the Responsible Electronics Recycling Act[a]—would have placed additional requirements and restrictions on exports of UEPs to developing countries.

The bill classified certain UEPs and materials as hazardous waste, including many of those that are the subject of this report. If enacted, the bill would have allowed federal agencies to regulate and to enforce a ban on exports of certain UEPs, except to OECD and European Union member countries and Liechtenstein. The bill specified the following exemptions to the ban on exports:

- products that are tested to be working and destined for reuse;
- products that fall under certain warranties of OEMs;
- products that are subject to an OEM or agency recall; or
- certain CRTs that are in a condition to be a "direct feedstock to a lead-glass manufacturing furnace without further processing or preparation."

The bill also included provisions that would allow U.S. electronics recycling facilities to obtain certification to export to consenting destinations (similar to current regulations for CRTs).

If such a bill were passed, it would likely decrease U.S. exports of UEPs to non-OECD countries; according to USITC estimates, those countries accounted for 34 percent of exported UEPs, by weight, in 2011. Some exports of UEPs to these countries would continue, due to the exemptions noted above. However, the product mix would likely change to reflect more tested and refurbished products and fewer end-of-life products. Conversely, exports of commodity-grade material would likely increase, as more recycling activity would take place in the United States and UEP-derived commodities would be exported to manufacturing centers in non-OECD countries.

[a] The bill was recorded in the 112th Congress as HR 2284 in the House of Representatives and S 1270 in the Senate. The title and content of the two bills are identical.

Certifications

Industry participants, electronic product consumers, and the general public have become more aware of concerns related to the disposal of UEPs, including acknowledgement of hazards to the environment and to human health. In response, industry groups have developed two separate certification programs for participants in the industry: R2 and e-Stewards. These certifications provide operational standards, accountability in the chain of custody for qualified materials, standards for product specifications, and environmental and human health standards for UEP facilities. Both programs' certification standards were introduced in 2008, and both programs have experienced significant increases in membership since that time.[34]

R2 was developed in a coordinated effort by the Institute of Scrap Recycling Industries (ISRI),[35] the EPA, and other stakeholders beginning in 2006.[36] The R2 certification focuses on setting standards for electronics recycling in a market-oriented way, meaning

[34] Gordon, "Comparisons of e-Stewards and R2," n.d. (accessed October 16, 2012); e-Stewards website, "e-Stewards Recyclers," http://e-stewards.org/find-a-recycler (accessed October 16, 2012); e-Stewards website, "About Us: Background and History," http://e-stewards.org/about (accessed October 16, 2012).

[35] An industry trade association, ISRI represents for-profit manufacturers and processors, brokers, and industrial consumers of scrap commodities companies.

[36] The stakeholders also included the EPA, state regulators, electronics industry representatives and trade associations, OEMs, customers of electronics recycling services, and NGO representatives.

that certified firms integrate the costs of higher standards into their business operations, rather than simply banning exports of certain goods to certain countries.[37] As of October 2012, there are 290 R2-certified facilities.[38] They are located primarily in the United States and Canada, but there are also certified facilities in other countries, including the United Kingdom, China, India, Singapore, Malaysia, and Mexico.

The Basel Action Network (BAN) developed e-Stewards. BAN is a nonprofit organization focused on promoting global responsibility in the disposal and handling of toxic materials, including electronic waste.[39] BAN initially participated in the development of the R2 certification, but withdrew before the standards were finalized (box 6.2).[40]

The e-Stewards standard prohibits the export of certain hazardous materials to non-OECD countries, strictly following the provisions of the Basel Convention. Most e-Stewards'–certified facilities are in the United States, but there are also sites in Canada, Mexico, and the United Kingdom.[41]

Eighteen percent of all UEP organizations, and 27 percent of UEP exporters, required their downstream business partners to participate in a certification program (figure 6.4).

This requirement was particularly prevalent for collection and sorting organizations and for disassemblers and processors. Most firms that required customers to be certified also required that downstream businesses not export. However, in most industry segments, it was not required to hold both a certification and a non-export commitment. Only in a few industry segments, particularly wholesalers of parts and materials, did a significant proportion of firms require both.

Enforcement and Auditing of Certifications

Organizations participating in either the R2 or e-Stewards certification program are subject to audits to ensure they are in compliance. Both certification programs use third-party auditing contractors that are employed by accredited certifying bodies to perform on-site certification inspections.[42] The certifying bodies also perform annual audits on facilities, which must reapply for certification every three years.[43] Auditors primarily focus on the operating procedures and processes within facilities. Additionally, they ensure that chain of custody is properly documented so materials can be tracked and, if needed, verify that the destinations are in compliance.[44]

[37] R2 Solutions, "Principles Underlying the R2 Standard" (accessed April 13, 2012).
[38] R2 Solutions, "Electronic Recyclers with R2 Certified Facilities" (accessed July 17, 2012).
[39] Basel Action Network, "About the Basel Action Network—BAN," http://www.ban.org/about (accessed on April 13, 2012); e-Stewards, "About Us: Background and History," http://e-stewards.org/about (accessed April 13, 2012).
[40] Industry representative, telephone interview by USITC staff, Washington, DC, January 31, 2012; Gordon, "Comparisons of e-Stewards and R2," n.d. (accessed October 16, 2012). The United States did not sign the Basel Convention agreement and reportedly does not follow its standards. However, the convention is the basis for BAN's work in the United States and internationally.
[41] e-Stewards, "Find e-Stewards Recyclers," http://e-stewards.org/find-a-recycler (accessed April 13, 2012).
[42] Industry representative, telephone interview by USITC staff, Washington, DC, January 31, 2012; Gordon, "Comparisons of e-Stewards and R2," n.d. (accessed October 16, 2012).
[43] Gordon, "Comparisons of e-Stewards and R2," n.d. (accessed October 16, 2012).
[44] Industry representative, interview by USITC staff, Pennsylvania, March 7, 2012.

BOX 6.2 Principal differences between the R2 and e-Stewards certification programs

The R2 and e-Stewards programs share the overall objective of reducing improper disposal of UEPs; both create a framework for increased accountability to ensure proper recycling and disposal practices. However, there are three key differences that distinguish the two programs: (1) certified organizations' ability to export potentially hazardous materials, (2) the need for organizations that handle UEPs to adopt environmental management standards (EMS) certification, and (3) the acceptance of prison labor.

The most important difference between the two programs relates to exports of UEPs. e-Stewards does not allow nonworking products to be exported to non-OECD countries due to concerns about the handling of potentially toxic materials. Under e-Stewards, only UEPs that have been confirmed to be tested and working in the United States may be exported to non-OECD countries. e-Stewards does allow exports of commodity materials, but requires that they be processed to a point where they are considered to be commodity grade and no longer toxic. This can affect products such as shredded circuit boards, which under e-Stewards can be smelted only in OECD countries to retrieve the valuable metals they contain.[a] By contrast, R2 allows exports to any country, as long as the facility in the destination country is operating in accordance with R2 standards and the destination country does not impose bans on the UEPs or related materials in question.[b] As a result, R2-certified facilities can ship products to many more markets.

A second key difference between the two programs is the requirement for a standard EMS certification. e-Stewards requires that facilities certified under that system also be certified under the ISO 14001 standard, which provides rules for environmental stewardship and workplace safety.[c] R2 requires that facilities have an EMS in place, but does not require a specific system.[d] Some R2 facilities do maintain the ISO 14001 standard, but ISRI offers an alternate EMS certification, called Recycling Industry Operating Standards (RIOS), which is frequently used in R2-certified facilities.[e]

Finally, the two programs differ on the use of prison labor in UEP facilities. Because it violates the Basel Convention, e-Stewards does not certify facilities where prison labor is used. R2 does not have this restriction, and in fact, the U.S. federal prison system operates several recycling facilities with UEP work-training programs that are R2 certified.[f]

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[a] e-Stewards, "The e-Stewards Standard" (accessed October 24, 2012); industry representatives, telephone interview by USITC staff, Washington, DC, February 8, 2012.

[b] Industry representative, telephone interview by USITC staff, Washington, DC, January 31, 2012.

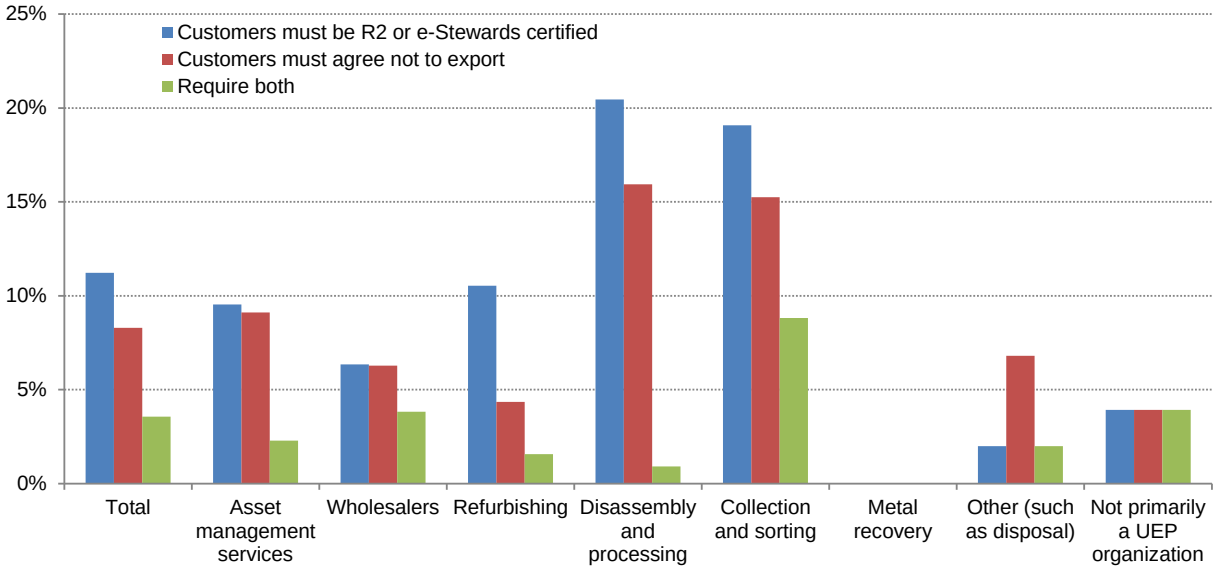
[c] Gordon, "Comparisons of e-Stewards and R2," n.d. (accessed October 16, 2012).

[d] Gordon, "Comparisons of e-Stewards and R2," n.d. (accessed October 16, 2012).

[e] ISRI, R2/RIOS website, "About R2/RIOS Certified Electronics Recycler." http://www.r2rios.org/ (accessed October 16, 2012).

[f] R2 Solutions website, "Electronic Recyclers with R2 Certified Facilities" (accessed October 16, 2012).

FIGURE 6.4 UEP customer requirements, 2011



Source: USITC calculations of weighted responses to the Commission questionnaire.

Certification programs appear to have a significant impact on how facilities audit their downstream partners; 87 percent of certified firms performed audits on their downstream partners, compared with only 13 percent for companies that were not certified. Additionally, 80 percent of certified facilities tracked their UEP materials to their final destination, compared with only 6 percent of facilities that were not certified.

Value of Certification for Facilities

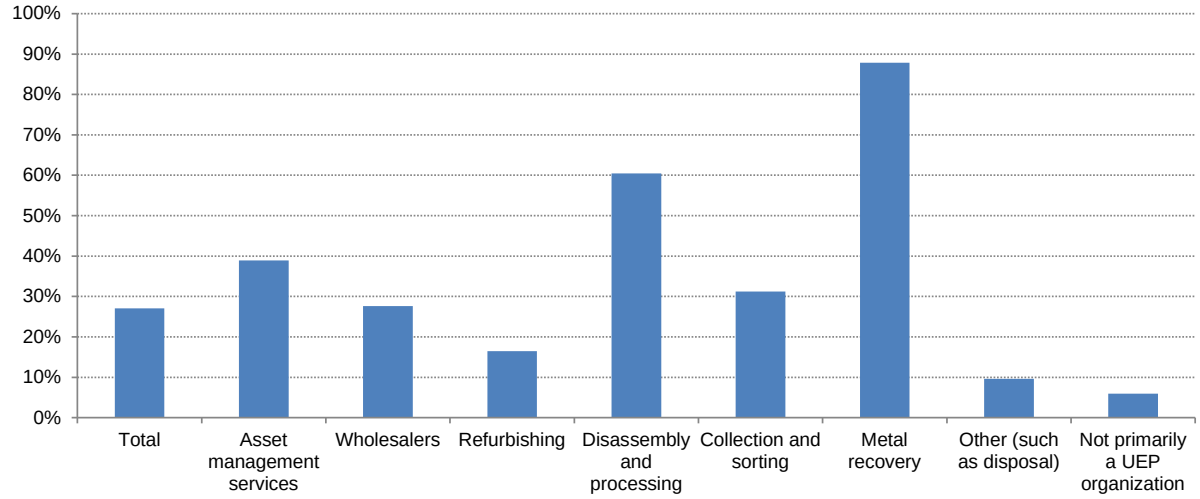
Certifications serve as a marketing vehicle for organizations, communicating an organization's standards and its commitments to its customers to responsibly handle potential hazards derived from UEPs. Certified organizations reportedly also benefit from preferred access to important contracts.[45]

For certain types of firms, certification is required simply to stay in business. Under the state regulations described above, OEMs and large retailers in many states are now responsible for collecting and recycling significant quantities of UEPs. Many of these companies hire recycling or asset management firms to handle this process. To guarantee that standards are met, and to safeguard their own reputations, many of those contracts now require the recyclers to be R2- or e-Stewards-certified. As a result, according to industry sources, certification has now become a necessity for many companies, particularly for relatively smaller, independent recycling facilities that depend on contracts with the large collectors.[46] These large business contracts drive market prices, volumes, and procedures.[47]

[45] Industry representatives, telephone interview by USITC staff, Washington, DC, January 31, 2012; industry representatives, telephone interview by USITC staff, Washington, DC, February 3, 2012; industry representatives, telephone interview by USITC staff, Washington, DC, April 23, 2012.
[46] Industry representative, telephone interview by USITC staff, Washington, DC, February 3, 2012.
[47] Industry representative, telephone interview by USITC staff, Washington, DC, February 1, 2012.

In addition to requiring that their contractors be certified under R2 or e-Stewards, 27 percent of UEP organizations require that downstream contractors meet the organizations' internal specifications as well (figure 6.5). This is particularly prevalent among contractors involved in metals recovery (88 percent require their contractors to meet their internal standards) and disassembly and processing (60 percent require contractors to meet internal standards). This practice applies to upstream firms as well, such as recycling services organizations (39 percent) and collection and sorting organizations (31 percent). Companies that are competing for contracts with these upstream entities will likely adjust their supply chains to ensure compliance, and may orient materials toward domestic facilities rather than exporting them.

FIGURE 6.5 UEP organizations with specialized downstream customer requirements, 2011



Source: USITC calculations of weighted responses to the Commission questionnaire.

Costs of Certifying

Due to the marketing benefits, many enterprises are willing to bear significant costs to become certified in the R2 or e-Stewards programs. The cost of certification varies by the size of the company, but can be thousands of dollars or even more, particularly for the largest companies in the industry.[48] In addition to the initial costs of becoming certified, companies bear the costs of bringing their facilities into compliance, of regular auditing of their own facilities, and of performing due diligence on their downstream customers.[49] Widespread certification is likely to reduce exports, at least for whole, nonworking equipment, but the overall impact on total U.S. exports is difficult to quantify. Even with

[48] Industry representatives, telephone interview by USITC staff, Washington DC, February 14, 2012; industry representatives, telephone interview by USITC staff, Massachusetts, February 24, 2012; industry representatives, telephone interview by USITC staff, Washington DC, February 2, 2012.

[49] Industry representative, telephone interview by USITC staff, Washington, DC, February 15, 2012. Materials that qualify are defined by the certification programs, but are essentially the same for each. The materials include items containing polychlorinated biphenyls (PCBs); items containing mercury; CRTs and CRT glass; whole and shredded circuit boards that have not been safely processed to remove certain materials, such as lead soldering; and mercury from batteries.

thorough auditing, the tracking and oversight of materials remains difficult, time consuming, and unreliable; some observers believe that not all companies strictly adhere to the programs' export requirements.[50]

Labor as a Factor in UEP Exports

Foreign labor costs positively influenced export decisions for 26 percent of recycling services firms and 32 percent of UEP processing firms (both exporters and nonexporters). On the other hand, for UEP wholesaling, refurbishing, and metals processing organizations, between 71 and 86 percent of these organizations indicated that foreign labor costs do not influence their decisions about exporting. This corresponds with the fact that these segments of the industry tend to be less labor intensive than others.

For UEP exporters only, 32 percent indicated that foreign labor costs encouraged them to export. These are firms for which the process of extracting maximum value from used electronics can be labor intensive, making foreign labor costs an important consideration in the decision of whether to export.[51] Labor costs were an important consideration for 56 percent of processing firms, 28 percent of refurbishing services firms, and 19 percent of recycling services firms.[52] By contrast, labor costs were not an important consideration in the decision of whether to export for UEPs that require capital-intensive processes such as mechanical shredding or metals processing. Indeed, foreign labor costs influenced the decision to export for only 13 percent[53] of exporting firms involved in metals processing.

Brokers represent another group of UEP exporters for which foreign labor costs were not an important factor influencing their exporting activities. They are important players when it comes to UEP exports. Nonetheless, foreign labor costs were a factor that positively influenced export decisions for only 17 percent of brokers. Instead, nearly 60 percent of exporting brokers identified foreign market demand as an important factor influencing exports, and 30 percent identified their firms' connections to a foreign firm as an important factor.

The major U.S. export markets for UEPs destined for recycling include the OECD countries of Mexico, Canada, Sweden, Belgium, and other Asian countries, particularly Korea and Japan, and the non-OECD countries of China, India, Pakistan, Philippines, and Vietnam. Figure 6.6 illustrates the sharp distinctions between hourly average labor compensation (wage and nonwage costs) in the manufacturing sector for the United States compared to those of five of its trading partners in the UEP industry. Not surprisingly, labor compensation in the U.S. is much higher than that of its non-OECD trading partners. In 2010, for example, hourly U.S. labor compensation for manufacturing was $34.74, far higher than in China ($1.70) and in the Philippines ($1.90).[54] In contrast, labor compensation in OECD trading partner countries cited in questionnaire responses is higher on average than in the United States.

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[50] Industry representative, telephone interview by USITC staff, Washington, DC, February 6, 2012; industry representative, telephone interview by USITC staff, Washington, DC, February 8, 2012.

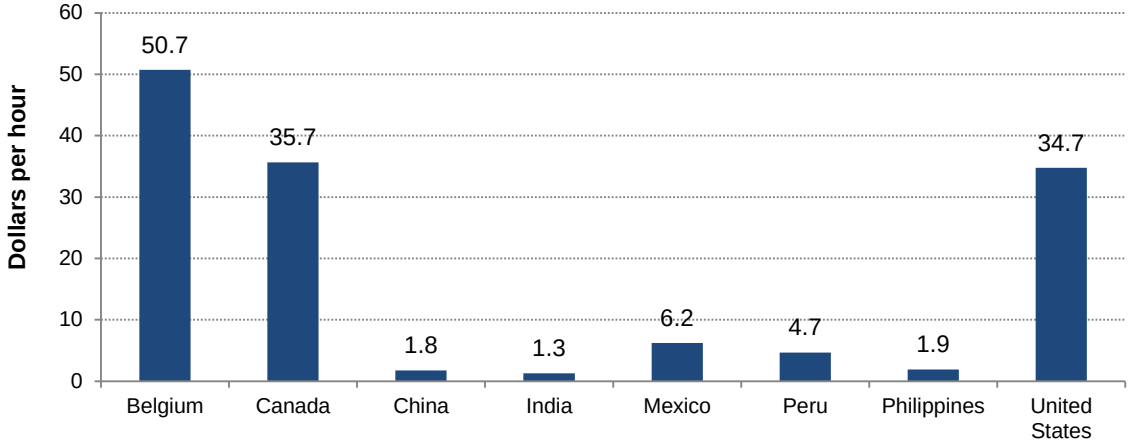
[51] It is important to note the key role that metal prices play in deciding whether to export the downstream segment of the recyclable used electronic products. The higher metal prices are, the higher the return on domestic recycling, and the less such products are exported for processing. Industry official, interview by USITC staff, February 24, 2012.

[52] For example, one industry official noted that labor costs are the driving force in his decision to export UEPs from his disassembly business. Industry representative, interview by USITC staff, March 13, 2012.

[53] Low-precision estimate, with an RSE of 84 percent.

[54] EIU, "Manufacturing Labor Costs per Hour," EIU Datatool, (accessed December 5, 2012).

FIGURE 6.6 Average hourly labor compensation, 2010



Source: Economist Intelligence Unit (EIU), "Manufacturing Labor Costs per Hour," EIU Datatool (accessed December 5, 2012).

Foreign Markets: Demand Factors

Significant foreign demand exists for U.S. exports of UEPs and for scrap materials derived from such products. Goods that are tested and working before export face few limits on trade; the same is true for scrap materials that do not contain such hazardous materials as polychlorinated biphenyls (PCBs), lead, mercury, CRTs and CRT glass, batteries, and whole and shredded circuit boards.

Factors affecting demand patterns for used electronic products differ in developed versus developing countries.[55] Demand in OECD countries is for circuit boards from which precious metals can be recovered. In developing countries, by contrast, where residents are often unable to afford the newest technology, there is a much greater demand for affordable UEPs that are tested and working before being exported, or that are shipped, then refurbished and resold in the export market.[56] There is also significant demand for commodity materials that can be extracted from UEPs and used as inputs into manufacturing processes.

OECD Countries

OEMs design and market products to consumers in developed countries who demand and can afford the latest electronics technology—faster processors and operating systems, cellphones with greater capabilities, video displays and television receivers with large flat screen displays. With the exception of Mexico, there is little demand for imports of intact U.S. UEPs in OECD countries, given that consumers in these countries generally have

[55] In this report, membership in the Organisation for Economic Co-operation and Development (OECD) is generally used as a proxy for developed countries, partially because the Basel Convention, discussed below, uses that distinction. Mexico, a country often thought of as developing, is an OECD member.

[56] USITC, hearing transcript, May 15, 2011, 142–47 (testimony of Robin Ingenthron, American Retroworks).

the same access to computers, cellphones, and televisions, and the same replacement cycles for them.[57]

Demand for UEPs in OECD and other developed countries is focused on disassembled scrap materials, primarily on circuit boards that contain precious metals like silver, gold, platinum, and palladium, as well as base metals like copper. As discussed in chapter 5, in 2011 there were only six recognized smelting operations in the world—all in OECD countries—that extract these valuable metals from used electronic scrap materials using environmentally sound methods.[58]

Developing Countries

In most countries, tested and working UEPs are legal to import and export, with only a few countries banning such trade.[59] Compared to residents of OECD countries, consumers and businesses in countries with lower incomes tend to have less access to the latest generation of new electronic products. This creates a strong demand for UEPs from the United States, which often have a productive second life in developing countries.[60]

This demand extends both to UEPs in working condition and to nonworking equipment, which can be repaired and resold, or from which components can be salvaged for repair of other equipment. Working UEPs are exported both by for-profit companies that refurbish such goods for export, and by charitable organizations that donate them in developing countries. Charities may also export whole goods that are not yet refurbished to charities in developing countries that refurbish and resell the goods locally.

Demand for disassembled materials also follows different patterns in non-OECD countries as opposed to OECD countries. In OECD countries, the most significant demand is for circuit boards that are sent to high-tech smelting facilities, which recover gold and other precious metals from them. In developing countries, many of which have extensive manufacturing industries, there is significant demand for metals, plastics, and glass that serve as inputs into manufacturing processes. This demand in part feeds the informal recycling sector, with its assorted environmental and health concerns. Individual country regulations, in concert with the Basel Convention, limit certain imports of UEPs into many developing countries.

As described above, most nonworking UEPs that are recycled in the United States are disassembled, and a significant share of their component parts is exported either as commodity materials or as goods for further recycling.[61] For example, the extraction of copper and aluminum from electronics scrap materials doesn't require the advanced technology used to recover precious metals. Thus there are dozens of copper smelters[62] and more than 150 aluminum smelters around the world.[63]

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[57] Parkinson, "Innovation and Hyper-connectivity," March 3, 2011; Patel, "Business IT Replacement Cycles," December 20, 2010.

[58] See table 5.3 for additional detail on these smelting operations. Prakash and Manhart, *Socio-economic Assessment and Feasibility Study,* August 2010.

[59] Barlas, "The Scrap Export Enigma," September/October 2006; Government of Vietnam, Ministry of Post and Telecommunications, Decision No. 20/2006/QD-BBCVT, 2006; Fripp, "Uganda Effects Ban on Used Electronic Imports," April 6, 2010.

[60] USITC, hearing transcript, May 15, 2012, 271–72.

[61] For example, the extraction of precious metals from printed circuit boards.

[62] U.S. Geological Service, Mineral Resources On-line Spatial Data.

[63] Alcor Technology website, www.alcortechnology.com, September 21, 2012. Not all of the copper and aluminum smelters mentioned necessarily recycle scrap from UEPs.

Restrictions on Trade in Used Electronics

Basel Convention

The Basel Convention is a multilateral treaty designed to reduce the movements of hazardous waste between nations and to control the transfer of hazardous waste from developed (OECD) to less developed (non-OECD) countries, by establishing a prior notification and consent system for shipments. The Convention was adopted on March 22, 1989, and entered into force on May 5, 1992.[64] There are 179 countries that are parties to the Basel Convention. The United States is one of only three countries that has signed but not ratified the Convention.[65]

The Basel Convention does not specifically address UEPs, but it does address goods (including UEPs) that contain hazardous elements, including lead, cadmium, and mercury, that are contained in many electronic products, as specified in an annex to the Convention. The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes, to ensure that such wastes are handled through environmentally sound management practices located as close as possible to the source of generation, and to assist developing countries in environmentally sound management of the hazardous and other wastes they generate.[66]

In 1995, following negotiations, the supreme decision-making body of the Convention, the Council of Plenipotentiaries, adopted the so-called Ban Amendment[67] to the Convention, to prohibit the export of hazardous wastes from developed to developing countries, as described in the Convention. The amendment has not yet been ratified by a sufficient number of countries, so has not entered into force. The Ban Amendment would prohibit:

- exports by states included in Annex VII of the convention (countries that are OECD and the European Union members, and Liechtenstein) to other Basel Convention parties of hazardous wastes covered by the convention that are intended for final disposal, and

- exports to states not included in Annex VII of hazardous wastes covered by paragraph 1 (a) of Article 1 of the Basel Convention that are destined for reuse, recycling, or recovery operations.

Although implementation of the Ban Amendment has been stalled since 1995, in October 2011 the parties reached agreement on a new ratification procedure intended to accelerate the ratification process. However, at the same meeting a representative of one of the Convention parties questioned whether the Ban Amendment remained necessary in light of changes in recycling techniques, changes in the perceived value of such wastes, and

[64] Text of the Basel Convention, http://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx, accessed September 12, 2012.

[65] Basel Convention website, www.basel,int, accessed February 14, 2012.

[66] Ibid.

[67] Amendment to the Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

increased demand for recycled products.[68] If the Ban Amendment does enter into force, it is possible that it could reduce foreign markets for U.S. UEP exports. Implementation of provisions in recently negotiated regional agreements between countries in Africa, Central America, and the South Pacific which ban imports of hazardous waste into their respective areas[69] may also limit the markets available to U.S. exporters of UEPs.

Although exports of nonworking UEPs from the United States are not illegal, their importation into other countries may well be. A special case would be exports of CRTs, which requires notification to the EPA. However, U.S. Customs and Border Patrol (CBP), which enforces regulations on U.S. imports, does not have the jurisdiction to enforce EPA licensing regulations on CRTs, nor does CBP enforce foreign regulations on U.S. exports.[70]

National/Regional Regulations

In addition to the international Basel Convention, most developed countries have implemented regulations to control the disposal of UEPs. In the European Union, for instance, recently passed regulations require that manufacturers and distributors arrange for the collection and recycling of waste electrical and electronic equipment (WEEE) (box 6.3). A number of developing countries specifically ban the importation of UEPs, regardless of whether or not they are working (table 6.2).

BOX 6.3 The WEEE directive

In February 2002, the European Union published Directive 2002/96/EC on waste electrical and electronic equipment (WEEE), which sets collection, recycling, and recovery targets for all types of electrical goods, including electronic products. The WEEE directive imposes responsibility for the disposal or recycling of WEEE on the manufacturers or distributors of such equipment. It requires that those companies establish an infrastructure for collecting WEEE, in such a way that "Users of electrical and electronic equipment from private households should have the possibility of returning WEEE at least free of charge." National "producer compliance schemes" have been implemented, into which manufacturers and distributors pay an annual fee for the collection and recycling of associated waste electronics from household waste recycling centers.

The directive classified WEEE into numerous categories, the first tier being historic and nonhistoric. Member states are expected to ensure that systems are established allowing the return of historic equipment (placed on the market before August 13, 2005) from private households, such systems being without cost to the household. Producers/distributors of WEEE equipment placed on the market after August 13, 2005, are responsible for financing the collection and recycling of WEEE.

Source: *Official Journal of the European Union,* L37/24, February 2, 2003.

[68] According to the official report of the meeting, representatives expressed support for modifying the ratification process such that ratification would be based on the number of parties to the Convention at the time the amendment was adopted. The report also states that at the meeting the representative of Japan "expressed what he termed skepticism regarding the effectiveness of the Ban Amendment once it entered into force. . . . [H]e said that circumstances had changed significantly since the adoption of the Amendment in that recycling techniques had improved, wastes were increasingly being seen and used as valuable resources and economic growth in developing countries was increasing the demand for recycled products." Secretariat of the Basel Convention, *Report of the Conference of the Parties*, November 1, 2011, 8–9, para. 56 and 68; see also Secretariat of the Basel Convention, "Historic Agreement Ends 15 Year Deadlock," October 25, 2011.

[69] For example, the Bamako Convention (African Union), Central American Agreement on Hazardous Waste, Waigani Convention (South Pacific), Barcelona Protocol (Mediterranean countries), http://www.basel.int/DNNAdmin/AllNews/tabid/2290/ctl/ArticleView/mid/7518/articleId/334/Historic-agreement-ends-15-year-deadlock-over-banning-North-South-movements-of-hazardous-waste.aspx.

[70] CBP official, interview by USITC staff, January 30, 2012.

TABLE 6.2 Regulations limiting imports of used electronics, selected countries, 2012

Country	Regulations limiting imports of used electronic products
China	China banned the importation of most UEPs in 2000, including remanufactured electronics;[a] the ban was further expanded in 2002.[b]
Hong Kong	Hong Kong does not permit the importation of UEPs containing hazardous materials from countries listed under the Basel BAN Amendment without permits issued by the Environmental Protection Department.[c]
India	India permits the importation of e-waste only for recycling, recovery, or reuse with specific government permission, under the 2008 Hazardous Wastes Rules and Guidelines for Environmentally Sound Management of E-Waste,[e] Authorities will consider granting permission to import and export e-waste only to parties with environmentally sound recycling facilities, registered with the appropriate state pollution control board. Only one such unit has permission to import e-waste for recycling. India banned the importation of used and reconditioned computers in 2010.[d] India maintains the only glass furnace worldwide that handles glass from CRTs.[f]
Indonesia	The Minister of Trade signed a regulation in October 2009 concerning general provisions in imports. Though not specifically addressing electronics, the regulation required that imported goods be in a brand-new state, with certain stipulated exceptions. UEPs are not included in the exceptions.[g]
Kenya	Kenya does not specifically restrict imports of UEPs, but imposes a 25 percent excise tax on imports of used computers.[h] The tax was intended to spur demand for an inexpensive domestic computer, which has yet to be introduced to the market.[i]
Malaysia	Malaysia had imported used CRTs and CRT monitors for refurbishing and recycling; those found to be unusable were sent to a plant in Malaysia for recycling into new CRT glass.[j] As demand for new CRTs waned, the manufacturer, Samsung SDI, announced plans to end CRT production in September 2012 and to convert the plant to manufacture secondary cells.[k]
Mexico	Mexico does not permit the importation of used or refurbished computer equipment.[l]
Philippines	The Philippines permits the importation of UEPs, but not those containing hazardous wastes. Recyclable materials containing hazardous substances, such as electronic goods containing printed circuit boards and electronic components, may be imported only upon obtaining prior written approval from the Secretary of the Department of Environment and Natural Resources.[m]
Thailand	Thailand does not allow the importation of used electronic parts.[n]
Vietnam	Vietnam bans the importation of virtually all used consumer goods, including electronics, and specifically excludes used information technology products as the result of a decree in January 2006.[o] Exceptions may be may be made by the Prime Minister in extraordinary cases.[p] This decree was amended in November 2007 to exclude certain products from the ban, most notably laptop computers.[q]
Uganda	The government of Uganda imposed a ban on imports of UEPs effective April 1, 2010.[r]

Source: Compiled by USITC.

[a] USITC, *Remanufactured Goods: An Overview,* October 2012.
[b] Barlas, "The Scrap Export Enigma," September/October 2006.
[c] U.S. Department of State, cable from Nairobi, April 12, 2012.
[d].Mann, "India Bans Imports of 'Second-Hand' Computers," December 20, 2010.
[e] Government of India, "Ban on Imports of Second-hand Computers," November 15, 2010.
[f] Industry representative, telephone interview by USITC staff, April 23, 2012.
[g] Republic of Indonesia, Minister of Trade, Regulation 54/m-dag/per/10/2009, 2009.
[h] U.S. Department of State, U.S. Embassy, Nairobi: "Electronics Exported from the United States: International Trade Commission Information Request," April 12, 2012.
[i] Wanjiku, "Still Waiting for Mandaraka PC," September 30, 2008.
[j] Institute of Scrap Recycling Industries, "A Second Life for CRTs," April 25, 2012.
[k] MK Business News, "Samsung SDI Halts CRT Production in Malaysia Plant," April 3, 2012.
[l] U.S. DOC, Office of Technology and Electronic Commerce, *Mexico: Customs, Taxes and Documentation Requirements for IT Products and Service Imports, .*accessed April 12, 2012
[m] U.S. Department of State, U.S. Embassy, Manila: "Response to U.S. International Trade Commission Request Concerning Used Electronics Exports from the United States," June 12, 2012.
[n] U.S. Department of State, email message to Alberto Goetzl, May 7, 2012.
[o] Government of Vietnam, Minister of Post and Telecommunications, Decision no. 20/2006/QD-BBCVT, 2006.
[p] U.S. Department of State, U.S. Embassy, Hanoi, "Vietnam Response to Information Request from USITC re Trade in Used Electronics," May 12, 2012.
[q] Government of Vietnam, Minister of Post and Telecommunications, Decision no. 11/2007/QD-BBCVT, 2007.
[r] Fripp, "Uganda Effects Ban on Used Electronic Imports," April 6, 2010.

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APPENDIX A
Request Letter

EXECUTIVE OFFICE OF THE PRESIDENT
THE UNITED STATES TRADE REPRESENTATIVE
WASHINGTON, D.C. 20508

JAN 0 9 2012

The Honorable Deanna Tanner Okun
Chairman
U.S. International Trade Commission
500 E Street, SW
Washington, DC 20436

Dear Chairman Okun:

The National Strategy for Electronics Stewardship, which was developed by an interagency task force, sets forth recommendations for better management of electronics throughout product lifecycles. One of the recommendations is to improve information on trade flows of used electronic products. Better data are needed to create a clear picture of trade flows, which will enhance the understanding of the U.S. government and stakeholders of trade in used electronic products.

Pursuant to authority delegated by the President to the United States Trade Representative (USTR) under Section 332(g) of the Tariff Act of 1930, I request that the U.S. International Trade Commission (Commission) undertake a study and prepare a report that describes U.S. exports of used electronic products, such as audio and visual equipment, computers and peripheral equipment, digital imaging devices, telecommunication equipment, and component parts of these products. Additional electronic products may be included in the report as the Commission deems relevant. The report should be based on a review of available data and other information, including primary data collected through a survey of enterprises engaged in exporting used electronic products from the United States. The Commission's report should cover 2011, or the latest year data are available, and, to the extent practicable, include information on the following:

- the type, volume, and value of, and foreign markets of significance for, exports of used electronic products from the United States;

- the forms and activities, with respect to used electronic products, of enterprises receiving U.S. exporters' shipments, most common end uses of exports in the foreign market (i.e., further processing, final disposal, etc.), and the extent of cross-border, intra-firm shipments by U.S. exporters;

- the characteristics of used electronic products exported from the United States, including product condition (e.g., working, non-working, remanufacturable, refurbishable, repairable), composition of shipments (single product type, multiple product types), and the extent to which exports are processed (broken down or stripped), or remain intact prior to exportation; and

- the forms, activities and characteristics of domestic exporting enterprises (e.g., original equipment manufacturers, remanufacturers, refurbishers, brokers, recyclers, non-profits, etc.) including the extent to which the exporter is foreign-invested.

In addition, USTR would benefit from information, to the extent it is available, on the following:

- the relative share of sales by U.S. companies of used electronic products that are (1) exported, (2) sold to firms in the United States, (3) processed by the exporter itself, and (4) disposed of by the exporter itself.

- the factors affecting trade in used electronic products.

I am requesting that the Commission deliver this report no later than 13 months from the date of receipt of this letter.

I anticipate that the Commission's report will be made available to the public in its entirety. Therefore, the report should not contain any confidential business or national security information.

The Commission's assistance in this matter is greatly appreciated.

Sincerely,

Ambassador Ron Kirk

APPENDIX B
Federal Register Notices

information, we cannot guarantee that we will be able to do so.

Information Collection Clearance Officer: Laura Dorey (202) 208–2654.

Dated: January 26, 2012.

Gregory J. Gould,

Director, Office of Natural Resources Revenue.

[FR Doc. 2012–2297 Filed 2–1–12; 8:45 am]

BILLING CODE 4310–T2–P

INTERNATIONAL TRADE COMMISSION

[DN 2874]

Certain Ink Application Devices and Components Thereof and Methods of Using the Same; Receipt of Complaint; Solicitation of Comments Relating to the Public Interest

AGENCY: U.S. International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the U.S. International Trade Commission has received a complaint entitled *In Re Certain Ink Application Devices and Components Thereof and Methods of Using the Same,* DN 2874; the Commission is soliciting comments on any public interest issues raised by the complaint.

FOR FURTHER INFORMATION CONTACT: James R. Holbein, Secretary to the Commission, U.S. International Trade Commission, 500 E Street, SW., Washington, DC 20436, telephone (202) 205–2000. The public version of the complaint can be accessed on the Commission's electronic docket (EDIS) at *http://edis.usitc.gov,* and will be available for inspection during official business hours (8:45 a.m. to 5:15 p.m.) in the Office of the Secretary, U.S. International Trade Commission, 500 E Street SW., Washington, DC 20436, telephone (202) 205–2000.

General information concerning the Commission may also be obtained by accessing its Internet server (*http://www.usitc.gov*). The public record for this investigation may be viewed on the Commission's electronic docket (EDIS) at *http://edis.usitc.gov.* Hearing-impaired persons are advised that information on this matter can be obtained by contacting the Commission's TDD terminal on (202) 205–1810.

SUPPLEMENTARY INFORMATION: The Commission has received a complaint filed on behalf of MT.Derm GmbH and Nouveau Cosmetique USA Inc., on January 30, 2012. The complaint alleges violations of section 337 of the Tariff Act of 1930 (19 U.S.C. 1337) in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain ink application devices and components thereof and methods of using the same. The complaint names T-Tech Tattoo Device Inc. of Canada; Yiwu Beyond Tattoo Equipments Co., Ltd. of China; and Guangzhou Pengcheng Cosmetology Firm of China, as respondents.

The complainant, proposed respondents, other interested parties, and members of the public are invited to file comments, not to exceed five pages in length, on any public interest issues raised by the complaint. Comments should address whether issuance of an exclusion order and/or a cease and desist order in this investigation would negatively affect the public health and welfare in the United States, competitive conditions in the United States economy, the production of like or directly competitive articles in the United States, or United States consumers.

In particular, the Commission is interested in comments that:

(i) Explain how the articles potentially subject to the orders are used in the United States;

(ii) Identify any public health, safety, or welfare concerns in the United States relating to the potential orders;

(iii) Indicate the extent to which like or directly competitive articles are produced in the United States or are otherwise available in the United States, with respect to the articles potentially subject to the orders; and

(iv) Indicate whether Complainant, Complainant's licensees, and/or third party suppliers have the capacity to replace the volume of articles potentially subject to an exclusion order and a cease and desist order within a commercially reasonable time.

Written submissions must be filed no later than by close of business, eight business days after the date of publication of this notice in the **Federal Register**. There will be further opportunities for comment on the public interest after the issuance of any final initial determination in this investigation.

Persons filing written submissions must file the original document and 12 true copies thereof on or before the deadlines stated above with the Office of the Secretary. Submissions should refer to the docket number (''Docket No. 2874'') in a prominent place on the cover page and/or the first page. The Commission's rules authorize filing submissions with the Secretary by facsimile or electronic means only to the extent permitted by section 201.8 of the rules (see Handbook for Electronic Filing Procedures, *http://www.usitc.gov/secretary/fed_reg_notices/rules/documents/handbook_on_electronic_filing.pdf.* Persons with questions regarding electronic filing should contact the Secretary ((202) 205–2000).

Any person desiring to submit a document to the Commission in confidence must request confidential treatment. All such requests should be directed to the Secretary to the Commission and must include a full statement of the reasons why the Commission should grant such treatment. *See* 19 CFR 201.6. Documents for which confidential treatment by the Commission is properly sought will be treated accordingly. All nonconfidential written submissions will be available for public inspection at the Office of the Secretary.

This action is taken under the authority of section 337 of the Tariff Act of 1930, as amended (19 U.S.C. 1337), and of sections 201.10 and 210.50(a)(4) of the Commission's Rules of Practice and Procedure (19 CFR 201.10, 210.50(a)(4)).

By order of the Commission.

Issued: January 30, 2012.

James R. Holbein,

Secretary to the Commission.

[FR Doc. 2012–2321 Filed 2–1–12; 8:45 am]

BILLING CODE 7020–02–P

INTERNATIONAL TRADE COMMISSION

[Investigation No. 332–528]

Used Electronic Products: An Examination of U.S. Exports; Institution of Investigation and Scheduling of Hearing

AGENCY: United States International Trade Commission.

ACTION: Institution of investigation and scheduling of public hearing.

SUMMARY: Following receipt of a request on January 9, 2012, from the United States Trade Representative (USTR) under section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)), the U.S. International Trade Commission (Commission) instituted investigation No. 332–528, *Used Electronic Products: An Examination of U.S. Exports.*

DATES: April 16, 2012: Deadline for filing request to appear at the public hearing.

April 30, 2012: Deadline for filing pre-hearing briefs and statements.

May 15, 2012: Public hearing.

May 22, 2012: Deadline for filing post-hearing briefs and statements.

September 14, 2012: Deadline for filing all other written submissions.

February 8, 2013: Transmittal of Commission report to the USTR.

ADDRESSES: All Commission offices, including the Commission's hearing rooms, are located in the United States International Trade Commission Building, 500 E Street SW., Washington, DC. All written submissions should be addressed to the Secretary, United States International Trade Commission, 500 E Street SW., Washington, DC 20436. The public record for this investigation may be viewed on the Commission's electronic docket (EDIS) at *http://edis.usitc.gov*.

FOR FURTHER INFORMATION CONTACT: Project Leader Laura Bloodgood (202) 708–4726 or *laura.bloodgood@usitc.gov* or Deputy Project Leader Andrea Boron (202) 205–3433 or *andrea.boron@usitc.gov* for information specific to this investigation. For information on the legal aspects of this investigation, contact William Gearhart of the Commission's Office of the General Counsel (202) 205–3091 or *william.gearhart@usitc.gov*. The media should contact Margaret O'Laughlin, Office of External Relations (202) 205–1819 or *margaret.olaughlin@usitc.gov*. Hearing-impaired individuals may obtain information on this matter by contacting the Commission's TDD terminal at (202) 205–1810. General information concerning the Commission may also be obtained by accessing its Internet server (*http://www.usitc.gov*). 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.

SUPPLEMENTARY INFORMATION:

Background

As requested by USTR, the Commission will conduct an investigation and prepare a report that describes U.S. exports of used electronic products, such as audio and visual equipment, computers and peripheral equipment, digital imaging devices, telecommunication equipment, and component parts of these products, and such additional electronic products as the Commission deems relevant. As requested, the report will be based on a review of available data and other information, including primary data collected through a survey of enterprises engaged in exporting used electronic products from the United States. The report will cover 2011, or the latest year for which data are available, and, to the extent practicable, include the following:

- The type, volume, and value of, and foreign markets of significance for, exports of used electronic products from the United States;
- The forms and activities, with respect to used electronic products, of enterprises receiving U.S. exporters' shipments, most common end uses of exports in the foreign market (*i.e.*, further processing, final disposal, *etc.*), and the extent of cross-border, intra-firm shipments by U.S. exporters;
- The characteristics of used electronic products exported from the United States, including product condition (*e.g.*, working, non-working, remanufacturable, refurbishable, repairable), composition of shipments (single product type, multiple product types), and the extent to which exports are processed (broken down or stripped), or remain intact prior to exportation;
- The forms, activities and characteristics of domestic exporting enterprises (*e.g.*, original equipment manufacturers, remanufacturers, refurbishers, brokers, recyclers, non-profits, etc.) including the extent to which the exporter is foreign-invested;
- The relative share of sales by U.S. companies of used electronic products that are (1) exported, (2) sold to firms in the United States, (3) processed by the exporter itself, and (4) disposed of by the exporter itself; and
- The factors affecting trade in used electronic products.

The USTR asked that the Commission provide its report no later than 13 months from the date of receipt of the letter.

Public Hearing

A public hearing in connection with this investigation will be held at the U.S. International Trade Commission Building, 500 E Street SW., Washington, DC, beginning at 9:30 am on May 15, 2012. Requests to appear at the public hearing should be filed with the Secretary no later than 5:15 p.m., April 16, 2012, in accordance with the requirements in the ''written submissions'' section below. All pre-hearing briefs and statements should be filed with the Secretary no later than 5:15 p.m. on April 30, 2012; and all post-hearing briefs and statements should be filed with the Secretary no later than 5:15 p.m., May 22, 2012. In the event that, as of the close of business on April 16, 2012, no witnesses are scheduled to appear at the hearing, the hearing will be canceled. Any person interested in attending the hearing as an observer or nonparticipant should contact the Office of the Secretary at (202) 205–2000 after April 16, 2012, for information concerning whether the hearing will be held.

Written Submissions

In lieu of or in addition to participating in the hearing, interested parties are invited to file written submissions concerning this investigation. All written submissions should be addressed to the Secretary, and should be received no later than 5:15 p.m., September 14, 2012. All written submissions must conform to the provisions of section 201.8 of the *Commission's Rules of Practice and Procedure* (19 CFR 201.8). Section 201.8 requires that a signed original (or a copy so designated) and fourteen (14) copies of each document be filed. In the event that confidential treatment of a document is requested, at least four (4) additional copies must be filed, in which the confidential information must be deleted (see the following paragraph for further information regarding confidential business information). The Commission's rules authorize filing submissions with the Secretary by facsimile or electronic means only to the extent permitted by section 201.8 of the rules (see Handbook on Electronic Filing Procedures, *http://www.usitc.gov/docket_services/documents/handbook_on_electronic_filing.pdf*). Persons with questions regarding electronic filing should contact the Secretary (202) 205–2000.

Any submissions that contain confidential business information (CBI) must also conform to the requirements of section 201.6 of the Commission's *Rules of Practice and Procedure* (19 CFR 201.6). Section 201.6 of the rules requires that the cover of the document and the individual pages be clearly marked as to whether they are the ''confidential'' or ''non-confidential'' version, and that the confidential business information be clearly identified by means of brackets. All written submissions, except for confidential business information, will be made available for inspection by interested parties.

In his request letter the USTR said that he anticipates that the Commission's report will be made available to the public in its entirety, and asked that the Commission not include any confidential business or national security information in the report it sends him. Accordingly, any confidential business information received by the Commission in this investigation and used in preparing this report will not be included in the report

that the Commission sends to the USTR and will not be published in a manner that would reveal the operations of the firm supplying the information.

By order of the Commission.

Issued: January 30, 2012.

James R. Holbein,

Secretary to the Commission.

[FR Doc. 2012–2349 Filed 2–1–12; 8:45 am]

BILLING CODE 7020–02–P

DEPARTMENT OF LABOR

Office of the Secretary

Agency Information Collection Activities; Submission for OMB Review; Comment Request; Shipyard Employment Standards

ACTION: Notice.

SUMMARY: The Department of Labor (DOL) is submitting the Occupational Safety and Health Administration (OSHA) sponsored information collection request (ICR) titled, ''Shipyard Employment Standard'' to the Office of Management and Budget (OMB) for review and approval for continued use in accordance with the Paperwork Reduction Act (PRA) of 1995 (44 U.S.C. 3501 *et seq.*).

DATES: Submit comments on or before March 5, 2012.

ADDRESSES: A copy of this ICR with applicable supporting documentation; including a description of the likely respondents, proposed frequency of response, and estimated total burden may be obtained from the RegInfo.gov Web site, *http://www.reginfo.gov/public/do/PRAMain,* on the day following publication of this notice or by contacting Michel Smyth by telephone at (202) 693–4129 (this is not a toll-free number) or sending an email to *DOL_PRA_PUBLIC@dol.gov.*

Submit comments about this request to the Office of Information and Regulatory Affairs, Attn: OMB Desk Officer for the Department of Labor, Occupational Safety and Health Administration (OSHA), Office of Management and Budget, Room 10235, Washington, DC 20503, Telephone: (202) 395–6929/Fax: (202) 395–6881 (these are not toll-free numbers), email: *OIRA_submission@omb.eop.gov.*

FOR FURTHER INFORMATION CONTACT: Michel Smyth by telephone at (202) 693–4129 (this is not a toll-free number) or by email at *DOL_PRA_PUBLIC@dol.gov.*

SUPPLEMENTARY INFORMATION: The information collection requirements of the Standard are directed towards reducing workers' risk of death or serious injury by ensuring that equipment has been tested and is in safe operating condition. The standard for shackles and hooks, 29 CFR 1915.113(b)(1), requires that all hooks for which no applicable manufacturer's recommendations are available be tested and that the employer retain a certification record. The standard on portable air receivers, 29 CFR 1915.172(d), requires that portable, unfired pressure vessels be examined quarterly and subjected to a yearly hydrostatic pressure test and that a certification record be maintained.

This information collection is subject to the PRA. A Federal agency generally cannot conduct or sponsor a collection of information, and the public is generally not required to respond to an information collection, unless it is approved by the OMB under the PRA and displays a currently valid OMB Control Number. In addition, notwithstanding any other provisions of law, no person shall generally be subject to penalty for failing to comply with a collection of information if the collection of information does not display a valid OMB Control Number. *See* 5 CFR 1320.5(a) and 1320.6. The DOL obtains OMB approval for this information collection under OMB Control Number 1218–0220. The current OMB approval is scheduled to expire on January 31, 2012; however, it should be noted that existing information collection requirements submitted to the OMB receive a month-to-month extension while they undergo review. For additional information, see the related notice published in the **Federal Register** on October 12, 2011 (76 FR 63327).

Interested parties are encouraged to send comments to the OMB, Office of Information and Regulatory Affairs at the address shown in the **ADDRESSES** section within 30 days of publication of this notice in the **Federal Register.** In order to help ensure appropriate consideration, comments should reference OMB Control Number 1218–0220. The OMB is particularly interested in comments that:

- Evaluate whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;
- Evaluate the accuracy of the agency's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used;
- Enhance the quality, utility, and clarity of the information to be collected; and
- Minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology, e.g., permitting electronic submission of responses.

Agency: Occupational Safety and Health Administration (OSHA).

Title of Collection: Standard on Shipyard Employment (29 CFR part 1915).

OMB Control Number: 1218–0220.

Affected Public: Private Sector—Business or other for-profits.

Total Estimated Number of Respondents: 635.

Total Estimated Number of Responses: 13,051.

Total Estimated Annual Burden Hours: 3,162.

Total Estimated Annual Other Costs Burden: $0.

Dated: January 26, 2012.

Michel Smyth,

Departmental Clearance Officer.

[FR Doc. 2012–2268 Filed 2–1–12; 8:45 am]

BILLING CODE 4510–26–P

DEPARTMENT OF LABOR

Office of the Secretary

Agency Information Collection Activities; Submission for OMB Review; Comment Request; Occupational Exposure to Hazardous Chemicals in Laboratories Standard

ACTION: Notice.

SUMMARY: The Department of Labor (DOL) is submitting the Occupational Safety and Health Administration (OSHA) sponsored information collection request (ICR) titled, ''Occupational Exposure to Hazardous Chemicals in Laboratories Standard'' to the Office of Management and Budget (OMB) for review and approval for continued use in accordance with the Paperwork Reduction Act (PRA) of 1995 (44 U.S.C. 3501 *et seq.*).

DATES: Submit comments on or before March 5, 2012.

ADDRESSES: A copy of this ICR with applicable supporting documentation; including a description of the likely respondents, proposed frequency of response, and estimated total burden may be obtained from the *RegInfo.gov* Web site, *http://www.reginfo.gov/public/do/PRAMain,* on the day

UNITED STATES INTERNATIONAL TRADE COMMISSION

INVESTIGATION NO. 332-528

USED ELECTRONIC PRODUCTS: AN EXAMINATION OF U.S. EXPORTS

SUBMISSION OF QUESTIONNAIRE FOR OMB REVIEW

AGENCY: United States International Trade Commission

ACTION: In accordance with the provisions of the Paperwork Reduction Act of 1995 (44 U.S.C. Chapter 35), the U.S. International Trade Commission (Commission) has submitted a request for approval of a questionnaire to the Office of Management and Budget for review.

PURPOSE OF INFORMATION COLLECTION: The form is for use by the Commission in connection with Investigation No. 332-528, *Used Electronic Products: An Examination of U.S. Exports*, instituted under the authority of section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)). This investigation was requested by the United States Trade Representative (USTR). The Commission expects to deliver the results of its investigation to the USTR by February 8, 2013.

SUMMARY OF PROPOSAL:

(1) Number of forms submitted: 1.
(2) Title of form: Electronic Products Questionnaire.
(3) Type of request: New.
(4) Frequency of use: Industry questionnaire, single data gathering, scheduled for 2012.
(5) Description of respondents: U.S. firms in the used electronics processing industry.
(6) Estimated number of questionnaires to be mailed: 5,500.
(7) Estimated total number of hours to complete the form per respondent: 2.5 hours.
(8) Information obtained from the form that qualifies as confidential business information will be so treated by the Commission and not disclosed in a manner that would reveal the individual operations of a firm.

ADDITIONAL INFORMATION OR COMMENT: Copies of the form and supporting documents may be obtained from project leader Laura Bloodgood (laura.bloodgood@usitc.gov or 202-708-4726) or deputy project leader Andrea Boron (andrea.boron@usitc.gov or 202-205-3433). Comments about the proposal should be directed to the Office of Management and Budget, Office of Information and Regulatory Affairs, Room 10102 (Docket Library), Washington, D.C. 20503, ATTENTION: Docket Librarian. All comments should be specific, indicating which part of the questionnaire is objectionable, describing the concern in detail, and including specific suggested revision or language changes. Copies of any comments should be provided to Andrew Martin, Chief Information Officer, U.S. International Trade Commission, 500 E Street S.W., Washington, D.C. 20436, who is the Commission's designated Senior Official

under the Paperwork Reduction Act.

Persons with mobility impairments who will need special assistance in gaining access to the form and supporting documents should contact the Secretary at 202-205-2000. Hearing impaired individuals are advised that information on this matter can be obtained by contacting our TTD terminal (telephone no. 202-205-1810). Also, general information about the Commission can be obtained from its internet site (http://www.usitc.gov).

By order of the Commission

James R. Holbein
Secretary to the Commission

Issued: May 11, 2012

UNITED STATES INTERNATIONAL TRADE COMMISSION

INV. NO. 332-528

USED ELECTRONIC PRODUCTS: AN EXAMINATION OF U.S. EXPORTS

PROPOSED INFORMATION COLLECTION; COMMENT REQUEST; USED ELECTRONIC PRODUCTS QUESTIONNAIRE

AGENCY: United States International Trade Commission

ACTION: In accordance with the provisions of the Paperwork Reduction Act of 1995 (44 U.S.C. Chapter 35), the U.S. International Trade Commission (Commission) will submit a request for approval of a questionnaire to the Office of Management and Budget for review.

DATES: To ensure consideration, written comments must be submitted on or before June 1, 2012.

ADDRESSES: Direct all written comments to Laura Bloodgood, Project Leader, U.S. International Trade Commission, 500 E Street S.W., Washington, D.C. 20436 (or via email at laura.bloodgood@usitc.gov).

ADDITIONAL INFORMATION: Copies of the questionnaire and supporting investigation documents may be obtained from project leader Laura Bloodgood (laura.bloodgood@usitc.gov or 202-708-4726) or deputy project leader Andrea Boron (andrea.boron@usitc.gov or 202-205-3433). Supporting documents may also be downloaded from the Commission website at http://www.usitc.gov/research_and_analysis/What_We_Are_Working_On.htm.

PURPOSE OF INFORMATION COLLECTION: The form is for use by the Commission in connection with Investigation No. 332-528, *Used Electronic Products: An Examination of U.S. Exports*, instituted under the authority of section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)). This investigation was requested by the United States Trade Representative (USTR). The Commission expects to deliver the results of its investigation to the USTR by February 10, 2013.

SUMMARY OF PROPOSAL:

(1) Number of forms submitted: 1.
(2) Title of form: Used Electronic Products Questionnaire.
(3) Type of request: New.
(4) Frequency of use: Industry questionnaire, single data gathering, scheduled for 2012.
(5) Description of respondents: U.S. firms acquiring, refurbishing, repairing, reselling, recycling, and/or exporting used electronic products in 2011.
(6) Estimated number of respondents: 5,000.
(7) Estimated total number of hours to complete the form per respondent: 2.5 hours.
(8) Information obtained from the form that qualifies as confidential business information will be so treated by the Commission and not disclosed in a manner that would reveal the individual operations of a firm.

SUPPLEMENTARY INFORMATION:

I. Abstract

The U.S. Trade Representative has directed the Commission to prepare a report that (1) provides estimates and details of U.S. exports of used electronic products, and the share of exports compared to all used electronic products sold or processed in the United States, (2) describes U.S. companies that export used electronic products, and (3) describes the foreign enterprises that import used electronic products from the United States. The Commission will base its report on a review of available data and other information, including the collection of primary data through a survey of enterprises engaged in the processing of used electronic products.

The report will cover 2011 annual data, and to the extent practicable will estimate and describe the following:

a. The type, volume, and value of, and foreign markets of significance for, exports of used electronic products from the United States;
b. The forms and activities, with respect to used electronic products, of enterprises receiving U.S. exporters' shipments, most common end uses of exports in the foreign market (i.e., further processing, final disposal, etc.), and the extent of cross-border, intra-firm shipments by U.S. exporters;
c. The characteristics of used electronic products exported from the United States, including product condition (e.g., working, non-working, remanufacturable, refurbishable, repairable), composition of shipments (single product type, multiple product types), and the extent to which exports are processed (broken down or stripped), or remain intact prior to exportation;
d. The forms, activities and characteristics of domestic exporting enterprises (e.g., original equipment manufacturers, remanufacturers, refurbishers, brokers, recyclers, nonprofits, etc.) including the extent to which the exporter is foreign-invested;
e. The relative share of sales by U.S. companies of used electronic products that are (1) exported, (2) sold to firms in the United States, (3) processed by the exporter itself, and (4) disposed of by the exporter itself; and
f. The factors affecting trade in used electronic products.

II. Method of Collection

Respondents will be mailed a letter directing them to download and fill out a form-fillable PDF questionnaire. Once complete, respondents may submit it by uploading it to a secure webserver, emailing it to the study team, faxing it, or mailing a hard copy to the Commission.

III. Request for Comments

Comments are invited on (1) whether the proposed collection of information is necessary; (2) the accuracy of the agency's estimate of the burden (including hours and cost) of the proposed collection of information; (3) ways to enhance the quality, utility, and clarity of the information to be collected; and (4) ways to minimize the burden of the collection of information on respondents, including through the use of automated collection techniques

or other forms of information technology.

The draft questionnaire and other supplementary documents may be downloaded from the USITC website at http://www.usitc.gov/332528comments.

Comments submitted in response to this notice will be summarized and/or included in the request for OMB approval of this information collection; they will also become a matter of public record.

By order of the Commission

/s/
James R. Holbein
Secretary

Issued: March 30, 2012

APPENDIX C
Hearing Witnesses

CALENDAR OF PUBLIC HEARING

Those listed below appeared as witnesses at the United States International Trade Commission's hearing:

Subject: Used Electronic Products: An Examination of U.S. Exports

Inv. No.: 332-528

Date and Time: May 15, 2012 - 9:30 a.m.

Sessions were held in connection with this investigation in the Main Hearing Room (room 101), 500 E Street, S.W., Washington, D.C.

PANEL 1: FOR-PROFIT RECYCLERS:

ORGANIZATION AND WITNESS:

HiTech Assets, Inc.
Oklahoma City, OK

Lane Epperson, President and CEO

Forever Green By Way of Recycling, Inc.
Chantilly, VA

Gordon F. Scott, Owner

LifeSpan Recycling Co. Inc.
LifeSpan Technology Recycling
Boston, MA

Dag Adamson, President

Regency Technologies
Twinsburg, OH

Jim Levine, President

Sims Recycling Solutions
Roseville, CA

Renee St. Denis, Vice President of Business Development

PANEL 2: REFURBISHERS/EXPORTERS:

ORGANIZATION AND WITNESS:

TechSoup Global
San Francisco, CA

Jim Lynch, Director of GreenTech & Electronics Recycling & Reuse Programs

InterConnection.org
Seattle, WA

Charles Brennick, Director

American Retroworks, Inc.
Middlebury, VT

Robin Ingenthron, President

PC Rebuilders & Recyclers, LLC
Chicago, IL

Willie Cade, Owner

iFixit
Atascadero, CA

Kyle Wiens, CEO

PANEL 3: GLOBAL COMPANIES, ASSOCIATIONS, AND NGOs:

ORGANIZATION AND WITNESS:

Umicore USA Inc.
Raleigh, NC

Holly A. Chapell, Director of Governmental Affairs

International Precious Metals Institute
Cheshire, CT

John Bullock, Chair, Environmental and Regulatory Affairs Committee

Coalition of American Electronics Recycling
New York, NY

Wendy Neu, Executive Vice President, Hugo Neu Corporation

National Center for Electronics Recycling
Parkersburg, WV

Jason Linnell, Executive Director

Institute of Scrap Recycling Industries, Inc.
Washington, D.C.

Joseph Pickard, Chief Economist and Director of Commodities

-END-

APPENDIX D
Summary of Views of Interested Parties

Summary of Views of Interested Parties

The Commission held a public hearing for its investigation on U.S. exports of used electronic products (UEPs) on May 15, 2012, in Washington, DC. Interested persons were also invited to file written submissions for the investigation. This appendix contains a summary of the views expressed to the Commission via testimony, written submission, or both, and reflects only the principal points made by the particular party. The views summarized are those of the submitting parties and not the Commission. In preparing this summary, Commission staff did not confirm the accuracy of, or otherwise correct, the information summarized. For the full text of hearing testimony, written submissions, and exhibits, see entries associated with investigation no. 332-528 at the Commission's Electronic Docket Information System (https://edis.usitc.gov).

Coalition of American Electronic Recycling (CAER)[1]

Wendy Neu testified at the Commission hearing representing both CAER and the Hugo Neu Corporation, where she serves as Executive Vice President. According to Ms. Neu, CAER represents 67 companies of all sizes, with operations in 33 states and the District of Columbia. The association was formed to support enactment of federal legislation that would prohibit the export of certain types of unprocessed "e-waste" and nonworking UEPs containing toxic materials.

Ms. Neu expressed support for the effort being made by the U. S. Trade Representative (USTR) to study the flow of UEPs, but said that she doubted that the Commission's survey methodology will produce meaningful results. For the questionnaire results to be accurate and useful to policymakers, she said that one would need to know not only the volume of exports to developing countries, but also whether the exported products are nonworking and hazardous. Without these data, according to Ms. Neu, the Commission's questionnaire results would be suspect and thereby jeopardize the overall intent of the study. She said that to obtain more reliable data, there will need to be more U.S. Customs and Border Patrol (Customs) inspections of containers at the loading port, while coordinating with Customs officials at the discharge ports. She believes that most questionnaire respondents will not acknowledge exports in violation of the Basel Convention. She cited a report by the U.S. Government Accountability Office that showed lack of enforcement and violations of existing U.S. Environmental Protection Agency (EPA) rules on cathode-ray tubes (CRTs).

Ms. Neu stated that CAER recognizes strong market demand for functioning UEPs in developing countries, but believes that exporting these products for recycling is environmentally and economically problematic. U.S. recyclers are disadvantaged because they cannot compete with recyclers that operate in countries with cheap labor and few environmental or worker safety laws. She noted that the United States is the only developed country that has not signed the Basel Convention, which restricts such exports of UEPs.

Ms. Neu commented that what will be difficult to quantify in the current study is the pervasive practice whereby unscrupulous brokers send junk electronics along with

[1] USITC, hearing transcript, May 15, 2012, 250–57 and 278–315 (testimony of Wendy Neu, CAER).

valuable working equipment to overseas buyers. She said that it is simple to send mixed electronics overseas that are misidentified as working equipment or something completely different. She stated that mixing used equipment that is tested and working with junk is a serious problem and one of the ways that the junk material ends up getting exported. She indicated that the cost of treating that "e-waste" is avoided by sending it to a developing country where they don't have the kinds of safety and health protections that exist in the United States.

According to Ms. Neu, the main purpose of the proposed Responsible Electronics Recycling Act (RERA), which CAER supports, is to reduce the massive amounts of toxic, nonworking, and obsolete electronics sent to developing countries. Absent the new law and better enforcement of existing regulations, irresponsible companies will continue to export these materials. Ms. Neu predicted that passage would cut U.S. exports of used electronics and increase investment and employment in U.S. recycling. She stated that the law would not affect exports of working electronics or processed commodities that do not contain what the law defines as "restricted electronic waste." She also indicated CAER's support for the United States' ratification of the Basel Convention.

Ms. Neu noted that equipment manufacturers are increasingly interested in being able to track this material through mass balancing for assurances it is not ending up being poorly handled in developing countries. She said that e-Stewards certification requires shippers to specify where material from electronics recycling is sent.

Forever Green Recycling (Forever Green)[2]

In testimony before the Commission, Gordon Scott, owner of Forever Green in Chantilly, VA, stated that his company is a collector and processor of UEPs with 10 years of UEP recycling experience. The company collects UEPs from a variety of clients, and then either processes them for downstream customers or refurbishes them for reuse. Forever Green employs between five and eight people and also has a reuse store for secondary market products that have been tested, refurbished, and the data removed. Mr. Scott stated that Forever Green was actively trying to open a new facility in Washington, DC at the time of the hearing.

According to Mr. Scott, Forever Green does not support the export of UEPs that are not either refurbished or resold in their original form. Mr. Scott stated that the value of the UEP recycling and refurbishing industry would best be kept within the United States to provide domestic jobs. Mr. Scott stated that testing and dismantling UEPs should be performed with domestic labor and would provide employment for low-skill workers. Mr. Scott also noted that keeping the processing facilities in the United States would benefit the country by conserving energy and natural resources. Mr. Scott also stated that there is value in retrieving rare earth materials from UEPs, as doing so makes global industries less reliant upon Chinese production and sale of rare earth materials. Lastly, Mr. Scott noted that there are a number of common industry practices which, though not illegal, are also not environmental "best practices."

[2] USITC, hearing transcript, May 15, 2012, 14–20 (testimony of Gordon Scott, Forever Green).

HiTech Assets, Incorporated (HiTech)[3]

Lane Epperson, President and CEO of HiTech, presented the Commission with a written submission and hearing testimony on U.S. exports of UEPs. Mr. Epperson described HiTech Assets as an electronics recycling company headquartered in Oklahoma, that focuses on asset recovery and reuse for large enterprises, including universities, public school systems, and major corporations. He said that HiTech typically accepts a range of UEPs from its clients, including photo kiosks, laptops, PCs, monitors, servers, and networking equipment.[4] According to Mr. Epperson, HiTech does not usually handle the household consumer product stream.[5] He identified his clients' three priorities as data security, environmental safety, and financial value.

Mr. Epperson explained that HiTech's principal output is products for reuse, which reportedly account for 90 percent of total revenues.[6] He stated that in the United States, equipment for reuse that is in tested and working condition is both sold domestically and exported.[7] Mr. Epperson noted that nonworking and obsolete products are processed in the United States by certified processors.[8] He characterized the export trade for UEPs as "very competitive," citing rapid declines in technology prices as a driving factor in used product sales.[9] Mr. Epperson said that Asia and the Middle East are important to HiTech's export business, accounting for 52 percent and 28 percent of total exports, respectively.[10]

Mr. Epperson expressed concern that any future restrictions delaying exports of tested and working equipment would "severely impact" his business and possibly lead to job losses at HiTech Assets.[11] He explained that because the export markets in Asia and the Middle East are very important for his business, restricting all U.S. exports of UEPs to countries belonging to the Organization for Economic Co-operation and Development (OECD) would gravely limit his sales base.[12] Mr. Epperson concluded by elaborating on the environmental benefits of reusing UEPs through reduced greenhouse gas emissions.[13]

[3] USITC, hearing transcript, May 15, 2012, 6–14 (testimony of Lane Epperson, HiTech); HiTech, written submission to the USITC, May 15, 2012.

[4] USITC, hearing transcript, May 15, 2012, 8.

[5] Ibid., 7.

[6] USITC, hearing transcript, November 18, 2009, 9.

[7] Ibid.

[8] He noted that HiTech Assets retains both R2 and Recycling Industry Operating Standard (RIOS) certifications. USITC, hearing transcript, November 18, 2009, 9.

[9] For example, Mr. Epperson observes that the prices of PCs and laptops depreciate between one-fourth and one-third of their value each year. USITC, hearing transcript, November 18, 2009, 10–11.

[10] Mr. Epperson stated that other major export markets for HiTech were Canada (9 percent) and Europe (6 percent), while Africa and South America split the remaining 5 percent of exports. USITC, hearing transcript, November 18, 2009, 9–10.

[11] USITC, hearing transcript, November 18, 2009, 12.

[12] Ibid., 13.

[13] Ibid., 13–14.

iFixit[14]

Kyle Wiens, CEO of iFixit, presented a written submission and hearing testimony to the Commission on U.S. exports of UEPs. IFixit maintains a website with free repair manuals written and edited by online users to guide consumers and small repair shops in fixing electronic devices. According to Mr. Wiens, "literally thousands of people" contribute to the material on iFixit's web site, and the site currently receives 3 million unique visitors each month.[15] These service manuals contain highly technical product specifications that are reportedly considered proprietary by the major electronics manufacturers and are not available to the public.[16] Mr. Wiens said that he believes it is unethical to ship "very complex electronics" abroad without also providing service information to users.[17]

In his remarks at the Commission hearing, Mr. Wiens said that the specialized nature of electronic goods necessitates very specific information in order to facilitate repairs. In his travels to China, Egypt, and Kenya, Mr. Wiens reported that he found "hyper-specialized" service technicians making repairs to specific models of cell phones and CRT TVs, some of which were reverse-engineered abroad.[18] According to Mr. Wiens, the dominance of the Asian repair and refurbishing industry is not explained by lower labor costs, but instead by localized, specific manufacturing and repair knowledge. Thus, repairmen in California cannot compete because they do not have access to the necessary circuit schematics to repair electronic goods. Mr. Wiens noted that the largest U.S. cell phone refurbisher, Recellular, performs low-skill work domestically, while more technical capabilities are outsourced to Asia.[19]

Mr. Wiens concluded that the worst problem facing the industry is not the export of used electronic goods, but rather that products designed to last for decades are being destroyed prematurely owing to a lack of repair expertise.[20] In his view, making service documentation available free of charge would prevent environmental problems and create jobs in the United States.

Institute of Scrap Recycling Industries, Inc. (ISRI)[21]

Joseph Pickard, chief economist and director of commodities at ISRI, testified that the association represents 1,650 for-profit companies involved in processing scrap metals, paper, plastics, glass, electronics, and other materials at over 3,000 locations. Mr. Pickard stated that more than 400 ISRI members recycle electronics and that electronics recycling is the fastest-growing segment of the recycling industry.

[14] USITC, hearing transcript, May 15, 2012, 153–63 (testimony of Kyle Wiens, iFixit); iFixit, written submission to the USITC, May 15, 2012.

[15] USITC, hearing transcript, May 15, 2012, 160.

[16] Mr. Wiens noted that unlike other OEMs, both Dell and HP provide service information to consumers free of charge. USITC, hearing transcript, May 15, 2012, 161.

[17] USITC, hearing transcript, May 15, 2012, 162.

[18] Ibid., 158.

[19] Ibid., 159–60.

[20] Ibid., 161.

[21] USITC hearing testimony, May 15, 2012, 266–74 (testimony of Joseph Pockard, ISRI); ISRI, written submission to the USITC, May 15, 2012.

In 2011, according to Mr. Pickard, the U.S. industry recycled more than 134 million metric tons of materials. He said that a recent study of the economic contributions of the scrap processing industry to the U.S. economy showed that in 2011 the industry accounted for $90.6 billion in output or approximately 0.6 percent of gross domestic product. He added that the industry employed and supported 459,100 U.S. jobs during that year, with $26.1 billion in wages and benefits. Mr. Pickard said that, in any given year, exports of scrap materials can vary, but generally range between 30 and 40 percent of total sales. In 2011, ISRI estimates that 34 percent of scrap materials, over 50 million metric tons, were eventually exported, with an export value of $39.2 billion. Those exports went to over 160 countries and accounted for as many as 161,931 direct, supporting, and induced jobs in the United States. Mr. Pickard observed that non-OECD countries are among the fastest-growing overseas markets for scrap materials from the United States, representing 45 percent of total exports. From 2006 through 2011, U.S. scrap exports more than doubled in value, from $16 billion to over $39 billion.

Mr. Pickard referenced an ISRI-sponsored a study by the International Data Corporation (IDC) in 2010 that estimated that approximately 3.5 million tons of used and end-of-life electronics equipment were treated for recycling in the United States. Of that amount, the study found that 70 percent was processed domestically, and more than 62 percent came from personal computer (PC) and information technology (IT) equipment. The study estimated that (1) the electronics recycling segment of the industry had revenues of $5.2 billion and employed 30,000 workers; (2) nearly 80 percent of the total output of recycled electronics was traded, sold, or transferred domestically; (3) nearly three-quarters of what was processed was sourced from businesses and commercial entities; and (4) about 2 percent of output from electronics recycling went to landfill, waste energy, or incineration. Mr. Pickard submitted a full copy of the report for the record.

Mr. Pickard said that in 2006, ISRI participated with EPA in developing the Responsible Recycling Practices for Use in Accredited Certification Programs for Electronics Recyclers (R2). An ISRI submission to the Commission noted that there are currently 207 recyclers certified to the R2 standard, with many more applicants. According to Mr. Pickard, ISRI has combined the R2 practices with its own Recycling Industry Operating Standard (RIOS) that enables companies to be recognized as certified electronics recyclers. Mr. Pickard noted that R2 and RIOS require downstream monitoring to ensure safe and responsible practices in the disposition of focus materials, defined as mercury, batteries, polychlorinated biphynels, CRT glass, and certain printed circuit boards.

According to Mr. Pickard, the global market for scrap commodities has increased 10-fold over the past two decades and supplies a significant share of global raw material needs. The market-driven free flow of scrap trade plays an important role in economic growth and raw material supply. He noted that markets for reusable or refurbished electronics in developing countries are also increasing in importance, helping to bring basic technologies and communications to countries that cannot afford to purchase the latest technologies.

Mr. Pickard observed that there seems to be a misunderstanding among the general public, as well as certain stakeholders, as to both the nature of the electronic scrap being exported from the United States, and the quantities; he stated that many in the marketplace still mislabel recyclables, particularly electronic equipment, as e-waste. He said that end-of-life electronics equipment consisting of metal, paper, glass, plastics, textiles, and rubber entering into the recycling facility are not waste, but rather reusable and recyclable materials which, once recycled, reenter the global marketplace as either reused products or commodity scrap materials. He advised that the responsible legitimate

trade of commodity scrap materials generated from the recycling electronics, as well as the trade of functioning reusable electronic equipment, be differentiated from illegal exports to informal recycling sectors. He said that the focus must be to promote responsible recycling globally, and efforts should be concentrated on enhancing and promoting facilities that will receive and properly handle recycled materials anywhere in the world.

InterConnection[22]

Charles Brennick, founder and director of InterConnection, presented a written submission and hearing testimony to the Commission on U.S. exports of UEPs. He stated that InterConnection is a nonprofit organization that provides refurbished computers to underserved populations in the United States and abroad.

Mr. Brennick said that he believes that exports of refurbished computers are necessary because people in Africa, Asia, and Latin America have less access to technology than do those in the United States.[23] According to Mr. Brennick, InterConnection sends computers abroad for a variety of reasons, principally to support education, healthcare, and the development of job skills in the recipient countries. As an example, Mr. Brennick described a case in which exported computers allowed individuals in a foster home in El Salvador to communicate with their U.S. sponsors.[24] He said that InterConnection works with several types of partners with a variety of aims: development workers, for use in the field; large corporations, to refurbish and distribute their surplus computers; humanitarian organizations, to help with relief efforts; and domestic nonprofits, to provide technology to other nonprofit organizations abroad.[25]

According to Mr. Brennick, InterConnection computers are refurbished in Seattle by a low-cost labor force consisting mostly of students and volunteers. Mr. Brennick noted that at between 2 and 3 percent, the failure rate for these refurbished machines is similar to that for the new machines sold by original equipment manufacturers (OEMs).[26] He said that each product is labeled with its specifications before it is exported, a practice that Mr. Brennick said should be the minimum standard for all exports of refurbished computers.[27] In conclusion, Mr. Brennick expressed support for the creation of a separate code in the Harmonized Tariff Schedule of the United States for refurbished computers, to distinguish them from exports of used computers.

[22] USITC, hearing transcript, May 15, 2012, 125–39 (testimony of Charles Brennick, InterConnection); and InterConnection, written submission to the USITC, May 15, 2012.

[23] According to Mr. Brennick, the share of the population with computer access in the United States (80 percent) is far greater than for the other major geographic regions: Africa (13.5 percent), Asia (26 percent), and Latin America (40 percent). USITC, hearing transcript, May 15, 2012, 134.

[24] USITC, hearing transcript, May 15, 2012, 135–36.

[25] Ibid., 137–38.

[26] Ibid., 139.

[27] Ibid.

International Precious Metals Institute (IPMI)[28]

John Bullock, chair of the Environmental and Regulatory Affairs Committee of IPMI, presented hearing testimony about the reclamation of precious metals from electronic scrap. Mr. Bullock stated that IPMI is an association of users, producers, and fabricators of precious metals. He explained that precious metals like gold and silver can be recovered from printed circuit boards subjected to the same processes as copper ores and concentrates. According to Mr. Bullock, there is already more than sufficient global capacity to smelt electronics. The industry of extracting precious metals from electronic scrap used to exist in the United States, but had died out by 1986.

Mr. Bullock stated that printed circuit boards collected in the United States for smelting are exported to OECD countries for responsible recovery. He explained that the process of smelting of electronic scrap requires the control of emissions of dioxins, given off when the plastics and hydrocarbons found in the electronics scrap are broken down. The technology to control the formation of dioxins is not new, he said, but it is quite expensive. He stated that all smelters of electronics in OECD countries have made substantial investments in their plants to control emissions. Mr. Bullock stated that the continuing export of circuit boards for environmentally sound recovery of precious metals should be encouraged. He further stated that "there has never been an environmental problem associated with precious metals recovery such as that created by the export of whole computers to countries unequipped to recycle them."

According to Mr. Bullock, the increasing price of gold has brought a tremendous amount of recyclable gold into the gold refiners market, but it has not affected the collection of electronic scrap as much as it has affected the business of re-buying gold jewelry. He said that about 200 tons of gold is recovered from goods recycled in the United States annually, of which no more than 10 tons come from electronic scrap collected within the United States but smelted in other countries.

Mr. Bullock stated that much of the electronic scrap intended for precious metal recovery is in the form of circuit boards. He said that some foreign customs regimes classify these boards, not as scrap, but rather as goods with a function other than scrap, and subject them to what the industry believes to be inappropriate import duties. Mr. Bullock expressed the view that goods that have become scrap should not be subject to the same duties as goods with a function besides scrap. Mr. Bullock said that Europe and Japan have regimes that control the import and recycling of used electronics and scrap, and several developed countries outside the OECD have good laws on monitoring imports and recycling of used electronics, but that he was not aware of any developing countries that have strong regimes for controlling imports and recycling of used electronic products.

Mr. Bullock stated that electronics recyclers may recover more precious metals when goods are dismantled by hand because the circuit boards remain intact, compared with electronically shredding them. He said that many recyclers mechanically shred circuit boards because the shredded material can be handled more easily when it goes into the smelter, and because the results can be sampled and assayed so that both the seller and the buyer have a good idea of what the precious metal content is.

[28] USITC, hearing transcript, May 15, 2012, 243–49 (testimony of John Bullock, IPMI).

Mr. Bullock estimated that the average value of the precious metal content of circuit boards may range from $4 to $7, depending on the quality. He evaluated that the value of the gold used in a circuit board is much higher than the value of the rare earths used, adding that only a minuscule amount of rare earths are used in the motors of the disk drives, so there is not a tremendous incentive to recover them from electronic scrap.

Mr. Bullock stated that the United States should join the Basel Convention. He indicated that only a few tweaks in U.S. law would be sufficient to implement the Basel Convention, but those tweaks seem to have been the basis for 20 years of delay. Originally, he said, there was legitimate opposition to the lack of definition of what would be and what would not be controlled under the Basel Convention. But, he added, most of the definitions were cleared up in 1994, when the convention was amended. According to Mr. Bullock, if the United States were to ratify and implement the Basel Convention, it could participate with the rest of the world in finalizing and implementing the definitions.

LifeSpan Technology Recycling Company, Inc. (Lifespan)[29]

In hearing testimony, Dag Adamson, president of LifeSpan Recycling Company, said that LifeSpan is a company with 80 employees and five locations around the United States. He said that Lifespan processes 10 million pounds of scrap material annually, or roughly 100,000 separate used electronic products, with the majority of its business coming from large enterprises and OEMs. Mr. Adamson stated that some of the flow of used materials goes back to OEMs domestically and abroad, and so the restriction on trade in UEPs would prevent his company from servicing those customers. Mr. Adamson said that Lifespan destroys the data on data-bearing products and then sells them domestically or abroad. He said that manufacturers and their partners need access to international markets for recycled UEPs. However, he noted that trade barriers in Brazil and other South American countries make it difficult to work in South America generally. He testified that rather than looking at how to curtail trade, the United States should focus on opportunities to improve trade.

Mr. Adamson noted the large size and complexity of the industry handling UEPs, and said that it extends beyond electronics recyclers and scrap companies and handles much larger flows of used electronics than the 3.5 million tons of U.S.-generated e-scrap generated reported by ISRI. He also said that, according to the Reverse Logistics Association, 10 to 20 percent of new computer equipment is returned, a third of which is exported.

From a cost perspective, Mr. Adamson stated that it makes sense to perform initial processing of UEP material in the United States because the materials are here to begin with. However, he cautioned that the market for much of this material is overseas, so much of the product will eventually be exported, as it forms part of the global supply chain.

[29] USITC, hearing transcript, May 15, 2012, 21–27 (testimony of Dag Adamson, Lifespan).

Adam Minter[30]

In a written submission, Adam Minter said that he is a freelance journalist who has been reporting on the UEP industry in China. In his written submission, Mr. Minter commented on the current situation in Guiyu, a city in China that has been the subject of attention from media and nongovernmental organizations (NGO) for its informal electronics processing industry. Mr. Minter said that he last visited Guiyu in November 2011 and met with a number of traders. According to Mr. Minter, they commented, and he observed that less than half of the material coming into Guiyu is now from the developed countries and that the developed-country share continues to decline. He attributes this to increased awareness and regulations regarding UEPs in the European Union (EU) and the United States; a slower upgrade cycle because of the global recession; greater competition; and increasing levels of enforcement, along with declining corruption in China. Mr. Minter observed that traders in Guiyu were not pleased with the decline of material from the United States because it contains more valuable materials and more reusable parts than equipment sourced locally and in other parts of Asia.

Mr. Minter said that Guiyu recycling mainly involves (1) recovery of material for reuse in China and increasingly for export, and (2) extraction of CPUs and integrated circuits for export to smelters in Japan and Europe for recovery of precious metals. Recovery of plastics and metals other than precious metals is a relatively minor business. The local government in Guiyu is setting up an electronics recycling park in which conditions should be an improvement over current conditions, although the facilities would probably not meet standards developed under the R2 certification program.

National Center for Electronics Recycling (NCER)[31]

In his testimony before the Commission, Jason Linnell, executive director of the NCER, stated that the NCER is a nonprofit organization that provides research and programs to improve infrastructure capacities for electronics reuse and recycling in the United States. Mr. Linnell stated that the NCER is the administrator for the Oregon State Contractor Program, which operates under the Oregon electronics recycling law. Operating on behalf of the manufacturers, the NCER establishes a network of collectors and recyclers throughout the state, provides input for the state's regulators on requirements for the participants, audits and reviews documentation, and provides reports to the state. Mr. Linnell stated that the NCER has also partnered with the Massachusetts Institute of Technology (MIT) in the EPA's Solving the e-Waste Problem Initiative (StEP). The center is an active participant in the research effort, has provided research support to the initiative and its stakeholders, and is working on developing studies to help characterize the transboundary flows of UEPs around the world.

Mr. Linnell stated that the NCER supports the work of the Commission, and he believes that the Commission report will fill an information and data gap. Mr. Linnell said that the Commission's study parallels similar, ongoing efforts by StEP and others, but that the

[30] Minter, written submission to the USITC, May 16, 2012.
[31] USITC, hearing transcript, May 15, 2012, 257–260 (testimony of Jason Linnell, NCER).

Commission investigation has certain unique attributes, including mandatory survey responses, which will aid in overall understanding of the subject.

In his testimony and follow-up written submission, Mr. Linnell made several suggestions for the questionnaire:

1. The Commission should focus on the right actors in the industry. Some recyclers may be indirectly exporting focus materials through non-certified recyclers or brokers which may not be captured in the Commission study's survey sample,

2. The Commission should ensure that there is no double-counting of exports by groups that export through an intermediary party,

3. The Commission should separate responses on exports of whole products from responses on the exports of components.

PC Rebuilders and Recyclers (PCRR)[32]

Willie Cade appeared at the hearing, representing his company, PCRR. Mr. Cade said that he is also the chairman of the Partnership for Action on Computer Equipment (PACE) for the United Nations Environmental Program of the Basel Convention, and submitted written testimony which included the most recent PACE report. The purpose of this PACE documentation, he said, is to create an international understanding of what constitutes environmentally sound refurbishment and reuse of computers.

Mr. Cade said that PCRR is R2 certified and is a Microsoft Authorized Refurbisher. Mr. Cade noted the discrimination towards used equipment in various countries, including Egypt, which passed legislation prohibiting the importation of equipment that is more than three years old. He said that some equipment coming out of corporations is still very lightly used, regardless of its age. For example, Mr. Cade noted that 25 percent of PCs have been used less than 500 hours when categorized as "end of use." Mr. Cade also suggested that laptop batteries be incorporated into the Commission's questionnaire; that the Commission clearly note the distinction between scrap and waste; and that the Commission recognize that the transboundary movement of used electronics is necessary for economies of scale. Mr. Cade stated that the advice and consent portion of the Basel Convention is nonfunctional and that the Basel Convention's definition for waste is problematic because it focuses on end of use, which has no particular physical characteristics.

Mr. Cade testified that in the last three years, PCRR has shipped 10 containers to developing countries, including Angola. To ensure responsible exporting, PCRR employed an Angolan monitoring agent to review the goods upon arrival in Angola, a process that was cheaper than certification and proved a workable alternative to simply banning Angolan imports of used computers. Mr. Cade recommends that the U.S. government require such a third-party observer for the loading of containers carrying used electronic goods. Mr. Cade reported an instance of a photocopier resale business having trouble exporting to India, on the basis that the copiers were electronic waste, even though the equipment was tested and working at the time of export. He also cited an instance of having products held up in South Korea, where PCRR is working with

[32] USITC, hearing transcript, May 15, 2012, 147–52 (testimony of Willie Cade, PCRR).

proponents in-country to have barriers removed. He also said that some PCRR equipment is sent for materials recovery and domestically dismantled into commodity scrap materials, which may then be exported.

Mr. Cade explained that the industry has changed, as reflected by the growing number of R2-certified organizations and their accompanying due diligence requirements that favor selling to other R2-certified organizations rather than brokers. In addition, commodity prices have increased. He said that both factors have led to increases in the number of firms that now manually dismantle used electronics in the United States, a practice almost unheard of five years ago. He also said that the number of PCs that are refurbished with legal licenses has grown dramatically, primarily in the United States. He explained that much of the decreased performance experienced by PC users is software related, and that the hardware is usually in good condition, allowing firms to refurbish them by installing new software.

Regency Technologies (Regency) [33]

In his hearing testimony, Jim Levine stated that Regency has been an IT recycler since 1998, with its core business being the recycling of computers, computer-related equipment, and consumer electronics. He said that the responsible electronics recycling industry promotes jobs and is a growth industry in the United States, unlike most of the traditional and more mature scrap-related industries.

Mr. Levine described the difference between scrap and waste: scrap is material from which value is recovered, while waste is material from which no further value can be recovered. Regency diverts recyclable waste from landfills which would be hazardous waste if left untreated. According to Mr. Levine, common examples of those hazardous materials are lead from printed circuit boards, lead-acid batteries, CRT glass, mercury from lamps and switches found in many instruments and appliances, PCBs sometimes found in older electronics and appliances, and CFCs in certain related equipment.

Mr. Levine noted that the IT industry continues to rapidly develop new technology with greater processing capacity, so equipment is becoming obsolete more quickly, leading to continued growth in the market for refurbished IT equipment. While much of the used computer equipment can be refurbished, repaired, and reused, many repairs are not economically feasible.

According to Mr. Levine, recyclers use brokers for two principal reasons: (1) some precious metal smelters don't want to deal with a lot of recyclers directly, so many recyclers deal with a handful of agents that work directly with the smelters; and (2) brokers are better versed in the import regulations of foreign markets, so working with a broker gives recyclers better access to those markets.

Mr. Levine stated that Regency has always followed a strict set of procedures and guidelines to make sure that it conforms with both the law and industry standards, well before the RIOS and R2 certifications became standard. He noted that the primary impact of certification programs is on acquiring what recyclers call “feed stock,” not on the downstream customer. According to Mr. Levine, holding an accredited certification is the responsible thing for an electronics recycler to do, as it gives the company a consistent

[33] USITC, hearing transcript, May 15, 2012, 28–35 (testimony of Jim Levine, Regency).

procedure for all of its locations, it works well for training, and it works well for customer audits. He said that every Regency location has been certified to the R2 RIOS standard as well as ISO 9001 and ISO 14001.

Retroworks, Inc. (Retroworks)[34]

In testimony and in written submissions to the Commission, Robin Ingenthron, CEO of Retroworks, described his experience in exporting UEPs. He said that Retroworks exports about one container per day of nonworking equipment and components for refurbishment and reuse and/or for recovery of materials, and that the company operates a recycling plant in Vermont and a maquiladora in Mexico that tears down used equipment to useable parts. For example, he said instead of shredding hard drives at the Mexican plant, they are taken apart down to the tiny motors that can then be used by toy manufacturers.

Mr. Ingenthron expressed criticism of the media coverage of the "e-waste" issue. He suggested that the depiction of communities burning UEPs in primitive ways does not take into account the thousands of factories and shops that are able to repair and refurbish UEPs. He said that the widely cited estimate that 80 percent of UEPs are unwanted garbage and end up in places like Guiyu, China, is highly exaggerated. He stated that even in Guiyu, pollutants such as arsenic are the byproduct of textile dyeing factories and not electronics recycling, and that most of the items being processed there are from Asian sources, not the United States. He indicated that entire factories in Asia are dedicated to repairing and refurbishing UEPs, and that many of these factories are or used to be contract manufacturers of new equipment as well.

Mr. Ingenthron stated that he uses a fair-trade recycling approach. He explained that he checks out his buyers by asking them a series of questions, that he looks for ISO 14001 certification, and that he works with steady buyers with whom he has long-term agreements. He said the perception that used electronics are going overseas to be burned in primitive conditions makes it challenging to work with suppliers and some buyers. He also noted that there is increasing competition from other overseas sources because there are more five-year-old computers and monitors available from places like Kuala Lumpur, Jakarta, Shanghai, and Hong Kong than there used to be. He stated that the internet is growing 10 times faster in developing countries than in OECD countries and more UEPs are being generated in Asia. Such equipment is displacing U.S.-sourced UEPs. Mr. Ingenthron described how in Peru, former buyers of used televisions from America were now obtaining used CRT TVs from China, where CRT TVs have been replaced with flat screens.

Mr. Ingenthron stated that the best markets for printed circuit boards are in Belgium, Japan, and Finland, where smelters can extract rhodium, platinum, and other metals from the boards. He said that some recyclers in China now send the boards to Dowa in Japan, where workers remove the good chips and then recover the metal. He said that many of the used monitors and televisions that are exported from the United States are sold to India and other developing countries, to be turned into working televisions and monitors for sale.

[34] USITC, hearing transcript, May 15, 2012, 140–47 and 163–299 (testimony of Robin Ingenthron, Retroworks); Retroworks, written submission to the USITC, May 15, 2012.

Mr. Ingenthron noted that the way different countries treat UEPs varies. He expressed the view that while lax environmental enforcement is a problem, some of the regulations are not conducive to efficient reuse. He said that China, for example, is defining second-hand electronic equipment as "e-waste," which it should not be, and that he has had experience with shipments of working processors to Egypt and CRTs to China that were considered "e-waste" and destroyed. He said that over the past 10 years, China has developed a very robust electronics recycling infrastructure.

Mr. Ingenthron said that he is an advocate of UEP exports because such exports promote reuse. He stated that the extraction of recyclable materials provides jobs, increases the affordability of technology in low-income countries, and can be much less environmentally harmful than mining for the same materials. According to Mr. Ingenthron, while harmful waste has been exported along with legitimate repair and reuse loads, as well as metals and plastics for recycling, he said that restricting exports is not the solution; instead, it would harm people in developing countries. He said that jobs dismantling UEPs overseas can provide good employment opportunities, offering the opinion that U.S. recyclers should be exporting more, not less, to the legal factories. Such exports would help the U.S. trade deficit, provide leverage to clean up standards at the factories, and lower the cost of recycling. He said that restricting U.S. exports would not be beneficial; the markets adapt and supplies are shifted to other sources. He stated that one effect of the California law regulating used, working CRTs has been that working CRTs are being broken instead of exported for reuse. More UEPs, he said, are being shredded, which is more wasteful than using the used equipment and results in fewer recovered metals.

Sims Recycling Solutions (Sims)[35]

Renee St. Denis, vice president of business development, testified that Sims is the largest electronics recycler in the world, with operations in 24 countries. She said that of their 50 electronics recycling facilities, 14 are in the United States, where the company employs 700 workers and last year recycled 250 million pounds of electronics. According to Ms. St. Denis, the company is R2 certified and participates in PACE and the StEP initiative, among others.

In her written testimony, Ms. St. Denis said that "illegal" exports of UEPs by unscrupulous electronics recyclers create an uneven playing field that reduces the competitiveness of responsible recyclers and leads to the proliferation of unscrupulous practices that damage human health and the environment.

Ms. St. Denis testified as to the importance of meaningful data on exports that take into account the entire supply chain of used electronics recycling and include all actors in the business. Without such data, she said, the United States is unable to craft sensible national trade policy. She noted the sheer number of parties who participate in the UEP supply chain, including resellers and recyclers; manufacturers and their agents; retailers; brokers; and charities. The recycling supply chain is many layers deep and may cross international borders more than once. Ms. St. Denis said that in addition to recycling, manufacturers also repair their products for customers, which often requires them to export whole products or parts to repair facilities or customers located abroad. She noted

[35] USITC, hearing transcript, May 15, 2012, 35–44 (testimony of Renee St. Denis, Sims); Sims, written submission to the USITC, May 15, 2012.

that these shipments pose the same environmental risks as shipments by other parties, and so they should also be included in the Commission's study. She said that retailers engage in similar trade, exporting for repair and refurbishment. Ms. St. Denis said that charities are sometimes unknowingly engaged in the export of nonworking equipment to other agencies and they also export directly to recipients around the world.

Ms. St. Denis also said that it is not possible to judge the legitimacy of shipments based purely on the economic circumstances surrounding particular shipments. In addition, she testified that most of the used products managed domestically still end up being exported as commodities rather than whole products. According to Ms. St. Denis, these commodity streams are often blended with commodities from other sources and then exported for use in manufacturing new products. Ms. St. Denis suggested these commodity streams be tracked and included in order to build an accurate picture of the scope and scale of UEP exports. She reported that, for Sims, 90 percent of the UEPs handled are sold as commodities, all of which are exported. The other 10 percent is sold globally for reuse.

Ms. St. Denis testified that both environmental and economic issues drive trade in UEPs, but the U.S. advantage lies in having the used material already here. She suggests creating incentives for consumers to have their used electronics go into a recycling process domestically. Ms. St. Denis also testified that the United States lags other countries because it allows landfills to be locally regulated and has not issued a nationwide ban on disposing of UEPs in landfills.

Ms. St. Denis testified that the spread between the value of a new product and a refurbished product is shrinking, limiting the profit opportunity and affecting companies' decisions to invest the labor in repairing or dismantling UEPs for materials recovery.

TechSoup Global[36]

In hearing testimony presented to the Commission, Jim Lynch, director of Greentech & Electronics Recycling & Reuse Programs of TechSoup Global, stated that secondhand PCs are a critical part of the technology infrastructure of many developing economies. For example, Mr. Lynch stated, in Uganda, half of all PCs owned by small and medium-sized businesses are secondhand, and in the Philippines, 24 percent of businesses and 37 percent of NGOs use secondary PCs. According to Mr. Lynch, demand for secondary PCs continues to exceed supply, and is expected to continue to grow, especially in emerging markets. Mr. Lynch said the number of PCs being reused worldwide increased from 55 million in 2004 to 75 million in 2007 (36 percent).

Mr. Lynch stated that noncommercial refurbishers of PCs supply mainly whole computers to schools, NGOs, and low-income people, both domestically and in developing countries. According to Mr. Lynch, TechSoup Global estimates that there are roughly 1,500 noncommercial organizations in the United States that refurbish PCs; most are small, refurbishing 1,000 PCs or less per year. He noted that a sub-sector of noncommercial refurbishers specializes in export to developing countries in Africa, Asia, and Latin America, where household penetration rates for computers are lowest – 5 percent or less in African countries, 18 percent on average in Latin America and the Caribbean. These refurbishers, he said, often have strategic partnerships for export with large companies like Microsoft and with organizations like TechSoup Global, the United

[36] USITC, hearing transcript, May 15, 2012, 125–33 (testimony of Jim Lynch, TechSoup Global).

Nations, the World Bank, and the U.S. Peace Corps. He stated that the refurbishers export to many more countries than most commercial companies, and do not use export brokers as commercial PC vendors do, but rather establish direct "receiving" partnerships, mainly with NGOs in receiving countries.

Mr. Lynch stated that the bulk of the refurbishing is done in the United States to ensure that exported equipment is functioning properly, often with operating systems and other software installed. Exported computers, he added, often are shipped with extra parts and whole systems to compensate for breakage in transit because warranty returns are not practical.

According to Mr. Lynch, refurbished and remanufactured UEPs provide the most environmentally friendly way to acquire computers and other IT equipment. According to a study cited by Mr. Lynch in his testimony,[37] the production of an average 53-pound desktop computer and CRT monitor requires 530 pounds of fossil fuels, 50 pounds of chemicals, and 3,330 pounds of water. Mr. Lynch stated that the study estimates that adding additional life to computers saves 5 to 20 times more energy than recycling over the computer's life cycle.

Mr. Lynch stated that electronics recycling in nearly all developing countries tends to be informal and amounts mainly to scavenging metals and discarding the remaining materials wherever convenient. He said that the export of computers by noncommercial refurbishers fosters the development of repair, demanufacturing, and eventually end-of-life processing of IT equipment in developing countries.

TransparentPlanet, LLC (TransparentPlanet)[38]

Lauren Roman, principal, submitted written comments to the Commission on behalf of TransparentPlanet. According to Ms. Roman, TransparentPlanet provides tracking services for monitoring "e-waste" throughout the recycling supply chain. In her submission, she states that "virtually every" organization that produces UEPs is linked to global export markets. Ms. Roman explained that a firm's decision to export is based primarily on price; however, requirements of certification programs such as R2 or e-Stewards may impact a firm's decision to export.

Ms. Roman noted a distinction between OECD and non-OECD markets for U.S. exports of UEPs, namely that OECD markets receive working products, products that meet certain specifications, or high-value scrap materials, while non-OECD markets receive lower-valued goods, such as plastics, leaded glass, and mixed shredded material, for example. Ms. Roman said that once these products are received in foreign markets, the hazardous materials such as CRTs or plastics may be dumped or burned.

Finally, Ms. Roman expressed concern that respondents to the Commission's questionnaire would not provide factual information. She suggested employing "tracking and monitoring of material flows" to provide data for the investigation.

[37] Eric Williams and Ruediger Kuehr, eds. *Computers and the Environment: Understanding and Managing Their Impacts*, Dordrecht: Kluwer Academic Publishers, 2003.

[38] TransparentPlanet, written submission to the USITC, August 30, 2012. For more information about TransparentPlanet, see http://transparentplanetllc.com/.

Umicore USA (Umicore)[39]

In her testimony before the Commission, Holly Chapell, director of governmental affairs for Umicore, stated that Umicore is a global materials technology company with expertise in materials science, chemistry, metallurgy, and recycling. She said that the company has a longer history in mining and metal smelting, but has developed its recycling capacity over the past 15 years, providing a "closed loop" business model. She stated that more than half of the materials they produce, they now receive back through their recycling operations. Ms. Chapell noted that Umicore has a recycling plant in Belgium, with a capacity of 350,000 metric tons of precious metals per year; it is the destination for such UEPs as circuit boards and end-of-life cell phones, and is capable of extracting gold, silver, copper, platinum, and other metals from these materials. These materials are processed into commodity-level material and can be recycled infinitely, according to the company. Ms. Chapell described Umicore as an "appropriate" recycler, taking responsibility for their workers, customers, and the environment. Ms. Chapell also noted that the company's recycling facility is often a destination for products that have been exported from other countries.

According to Ms. Chapell, some UEPs are illegally shipped to countries where rudimentary recycling methods are used; such methods are harmful to workers and the environment, and actually are less efficient in extracting materials than is the Umicore process. Ms. Chapell stated that Umicore supports the effort to certify end refiners of UEPs, which the company sees as an extension of the existing Basel Convention agreement and certification programs, such as the R2 and e-Stewards programs.

Ms. Chapell noted that Umicore supports the RERA legislation, which has been introduced in the House and Senate. She said that her company agrees that the requirements on exported products contained within the legislation would be helpful in curtailing the exports of UEPs to inappropriate recyclers. According to Ms. Chapell, jobs would be created in the United States if more dismantling and preprocessing of electronic materials took place in the United States, before the disassembled materials were sent to end refiners such as Umicore.

Wistron GreenTech (Wistron)[40]

Bill Long of Wistron provided a written submission to the Commission, stating that his company participates in the global industry that "designs, manufactures, repairs and recycles electronic products," including laptops, televisions, and servers. He noted that Wistron operates globally, with 25 facilities and 70,000 employees worldwide, including repair and recycling facilities in Texas. Mr. Long reported that the company is currently establishing a facility to recycle circuit boards in Texas and a facility to recycle plastic scrap from electronics in China.

Mr. Long explained that many consumer electronics for use in Western Europe and North America are manufactured and assembled in regions such as China, Eastern Europe, and Mexico. He said that when these products are retired from their initial use through lease

[39] USITC, hearing transcript, May 15, 2012, 238 (testimony of Holly Chapell, Umicore USA Inc.).
[40] Long, Bill, Wistron GreenTech, written submission to the USITC, September 11, 2012.

termination, corporate refresh, or personal replacement, these UEPs are typically deployed for a "second life" either domestically or in a different country, based on market conditions. Mr. Long said that these UEPs can be reused in developing nations, where there is often a vibrant market for products that are obsolete in mature markets; it is after this "second life" that electronics require end-of-life recycling.

Mr. Long pointed out that there is little or no outcry over original manufacturers and distributors importing electronics containing materials of concern (lead, mercury, etc.) that corresponds to the concern expressed over exports of UEPs containing the same materials during the recycling process or reverse supply chain activities.

Mr. Long states that responsible recycling includes using recovered materials as inputs into manufacturing new products, a process which often requires exports of the recycled materials to the location of manufacture, frequently in developing nations. It is more important how the products are recycled than where they are recycled, according to Mr. Long.

APPENDIX E
Survey Methods

Survey Methods

Description of USITC Survey Methodology

In his letter to the Chairman of the U.S. International Trade Commission (Commission), the U.S. Trade Representative requested that the Commission investigate U.S. exports of used electronic products (UEPs) using, among other sources, primary data collected through questionnaires. In order to comply with this request, the Commission developed a questionnaire to collect primary data on the operations of companies that handled and exported UEPs during 2011. The Commission field-tested its questionnaire with organizations in April 2012 and submitted it to the Office of Management and Budget for clearance in May 2012. After receiving clearance in June 2012, the Commission sent the questionnaire to a sample of nearly 5,200 U.S. organizations.

Surveying for this study consisted of three major steps. First, the Commission generated a list of relevant companies to be surveyed (the sampling frame). Second, it decided on a method of selecting individual companies from that list to receive the survey. Finally, it combined the responses from individual questionnaires to produce statistically valid estimates of UEP activity in specific industry segments and in the entire U.S. economy.

The Sampling Frame

The first step in determining which organizations would receive the survey was generating the sampling frame, which is the list of organizations from which the sample was selected. The list had to be comprehensive enough to provide a representative picture of U.S. UEP activity, but defined narrowly enough to let the Commission obtain precise estimates. For this investigation, producing the sampling frame was complicated because the Commission's research showed a complex industry with an extensive supply chain. As repeatedly emphasized by industry representatives, exports of UEPs occur at multiple points throughout this supply chain,[1] making it necessary to survey organizations in several different industries.[2] In the sampling frame, these industries were defined according to the North American Industrial Classification System (NAICS).

Because the sampling frame is based on NAICS, which does not have specific UEP classifications, the list of industries in the sampling frame may differ from the list of UEP industry segments discussed in the body of this report. For example, organizations in the waste management and remediation industry as defined by NAICS are involved in a number of UEP industry segments, such as collection and sorting, disassembly and

[1] At the public hearing for this report, Wendy Neu, executive vice president for the Hugo Neu Corporation and the Coalition of American Electronics Recycling, noted the difficulties in tracking exports of UEPs along the supply chain. USITC, Hearing transcript, May 15, 2012, 310–12.

[2] Industry representatives noted that the types of firms that handle or export products include collectors, recyclers, shredders, brokers, asset managers, and nonprofit refurbishers, among others, and the "path" that products take through the supply chain can vary by product. Industry official, interview by USITC staff, Washington, DC, February 3, 2012.

processing, and wholesale sales of parts and scrap.[3] In addition, NAICS categories typically contain organizations that handle either electronic products or used goods more generally, but there is no specific NAICS category that covers only organizations that handle UEPs. UEP organizations thus make up portions of multiple NAICS-based industries in both the manufacturing and services sectors. Further, no previous survey or study has enumerated all industries that handle UEPs or all the organizations in a particular industry that handle UEPs. Therefore, it was not possible for this study to rely on an existing list of firms to correctly identify and account for the population in this study.

In an effort to fully capture the complex flow of UEPs, the Commission's survey included organizations drawn from the six NAICS-based industries deemed most likely to handle and export UEPs:

1. waste management and remediation;
2. smelting of nonferrous materials;
3. electronic products manufacturing;
4. wholesaling and brokering of electronic products and of recyclable materials;
5. electronic products repair and refurbishing; and
6. other services, such as IT asset management.

Each of these industries covered multiple NAICS codes and contained organizations that performed one or more activities identified in the UEP supply chain (table E.1).

TABLE E.1 Composition of industries and organizations selected from the Orbis database

Industry	UEP organizations	NAICS codes
Waste management and remediation	Collectors, recyclers and disassemblers of UEPs	562111, 562119, 562219, 562112, 562211, 562910, 562920, 562998
Smelting of nonferrous materials	Smelters that receive and process UEPs, including shredding facilities	331419, 331492
Electronic products manufacturing	Repair and refurbishing organizations	333315, 334111, 334112, 334113, 334119, 334210, 334220, 334290, 334310, 334411, 334412, 334413, 334414, 334415, 334416, 334417, 334418, 334419, 334510, 334517
Wholesaling and brokering of electronic products and recyclable materials	Brokers of intact UEPs, scrap metals, plastics, and glass	423430, 423610, 423620, 423690, 423930
Electronic products repair and refurbishing	Repair and refurbishing organizations	811211, 811212, 811219
Other services	IT asset management, reverse logistics, and supply chain management organizations; charitable organizations	519190, 541512, 541519, 541611, 541614, 541618, 541712, 561110, 561210, 561439, 611420, 624190, 624310

Source: Compiled by the Commission.

[3] To generate statistics by UEP industry segment, as in chapters 2 and 6, firms were assigned to the segment that they indicated was their organization's most significant UEP business activity.

Within each of these six industries, the Commission selected organizations for the survey from two sources: the Orbis database and a database of organizations associated with the industry derived from Commission staff research. The Orbis database is a commercial database produced by Bureau van Dijk that consolidates firm-level financial information. Orbis reports a NAICS code for each organization in its database, and this code was used to generate a list of companies and nonprofits in each target industry. The second source (the "industry list") was a database compiled from industry lists and Commission staff research. It includes members of industry associations, subscribers to industry publications, organizations listed in recycling and refurbishing directories, companies in state and federal government directories (e.g., companies approved by the U.S. Environmental Protection Agency to export cathode-ray tubes), and companies reporting sales of UEPs in online markets. Organizations that appeared on both lists were removed from the Orbis list to ensure that each organization was included only once in the sampling frame.

Organizations in the "other services" sector included companies that manage IT assets and charitable groups that send used computers abroad. Some of these organizations were identified in industry sources. Others were identified in Orbis, but these organizations were selected in a more targeted way than those in the other sectors, because of the breadth of these "other services" industries and the limited number of relevant organizations included in them. Specific organizations were targeted through a text search of organization names and activities in the Orbis database.

The Commission used stratified random sampling to sample organizations from the population. In a stratified sampling process, the population is first divided into distinct strata, and then organizations are independently selected from each stratum. By choosing strata that contain relatively homogenous organizations, stratified sampling can produce statistical estimates with lower standard errors than simple random sampling, in which all organizations in the list have the same probability of selection. Organizations in this study were stratified by three criteria: industry, organization size, and source of organization information (Orbis database or industry list). Organization size was determined by the number of employees, with the following cutoffs:

1. The smallest organizations in each stratum were not sampled, to reduce respondent burden and to improve the statistical properties of the estimates.[4]

2. Small organizations were defined as organizations with fewer than 100 employees.

3. Large organizations were defined as organizations with 100 or more employees.

4. Very large organizations were defined as organizations with more than 1,000 employees. This distinction was introduced only in the electronic products manufacturing and other services sectors, which had the most heterogeneous large organizations. In other sectors, very large organizations were combined with large organizations.

[4] In all industries except manufacturing, the smallest firms are defined as those with fewer than 10 employees. In manufacturing, the cutoff varied by NAICS 6-digit industry, and ranged from 10 to 50 employees. Manufacturing cutoffs were higher because small firms account for a much smaller share of employment and revenue in manufacturing than in the other industries in our sampling frame.

Stratifying by the three dimensions noted above (industry, organization size, and data source), there were 28 strata in total (table E.2).

TABLE E.2 Composition of the 28 strata in the sampling frame

NAICS-based industry	Orbis database			Industry list		
	Small	Large	Very large	Small	Large	Very large
Waste management and remediation	X	X	([a])	X	X	([a])
Smelting of nonferrous metals	X	X	([a])	X	X	([a])
Electronic products manufacturing	X	X	X	X	X	X
Wholesaling of electronics and recyclables	X	X	([a])	X	X	([a])
Electronic products repair and refurbishing	X	X	([a])	X	X	([a])
Other services	X	X	X	X	X	X

Source: Compiled by the Commission.

[a]Included but not distinguished from large organizations in the sampling frame.

After the strata were defined, a specific number of firms from each stratum were selected. Allocation in this survey was based on a two-part procedure designed to maximize the statistical precision of the survey estimates. First, organizations identified by the Orbis database were optimally allocated across size and industry strata based on a modified Neyman allocation method. Using this method, strata with organizations that were very heterogeneous in size, as determined by the variance in employment across organizations in the stratum, were sampled at relatively high rates, while strata that were relatively homogeneous were sampled at lower rates.[5] Second, organizations identified from the industry association list were sampled at a higher rate than organizations from the Orbis database, to reflect the higher expected prevalence of UEP exporters in the industry list. The relative sampling rates for each industry were based on presurvey estimates of the share of organizations in each industry that handles UEPs.[6]

The two-part stratification procedure resulted in sampling rates that differed depending on an organization's NAICS-based industry, its size, and the data source from which it was selected. The sampling rate was highest in the "other services" industry (because a high share of these organizations came from the industry association list) and in electronic products manufacturing (because these organizations are relatively heterogeneous). Table E.3 presents the number of organizations sampled in each industry, and the associated sampling rates.[7] The Commission mailed a total of 5,197 questionnaires to organizations in the six target industries.

[5] The sample allocation is proportional to the product of a stratum's population and the variance of firm employment within that stratum.

[6] Shares are based on USITC assessment of the likelihood of handling used electronics; the likelihood of exporting used electronics could not be estimated in advance. For calculation of disproportionate sampling rates, see Christman, "Sampling of Rare Populations," 2009, 112; Kalton, "Methods for Oversampling Rare Subpopulations in Social Surveys," 2009, 127.

[7] These rates represent the average within each industry; as noted above, each industry contains several strata which may have been sampled at different rates.

TABLE E.3 Sample selection and response rates, by industry

NAICS-based industry	Population	Sample size	Sampling rate
	Number of organizations		Percent
Waste management and remediation	4,591	774	16.9
Smelting of nonferrous metals	204	79	38.7
Electronic products manufacturing	3,320	1,352	40.7
Wholesaling of electronics and recyclables	11,413	1,894	16.6
Electronic products repair and refurbishing	2,520	345	13.7
Other services	1,377	753	54.7
Total	23,425	5,197	22.2

Source: Compiled by the Commission.

Response Rates

Based on the Commission's authority under section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1333(a)), all organizations that received a questionnaire were legally required to complete it. The organizations included in the sample received an initial mailing telling them that the survey was coming, a letter containing instructions for completing it within 30 days, and two follow-up mailings reminding them to complete the questionnaire.

Of the 5,197 questionnaires mailed to organizations in the sampling frame, 405 were returned as undeliverable by the U.S. Post Office (table E.4). Ninety-three organizations contacted the Commission and were exempted from the survey. The majority of these organizations were either too small (had fewer than 10 employees) or were out of business. Sixty-three responses stated that a recipient had received duplicate surveys; in these cases, multiple surveys had been sent to separate affiliates of a single organization that reported survey results on a consolidated basis. Sixty-five responses were received in addition to the original sample from organizations in the sampling frame that returned multiple questionnaires for affiliated firms without consolidating them.[8] After all adjustments, there were 4,701 organizations in the sample.

TABLE E.4 Adjustments to the sample size and number of respondents

	Sample	Respondents
Initial number of organizations	5,197	2,612
Less undeliverables	–405	([a])
Less exemptions	–93	–3
Less duplicates	–63	–4
Plus additions	+65	+65
Final number of organizations	4,701	2,670

Source: Compiled by the Commission.

[a]Not applicable.

After excluding a handful of responses that were out of scope or duplicative, and including the 65 questionnaires from affiliated firms reported on an unconsolidated basis,

[8] Questionnaires returned by firms that were not affiliated with any firm in the sampling frame were excluded from the analysis.

the Commission received a total of 2,670 completed and timely responses. Hence, among active organizations in applicable industries, including both organizations that handled UEPs and those that did not, the resulting overall response rate was 56.8 percent (i.e., 2,670 of 4,701 organizations). Table E.5 presents the response rate for each stratum and industry after adjusting the sample and responses as described above. Among individual strata, the response rates were generally higher for organizations selected from the industry list.

TABLE E.5 Response rates by industry and stratum, percent

NAICS-based industry	Orbis database			Industry list			Industry average
	Small	Large	Very large	Small	Large	Very large	
Waste management and remediation	40.1	45.3	([a])	62.4	67.7	([a])	45.7
Smelting of nonferrous metals	61.1	([b])	([a])	52.4	([b])	([a])	([b])
Electronic products manufacturing	72.7	54.2	68.3	55.2	66.7	80.5	62.9
Wholesaling of electronics and recyclables	54.9	52.3	([a])	61.1	56.3	([a])	54.7
Electronic products repair and refurbishing	39.6	54.4	([a])	66.0	71.4	([a])	65.4
Other services	75.0	59.1	64.4	72.5	71.7	51.6	47.7
Total	55.4	53.8	67.0	64.6	65.6	68.1	56.8

Source: Compiled by the Commission.

[a]Included but not distinguished from large organizations in the sampling frame.
[b]Not reported because of requirements which prohibit disclosure of individual company information.

Weighting and Analysis of Questionnaire Responses

Once the Commission received completed questionnaires, they were reviewed by Commission staff to ensure that respondents had properly reported all data. In cases where data were missing or appeared inconsistent, staff attempted to contact respondents to obtain corrected data.

After the data were collected and reviewed, Commission staff combined the responses from individual companies to produce statistically valid estimates of UEP activity in specific industries and in the entire U.S. economy. As noted above, under the stratified random sampling approach used here, the sampling rate differed by strata, based on an organization's industry, its size, and the data source from which it was selected. Response rates also varied by strata, as shown above in table E.5. Because sampling and response rates differed by strata, Commission staff weighted the responses of organizations in different strata to produce the required estimates.

Weights were determined by three factors: the sample selection weight, a nonresponse adjustment factor, and a poststratification factor. The sample selection weight was used to account for organizations that were not sampled; the specific weight depended on the sampling rate. Strata with the lowest sampling rates (e.g., small organizations in the electronic products repair and refurbishing industry) received the highest sample selection weights, since each survey respondent in these strata stood in for more organizations in the population than respondents in other strata.[9]

[9] Weighting is also adjusted for duplicates, as discussed in USITC, *Remanufactured Goods*, 2012, Appendix F.

The nonresponse adjustment factor was used to account for organizations that did not respond to the survey. The propensity cell adjustment approach was used to account for nonresponse. This approach assigned a nonresponse rate to each organization that is equal to the reciprocal of the estimated probability that the organization participated in the survey.[10]

The probability of survey participation was estimated in a logistic regression of responses on organization characteristics. These characteristics included the following: revenue; number of employees; location in border or coastal states; affiliate status; and the data source, organization size cutoffs, and industry information used for stratification.[11] These variables, and their interactions, had statistically significant effects on response rates, as shown in the first two columns of table E.6. The last two columns of that table show that these variables had economically significant effects as well. For example, large organizations had response rates 37.4 percent higher than small organizations, holding other characteristics constant. After controlling for the size category of organizations (small, large, and very large), a 1-percent increase in revenue raised participation by 4.3 percent, but a 1-percent increase in employees lowered participation by 4.6 percent. Across industries, electronic products manufacturers had the highest response rates; for example, organizations in electronics repair and refurbishing had a response rate 12.9 percent lower than the electronics products manufacturers.[12] Organizations selected from the Orbis database had a response rate 12.3 percent lower than those selected from the industry list.

In contrast to the first two factors, poststratification weighting incorporates data about the population from sources outside the survey to improve the accuracy and precision of survey estimates. This study used public data from the U.S. Census Bureau (Census) about certain population subgroups (the number of large and small organizations) that can help overcome known deficiencies of the Orbis database.[13] As noted in previous Commission studies,[14] the Orbis database contains a lower share of large organizations than the "true" share reported by Census in many U.S. industries. This discrepancy exists because the Orbis database incorporates organizations and their subsidiaries listed in a number of financial databases but does not represent a true census of U.S. businesses. In the industries in the used electronics sampling frame, Orbis reported that 9.9 percent of organizations have 100 or more employees, while Census reported that the actual share is twice as high (19.6 percent).[15]

[10] For details, see Heeringa, West, and Berglund, *Applied Survey Data Analysis*, 2010, 39–42.

[11] Estimated probabilities, or propensity scores, from this analysis were used to match organizations into three equal-sized classes, representing low, medium, and high probability of responding. This matching was done separately for each industry to preserve counts at the industry and higher level.

[12] For econometric reasons (to avoid perfect collinearity with the constant term), one industry must be omitted from the regression; in table E.6, the electronic products manufacturing industry was omitted. Coefficients in table E.6 thus show the response rates in the other five industries relative to the omitted industry (electronic products manufacturing). For the same reason, one of the size categories (small firms) has been omitted from the regression.

[13] These Census data are based on NAICS and differ from the proprietary shipment-level export data obtained from Census by the Commission for this study. See chapter 2 for a discussion of the proprietary data.

[14] See, for example, USITC, *Small and Medium-Sized Enterprises: Overview of Participation in U.S. Exports*, 2010, table D.2.

[15] These shares exclude firms in the "other services" industry, for which totals in the sampling frame cannot be compared to Census totals, since the sampling frame was restricted by a text search within selected NAICS codes.

TABLE E.6 Determinants of survey participation

	Logistic regression		Marginal effects	
Organization characteristic	Coefficient	Standard error	Coefficient (dy/dx)	Standard error
Log of revenues	0.193***	0.048	0.043***	0.010
Log of employees	–0.206***	0.076	–0.046***	0.017
Headquartered on U.S. coast or border	–0.183*	0.095	–0.041*	0.021
Organization is a subsidiary	–0.542***	0.200	([d])	([d])
NAICS-based industry[a]				
Waste management and remediation	–0.605***	0.124	–0.129***	0.027
Smelting of nonferrous metals	–0.357	0.334	([d])	([d])
Wholesaling of electronics and recyclables	–0.244**	0.101	–0.055**	0.022
Electronics products repair and furbishing	–0.674***	0.153	–0.136***	0.033
"Other services"	–0.191	0.126	–0.049*	0.028
Organization size[b]				
Large (100–999 employees)	1.698***	0.134	0.374***	0.025
Very large (1,000 or more employees)	1.373***	0.298	0.316***	0.059
Selected from the Orbis database[c]	–0.554***	0.105	–0.123***	0.023
Subsidiary status interacted with industry				
Waste management and remediation	1.073*	0.631	([e])	([e])
Smelting of nonferrous metals	0.000	([d])	([e])	([e])
Wholesaling of electronics and recyclables	0.038	0.393	([e])	([e])
Electronics products repair and refurbishing	2.775***	0.944	([e])	([e])
"Other services"	–0.800**	0.355	([e])	([e])
Constant	–1.551***	0.588	([e])	([e])
Number of observations	4,867		4,867	

Source: Compiled by the Commission.

Note: Stars indicate level of statistical significance: 1 percent (***), 5 percent (**), and 10 percent (*).

[a]Relative to the omitted category (electronic products manufacturing).
[b]Relative to the omitted category (small organizations).
[c]Relative to the omitted category (the industry association list).
[d]Not estimated by Stata.
[e]Not applicable.

Imposing the true share of large organizations in each industry through poststratification weighting raised the weight on large organizations and ensured that the resulting estimates are more consistent with underlying U.S. government statistics on the size of U.S. organizations. As the industry association list was designed to capture the most significant organizations handling and exporting UEPs, and the Orbis database also has near-comprehensive coverage of extremely large firms, it was not believed that any organizations of this magnitude were omitted from the sample. Hence, activities for the most significant organizations were not reweighted.[16]

Poststratification adjusts the total weight of all responding organizations to match the size distribution in Census data. Because the set of organizations that provide data can vary by question, poststratification weights may also vary by question. In some cases, consistent weighting was imposed for several related estimates. For example, similar weights were imposed to estimate total exports and the subcategory of exports for disposal. This approach improved the consistency of totals and subtotals in the report.

As noted, the combination of the sample selection weight, the nonresponse weight, and the poststratification weight determined the final weight given to each observation. The

[16] Specifically, the poststratification weight was set equal to one for any large or very large organization that accounted for more than 10 percent of the total exports within its stratum. There were fewer than 20 such organizations in the sample.

components of the weighting are consistent with the tables and information provided above. For example, sample selection weights ranged from 1.0 to 11.1 (table E.7), indicating that sampling rates by stratum ranged from 9.0 percent to 100.0 percent, consistent with the industry rates in table E.3. Nonresponse weights ranged from 1.5 to 2.9, and are consistent with the response rates provided in table E.5.[17] Except for the "other services" industry, poststratification weights for large and very large firms were all above 1.0, indicating that weights on large firms were raised to match Census information, while weights on smaller firms were below 1.0, indicating that these weights were correspondingly lowered. As noted, the "other services" industry was not reweighted, so poststratification weights for all strata in this industry were set equal to 1.0. Overall, the final weights ranged from 1.5 to 25.2.

[17] As discussed above, nonresponse rates were not calculated as the inverse of the response rates in table E.5, but the weights are consistent with these inverses. Also as noted above, nonresponse weights, poststratification weights, and final weights may vary by organization within a stratum, so table E.7 reports the average value for each stratum.

TABLE E.7 Detailed weighting for each stratum

Industry	Sample selection weight			Nonresponse weight[a]			Poststratification weight[a]			Final weight[a]		
	Small	Large	Very large	Small	Large	Very large	Small	Large	Very large	Small	Large	Very large
Orbis database												
Waste management	9.7	1.0	([c])	2.7	2.1	([c])	0.9	3.0	([c])	23.1	6.2	([c])
Smelting of nonferrous metals	7.1	([b])	([c])	1.9	([b])	([c])	0.8	([b])	([c])	10.7	([b])	([c])
Electronic products manufacturing	7.7	1.0	1.0	1.8	1.7	1.7	0.5	1.8	1.7	6.4	2.9	3.0
Wholesaling of electronics and recyclables	10.2	1.0	([c])	2.2	1.9	([c])	0.8	3.3	([c])	17.5	6.2	([c])
Electronic products repair and refurbishing	11.1	1.0	([c])	2.9	2.0	([c])	0.8	5.5	([c])	25.2	11.2	([c])
“Other services”	7.2	1.0	1.0	1.7	1.7	1.8	1.0	1.0	1.0	12.4	1.7	1.8
Industry list												
Waste management	3.2	1.0	([c])	2.3	2.1	([c])	0.9	2.8	([c])	6.6	5.9	([c])
Smelting of nonferrous metals	1.2	([b])	([c])	1.7	([b])	([c])	0.8	([b])	([c])	1.6	([b])	([c])
Electronic products manufacturing	2.6	1.0	1.0	1.9	1.6	1.6	0.5	1.7	1.7	2.2	2.7	2.7
Wholesaling of electronics and recyclables	2.4	1.0	([c])	1.8	1.7	([c])	0.8	3.1	([c])	3.5	5.4	([c])
Electronic products repair and refurbishing	5.3	1.0	([c])	1.9	1.8	([c])	0.8	5.9	([c])	8.1	10.6	([c])
“Other services”	2.9	1.0	1.0	1.7	1.5	1.6	1.0	1.0	1.0	5.0	1.5	1.6

Source: Compiled by the Commission.

[a]These weights may vary by organization. The table reports the average weight of all organizations within each stratum.
[b]Not reported because of prohibitions on disclosing individual company information.
[c]Included but not distinguished from large organizations in the sampling frame.

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APPENDIX F
Written Questionnaire

UNITED STATES INTERNATIONAL TRADE COMMISSION

ELECTRONICS SECTOR QUESTIONNAIRE

Written Completion Version

United States International Trade Commission
Attention: UE Project Team
Office of Industries, Room 501
500 E Street, SW, Washington, DC 20436
Fax: 202-205-2018

The U.S. International Trade Commission (USITC) is conducting a fact-finding investigation to examine the electronics sector to get a clearer picture of U.S. exports of used electronic products. This investigation has been requested by the United States Trade Representative (USTR), who has directed the USITC to prepare a report that (1) provides estimates and details about U.S. exports of used electronic products, and the share of exports compared to all used electronic products sold or processed in the United States, (2) describes the types and activities of U.S. organizations that export used electronic products, and (3) describes the types and activities of the foreign enterprises that import used electronic products from the United States. According to the USTR (*www.ustr.gov*), such data and analysis will aid the National Strategy for Electronics Stewardship in helping U.S. firms and other groups to better manage electronic products throughout their lifecycles.

This questionnaire has been designed to collect information to fulfill this request. More information about this report and the investigation for which it is being prepared (no. 332-528) can be found by going to the following website:

http://www.usitc.gov/research_and_analysis/What_We_Are_Working_On.htm

Your organization is required by law to respond to this questionnaire

Please read all instructions and return the completed questionnaire to the USITC no later than July 25, 2012

The information is requested under the authority of section 332(g) of the Tariff Act of 1930 (19 U.S.C. § 1332(g)). Completing the questionnaire is mandatory, and failure to reply as directed can result in a subpoena or other order to compel the submission of records or information in your possession (19 U.S.C. § 1333(a)). For more information on this questionnaire, contact the following project team members:

Andrea Boron (202-708-2719; *andrea.boron@usitc.gov*)
Laura Bloodgood (202-708-4721; *laura.bloodgood@usitc.gov*)

Confidentiality

The Commission has designated as "confidential business information" the information you provide in response to this questionnaire, to the extent that such information would reveal the operations of your organization and is not otherwise available to the public. The Commission will not disclose such confidential business information except as provided for in section 9 of this questionnaire. Information received in response to this questionnaire will be aggregated with information from other questionnaire responses and will not be published in a manner that would reveal the operations of your organization.

OMB No. 3117-0224; Expiration Date: 2/28/2013
No response is required if currently valid OMB control number is not displayed

Instructions

Completing the Questionnaire

1. **Retrieving the written completion version of the questionnaire.** If you need another copy of the questionnaire, please contact the project team (see cover for contact details). This version of the questionnaire is appropriate if you are completing the questionnaire using written responses. An interactive completion version of this questionnaire is also available. It has been designed to simplify the entry process and minimize the need for our staff to contact your organization for clarifications. If your organization would prefer to use the interactive version, please go to the website below using a web browser and download it to your computer.

   http://www.usitc.gov/usedelectronics

2. **Entering information.** Provide responses for each question that applies to your organization. Write in a response or check a box as indicated in each question.

3. **Numeric data.** Note that data for sales, employees, shipments, exports, and imports should be entered as full figures, not in thousands, millions, or similar format.

4. **Submitting the questionnaire.** After completing the questionnaire, follow the submission instructions in section 10. Please keep a copy of the completed questionnaire for your records.

General information

1. **Types of organizations that should complete this questionnaire.** This questionnaire is intended for organizations that refurbish, recycle, broker, resell, export, consolidate, or otherwise handle electronic products in the United States.

   Organizations that participate in operations related to electronic products, but do not conduct any ***used*** electronic products activities, will only have to complete a few questions in section 1 before submitting their response.

2. **Coordinating your organization's response.** If separate persons or departments within your organization will share responsibility for completing this questionnaire, please make sure they coordinate their responses so that the information your organization gives us is internally consistent. This will minimize our need to call you back for clarifications.

3. **Relationship to corporate structure.** Please provide a single response for your organization's activities. This may require that your organization combine information from two or more business units.

   If it is not possible to combine responses, or it is unreasonably burdensome, then your organization may provide separate responses for business units, but please ensure that the information is complete and there is no double-counting.

   Joint venture organizations operating in the United States should submit a separate response, and there should be no double-counting with other business units of the joint venture partners.

4. **U.S. affiliates of foreign companies.** Please respond as if the affiliate were an independent organization operating in the United States. For example, show total sales for the affiliate only, and not for the foreign corporation. When listing investments, include both investments the affiliate has made in the United States, and investments in foreign countries that can be directly linked to the U.S. affiliate.

5. **Questionnaire structure.** This questionnaire is composed of ten sections, as shown below.

Table of Contents

Definitions

1. **Used electronic products:** Includes electronic products that have been refurbished, remanufactured, or repaired for resale; products that are intended for refurbishment or repair when sold or exported; and products that are at end of life, and are recycled, disassembled, or disposed of, or sold to be recycled or disassembled.

2. **Refurbished, remanufactured, and repaired products:** Includes used electronic products that are collected from their original users and then cleaned, fixed, or otherwise brought back to working condition and resold. This category **includes** products that are disassembled and resold as reclaimed electronic parts for use in repairing of other electronic products.

3. **Recycled:** Refers to products that are demanufactured or disassembled to a point where they will no longer perform their original functions. This category includes products that are resold as scrap materials, such as bulk metals or plastics, but **DOES NOT** include products that are resold as working electronic parts for use in the repair of other electronic products. Also includes leftover materials from products that have been harvested for parts.

4. **Disposal:** Refers to end-of-life disposition of used electronic products that a recycler or disassembler pays to dispose of, rather than products that bring in income because they are sold as the output of a recycling process. Includes both goods disposed of as trash, often in a landfill, and goods that your organization pays to have recycled, such as glass from cathode ray tubes (CRTs).

5. **Direct Exports:** Refers to a shipment of used electronic products, or material derived from those products, by an organization from its operations in the United States directly to an organization located in a foreign country. These exports may be facilitated by a logistics organization or a freight forwarder. Direct exports do not include sales made through an intermediate broker.

6. **Original Equipment Manufacturer (OEM) and Original Device Manufacturer (ODM):** Original manufacturer of new electronic products and parts. OEMs and ODMs of new equipment may or may not be involved in sales and distribution of used electronic products.

7. **Broker:** Organization that buys and sells used electronic products. The brokerage function does not include refurbishing, repairing, or recycling electronic products, although some organizations may do these things in addition to buying and selling. In some cases, a broker may not even take physical possession of the used electronic product.

8. **Collector:** A for-profit or nonprofit organization that collects used electronic products from their original users. Collectors may or may not decide whether used electronic products will be refurbished, repaired, or recycled. May include organizers of public and charity collections, municipal waste collection sites, IT asset management organizations that collect used electronic products from commercial organizations, and organizations that buy used computers and mobile phones from individuals.

9. **Processed used electronic products:** Products that have been broken down, stripped, shredded, disassembled, or demanufactured by hand or using a machine.

10. **Computers and parts:** Includes desktop, laptop, and mainframe computers, network servers, netbooks, tablets, and e-readers, as well as parts integrated into a computer, such as hard drives, motherboards, and internal modems. Includes laptop batteries integrated into the unit, but not other batteries collected separately.

11. **Computer peripheral equipment**: Includes flat screen monitors but **NOT** monitors containing CRTs. Also includes equipment external to computers, such as external hard drives and other storage, external optical drives, keyboards, and mice. Printers, including those that also copy, fax, and scan documents, should be included with office imaging equipment (see next definition).

Definitions (continued)

12. **Office imaging equipment:** Includes printers, copiers, fax machines, and scanners. Multipurpose machines that print as well as fax, scan, and copy should be included here.

13. **Medical imaging equipment**: Scanning equipment for medical purposes, including but not limited to x-ray, MRI, and CT scan machines.

14. **Audio equipment:** Stereo systems, microphones, MP3 players, and other sound equipment without integrated video capabilities.

15. **Video equipment:** Televisions, video game systems and accessories, still image cameras and camcorders, both digital and analog, **NOT** including CRT televisions. All CRTs, regardless of size, should be included in the "Monitors and televisions containing CRTs" category.

16. **Mobile handsets (cell phones) and other telecommunication equipment:** Refers to telephones and electronic communication devices such as cell phones, smartphones, pagers, radios, personal digital assistants (PDAs), GPS navigation devices, Bluetooth headsets, and handheld scanners, including batteries and peripheral equipment that are part of those handsets. Also includes telecommunications network devices such as routers, switches, modems, hubs, network cards, and mobile communications equipment.

17. **Cathode ray tube (CRT):** A glass vacuum tube used in some televisions and monitors.

18. **R2 certification:** The R2 Standard is an electronics recycling standard that sets forth requirements for the environmental, health, safety, and security aspects of electronics recycling. The standard is administered by R2 Solutions, a nonprofit organization. More information on the standard is available at *http://www.r2solutions.org/*.

19. **e-Stewards certification:** The e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment® is an industry-specific environmental management system standard for electronics recycling and reuse. The e-Stewards initiative was developed by the Basel Action Network and incorporates the ISO 14001 standard. More information on the standard is available at *http://e-stewards.org/*.

20. **ISO 14001-ISO 14001:2004:** This lays out the requirements for an environmental management system, giving a framework for an organization's environmental policy, plans, and actions. More information on the standard is available at *http://www.iso.org/iso/iso_14000_essentials.htm*.

21. **Recycling Industry Operating Standard (RIOS):** A third party certification standard for environmental management systems.

Other definitions appear throughout this questionnaire. Many of these can be viewed by clicking on a button.

Section 1: Contact Information and Overview

1.1 Please list your organization's primary address and a contact person.

Organization name

Address

City | State | Zip code | Web site address (www.name.domain)

Contact person's name | Contact person's job title

Contact person's telephone number (xxx-xxx-xxxx) | Contact person's e-mail address (xxx@xxx.xxx)

1.2 Does the organization named above have any joint ventures that operate in the United States?

- ☐ Yes
- ☐ No
- ☐ Not applicable (check this box if the organization named above is a joint venture)

If your organization has joint venture operations, each should provide a separate questionnaire response.

1.3 Is the organization named above a subsidiary of a organization operating in the United States?

- ☐ Yes
- ☐ No

We developed the mailing list from many sources that may have not explicitly indicated company relationships. Therefore, we may have sent this questionnaire to one or more subsidiaries, the related parent company, and combinations of the foregoing. This submission should be coordinated with the parent company.

1.4 Is the organization named above a holding company operating in the United States?

- ☐ Yes
- ☐ No

If your organization is a holding company, then this submission should reflect all the activities of the held companies that have U.S. operations. Alternatively, each held company with U.S. operations could provide a separate questionnaire response.

How to report numerical figures	
If sales or costs are $1,200,500, report in full figures as:	1,200,500
If the number of employees or number of units is 1,550, report in full figures as:	1,550
If the weight of products sold is 1,000 pounds, report in full figures as:	1,000

Total sales definition: Total sales, net of returns, discounts, and allowances. Includes internal consumption and transfers to related firms, as applicable, at fair market value. Same as sales as shown on a typical income statement.

Employee and full-time equivalent (FTE) definitions: Includes the number of your firm's employees, including part-time and temporary workers, at facilities located in the United States. Include production and related workers, managers, supervisors, technicians, office workers, etc. related to your organization's activities on a full-time equivalent (FTE) basis. If your firm is an affiliate of a foreign firm, include only employees that can be attributed directly to your firm's U.S. operations. Full-time equivalent (FTE) reflects the total number of regular straight-time hours (i.e., not including overtime or holiday hours) worked by employees divided by the number of compensable hours applicable to each calendar year. Annual leave, sick leave, and compensatory time off and other approved leave categories are considered to be "hours worked" for purposes of defining FTE employment.

1.5 Please list (1) the value of your organization's total U.S. sales in 2011 for all activities, including but not limited to activities related to used electronic products and (2) the number of employees in 2011 (on a full-time equivalent (FTE) basis) for your organization's operations **in the United States**. **Your best estimate is acceptable**. If your organization is an affiliate of a foreign organization, include only sales and employees that can be directly attributed to your organization's U.S. operations.

Total sales should include sales to domestic and foreign markets from U.S. operations.

#	Item	2011
1	Total sales for all activities in the United States (in full figure dollars, not thousands or other format)	
2	Total number of employees engaged in activities in the United States, including part-time and temporary workers, FTE basis (in full figures, not thousands or similar format)	

Section 2: Organization Information

The questions in this section refer to all of your organization's sales of used electronic products, parts, components, and materials derived from recycled electronic products, not just exported goods. We need this information so we can see how the amount of exports compares with total U.S. sales of these products.

2.1 Did your organization do any of the following in 2011: acquire, refurbish, repair, resell, disassemble, recycle, export, or otherwise process used electronic products? If so, select "Yes." Also select "Yes" if your organization has any activities related to used electronics wholesale or distribution activities.

☐ Yes. Continue to next question

☐ No. Skip to section 9

2.2 What year did your organization begin working with used electronics?

Year (use four digits) ☐

2.3 Is your organization a nonprofit entity?

☐ Yes

☐ No

2.4 A. Did one or more foreign entities have a substantial ownership interest (10 percent or greater) in your organization as of December 31, 2011? (An entity can include a corporation, limited liability company, partnership, sole proprietorship, or any subsidiary related to the foregoing.) Include your entire organization, not just establishments with used electronic products activities.

☐ Yes. Continue with part B of this question

☐ No. Go to question 2.5

B. If you responded "Yes" to part A, indicate the country of origin of the foreign entities, up to a maximum of three.

Top country	
Second country	
Third country	

C. Is the combined foreign ownership interest in your organization as of December 31, 2011 more than 50 percent?

☐ Yes

☐ No

D. Does at least one of these foreign entities have activities related to used electronic products in countries other than the United States?

☐ Yes. Continue with part E of this question

☐ No. Go to question 2.5

E. If you responded "Yes" to part D, indicate the country in which these activities take place, up to a maximum of three.

Country 1	
Country 2	
Country 3	

Establishment definition: An establishment is a single physical location at which business is conducted and/or services are provided. It is not necessarily identical with a company or enterprise, which may consist of one establishment or more. Establishments are often described as plants, factories, mills, or branches.

2.5 How many separate, used electronics-related establishments did your organization operate in the United States in 2011? Include facilities that collect, sort, refurbish, recycle, repair, disassemble, recover parts or metals, mechanically process, or provide related support services such as brokering or wholesaling. Do not include facilities owned by other organizations, even if those organizations perform work for your organization.

Number of establishments	

2.6 A. Did your organization hold a third-party certification for the processing and/or sales of used electronic products in 2011?

☐ Yes. Continue with part B of this question

☐ No. Go to question 2.7

B. Please provide the following information on the type of certifications that apply to all of your organization's establishments that are involved in used electronics. Answer only for establishments owned by your organization.

#	Certification	Number of establishments holding the certification in 2011	Number of establishments for which certification was in process during 2011
1	R2		
2	e-Stewards		
3	ISO 14001		
4	RIOS		
5	ISO 9001		
6	Microsoft authorized or registered refurbisher program		
7	Other-specify:		

2.7 In which of the following activities related to used electronics did your organization engage in 2011 in the United States? Check all that apply.

☐ Collection

☐ Sorting of incoming used electronic products (including for immediate resale of working goods)

☐ Refurbishing/remanufacturing/repair for resale or donation (systems and/or parts)

☐ Manual demanufacturing or disassembly

☐ Parts recovery and reuse

☐ Metals recovery/smelting/refining

☐ Wholesaling or brokering (equipment and parts)

☐ Wholesaling or brokering (commodity scrap materials)

☐ Mechanical processing (shredding, shearing, baling of metals, plastics, glass), including sorting

☐ Recycling services for businesses (asset management, data security, logistics)

☐ Electronics retailer

☐ IT asset management or asset disposition services

☐ Logistics or consulting services

☐ Other-specify: _____

2.8 Of the activities you checked in question 2.7, which do you consider to be your organization's most significant business activity, based on hours of employment devoted to each of these activities? Select one from the list in question 2.7 and write it in the space below.

Primary activity _____

Section 3: Processing and Sales of Used Electronic Products in the United States

3.1 Please provide your organization's sources of used electronic products and parts, by weight (pounds), in 2011. **Your best estimate is acceptable**.

#	Source	Weight (full figure pounds)
1	Commercial collections, including acquisitions from businesses, institutions, and government agencies	
2	Nongovernment public collection events, including materials charged to OEM takeback programs	
3	Local government consumer waste collection and drop-off sites, including materials charged to OEM takeback programs	
4	Contracts with takeback programs run by retailers (phone carriers, retail electronics outlets), to take products back directly from end users	
5	Contracts with takeback programs run by OEMs or ODMs (computer manufacturers, consumer electronics manufacturers), to take products back directly from end users. (Do not include materials included in lines 2 and 3 above).	
6	Another recycler or disassembler	
7	Wholesaler or broker	
8	IT asset manager	
9	Direct from OEMs or ODMs, reflecting consumer returns of new products, scrap from warehouses, production scrap, etc.	
10	Other-specify:	
11	Unknown	
12	Total	

Total sales reported in questions 3.2, 3.3, 3.4, and 3.5 below should include sales to domestic and foreign markets from U.S. operations.

3.2 Please indicate the total sales value (excluding commercial asset disposition fees) of used electronic products and parts that your organization **refurbished or repaired** in the United States in 2011. **Your best estimate is acceptable**.

1	Total sales value (in full figure dollars)	

3.3 Please indicate the total sales value (excluding commercial asset disposition fees) and weight of all used electronic products and parts that your organization **recycled** (disassembled, not intended for reuse) in the United States in 2011. Exclude products that you paid other organizations to recycle. **Your best estimate is acceptable**.

1	Total sales value (in full figure dollars)	
2	Total weight (pounds, in full figures)	

3.4 Please indicate the total sales value (excluding commercial asset disposition fees) and weight of **commodity metals, plastics and glass, not including circuit boards (whole or shredded) or CRT glass** that resulted from your organization's recycling activities in the United States in 2011. **Your best estimate is acceptable**.

1	Total sales value (in full figure dollars)	
2	Total weight (pounds, in full figures)	

3.5 Please indicate the total sales value (excluding commercial asset disposition fees) and weight of **whole and shredded circuit boards** that resulted from your organization's recycling activities in the United States in 2011. **Your best estimate is acceptable**.

#	Item	Whole circuit boards	Shredded circuit boards
1	Total sales value (in full figure dollars)		
2	Total weight (pounds, in full figures)		

Total disposal costs reported in question 3.6 below should reflect used electronic products sent to domestic organizations or organizations in foreign countries from U.S. operations.

3.6 Please indicate the total recycling or disposal costs (excluding commercial asset disposition fees) and weight of all used electronic products that your organization **sent for disposal or paid another organization to recycle** in the United States or in other countries in 2011. **Your best estimate is acceptable**.

#	Item	Sent for disposal	Sent to another organization for recycling
1	Total disposal cost (in full figure dollars) Enter zero if no costs were incurred		
2	Total weight (pounds, in full figures)		

3.7 Please list the percentage of different products in your organization's total output of used electronic products, based on weight, in 2011. **Your best estimate is acceptable**. Output includes products that your organization sold and products that your organization disposed of.

#	Product group and related parts and components	Percent of 2011 output, based on weight
1	Equipment sold, tested, and working for reuse	
2	Equipment sold to other organization for refurbishment, repair, or resale	
3	Printed circuit boards (whole or shredded)	
4	CRT monitors and televisions, including component parts from CRTs and separated CRT glass disassembled by your organization	
5	Commodity-grade scrap metals not including circuit boards or CRTs	
6	Commodity-grade scrap plastics, not including circuit boards	
7	Commodity-grade scrap glass, not including CRTs	
8	Disposal and goods that you paid to recycle	
9	Other-specify:	
10	Unknown	
11	Total (the sum of the figures above should equal 100)	

3.8 A. Does your organization have one or more internal processes for monitoring organizations that purchase your recycled and/or refurbished products, and tracking the products you sell? Do not include buyers of tested and working products that do not require further refurbishment or repair.

☐ Yes. Complete parts B, C, and D of this question

☐ No. Go to question 3.9

B. Does your organization perform audits of downstream customers?

☐ Yes If yes, are the audits performed by (check one): Your organization ☐ Outside auditor ☐

☐ No

C. How extensively do you track downstream channels? Check one.

☐ To first sale only

☐ To first and second sales only

☐ To final destination

D. Which used electronic products does your organization track in downstream channels? Check all that apply. If none apply, leave all boxes unchecked.

☐ All goods

☐ Sales of goods that are intended for refurbishment or repair

☐ Printed circuit boards (whole or shredded)

☐ CRT monitors and televisions

☐ Other hazardous electronic waste, including batteries and devices containing mercury

☐ Commodity scrap materials, including metals, plastics, and glass, but not printed circuit boards or CRTs

☐ Other-specify: ____

3.9 What types of requirements does your organization impose on buyers of your output of hazardous materials, including CRTs, circuit boards, and batteries? Do not include buyers of tested and working products that do not require further refurbishment or repair. Check all that apply. If none apply, leave all boxes unchecked.

☐ Customers must be U.S. organizations

☐ Customers must agree not to export

☐ Customers must be R2 or e-Stewards certified

☐ Customers must have passed your organization's qualifications

3.10 What types of requirements does your organization impose on buyers of your output of non-hazardous materials, including ferrous and nonferrous metals and plastics? Do not include buyers of working products that do not require further refurbishment or repair. Check all that apply. If none apply, leave all boxes unchecked.

☐ Customers must be U.S. organizations

☐ Customers must agree not to export

☐ Customers must be R2 or e-Stewards certified

☐ Customers must have passed your organization's qualifications

3.11 Please rank the factors below as to whether they discouraged or encouraged your organization from exporting in 2011, even if your organization did not export any used electronic products. If your organization has no knowledge about a factor, leave all boxes in that row unchecked.

For example, if labor costs in foreign countries are lower than labor costs in the United States, you may consider this as encouraging exports by your organization, in which case you would check box 4 or 5 for factor number 3.

If your responses to this question vary based on the type of used electronic products your organization sells, please explain this variation in your response to question 8.1.

#	Factor your company faces	Rank from 1 (strongly discouraged exporting) to 5 (strongly encouraged exporting)				
		Strongly discouraged exporting	**Discouraged exporting**	**No impact**	**Encouraged exporting**	**Strongly encouraged exporting**
1	Requirements of certification program (e-Stewards, R2, or other)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
2	Market demand for your products in foreign countries	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
3	Labor costs in foreign markets	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
4	Lack of recycling or processing capacity in the United States	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
5	Environmental concerns	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
6	General commitment to keeping work in the United States	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
7	Commodity prices	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
8	State laws requiring used electronics collection/take back	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
9	Transportation costs	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
10	Low product volume	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
11	Knowledge of foreign markets	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
12	Foreign tariffs, taxes, or regulations governing trade in used electronic products	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
13	Existing relationship between U.S. and foreign organizations	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
14	Other-specify:	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
15	Other-specify:	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

3.12 Please indicate the share of your organization's U.S. output of used electronic products in 2011 **that you believe (or are reasonably certain) was later exported by another organization**, by weight. Do not include your organization's direct exports. **Your best estimate is acceptable**.

#	Product group and related parts and components	Percent of 2011 output, based on weight
1	Equipment sold, tested, and working for reuse	
2	Equipment sold to other organization for refurbishment, repair, or resale	
3	Printed circuit boards (whole or shredded)	
4	CRT monitors and televisions, including component parts from CRTs disassembled by your organization	
5	Commodity-grade scrap metals not including circuit boards or CRTs	
6	Commodity-grade scrap plastics, not including circuit boards	
7	Commodity-grade scrap glass, not including CRTs	
8	Disposal and goods that you paid to recycle	
9	Other-specify:	
10	Unknown	

Direct sales definition: Refers to a shipment of used electronic products, or material derived from those products, by an organization from its operations in the United States directly to an organization located in a foreign country. These exports may be facilitated by a logistics organization or a freight forwarder. Direct exports do not include sales made through an intermediate broker.

3.13 Please indicate which product groups your organization exported in 2011. Only consider products your organization exported directly (not products that were later exported by another organization). Check all that apply.

- ☐ Refurbished or repaired electronic products, sold tested and working
- ☐ Used electronic products, not tested and working
- ☐ CRT monitors or televisions
- ☐ Whole or shredded circuit boards
- ☐ Commodity-grade scrap from used electronic products
- ☐ Wires and cables from used electronic products

3.14 Did you check any of the boxes in the previous question?

- ☐ Yes. Go to section 4
- ☐ No. Skip to section 8

Section 4: U.S. Exports of Refurbished or Repaired Used Electronic Products

In this section we are requesting information about your organization's exports of **refurbished or repaired** used electronic products.

4.1 Did your organization export refurbished or repaired used electronic products during 2011?

- ☐ Yes. Continue to next question
- ☐ No. Go to section 5

4.2 Which of the following best describes the majority of your export shipments of used electronic products in 2011? Check one.

- ☐ Shipments including only a single type of used electronic product
- ☐ Shipments including mixed types of used electronic products
- ☐ Shipments including used electronic products mixed with other types of products
- ☐ Shipments of used electronic products for repair overseas that were expected to be shipped back to the United States after repair

4.3 For your organization, please compare 2011 exports of refurbished or recycled used electronic products (by number of units), with exports in previous years. Check one.

- ☐ About the same
- ☐ Higher than most years
- ☐ Lower than most years

4.4 For the refurbished or repaired used electronic products (including related parts and components) that your organization exported in 2011, please list the export classification codes in the format shown for your top five products, ranked by weight. These export categories can be found at U.S. Schedule B: Statistical Classification of Domestic and Foreign Commodities Exported from the United States (*http://www.census.gov/foreign-trade/schedules/b/2012/index.html*.

Rank (by weight, descending order)	Schedule B 10-digit subheading (xxxx.xx.xxxx)
1	
2	
3	
4	
5	

4.5 **Sales by value**: For used electronic products that your organization **refurbished or repaired** in 2011, or that your organization processed but sold to another organization for refurbishment or repair, please indicate where and how those products were sold. For each product group, please estimate the ***value of sales*** by destination. **Your best estimate is acceptable**. In all columns, include sales to affiliates of your organization.

#	Product group and related parts and components	Sold, tested and working, in the United States	Sold, tested and working, outside the United States (exported)	Sold to another U.S. organization for refurbishing or repair	Sold to another organization outside the U.S. for refurbishing or repair (exported)	Unknown	Total sales of repaired or refurbished products ($)
		Sales in 2011 (full figure dollars)					
1	Computers						
2	Computer peripheral equipment						
3	Flat screen monitors						
4	Monitors and televisions containing CRTs						
5	Televisions and other video and audio equipment, not including CRTs, but including still-image cameras and camcorders						
6	Mobile handsets (cell phones) and other telecommunication equipment						
7	Office imaging equipment (printers, copiers, fax machines, scanners, etc.)						
8	Medical imaging equipment (x-ray, MRI, CT scan machines, etc.)						
9	Whole printed circuit boards						
10	Other-specify:						
11	All other and unknown						
12	Total sales ($)	This figure should match figure in question 3.2, line 1 ------>>					

4.6 **Sales by number of units:** For used electronic products that your organization **refurbished or repaired** in 2011, or that your organization processed but sold to another organization for refurbishment or repair, please indicate where and how those products were sold. For each product group, please estimate the ***number of units*** sold by destination. **Your best estimate is acceptable**. In all columns, include sales to affiliates of your organization.

#	Product group and related parts and components	Sold, tested and working, in the United States	Sold, tested and working, outside the United States (exported)	Sold to another U.S. organization for refurbishing or repair	Sold to another organization outside the U.S. for refurbishing or repair (exported)	Unknown	Total sales of repaired or refurbished products
		Sales in 2011 (number of units)					
1	Computers						
2	Computer peripheral equipment						
3	Flat screen monitors						
4	Monitors and televisions containing CRTs						
5	Televisions and other video and audio equipment, not including CRTs, but including still-image cameras and camcorders						
6	Mobile handsets (cell phones) and other telecommunication equipment						
7	Office imaging equipment (printers, copiers, fax machines, scanners, etc.)						
8	Medical imaging equipment (x-ray, MRI, CT scan machines, etc.)						
9	Whole printed circuit boards						
10	Other-specify:						
11	All other and unknown						
12	Total units						

Section 5: U.S. Exports of Recycled Used Electronic Products

In this section we are requesting information about your organization's exports of **recycled** used electronic products.

5.1 Did your organization export recycled or disassembled used electronic products, or export used electronic products for recycling or disassembly during 2011? Do not include used electronic products that you paid another organization to recycle or dispose of.

☐ Yes. Continue to next question

☐ No. Go to section 6

5.2 Which of the following best describes the majority of your export shipments of used electronic products that were recycled or disassembled by your organization, that you paid another organization to recycle, or that you exported for final disposal in 2011? Check one.

☐ Shipments including only a single type of used electronic product

☐ Shipments including mixed types of used electronic products

☐ Shipments including used electronic products mixed with other types of products

5.3 For your organization, please compare 2011 exports of used electronic products that were recycled or disassembled by your organization (by weight) with exports in previous years. Check one.

☐ About the same

☐ Higher than most years

☐ Lower than most years

5.4 For the recycled used electronic products (including related parts and components) that your organization exported in 2011, please list the export classification codes in the format shown for your top five products, ranked by weight. These export categories can be found at U.S. Schedule B: Statistical Classification of Domestic and Foreign Commodities Exported from the United States (*http://www.census.gov/foreign-trade/schedules/b/2012/index.html*).

Rank (by weight, descending order)	Schedule B 10-digit subheading (xxxx.xx.xxxx)
1	
2	
3	
4	
5	

5.5 **Sales by value:** For used electronic products that your organization **recycled (or sold to another organization for recycling)** in 2011, please indicate where and how those products were sold. For each product group, estimate the ***value of sales*** by destination. **Your best estimate is acceptable**. Your response should reflect the state of the product when it left your organization. In all columns, include sales to affiliates of your organization. Do not include used electronic products that you paid another organization to recycle or dispose of.

#	Product group and related parts and components	Sold recycled materials to a U.S. organization	Sold recycled materials outside the United States (exported)	Sold electronic products or parts for recycling by another U.S. organization	Sold electronic products or parts for recycling outside the United States (exported)	Sold recycled or whole, unknown destination	Total sales ($)
		Sales in 2011 (full figure dollars)					
1	Computers						
2	Computer peripheral equipment						
3	Flat screen monitors						
4	Monitors and televisions containing CRTs						
5	Televisions and other video and audio equipment, not including CRTs, but including still image cameras and camcorders						
6	Mobile handsets (cell phones) and other telecommunication equipment						
7	Office imaging equipment (printers, copiers, fax machines, scanners, etc.)						
8	Medical imaging equipment (x-ray, MRI, CT scan machines, etc.)						
9	Separated CRTs, mercury lamps, and batteries						
10	Whole printed circuit boards						
11	Shredded printed circuit boards			Not applicable	Not applicable		
12	Wires and cables from any electronic product						
13	Commodity metals, plastics, and glass (not including CRTs)			Not applicable	Not applicable		
14	Other-specify:						
15	All other and unknown						
16	Total sales ($)						

5.6 **Sales by weight:** For used electronic products that your organization **recycled (or sold to another organization for recycling)** in 2011, please indicate where and how those products were sold. For each product group, estimate the ***weight*** of the recycled products by destination. **Your best estimate is acceptable**. Your response should reflect the state of the product when it left your organization. In all columns, include sales to affiliates of your organization. Do not include used electronic products that you paid another organization to recycle or dispose of.

#	Product group and related parts and components	Sold recycled materials to a U.S. organization	Sold recycled materials outside the United States (exported)	Sold electronic products or parts for recycling by another U.S. organization	Sold electronic products or parts for recycling outside the United States (exported)	Sold recycled or whole, unknown destination	Total sales weight
		Weight of sales in 2011 (full figure pounds)					
1	Computers						
2	Computer peripheral equipment						
3	Flat screen monitors						
4	Monitors and televisions containing CRTs						
5	Televisions and other video and audio equipment, not including CRTs, but including still image cameras and camcorders						
6	Mobile handsets (cell phones) and other telecommunication equipment						
7	Office imaging equipment (printers, copiers, fax machines, scanners, etc.)						
8	Medical imaging equipment (x-ray, MRI, CT scan machines, etc.)						
9	Separated CRTs, mercury lamps, and batteries						
10	Whole printed circuit boards						
11	Shredded printed circuit boards			Not applicable	Not applicable		
12	Wires and cables from any electronic product						
13	Commodity metals, plastics, and glass (not including CRTs)			Not applicable	Not applicable		
14	Other-specify:						
15	All other and unknown						
16	Total sales by weight						

Section 6: U.S. Exports of Used Electronic Products For Disposal

In this section we are requesting information about used electronic products that your organization **paid** another organization to recycle or dispose of.

6.1 Did your organization export used electronic products that you paid a foreign organization to recycle or dispose of during 2011?

☐ Yes. Continue to next question

☐ No. Go to section 7

6.2 Which of the following best describes the majority of your export shipments of used electronic products that you paid another organization to recycle, or that you exported for final disposal in 2011? Check one.

☐ Shipments including only a single type of used electronic product

☐ Shipments including mixed types of used electronic products

☐ Shipments including used electronic products mixed with other types of products

6.3 For your organization, please compare 2011 exports of used electronic products that you paid another organization to recycle, or that you exported for final disposal (by weight) with exports in previous years. Check one.

☐ About the same

☐ Higher than most years

☐ Lower than most years

6.4 For the used electronic products (including related parts and components) that your organization paid another organization to recycle or dispose of, and exported in 2011, please list the export classification codes in the format shown for your top five products, ranked by weight. These export categories can be found at U.S. Schedule B: Statistical Classification of Domestic and Foreign Commodities Exported from the United States (*http://www.census.gov/foreign-trade/schedules/b/2012/index.html*).

Rank (by weight, descending order)	Schedule B 10-digit subheading (xxxx.xx.xxxx)
1	
2	
3	
4	
5	

6.5 **Payments for recycling or disposal by value:** For used electronic products that your organization **paid to recycle or dispose of** in 2011, please indicate what happened to those products. For each product group, estimate the disposal costs by destination. **Your best estimate is acceptable**. In all columns, include sales to affiliates of your organization.

#	Product group and related parts and components	Paid for recycling or disposal in the United States	Paid for recycling or disposal outside the United States (exported)	Paid for recycling or disposal, destination unknown	Total recycling and disposal costs ($)
		Costs in 2011 (full figure dollars)			
1	Computers				
2	Computer peripheral equipment				
3	Flat screen monitors				
4	Monitors and televisions containing CRTs				
5	Televisions and other video and audio equipment, not including CRTs, but including still image cameras and camcorders				
6	Mobile handsets (cell phones) and other telecommunication equipment				
7	Office imaging equipment (printers, copiers, fax machines, scanners, etc.)				
8	Medical imaging equipment (x-ray, MRI, CAT scan machines, etc.)				
9	Whole printed circuit boards				
10	Shredded printed circuit boards				
11	Wires and cables from any electronic product				
12	Commodity metals, plastics, and glass (not including CRTs)				
13	Separated CRTs, mercury lamps, and batteries				
14	Other-specify:				
15	All other and unknown				
16	Total recycling and disposal costs ($)	This figure should match the sum of the figures in both columns in question 3.6, line 1 ------>>			

6.6 **Payments for recycling or disposal by weight:** For used electronic products that your organization **paid to recycle or dispose of** in 2011, please indicate what happened to those products. For each product group, estimate the ***weight*** of the material disposed of by destination. **Your best estimate is acceptable**. In all columns, include sales to affiliates of your organization.

#	Product group and related parts and components	Paid for recycling or disposal in the United States	Paid for recycling or disposal outside the United States (exported)	Paid for recycling or disposal, location unknown	Total recycling and disposal weight
		Weight of disposed products in 2011 (full figure pounds)			
1	Computers				
2	Computer peripheral equipment				
3	Flat screen monitors				
4	Monitors and televisions containing CRTs				
5	Televisions and other video and audio equipment, not including CRTs, but including still image cameras and camcorders				
6	Mobile handsets (cell phones) and other telecommunication equipment				
7	Office imaging equipment (printers, copiers, fax machines, scanners, etc.)				
8	Medical imaging equipment (x-ray, MRI, CAT scan machines, etc.)				
9	Whole printed circuit boards				
10	Shredded printed circuit boards				
11	Wires and cables from any electronic product				
12	Commodity metals, plastics, and glass (not including CRTs)				
13	Separated CRTs, mercury lamps, and batteries				
14	Other-specify:				
15	Unknown				
16	Total recycling and disposal weight	This figure should match the sum of the figures in both columns in question 3.6, line 2 ------>>			

Section 7: Destination of U.S. Exports of Used Electronic Products

We are requesting the data in this section to help us track trends in U.S. export markets. There is no need to separate your exports by product group. Include goods that were repaired, refurbished, recycled, or disassembled by your organization; products that your organization is selling to a foreign organization to repair, refurbish, recycle, or disassemble; or goods that your organization is paying another organization to recycle or dispose of overseas.

7.1 Please list your organization's 2011 exports by weight of used electronic products that went to each type of foreign enterprise shown below. **Your best estimate is acceptable**. Do not include products that your organization sold in the United States that were later exported by another organization.

#	Foreign enterprise type	Export weight (full figure pounds)
1	Original equipment manufacturer (OEM)/Original device manufacturer (ODM)	
2	Recycler of used electronics	
3	Refurbisher/remanufacturer	
4	Reseller/broker	
5	Non-profit organization/charity	
6	Smelter/metal foundry	
7	Plastics reprocessor	
8	Other-specify:	
9	Unknown	
10	Total	

7.2 Please list your organization's 2011 exports by weight of used electronic products that went to each product end use shown below. **Your best estimate is acceptable**. Do not include products that your organization sold in the United States that were later exported by another organization.

#	End use	Export weight (full figure pounds)
1	Resale of whole equipment or working parts without further processing (tested/working in the United States)	
2	Resale of whole equipment or working parts with further processing (recycle, repair, refurbish, etc.)	
3	Charitable donation (operational goods)	
4	Recycling or disassembly	
5	Materials processing (smelting, refining, sorting)	
6	Final disposal	
7	Other-specify:	
8	Unknown	
9	Total (this figure should match total in question 7.1)	

7.3 In 2011, did your organization export any used electronic products to foreign affiliates of your organization?

☐ Yes

☐ No

If yes, what share of your organization's exports of used electronic products, by weight, was shipped to affiliates (percent)? ☐

7.4 Please list your organization's 2011 exports by weight of used electronic products that went to each destination country. **Your best estimate is acceptable**. Do not include products that your organization sold in the United States that were later exported by another organization.

#	Country	Export by weight (full figure pounds)
	European Union (EU):	
1	Belgium	
2	Germany	
3	Sweden	
4	Other EU	
5	Brazil	
6	Canada	
7	China	
8	Colombia	
9	Ghana	
10	Hong Kong	
11	India	
12	Japan	
13	Kenya	
14	Mexico	
15	Nigeria	
16	Philippines	
17	Singapore	
18	South Africa	
19	Vietnam	
20	Other-specify:	
21	Other-specify:	
22	Other-specify:	
23	Unknown country	
24	Total (this figure should match total in question 7.1)	

7.5 For your organization's top three export markets of used electronic products identified in question 7.4, please list the top three products exported based on **weight**. First write-in a country in the country column. Then select the appropriate product group(s) in the list below (up to a maximum of three) and write-in a product group number in the appropriate column(s)

Product group number	Product group
1	Computers
2	Computer peripheral equipment
3	Flat screen monitors
4	Monitors and televisions containing CRTs
5	Televisions and other video and audio equipment, not including CRTs, but including still image cameras and camcorders
6	Mobile handsets (cell phones) and other telecommunication equipment
7	Office imaging equipment (copiers, fax machines, scanners, etc.)
8	Medical imaging equipment (x-ray, MRI, CT scan machines, etc.)
9	Whole printed circuit boards
10	Shredded printed circuit boards
11	Wires and cable from any electronic product
12	Commodity metals, plastics, and glass (not including CRTs)
13	Other

		Product group number (write-in below as appropriate)		
#	Country	Leading product group	Second leading product group	Third leading product group
1				
2				
3				

Section 8. Other Information

8.1 If your organization would like to further explain any of the responses in this questionnaire, use the space below.

8.2 If your organization would like to give more details about your own organization's exports of used electronic products, or about U.S. exports of such products more generally, use the space below.

8.3 If your organization would like to give us a written submission for the public record, go to the link below to view the *Federal Register* notice regarding this investigation and go to page 2 for submission instructions.

(*http://www.usitc.gov/secretary/fed_reg_notices/332/Fed%20Reg%20approved%20Used%20Electronic%20Prod%20013012%20ss.pdf*)

Section 9. Certification

The undersigned certifies that the information supplied herein in response to this questionnaire is complete and correct to the best of his/her knowledge and belief and understands that the information submitted is subject to audit and verification by the USITC.

Section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)) provides that the Commission may not release information which it considers to be confidential business information unless the party submitting such information had notice, at the time of submission, that such information would be released by the Commission, or such party subsequently consents to the release of the information. The undersigned acknowledges that information submitted in this questionnaire response and throughout this investigation may be used by the USITC, its employees, and contract personnel who are acting in the capacity of USITC employees, for the purposes of developing or maintaining the records of this investigation or related proceedings for which this information is submitted, or in internal audits and in investigations relating to the programs and operations of the USITC pursuant to 5 U.S.C. Appendix 3. The undersigned understands that all contract personnel will sign nondisclosure agreements.

The information your organization provides in response to this questionnaire will be treated by the Commission as confidential and will not be disclosed to the public unless required by law. The information will be aggregated with information from other questionnaire responses and will be published in a manner that will not reveal the operations of your organization. The USTR has asked that the Commission not include any confidential business information in the report it transmits to him.

Certifier's name and title	Date of certification

Certifier's signature (not necessary if submitting electronically)

If submitting an electronic version of this certificate to the Commission, check the box below in place of a written signature to indicate that the authorized official listed has certified the information provided.

☐ Certified

Section 10. Submitting the Questionnaire

10.1 Before submitting your organization's completed questionnaire, please report the actual number of hours required and the cost to your organization of completing this questionnaire, including all preparatory activities.

Hours | | Cost ($) | |

10.2 Please make sure that the following items have been addressed before submitting your organization's questionnaire.

All responders:

- ☐ Contact information is shown in question 1.1

Responders that selected "Yes" for question 2.1:

- ☐ All numeric data are in full figures, not thousands, millions, or similar format
- ☐ Rest of section 2 and all of section 3 has been completed

Responders that selected "Yes" for question 3.14:

- ☐ Total in questions 4.5 matches the total in line 1 of question 3.2
- ☐ Totals in questions 6.5 and 6.6 match the sum of totals in both columns in question 3.6

10.3 Mail or fax the completed questionnaire to us (see address and fax number below). Sending the questionnaire by U.S. mail is not recommended because this type of mail undergoes additional processing to screen for hazardous materials that will likely substantially delay the delivery. Overnight mail service is recommended.

United States International Trade Commission
Attention: UE Project Team
Office of Industries, Room 501
500 E Street, SW, Washington, DC 20436
Fax: 202-205-2018

APPENDIX G
Additional Questionnaire Data

This appendix presents data compiled from the questionnaire that were not presented earlier in the report.

UEP Exports in 2011 Compared to Previous Years

The questionnaire asked only about U.S. exports of used electronic products (UEPs) during calendar year 2011. However, exporters were asked to estimate whether their 2011 exports were about the same, higher, or lower than their exports in previous years. The results are presented in table G.1 and figure G.1.

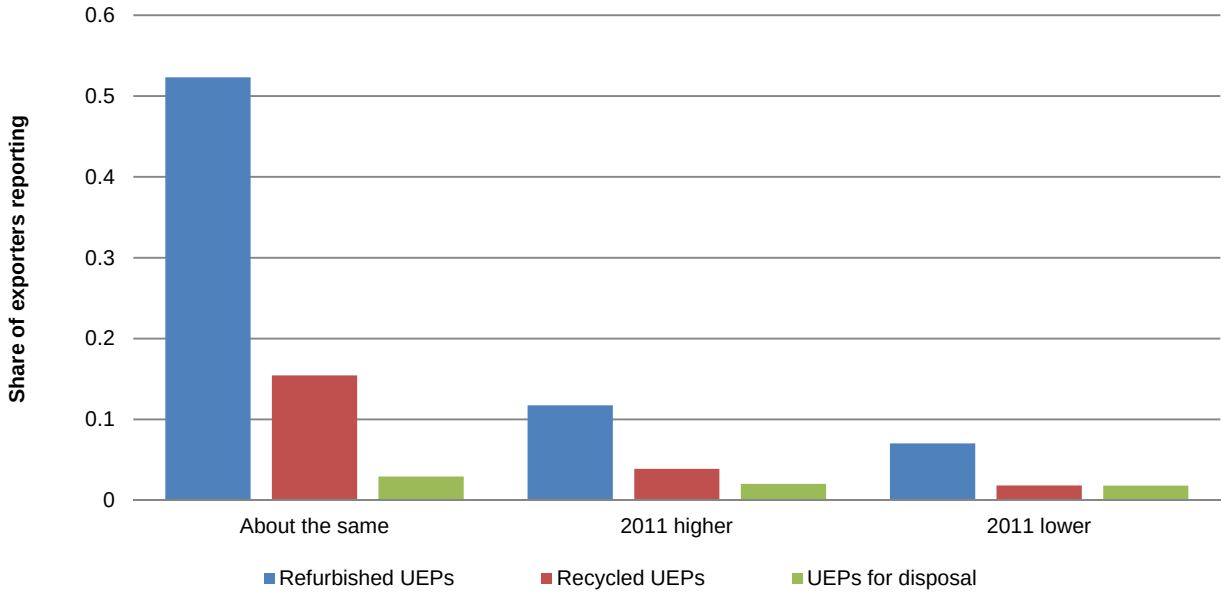
TABLE G.1 UEP exports in 2011 compared to previous years

Export comparison	Refurbished UEPs	Recycled UEPs	UEPs for disposal
		share of exporters	
About the same	52	15	3
2011 exports were higher	12	4	[a]2
2011 exports were lower	7	[a]2	[a]2
No answer	29	79	93

Source: USITC calculations of weighted responses to the Commission questionnaire.

[a]Low-precision estimate, with RSE above 50 percent.

FIGURE G.1 2011 UEP exports compared to previous years



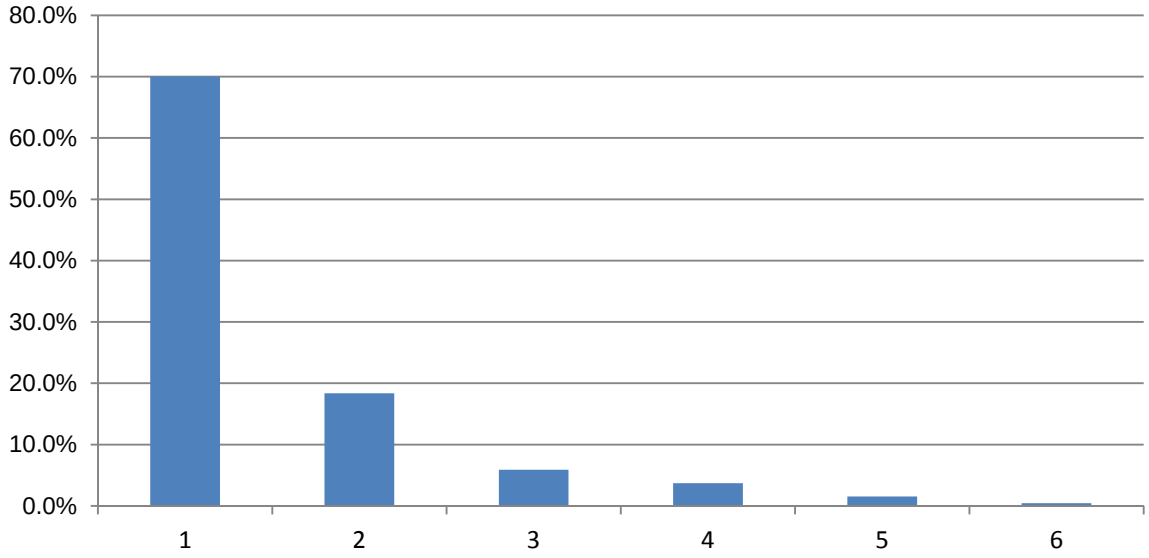
Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: Not all exporters answered the question, so totals do not add to 100 percent.

UEP Exports by Product Group

Based on responses to question 3.13 in the questionnaire, exporters tend to specialize in shipping one or two types of product groups, as defined in the questionnaire (see table G.2 below). Seventy percent of the industry reported exporting only one product group in 2011, while 18 percent reported exporting two product groups.

FIGURE G.2 Number of separate product groups shipped by exporters



Source: USITC calculations of weighted responses to the Commission questionnaire.

TABLE G.2 Number of exporters of each product group

Product group	No. of responses
Refurbished or repaired electronic products, sold tested and working	944
Used electronic products, not tested and working	350
CRT monitors or televisions	93
Whole or shredded circuit boards	202
Commodity-grade scrap from UEPs	184
Wires and cables from UEPs	269

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: Respondents were allowed to pick more than one option, so the total adds up to more than the 1,370 exporters cited elsewhere in this report.

UEP Exports by Primary Activity of Exporter

The following graphs and tables supplement the data presented in chapter 4. The Commission questionnaire asked for data on three different sets of UEPs—sales related to refurbished and repaired goods, sales related to recycling, and payments for recycling or disposal. Data were collected on both value and volume of exports, and are examined by primary activity of the exporting entity.

TABLE G.3 Primary activity groupings

Questionnaire response selection	Primary activity grouping	Shorthand
Collection	Collection and sorting	Collectors
Sorting of incoming used electronic products		
IT asset management or asset disposition services	IT asset management services	IT Asset Managers
Recycling services for businesses		
Logistics or consulting services		
Refurbishing/remanufacturing/repair for resale or donation	Refurbishing and repair	Refurbishers
Parts recovery and reuse		
Manual demanufacturing or disassembly	Disassembly	Recyclers
Mechanical processing		
Metals recovery/smelting/refining	Metals recovery	Metals Processors
Wholesaling or brokering equipment and parts	Wholesaling, brokering, and retailing	Resellers
Wholesaling or brokering commodity scrap materials		
Electronics retailer		
Other	Other	Other

Source: USITC calculations of weighted responses to the Commission questionnaire.

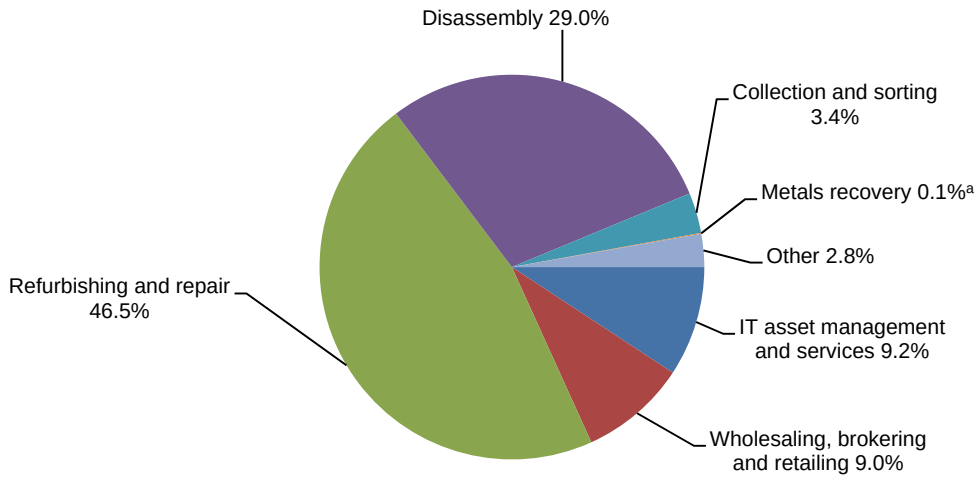
TABLE G.4 Exporters broken down by primary activity, 2011

Primary activity of exporter	Number of UEP exporting entities
Refurbishing and repair	560
Wholesaling, brokering, and retailing	370
Collection and sorting	110
Disassembly	130
IT asset management and services	80
Metals recovery	10
Other	110
Total	1,370

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: Estimates have been rounded to the nearest 10 exporting entities. Totals may not add exactly due to rounding.

FIGURE G.3 Value share of UEP exports by primary activity, 2011



Total = $1,451 million

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: The value of UEPs exported for disposal, or which the exporter paid another foreign firm to recycle are not included.

[a]Low-precison estimate, with RSE above 50 percent.

TABLE G.5 Value of refurbishing- and recycling-related UEP exports by primary activity, 2011

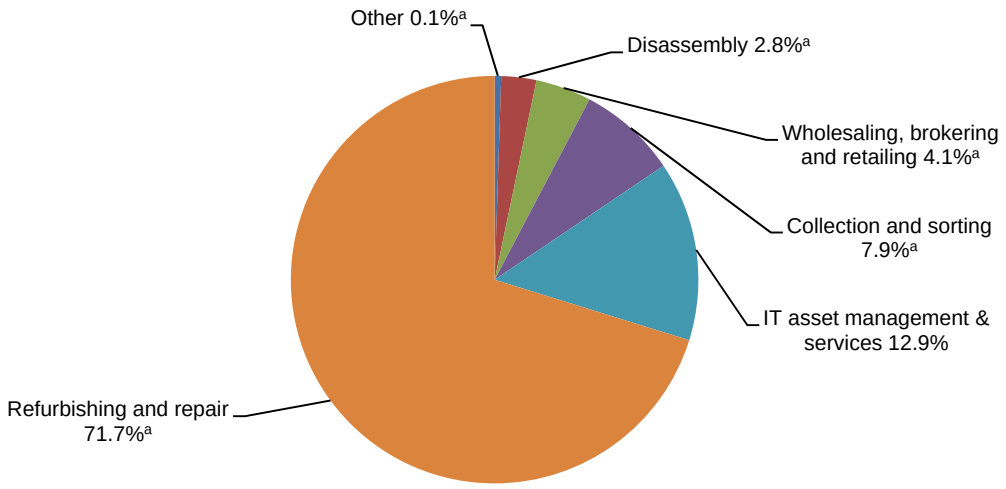
Primary activity of exporter	Refurbished-related exports	Recycled-related exports	Estimated export value
		(Million $)	
Refurbishing and repair	666	[a]9	675
Disassembly	27	395	421
IT asset management and services	132	[a]3	134
Wholesaling, brokering, and retailing	107	23	130
Collection and sorting	40	[a]9	49
Metals recovery	0	[a]1	[a]1
Other	[a]40	0	40
Total			1,451

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: The value of UEPs exported for disposal, or which the exporter paid another foreign firm to recycle are not included.

[a]Low-precision estimates, with RSE above 50 percent.

FIGURE G.4 Unit volume share of refurbishing-related UEP exports by primary activity of exporter, 2011



Total = 84 million units

Source: USITC calculations of weighted responses to the Commission questionnaire.

Note: Firms whose primary activity is metals recovery are not significant exporters of refurbished goods.

[a]Low-precision estimates, with RSE above 50 percent.

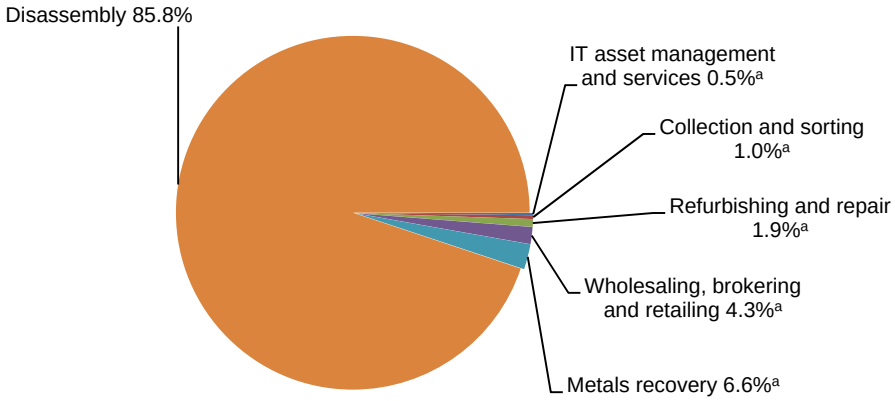
TABLE G.6 Volume of refurbishing-related UEP exports by primary activity, 2011

Primary activity of exporter	Estimated export volume (units)	Estimated share tested and working (percent)	Estimated share to be refurbished at destination (percent)
Refurbishing and repair	[a]60,199,401	[a]99.9	[a]0.1
IT asset management and services	10,849,839	[a]49.9	[a]50.1
Collection and sorting	[a]6,641,984	[a]80.0	[a]20.0
Wholesaling, brokering, and retailing	[a]3,458,739	41.8	[a]58.2
Disassembly	[a]2,337,300	[a]87.6	[a]12.4
Other	[a]439,986	[a]82.9	[a]17.1
Total	[a]83,927,249	[a]89.1	[a]10.9

Source: USITC calculations of weighted responses to the Commission questionnaire.

[a]Low-precision estimates, with RSE above 50 percent.

FIGURE G.5 Share by weight of recycling-related UEP exports by primary activity of exporter, 2011



Total = 325,733 short tons

Source: USITC calculations of weighted responses to the Commission questionnaire.

[a]Low-precision estimates, with RSE above 50 percent.

TABLE G.7 Volume by weight of recycling-related UEP exports, by primary activity, 2011

Primary activity of exporter	Estimated export volume (short tons)	Estimated share sold as recycled materials (percent)	Estimated share sold for recycling at destination (percent)
Disassembly	279,485	[a]6.7	[a]3.3
Metals recovery	[a]21,385	[a]100	0
Wholesaling, brokering, and retailing	[a]13,902	[a] 98.8	[a]1.2
Refurbishing and repair	[a]6,167	[a]70.8	[a]29.2
Collection and sorting	[a]3,107	[a] 21	[a] 79
IT asset management and services	[a]1,757	[a]100	0
Total	325,733	95.8	4.2

Source: USITC calculations of weighted responses to the Commission questionnaire.

[a]Low-precision estimates, with RSE above 50 percent.

TABLE G.8 Volume of UEP exports that entities paid to recycle or dispose of, 2011

Primary activity of exporter	Estimated export volume (short tons)
Disassembly	169,471
Wholesaling, brokering, and retailing	[a]69,745
Metals recovery	[a]1,627
Refurbishing and repair	[a]437
IT asset management and services	([b])
Collection and sorting	([b])
Total	239,653

Source: USITC calculations of weighted responses to the Commission questionnaire.

[a]Low-precision estimate, with RSE greater than 50 percent.
[b]Data not reported.

TABLE G.9 Number of reported UEP business activities, 2011

Type of entity based on reported primary activity	Average number of reported UEP business activities
Collectors	3
IT asset managers	6
Refurbishers	3
Recyclers	6
Metals processors	3
Wholesalers	3

Source: USITC calculations of weighted responses to the Commission questionnaire.

Export Classification Codes Used by UEP Exporters

The following tables reproduce a list of the Schedule B (export classification) codes reported by questionnaire respondents in sections, 4, 5, and 6 of the questionnaire. The codes are reported in order, with the most frequently cited codes listed first.

TABLE G.10 Schedule B codes for exports related to refurbished and repaired UEPs

HTS codes		
8517.62.0050	9018.90.7080	8504.40.6012
8471.30.0100	8471.70.3000	8525.60.2000
8471.49.0000	8542.32.0050	8526.92.0000
8471.41.0150	8529.10.9000	8543.90.9000
8471.70.4065	8526.91.0010	8534.00.0020
8542.31.0000	8531.90.0002	9006.30.0000
8473.30.0002	9030.33.0040	8518.50.0000
8471.60.7000	9014.20.8040	8518.21.0000
8528.51.0000	8443.31.0000	8419.50.0000
8519.81.4050	8543.70.9610	9018.11.8000
8471.80.4000	8471.50.0150	8608.00.0000
8471.60.8000	8531.80.0050	8443.32.1030
8531.20.0020	8517.62.0010	8443.32.1040
8471.60.1050	8538.90.7080	9030.40.0000
8471.90.0000	9801.10.0000	9031.49.4000
8471.70.5065	9022.90.6000	8543.70.8000
8471.80.1000	8525.80.0045	8443.32.1080
8544.42.0000	8527.13.6000	8443.32.1090
8523.51.0000	8525.80.0035	8443.99.2250
8504.40.8500	8527.99.3060	8515.39.0020
8542.32.0015	8527.92.0000	9032.89.6075
8537.10.9050	9022.19.0000	9018.11.3000
8471.60.2000	8528.72.6040	8504.50.0000
8517.12.0080	8504.40.9570	9031.41.0000
9030.82.0000	8443.32.1020	9022.21.0000
8517.69.0000	8504.40.9580	9013.20.0000
8517.70.0000	8443.91.3000	9026.80.0000
8528.59.0100	8543.70.6000	8536.69.4040
8518.40.2000	8471.70.2000	8471.60.1010
8517.18.0000	8542.39.0000	8514.90.8000
8504.40.6007	8471.70.6000	8529.90.6000
8443.19.2000	8504.40.9540	9018.19.7500
8518.40.1000	8443.99.4100	9018.19.5500
9018.19.9560	8530.80.0000	8542.33.0000
8542.32.0023	8530.90.0000	8517.11.0000
8542.32.0070	8443.32.1050	8519.30.2000
8528.72.6057	9018.13.0000	8525.50.2010
9030.33.0080	8472.90.1000	8516.50.0000
8517.12.0050	8528.41.0000	7404.00.0085
8518.22.0000	8470.50.0020	8471.41.0110
8518.10.0000	8486.90.0000	9022.14.0000
9015.80.8040	8544.49.9000	
8523.52.0010	8542.90.0000	
8528.59.6000	9022.12.0000	
8501.52.4000	9018.12.0000	

Source: USITC calculations of weighted responses to the Commission questionnaire.

TABLE G.11 Schedule B codes for UEPs related to recycling

HTS codes	
8542.31.0000	7204.29.0000
7404.00.0030	8473.30.0002
8501.20.6000	9030.33.0080
8501.20.3000	8486.90.0000
8501.10.6040	8542.39.0000
8471.30.0100	3915.10.0000
7602.00.0090	8504.40.6018
8504.40.8500	8525.80.4000
9030.82.0000	9032.89.6075
7001.00.0000	9026.80.0000
8471.41.0150	8528.72.6040
3915.90.0090	8471.70.5095
7112.99.0000	8471.70.4095
3903.30.0000	8471.80.1000
7204.10.0000	8504.40.9510
8518.30.1000	8471.49.0000
8501.10.3000	7404.00.0085
8504.40.6001	3906.10.0000
8542.32.0015	7202.11.0000
8528.41.0000	8534.00.0040
8519.81.4020	8535.90.8020
8507.10.0030	7112.30.0000
7404.00.0025	
8504.31.2000	
8530.80.0000	
8471.70.2000	
8542.32.0040	

Source: USITC calculations of weighted responses to the Commission questionnaire.

TABLE G.12 Schedule B codes for UEPs that exporters paid to dispose of

HTS codes
9030.82.0000
8473.10.0020
8528.41.0000
8507.10.0030
7011.20.0000
7112.99.0000
8528.72.6040
8525.80.4000
7109.00.0000
3915.90.0090
3915.20.0000
7204.49.0080
8542.31.0000
8517.11.0000
8519.30.2000
8525.50.2010
8516.50.0000
7112.30.0000

Source: USITC calculations of weighted responses to the Commission questionnaire.

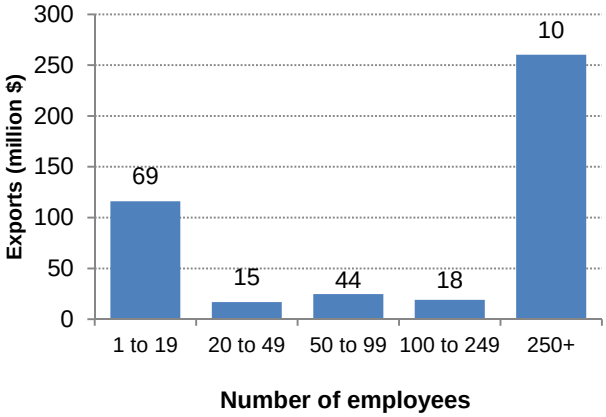
Note: Also includes UEPs that exporters paid another organization to recycle.

UEP Exports by Organization Size

Total exports of recycled and refurbished UEPs, distinguished by organization size, are presented in figure G.6; figure G.7 reports UEP exports by wholesalers. The total amount of UEP exports by firms with fewer than 10 employees is not known since these firms were not included in the sampling frame.[1] The distribution of U.S. exports reported by Census is reported in the figures for comparison.

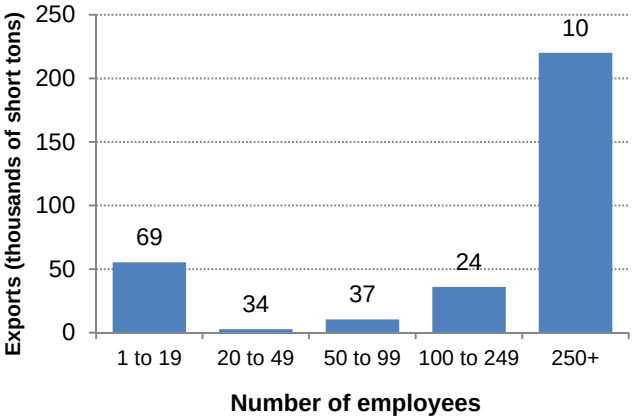
FIGURE G.6 Exports of UEPs and all merchandise, by company size

Export value, recycled products (156 organizations)[a]



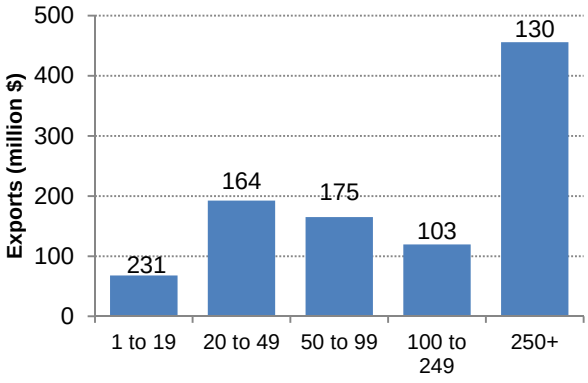
Source: USITC calculations of weighted responses to the Commission's questionannaire.

Export weight, recycled products (174 organizations)[a]



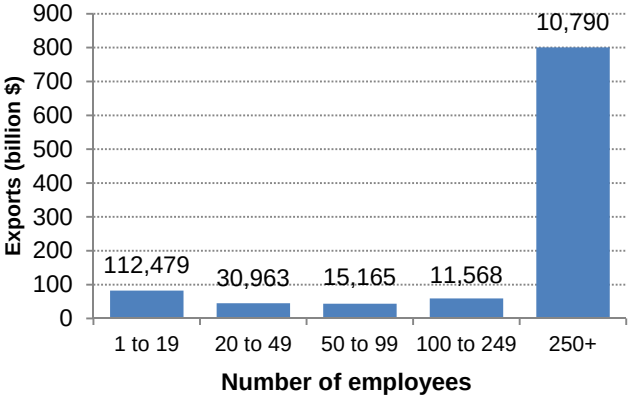
Source: USITC calculations of weighted responses to the Commission's questionannaire.

Export value, refurbished products (810 organizations)[a]



Source: USITC calculations of weighted responses to the Commission's questionannaire.

Export value, all merchandis (293,131 organizations)[a]



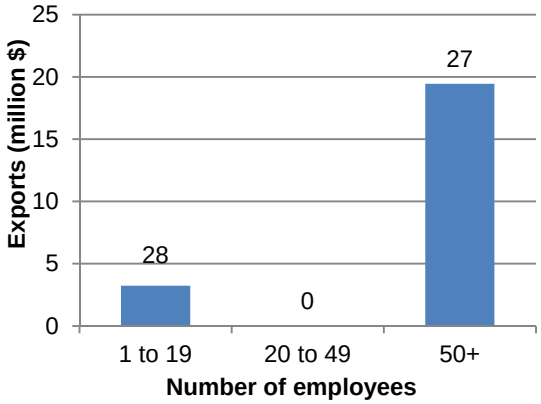
Source: U.S. Census Bureau, "A profile of U.S. importing and exporting companies, 2009-2010," exhibit 1a.

[a]The total number of exporters (including exporters with an unknown number of employees) is provided in parentheses at the top of each figure; the number of exporters by size class is provided at the top of each bar.

[1] Ex post, some surveyed firms did report having fewer than 10 employees, and UEP activity by these firms was included in this report.

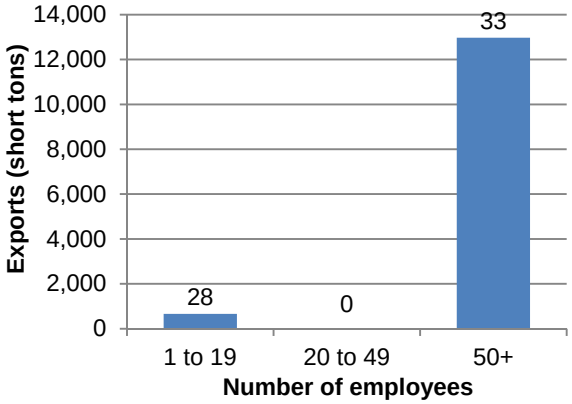
FIGURE G.7 Exports of UEP products and all merchandise by wholesalers, by company size

Export value by wholesalers, recycled products (55 organizations)[a]



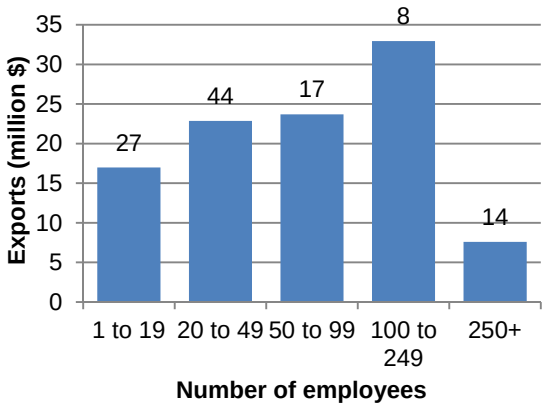
Source: USITC calculations of weighted responses to the Commission's questionnaire.

Export weight by wholesalers, recycled products (61 organizations)[a]



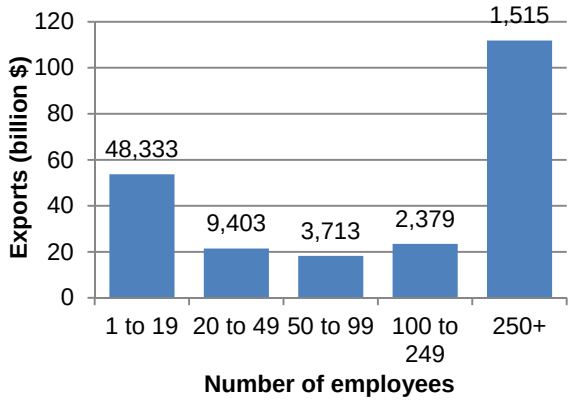
Source: USITC calculations of weighted responses to the Commission's questionnaire.

Export value by wholesalers, refurbished products (110 organizations)[a]



Source: USITC calculations of weighted responses to the Commission's questionnaire.

Export value by wholesalers, all merchandise (97,873 organizations)[a]



Source: U.S. Census Bureau, "A profile of U.S. importing and exporting companies, 2009-2010," exhibit 1a.

Note: Size categories for recycled products have been combined because of prohibitions on disclosing individual company information.

[a]The total number of exporters (including exporters with an unknown number of employees) is provided in parentheses at the top of each figure; the number of exporters by size class is provided at the top of each bar.

Bibliography

U.S. Census Bureau (Census). "A Profile of U.S. Importing and Exporting Companies, 2009–2010." Washington, DC: Census, 2012. http://www.census.gov/foreign-trade/Press-Release/edb/2010/edbrel.pdf.

APPENDIX H
Census Data Tables

Analysis of Selected Schedule B Export Data

At the request of the Commission, the U.S. Census Bureau (Census) provided certain firm-level export data for additional analysis in this investigation.[1] These data were provided under a under a National Interest Determination that permitted the information to be used by Commission staff only, and prohibited the Commission from sharing these data with any other party, governmental or otherwise. The interagency agreement required that the data be treated as business confidential information and used or published in aggregate form only, subject to review by Census.

Census export data analyzed by Commission staff covered certain electronic products in chapters 84 and 85 of Schedule B.[2] These data were used to provide additional insight into "low-value" electronic product export flows from the United States. Schedule B codes do not distinguish between used and new products. However, average unit values (AUVs) for each shipment were used as proxies to analyze U.S. export flows, under the assumption that lower-valued goods were more likely to be used products. Selected Schedule B products at the 10-digit level were grouped and analyzed based on three factors—their significance in the used electronic product (UEP) market, the ease with which they could be grouped into homogenous, well-defined product categories, and the use of units of quantity in the reported data.[3] Analysis focused on six major product groupings: cell phones, laptop computers, desktop computers, CRTs, hard drives, and flat screen monitors. Exports of products containing CRTs were further broken out into four groups: CRT televisions, CRT monitors, CRTs with processing units, and CRTs alone ("bare" CRTs).

For each product grouping, data were aggregated by the bottom 10th, 25th, and 50th percentiles of all shipment values, based on AUV. The discussion of cell phones is presented as an example in chapter 2. Discussion and tabularized data for the remaining products follows. The tables presented in this appendix show the top 10 country markets for each of the product groups selected for analysis. For each product group, data are displayed at each of the aggregated percentiles. In addition, a histogram displays the distribution of shipments in the bottom 50 percent of exports based on unit value for each product grouping.

Laptops

While the export value of cell phones was greater, laptops had the largest number of shipments among the selected product groups (table H.1). Shipment AUVs were distributed more normally than was the case for cell phones: the average AUVs fell closer to the median, and AUVs were distributed more widely.[4] However, about one-third of U.S. exports by unit fell below the 10th percentile. Unlike the case for cell phones, the share of used laptop shipments going to OECD versus non-OECD countries is relatively stable among each AUV percentile, with between 75 and 80 percent of shipments destined for non-OECD countries. Hong Kong, the United Arab Emirates, and Mexico are the top three destinations, by shipments and export value, for AUVs at the 10th and 25th percentile.

[1] See chapter 1.

[2] Schedule B Numbers are used to classify products exported from the United States and are based on the international Harmonized System (HS) nomenclature.

[3] Many Schedule B subheadings do not require reporting of unit quantities.

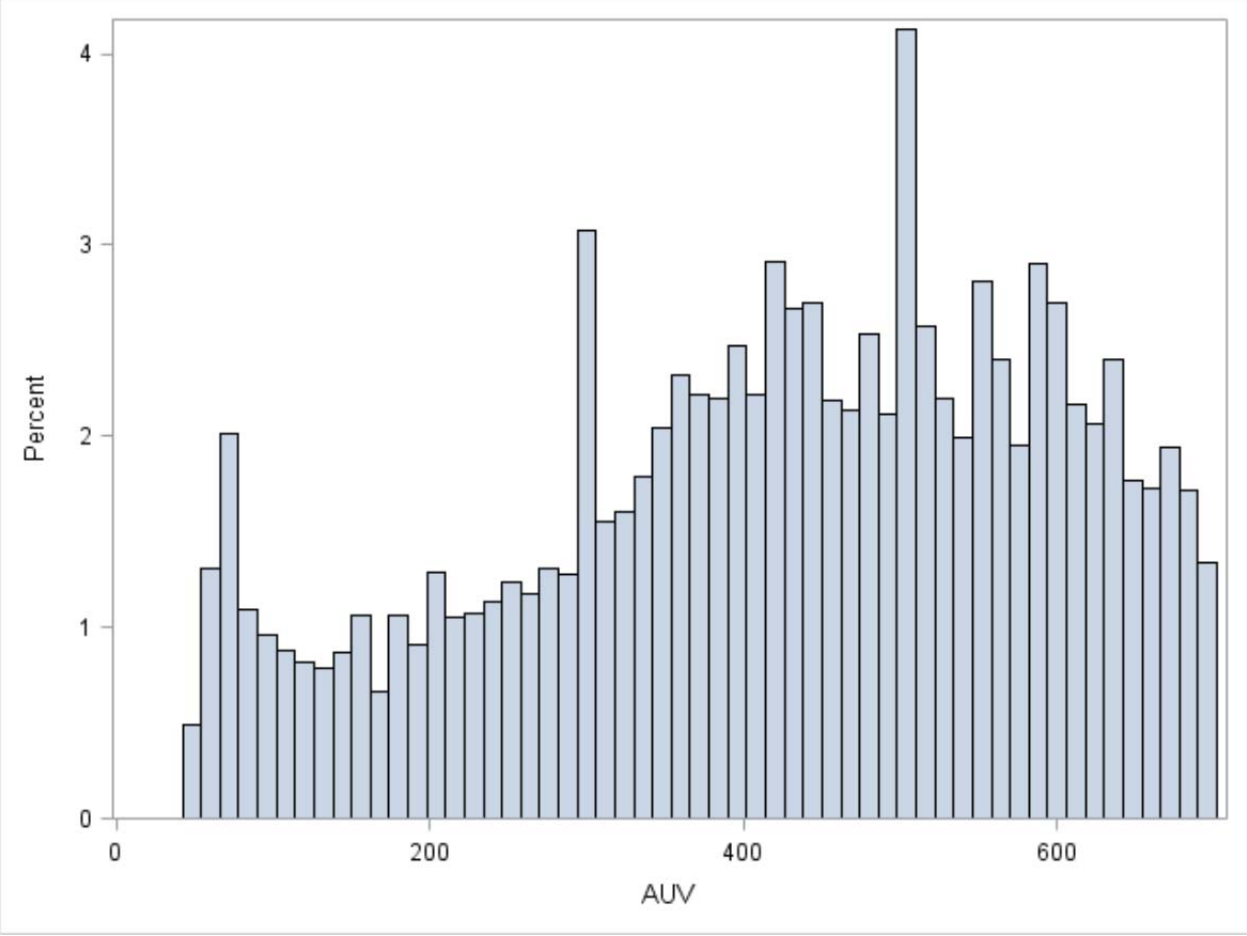
[4] As discussed in Chapter 2, the vast majority of cell phone shipments in the bottom 50th percentile of exports were heavily weighted in a narrow AUV range of between $130 and $150 (see figure 2.10).

TABLE H.1 Summary of U.S. Census export data, laptops

Schedule B export code		8471300100						
	Unit value $		No. of shipments	No. of units	Value of shipments $	% of total value	% shipments to OECD countries	% shipments to non-OECD countries
Total exports	avg.	485.74	93,620	8,945,357	4,345,120,898	100	32.8	67.2
Lowest 50%	≤	700.00	46,914	7,407,077	2,366,839,292	54	26.3	73.7
Lowest 25%	≤	440.00	23,493	5,313,896	1,217,714,730	28	21.4	78.6
Lowest 10%	≤	270.21	9,362	2,952,466	377,357,007	9	25.1	74.9

Source: U.S. Census Bureau, unpublished export data, 2011.

FIGURE H.1 Laptop computers, Schedule B code 8471300100: Percent distribution of shipments in the bottom 50 percentile based on average unit value



Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011.

TABLE H.2 Laptop computers: U.S. exports with unit values in lowest 10 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Hong Kong	97.88	917,175	1,874	89,775,853	24
United Arab Emirates	127.96	652,653	1,106	83,515,170	22
Mexico	159.58	226,056	871	36,074,311	10
Paraguay	143.77	117,616	364	16,909,240	4
Chile	190.55	62,826	188	11,971,745	3
Colombia	132.94	89,584	176	11,909,296	3
Singapore	175.42	57,172	204	10,029,014	3
China	104.66	90,463	188	9,468,176	3
Argentina	162.51	46,487	192	7,554,538	2
Brazil	136.87	43,352	182	5,933,757	2
All other	145.15	649,082	4,017	94,215,907	25
OECD countries	150.52	470,897	2,347	70,878,286	19
Developing countries	123.50	2,481,569	7,015	306,478,721	81
Total	127.81	2,952,466	9,362	377,357,007	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B code 8471300100).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $270.21 (see chapter 2).

TABLE H.3 Laptop computers: U.S. exports with unit values in lowest 25 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Hong Kong	171.13	1,346,676	2,711	230,458,546	19
United Arab Emirates	207.76	980,694	2,510	203,744,328	17
Mexico	231.67	397,842	1,727	92,167,308	8
Paraguay	277.25	306,831	1,531	85,069,368	7
Chile	307.80	195,305	550	60,115,300	5
Colombia	268.74	205,420	592	55,204,186	5
Ecuador	309.69	110,452	444	34,205,488	3
China	207.48	150,538	298	31,234,355	3
Costa Rica	364.91	79,155	353	28,884,700	2
Peru	326.63	75,786	156	24,753,750	2
All other	253.81	1,465,197	12,621	371,877,401	31
OECD countries	243.19	880,260	5,036	214,067,864	18
Developing countries	226.37	4,433,636	18,457	1,003,646,866	82
Total	229.16	5,313,896	23,493	1,217,714,730	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B code 8471300100).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $440.00 (see chapter 2).

TABLE H.4 Laptop computers: U.S. exports with unit values in lowest 50 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
United Arab Emirates	276.05	1,221,731	4,041	337,264,335	14
Mexico	380.88	710,400	5,603	270,578,130	11
Hong Kong	181.88	1,391,943	3,074	253,164,845	11
Colombia	419.04	447,802	2,222	187,646,522	8
Paraguay	368.79	471,646	3,120	173,937,957	7
Chile	394.34	300,797	1,302	118,614,987	5
Peru	451.63	182,616	553	82,475,229	3
Ecuador	411.27	198,562	956	81,661,603	3
Brazil	380.24	161,789	1,461	61,519,319	3
Argentina	393.10	150,813	1,506	59,283,897	3
All other	341.49	2,168,978	23,076	740,692,468	31
OECD countries	369.06	1,445,723	12,322	533,553,622	23
Developing countries	307.53	5,961,354	34,592	1,833,285,670	77
Total	319.54	7,407,077	46,914	2,366,839,292	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B code 8471300100).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $700.00 (see chapter 2).

Desktops

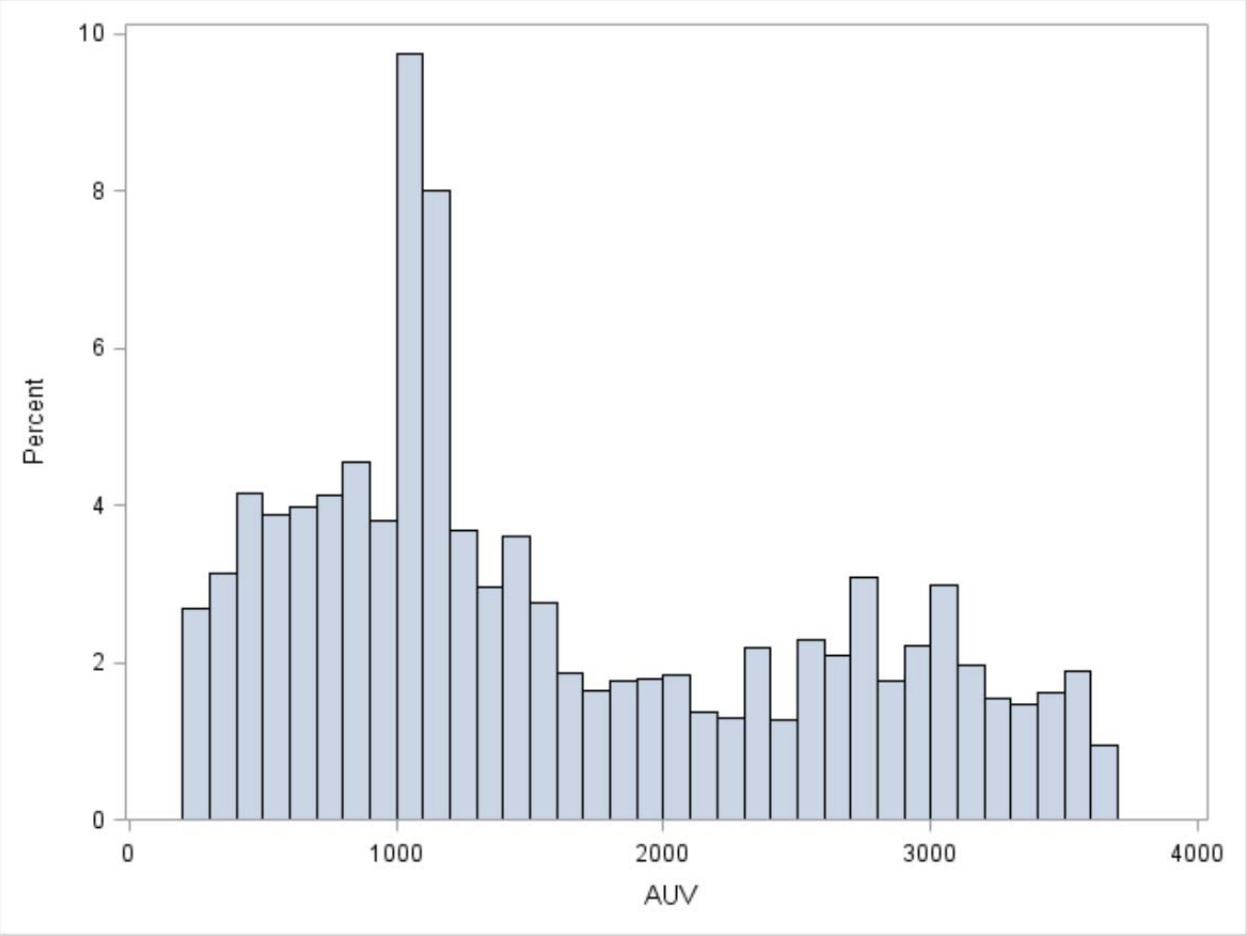
Shipments of desktop computers had a wide range of AUVs, suggesting a diverse range of products within the Schedule B groupings (table H.5). Additionally, a large amount of the value was in the higher-AUV shipments that had fewer units per shipment. The bottom 10th percentile of AUV shipments were distributed somewhat more evenly between OECD and non-OECD countries, compared with other products. United Arab Emirates and Hong Kong were the most common destinations for relatively low-AUV exports of desktop computers in terms of number of units. Mexico, Brazil, and Great Britain were the most common destinations in terms of number of shipments (tables H.6–H.8).

TABLE H.5 Summary of U.S. Census export data, desktops

Schedule B export codes:		8471410110, 8471410150, 8471490000						
	Unit value $		No. of shipments	No. of units	Value of shipments $	% of total value	% shipments to OECD countries	% shipments to non-OECD countries
Total exports	avg.	2,294.07	37,681	600,663	1,377,963,775	100	58.9	41.1
Lowest 50%	≤	3,654.50	18,841	537,430	479,729,519	35	54.0	46.0
Lowest 25%	≤	1,250.00	9,431	449,518	291,051,858	21	46.0	54.0
Lowest 10%	≤	750.00	3,788	273,064	109,130,667	8	44.8	55.2

Source: U.S. Census Bureau, unpublished export data, 2011.

FIGURE H.2 Desktop computers, Schedule B codes 8471410110, 8471410150, and 847149000: Percent distribution of shipments in the bottom 50 percentile based on average unit value



Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011.

TABLE H.6 Desktop computers: U.S. exports with unit values in lowest 10 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
United Arab Emirates	473.80	26,795	150	12,695,446	12
Hong Kong	311.04	40,720	157	12,665,660	12
Italy	([b])	([b])	([b])	([b])	([b])
China	309.30	22,134	115	6,845,943	6
Brazil	421.19	13,979	204	5,887,791	5
Mexico	502.94	11,369	572	5,717,895	5
United Kingdom	507.77	8,679	202	4,406,898	4
Netherlands	514.27	4,622	144	2,376,949	2
Paraguay	([b])	([b])	([b])	([b])	([b])
Japan	([b])	([b])	([b])	([b])	([b])
All other	446.11	98,534	2,115	43,957,098	40
OECD countries	399.02	94,424	1,696	37,676,889	35
Developing countries	399.99	178,640	2,092	71,453,778	65
Total	399.65	273,064	3,788	109,130,667	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 8471410110, 8471410150, and 8471490000).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $750.00 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.7 Desktop computers: U.S. exports with unit values in lowest 25 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Hong Kong	771.03	100,745	830	77,677,515	27
United Arab Emirates	586.35	34,934	272	20,483,377	7
Brazil	624.17	21,873	492	13,652,505	5
Mexico	676.34	18,435	1,120	12,468,273	4
Germany	785.25	15,759	583	12,374,731	4
United Kingdom	737.30	15,997	559	11,794,605	4
Italy	294.77	36,967	76	10,896,881	4
China	406.27	25,480	265	10,351,765	4
Netherlands	754.94	10,355	302	7,817,365	3
Singapore	856.47	7,283	179	6,237,670	2
All other	663.60	161,690	4,753	107,297,171	37
OECD countries	619.83	150,176	4,335	93,083,336	32
Developing countries	661.35	299,342	5,096	197,968,522	68
Total	647.48	449,518	9,431	291,051,858	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 8471410110, 8471410150, and 8471490000).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $1,250.00 (see chapter 2).

TABLE H.8 Desktop computers: U.S. exports with unit values in lowest 50 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Hong Kong	884.83	108,839	1,045	96,304,387	20
United Kingdom	1,393.97	27,782	1,516	38,727,208	8
Brazil	920.35	27,046	775	24,891,750	5
United Arab Emirates	614.68	35,641	397	21,907,728	5
Germany	1,099.97	19,729	1,256	21,701,375	5
Mexico	912.52	22,171	1,757	20,231,393	4
Netherlands	1,152.62	14,618	864	16,849,036	4
Belgium	1,630.59	9,785	678	15,955,297	3
China	547.77	27,568	567	15,101,042	3
Australia	1,443.05	10,280	601	14,834,578	3
All other	825.85	233,971	9,385	193,225,725	40
OECD countries	1,020.72	203,383	10,191	207,596,740	43
Developing countries	814.65	334,047	8,650	272,132,779	57
Total	892.64	537,430	18,841	479,729,519	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 8471410110, 8471410150, and 8471490000).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $3,694.50 (see chapter 2).

CRTs and Products Containing CRTs

CRTs and products containing CRTs were separated into four subgroups: televisions, computer monitors, other equipment containing CRTs, and bare tubes (tables H.9 to H.24; figures H.3–H.6). Each subgroup had a unique AUV and shipment profile due to the diversity of the products contained within the group. For CRT product groupings, the share of shipments going to OECD countries was considerably higher than for cell phones and computers. This is primarily due to the fact that Mexico was the leading destination for shipments in each category. In most subgroups, Mexico was also the leading destination for the highest number of units.

Of CRT-containing products, televisions were the largest exported subgroup, in terms of both quantity and value. For the bottom 10th percentile of AUVs, Mexico was the primary market for U.S. exports by a considerable margin. The next-largest destinations were also in Latin America, particularly Panama, Venezuela, and Argentina. A noticeable distinction between Mexico and other markets is that shipments to Mexico contained far fewer units per shipment. This could indicate that the proximity of Mexico and its land border allow shipments by trucks, rather than by ship, making it a more economical market for heavy, bulky CRT televisions.

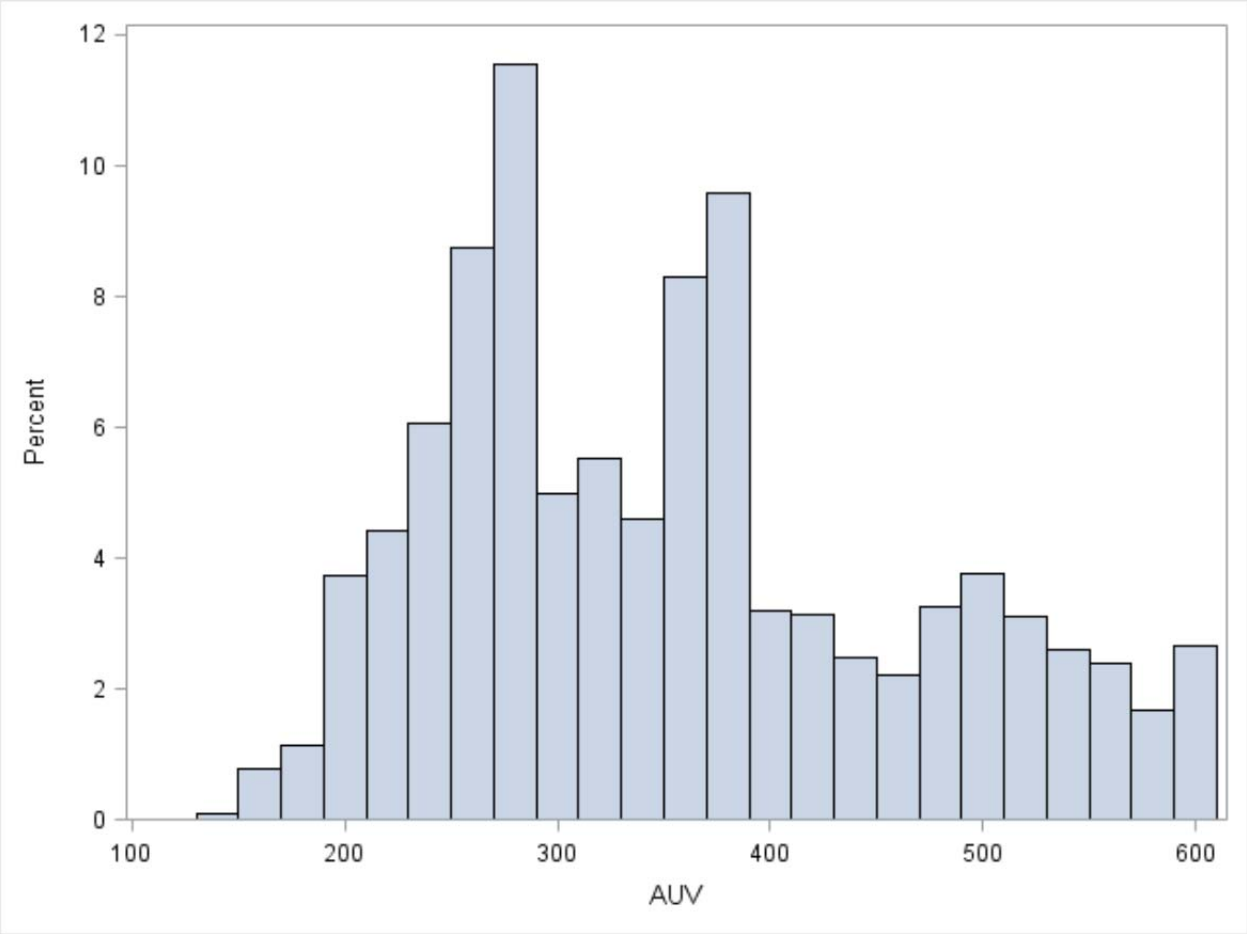
The Census data show a relatively small number of U.S. low-value exports of CRTs housed with data processing units and exports of bare CRTs (tables H.17-H.24; figures H. 5-H.6). In fact, in many cases, the data cannot be reported because of the low number of shipments or firms involved in exports to specific countries.

TABLE H.9 Summary of U.S. Census export data, CRT televisions

Schedule B export codes:		8528723000, 8528726005, 8528726010, 85286040						
	Unit value $		No. of shipments	No. of units	Value of shipments $	% of total value	% shipments to OECD countries	% shipments to non-OECD countries
Total exports	avg.	430.96	7,260	549,145	236,658,502	100	63.1	36.9
Lowest 50%	≤	603.55	3,630	443,789	147,259,440	62	57.9	42.1
Lowest 25%	≤	341.00	1,816	250,299	65,232,287	28	58.3	41.7
Lowest 10%	≤	263.64	726	112,748	24,981,810	11	63.4	36.6

Source: U.S. Census Bureau, unpublished export data, 2011.

FIGURE H.3 CRT televisions, Schedule B codes 8528723000, 8528726005, 8528726010, and 85286040: Percent distribution of shipments in the bottom 50 percentile based upon unit value



Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011.

TABLE H.10 CRT TV's: U.S. exports with unit values in lowest 10 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	225.49	65,528	399	14,775,650	59
Panama	228.91	12,069	22	2,762,665	11
Argentina	(b)	(b)	(b)	(b)	(b)
Guyana	(b)	(b)	(b)	(b)	(b)
United States	(b)	(b)	(b)	(b)	(b)
Venezuela	239.46	2,037	22	487,774	2
Singapore	(b)	(b)	(b)	(b)	(b)
Hong Kong	(b)	(b)	(b)	(b)	(b)
Japan	(b)	(b)	(b)	(b)	(b)
Guatemala	(b)	(b)	(b)	(b)	(b)
All other	220.01	11,682	177	2,570,131	10
OECD countries	224.98	72,549	460	16,322,431	65
Developing countries	215.41	40,199	266	8,659,379	35
Total	221.57	112,748	726	24,981,810	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 8528723000, 8528726005, 8528726010, and 85286040).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $263.64 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.11 CRT TVs: U.S. exports with unit values in lowest 25 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	261.76	147,274	892	38,550,836	59
Panama	257.14	18,247	36	4,692,031	7
Venezuela	291.53	10,678	66	3,112,999	5
Argentina	(b)	(b)	(b)	(b)	(b)
Dominican Republic	287.87	4,419	57	1,272,097	2
Colombia	(b)	(b)	(b)	(b)	(b)
Singapore	(b)	(b)	(b)	(b)	(b)
Saint Vincent and the Grenadines	(b)	(b)	(b)	(b)	(b)
Taiwan	(b)	(b)	(b)	(b)	(b)
Hong Kong	224.73	3,536	12	794,641	1
All other	257.72	40,473	583	10,430,595	16
OECD countries	260.67	160,218	1,058	41,764,346	64
Developing countries	260.52	90,081	758	23,467,941	36
Total	260.62	250,299	1,816	65,232,287	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 8528723000, 8528726005, 8528726010, and 85286040).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $341.00 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.12 CRT TVs: U.S. exports with unit values in lowest 50 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	331.51	248,396	1,734	82,344,585	56
Venezuela	367.57	33,271	154	12,229,295	8
Dominican Republic	391.20	14,736	138	5,764,762	4
Panama	276.33	20,477	58	5,658,463	4
Argentina	(b)	(b)	(b)	(b)	(b)
Hong Kong	321.15	11,512	36	3,697,031	3
Taiwan	(b)	(b)	(b)	(b)	(b)
Colombia	327.38	7,509	51	2,458,277	2
Trinidad and Tobago	406.40	5,643	91	2,293,316	2
Germany	353.66	5,292	48	1,871,575	1
All other	322.52	72,876	1,207	23,503,798	16
OECD countries	330.21	273,253	2,100	90,230,564	61
Developing countries	334.41	170,536	1,530	57,028,876	39
Total	331.82	443,789	3,630	147,259,440	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 8528723000, 8528726005, 8528726010, and 85286040).

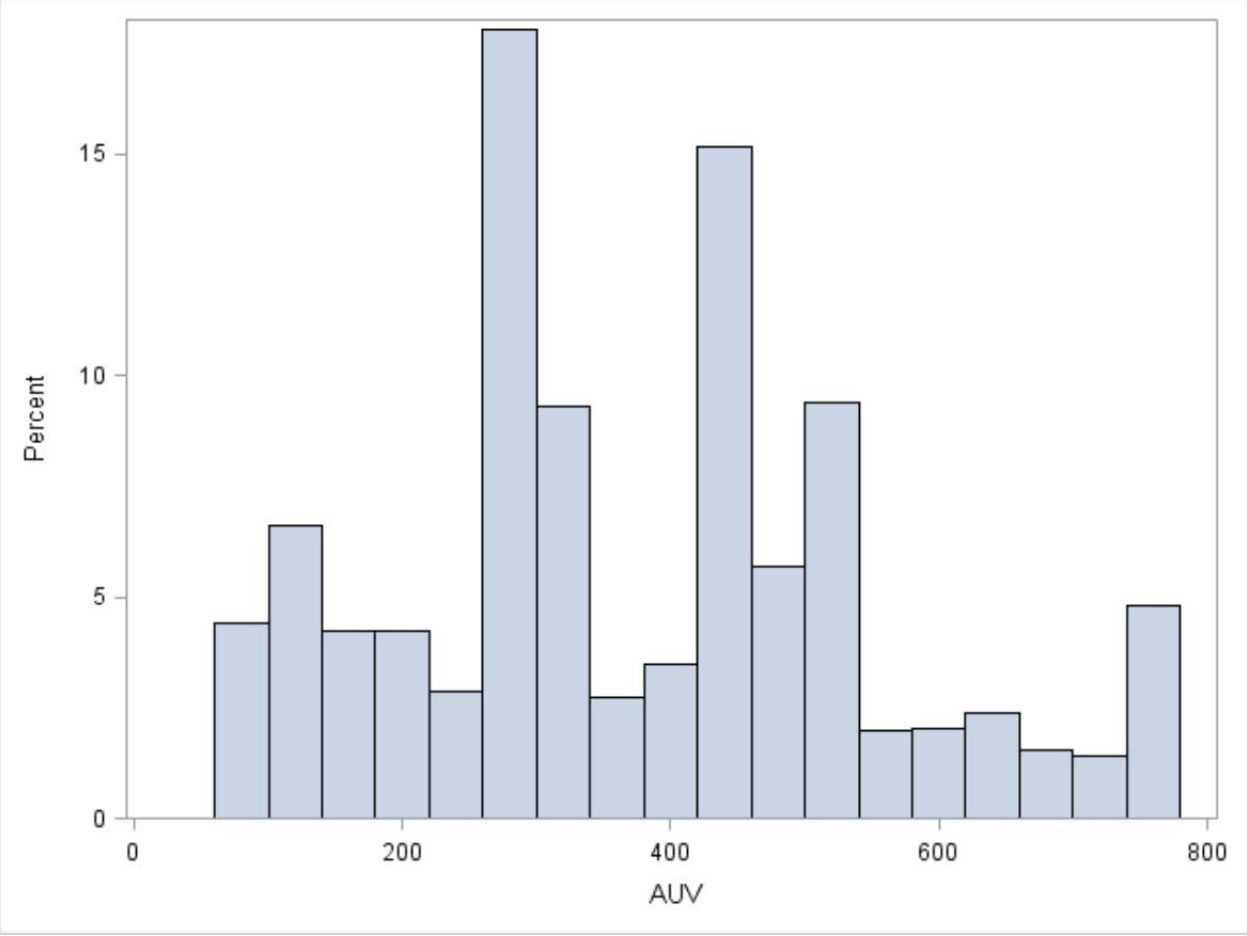
[a]Represents shipments of U.S. exports with average unit values less than or equal to $603.55 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.13 Summary of U.S. Census export data, CRT monitors

Schedule B export codes:		8528410000, 8528490100, 8528498000						
	Unit value $		No. of shipments	No. of units	Value of shipments $	% of total value	% shipments to OECD countries	% shipments to non-OECD countries
Total exports	avg.	359.28	2,947	135,810	48,794,479	100	47.5	52.5
Lowest 50%	≤	779.83	1,474	128,193	34,547,693	71	33.2	66.8
Lowest 25%	≤	353.01	737	98,910	20,050,130	41	31.9	68.1
Lowest 10%	≤	226.72	295	52,718	6,308,227	13	34.2	65.8

Source: U.S. Census Bureau, unpublished export data, 2011.

FIGURE H.4 CRT monitors, Schedule B codes 852841000, 8528490100, and 85284980000: Percent distribution of shipments in the bottom 50 percentile based upon unit value



Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011.

TABLE H.14 CRT monitors: U.S. exports with unit values in lowest 10 percent of shipments, 2011[a]

	AUV$	No. of units	No. of shipments	Export value $	Share of total value %
Ecuador	103.52	19,573	38	2,026,187	32
Venezuela	127.52	10,886	38	1,388,154	22
Bolivia	101.37	3,777	22	382,856	6
Philippines	(b)	(b)	(b)	(b)	(b)
Colombia	112.03	2,611	13	292,520	5
Egypt	(b)	(b)	(b)	(b)	(b)
Germany	133.79	1,739	13	232,658	4
Mexico	137.55	1,621	38	222,975	4
Nigeria	(b)	(b)	(b)	(b)	(b)
Finland	(b)	(b)	(b)	(b)	(b)
All other	136.27	7,172	124	977,361	15
OECD countries	135.98	6,555	101	891,344	14
Developing countries	117.34	46,163	194	5,416,883	86
Total	119.66	52,718	295	6,308,227	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 852841000, 8528490100, and 85284980000).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $226.72 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.15 CRT monitors: U.S. exports with unit values in lowest 25 percent of shipments, 2011[a]

	AUV$	No. of units	No. of shipments	Export value $	Share of total value %
Venezuela	180.06	15,588	62	2,806,781	14
Egypt	274.70	8,562	72	2,351,997	12
Ecuador	108.21	20,084	47	2,173,322	11
Singapore	(b)	(b)	(b)	(b)	(b)
Bahrain	(b)	(b)	(b)	(b)	(b)
Saudi Arabia	(b)	(b)	(b)	(b)	(b)
Pakistan	299.27	2,445	27	731,711	4
Brazil	252.56	2,866	36	723,847	4
Japan	287.02	2,164	13	621,118	3
Mexico	197.08	2,698	81	531,719	3
All other	207.73	34,854	380	7,240,212	36
OECD countries	230.19	16,518	235	3,802,352	19
Developing countries	197.20	82,392	502	16,247,778	81
Total	202.71	98,910	737	20,050,130	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 852841000, 8528490100, and 85284980000).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $353.01 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.16 CRT monitors: U.S. exports with unit values in lowest 50 percent of shipments, 2011[a]

	AUV$	No. of units	No. of shipments	Export value $	Share of total value %
Venezuela	213.88	17,790	86	3,804,866	11
Ecuador	135.01	21,625	73	2,919,699	8
Egypt	289.05	9,300	95	2,688,209	8
Singapore	370.41	7,100	25	2,629,924	8
Mexico	346.59	5,610	154	1,944,372	6
Brazil	319.02	3,942	63	1,257,569	4
Japan	353.50	3,267	46	1,154,894	3
Paraguay	(b)	(b)	(b)	(b)	(b)
Thailand	(b)	(b)	(b)	(b)	(b)
Bahrain	(b)	(b)	(b)	(b)	(b)
All other	294.49	51,363	766	15,125,892	44
OECD countries	334.87	26,356	490	8,825,900	26
Developing countries	252.58	101,837	984	25,721,793	74
Total	269.50	128,193	1,474	34,547,693	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 852841000, 8528490100, and 85284980000).

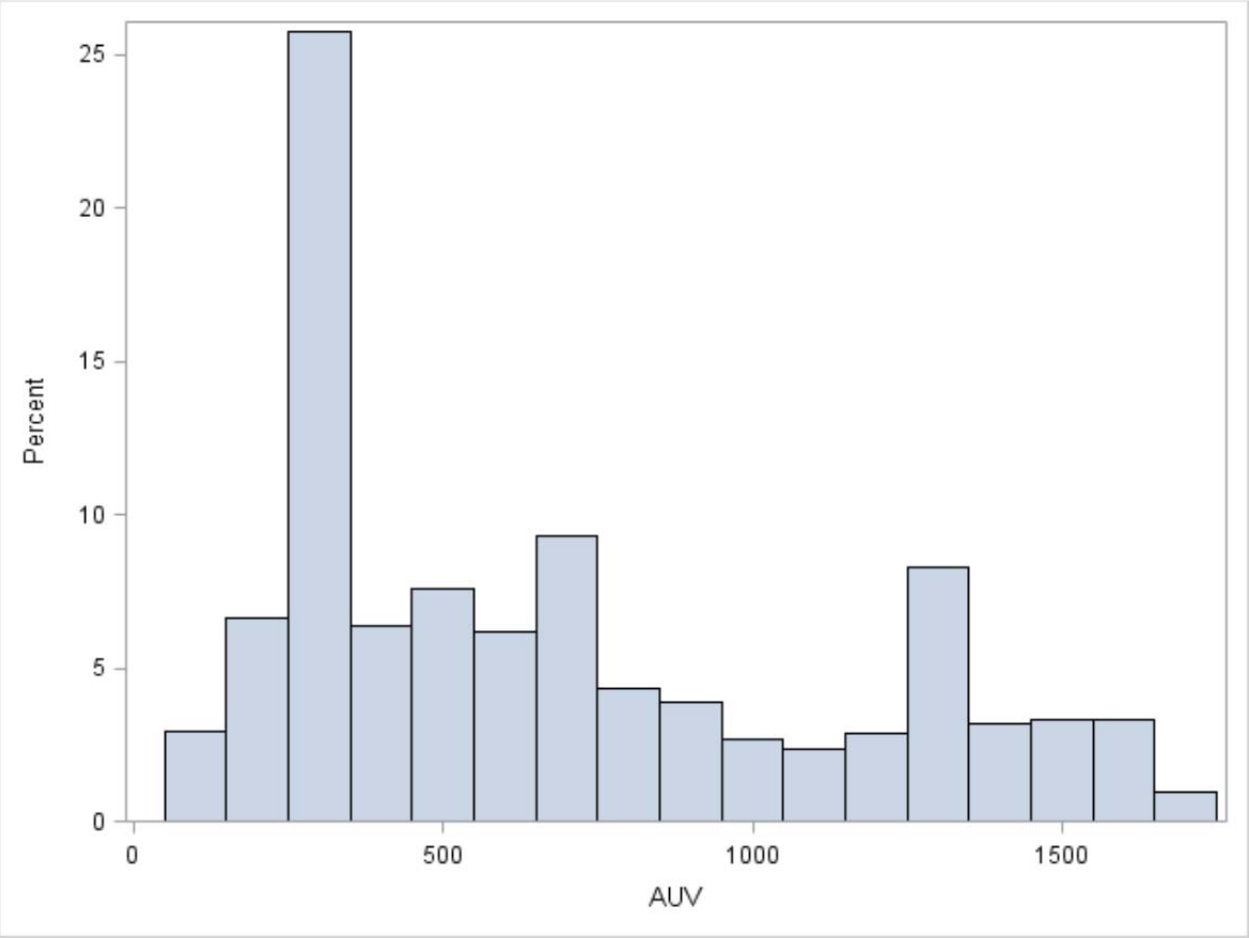
[a]Represents shipments of U.S. exports with average unit values less than or equal to $779.83 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.17 Summary of U.S. Census export data, CRTs incorporated into other automated data processors

Schedule B export codes:		8471500110, 8471601010						
	Unit value $		No. of shipments	No. of units	Value of shipments $	% of total value	% shipments to OECD countries	% Shipments to non-OECD countries
Total exports	avg.	740.07	2,679	84,694	62,679,384	100	70.7	29.3
Lowest 50%	≤	1,712.00	1340	80,916	31,938,750	51	73.1	26.9
Lowest 25%	≤	570.00	670	66,210	18,005,571	29	72.7	27.3
Low st 10%	≤	324.07	268	34,610	6,066,418	10	76.1	23.9

Source: U.S. Census Bureau, unpublished export data, 2011.

FIGURE H.5 CRTs w/ automatic data processors, Schedule B codes 8471500110 and 8471601010: Percent distribution of shipments in the bottom 50 percentile based upon unit value



Source: U.S. Census Bureau, unpublished export data, 2011.

TABLE H.18 CRTs w/ automatic data processors: U.S. exports with unit values in lowest 10 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	226.75	9,687	145	2,196,559	36
Panama	(b)	(b)	(b)	(b)	(b)
Brazil	(b)	(b)	(b)	(b)	(b)
Australia	(b)	(b)	(b)	(b)	(b)
Saudi Arabia	(b)	(b)	(b)	(b)	(b)
Singapore	254.55	752	9	191,419	3
Russia	(b)	(b)	(b)	(b)	(b)
Chile	(b)	(b)	(b)	(b)	(b)
Germany	235.84	425	11	100,232	2
Argentina	(b)	(b)	(b)	(b)	(b)
All other	187.04	8,433	80	1,577,285	26
OECD countries	196.79	15,624	204	3,074,606	51
Developing countries	157.58	18,986	64	2,991,812	49
Total	175.28	34,610	268	6,066,418	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 84715001101and 8471601010).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $324.07 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.19 CRTs w/ automatic data processors: U.S. exports with unit values in lowest 10 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	321.98	20,255	304	6,521,706	36
Brazil	340.58	4,535	16	1,544,539	9
Korea	324.40	3,982	27	1,291,772	7
Panama	(b)	(b)	(b)	(b)	(b)
Australia	(b)	(b)	(b)	(b)	(b)
Russia	353.25	1,508	6	532,706	3
Japan	(b)	(b)	(b)	(b)	(b)
Germany	312.21	1,460	24	455,831	3
Taiwan	(b)	(b)	(b)	(b)	(b)
United Kingdom	368.65	1,077	21	397,034	2
All other	267.08	15,457	191	4,128,274	10
OECD countries	299.21	37,382	487	11,185,185	62
Developing countries	236.59	28,828	183	6,820,386	38
Total	271.95	66,210	670	18,005,571	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 84715001101and 8471601010).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $570.00 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.20 CRTs w/ automatic data processors: U.S. exports with unit values in lowest 10 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	526.43	29,282	627	15,414,827	48
Brazil	436.34	5,582	30	2,435,623	8
Panama	(b)	(b)	(b)	(b)	(b)
Korea	344.02	4,087	33	1,406,010	4
United Kingdom	582.60	2,019	70	1,176,269	4
Australia	190.03	5,720	59	1,086,972	3
Germany	406.57	1,797	45	730,615	2
Russia	375.15	1,605	10	602,109	2
Japan	(b)	(b)	(b)	(b)	(b)
Paraguay	347.07	1,574	27	546,292	2
All other	365.43	17,873	400	6,531,397	15
OECD countries	454.38	48,562	979	22,065,366	69
Developing countries	305.17	32,354	361	9,873,384	31
Total	394.71	80,916	1,340	31,938,750	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 84715001101and 8471601010).

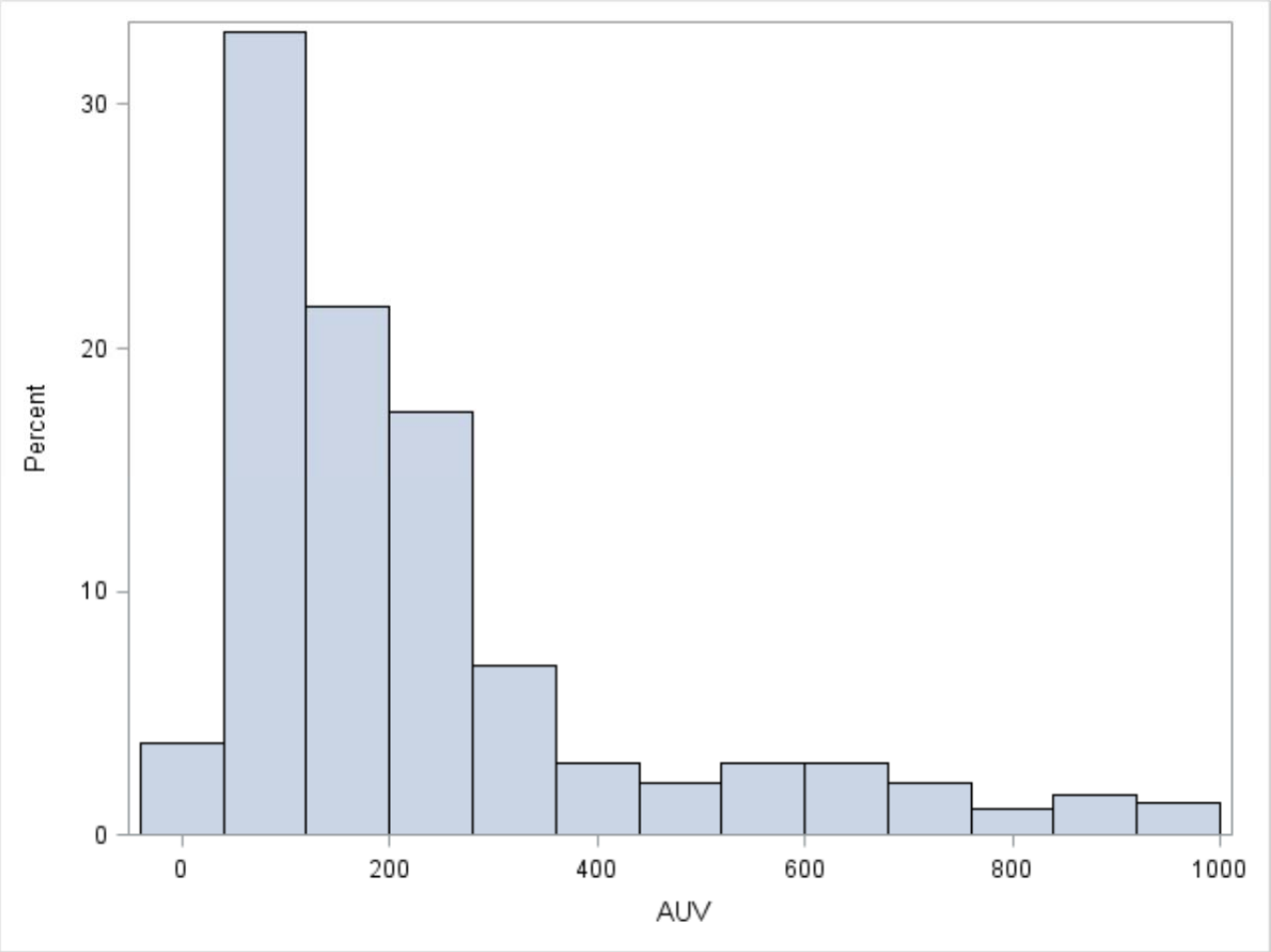
[a]Represents shipments of U.S. exports with average unit values less than or equal to $1,712.00 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.21 Summary of U.S. Census export data, CRTs bare

Schedule B export codes:	8540110035, 8540110070, 8540110080, 8540120000, 8540401010, 8540401050, 8540600055, 8540600080							
	Unit value $		No. of shipments	No. of units	Value of shipments $	% of total value	% shipments to OECD countries	% Shipments to non-OECD countries
Total exports	avg.	154.29	747	78,459	12,105,557	100	31.7	68.3
Lowest 50%	≤	970.00	374	76,842	6,967,548	58	42.0	58.0
Lowest 25%	≤	148.97	187	60,079	3,260,835	27	42.8	57.2
Lowest 10%	≤	95.00	75	41,705	1,216,678	10	66.7	33.3

Source: U.S. Census Bureau, unpublished export data, 2011.

FIGURE H.6 CRTs bare, Schedule B codes 8540110035, 8540110070, 8540110080, 8540120000, 8540401010, 8540401050, 8540600055, and 85406000080: Percent distribution of shipments in the bottom 50 percentile based upon unit value



Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011.

TABLE H.22 CRTs Bare: U.S. exports with unit values in lowest 10 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	(b)	(b)	(b)	(b)	(b)
Korea, Republic of	(b)	(b)	(b)	(b)	(b)
Qatar	(b)	(b)	(b)	(b)	(b)
Brazil	(b)	(b)	(b)	(b)	(b)
United Arab Emirates	(b)	(b)	(b)	(b)	(b)
Sweden	(b)	(b)	(b)	(b)	(b)
Barbados	(b)	(b)	(b)	(b)	(b)
Venezuela	(b)	(b)	(b)	(b)	(b)
Colombia	(b)	(b)	(b)	(b)	(b)
Dominican Republic	(b)	(b)	(b)	(b)	(b)
All other	56.33	2,213	18	124,669	10
OECD countries	21.82	33,757	52	736,697	61
Developing countries	60.39	7,948	23	479,981	39
Total	29.17	41,705	75	1,216,678	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 8540110035, 8540110070, 8540110080, 8540120000, 8540401010, 8540401050, 8540600055, and 85406000080).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $95.00 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.23 CRTs Bare: U.S. exports with unit values in lowest 25 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	(b)	(b)	(b)	(b)	(b)
China	(b)	(b)	(b)	(b)	(b)
Saudi Arabia	(b)	(b)	(b)	(b)	(b)
India	(b)	(b)	(b)	(b)	(b)
Korea, Republic Of	(b)	(b)	(b)	(b)	(b)
Qatar	(b)	(b)	(b)	(b)	(b)
United Arab Emirates	(b)	(b)	(b)	(b)	(b)
Germany	107.49	708	4	76,101	2
Singapore	(b)	(b)	(b)	(b)	(b)
Brazil	(b)	(b)	(b)	(b)	(b)
All other	97.05	7,109	60	689,908	21
OECD countries	34.72	39,798	85	1,381,809	42
Developing countries	92.65	20,281	102	1,879,026	58
Total	54.28	60,079	187	3,260,835	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 8540110035, 8540110070, 8540110080, 8540120000, 8540401010, 8540401050, 8540600055, and 85406000080).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $148.97 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.24 CRTs Bare: U.S. exports with unit values in lowest 50 percent of shipments, 2011[a]

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	67.94	41,707	86	2,833,464	41
China	(b)	(b)	(b)	(b)	(b)
Saudi Arabia	(b)	(b)	(b)	(b)	(b)
Venezuela	259.54	1,008	10	261,618	4
Cayman Islands	484.25	432	30	209,198	3
United Arab Emirates	(b)	(b)	(b)	(b)	(b)
India	(b)	(b)	(b)	(b)	(b)
Korea, Republic Of	(b)	(b)	(b)	(b)	(b)
Bahamas	330.88	441	25	145,916	2
Qatar	(b)	(b)	(b)	(b)	(b)
All other	131.29	11,787	126	1,547,504	22
OECD countries	71.59	50,896	168	3,643,661	52
Developing countries	128.11	25,946	206	3,323,887	48
Total	90.67	76,842	374	6,967,548	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B codes 8540110035, 8540110070, 8540110080, 8540120000, 8540401010, 8540401050, 8540600055, and 85406000080).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $970.00 (see chapter 2).
[b]Data suppressed to protect confidentiality.

Hard Drives and Flat-screen Monitors

The Commission also analyzed the data for the Schedule B codes that encompass detached hard drives and flat-screen monitors (tables H.25 to H.32).[5] These Schedule B codes were commonly referenced by respondents in the Commission's survey. U.S. exports of these products were considerable in terms of value and the number of units in 2011, relative to the other products listed, both in terms of total exports and exports at each AUV cut-off. As with many of the other product groups analyzed, the majority of the shipments in these Schedule B codes were shipped to Mexico which also explains why a high percentage of shipments were destined for OECD countries.

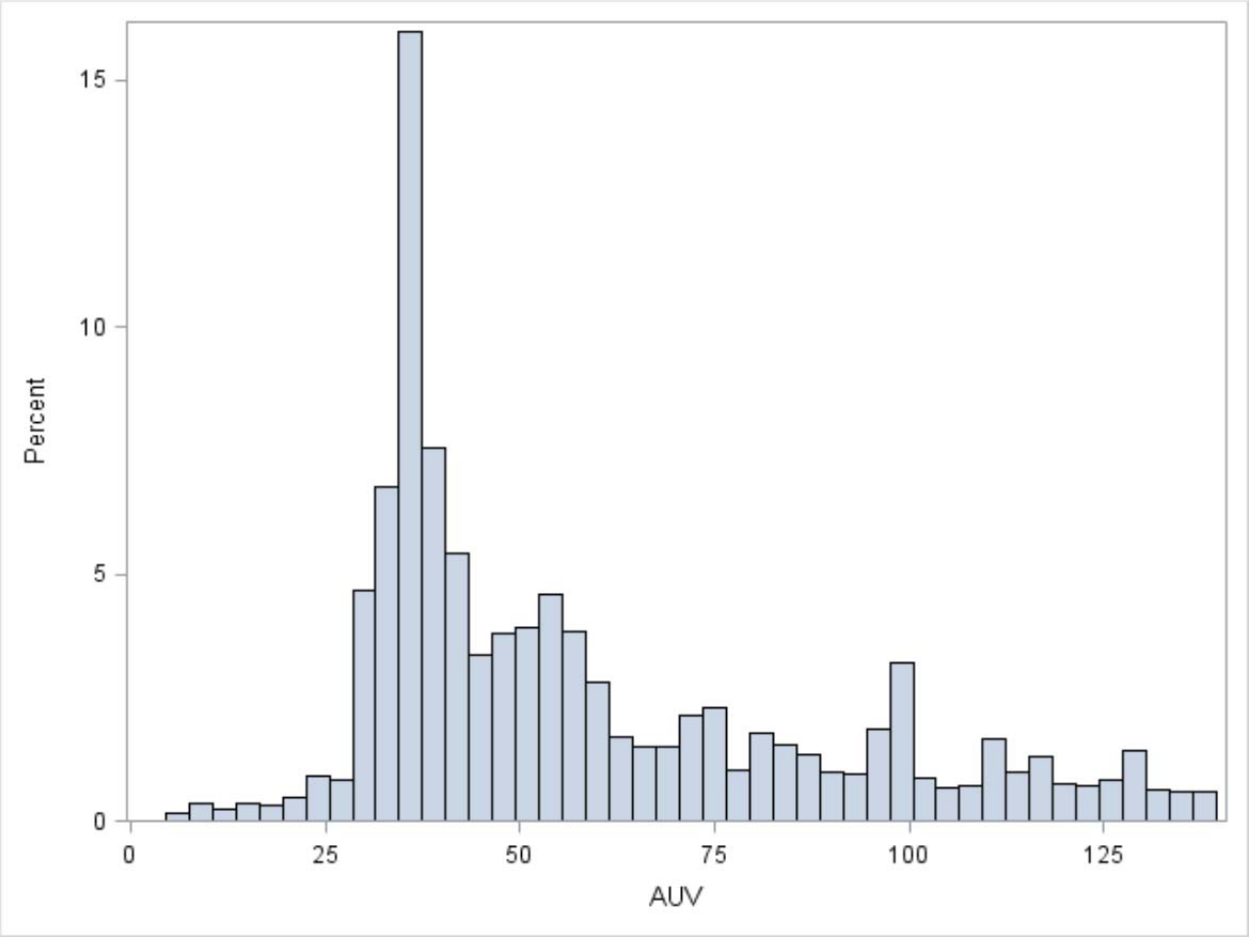
[5] The Schedule B codes identified were: 8471.70.4065 (hard magnetic disk drive units, NESOI, not assembled in cabinets, and w/out attached external power supply units) and 8528.51.0000 (monitors, of a kind solely or principally used in an automatic data processing system of heading 8471, NESOI).

TABLE H.25 Summary of U.S. Census export data, hard drives

Schedule B export codes:		8471704065						
	Unit value $		No. of shipments	No. of units	Value of shipments $	% of total value	% shipments to OECD	% shipments to non-OECD
Total exports	avg.	79.33	54,682	35,208,517	2,793,230,106	100	65.0	35.0
Lowest 50%	≤	138.68	27,341	31,213,191	1,668,212,841	60	68.7	31.3
Lowest 25%	≤	48.50	13,673	18,589,869	656,405,148	23	72.6	27.4
Lowest 10%	≤	36.00	6,507	8,373,417	244,698,810	9	71.7	28.3

Source: U.S. Census Bureau, unpublished export data, 2011.

FIGURE H.7 Hard drives, Schedule B code 8471704065: Percent distribution of shipments in the bottom 50 percentile based upon unit value



Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011.

TABLE H.26 Hard drives: U.S. exports with unit values in lowest 10 percent of shipments, 2011

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	32.32	3,356,637	4,221	108,472,494	44
Malaysia	(b)	(b)	(b)	(b)	(b)
Brazil	31.23	1,042,374	473	32,554,341	13
Hong Kong	19.07	906,303	228	17,279,444	7
Vietnam	(b)	(b)	(b)	(b)	(b)
Argentina	30.80	224,082	106	6,901,276	3
Paraguay	23.68	152,495	109	3,611,205	1
China	26.43	105,960	73	2,800,221	1
Chile	27.34	83,679	59	2,288,044	1
India	23.27	85,112	67	1,980,391	1
All other	26.37	711,938	788	18,773,373	8
OECD countries	31.83	3,759,275	4,668	119,667,798	49
Developing countries	27.10	4,614,142	1,839	125,031,012	51
Total	29.22	8,373,417	6,507	244,698,810	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B code 8471704065).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $36.00 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.27 Hard drives: U.S. exports with unit values in lowest 25 percent of shipments, 2011

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	36.62	9,241,694	8,788	338,414,084	52
Brazil	37.34	2,366,525	1,065	88,365,122	13
Malaysia	(b)	(b)	(b)	(b)	(b)
Vietnam	(b)	(b)	(b)	(b)	(b)
Hong Kong	22.59	1,067,795	343	24,124,286	4
Argentina	36.67	537,884	242	19,725,237	3
Philippines	(b)	(b)	(b)	(b)	(b)
Paraguay	31.45	258,452	205	8,129,264	1
Chile	36.08	219,910	148	7,934,256	1
China	33.83	179,625	165	6,077,488	1
All other	34.61	1,658,238	2,008	57,389,085	9
OECD countries	36.62	10,257,641	9,929	375,593,328	57
Developing countries	33.70	8,332,228	3,744	280,811,820	43
Total	35.31	18,589,869	13,673	656,405,148	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B code 8471704065).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $48.50 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.28 Hard drives: U.S. exports with unit values in lowest 50 percent of shipments, 2011

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	(b)	(b)	(b)	(b)	(b)
Brazil	45.98	3,404,749	2,210	156,563,470	9
Malaysia	32.86	1,740,663	416	57,198,819	3
Hong Kong	29.93	1,267,870	632	37,941,535	2
Vietnam	(b)	(b)	(b)	(b)	(b)
China	65.11	525,582	592	34,221,777	2
Argentina	43.95	708,825	589	31,150,472	2
Philippines	(b)	(b)	(b)	(b)	(b)
Netherlands	62.25	373,122	779	23,225,681	1
Germany	60.29	372,249	471	22,442,921	1
All other	51.31	3,193,401	5,995	163,860,467	10
OECD countries	59.33	20,134,597	18,784	1,194,605,457	72
Developing countries	42.75	11,078,594	8,557	473,607,384	28
Total	53.45	31,213,191	27,341	1,668,212,841	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B code 8471704065).

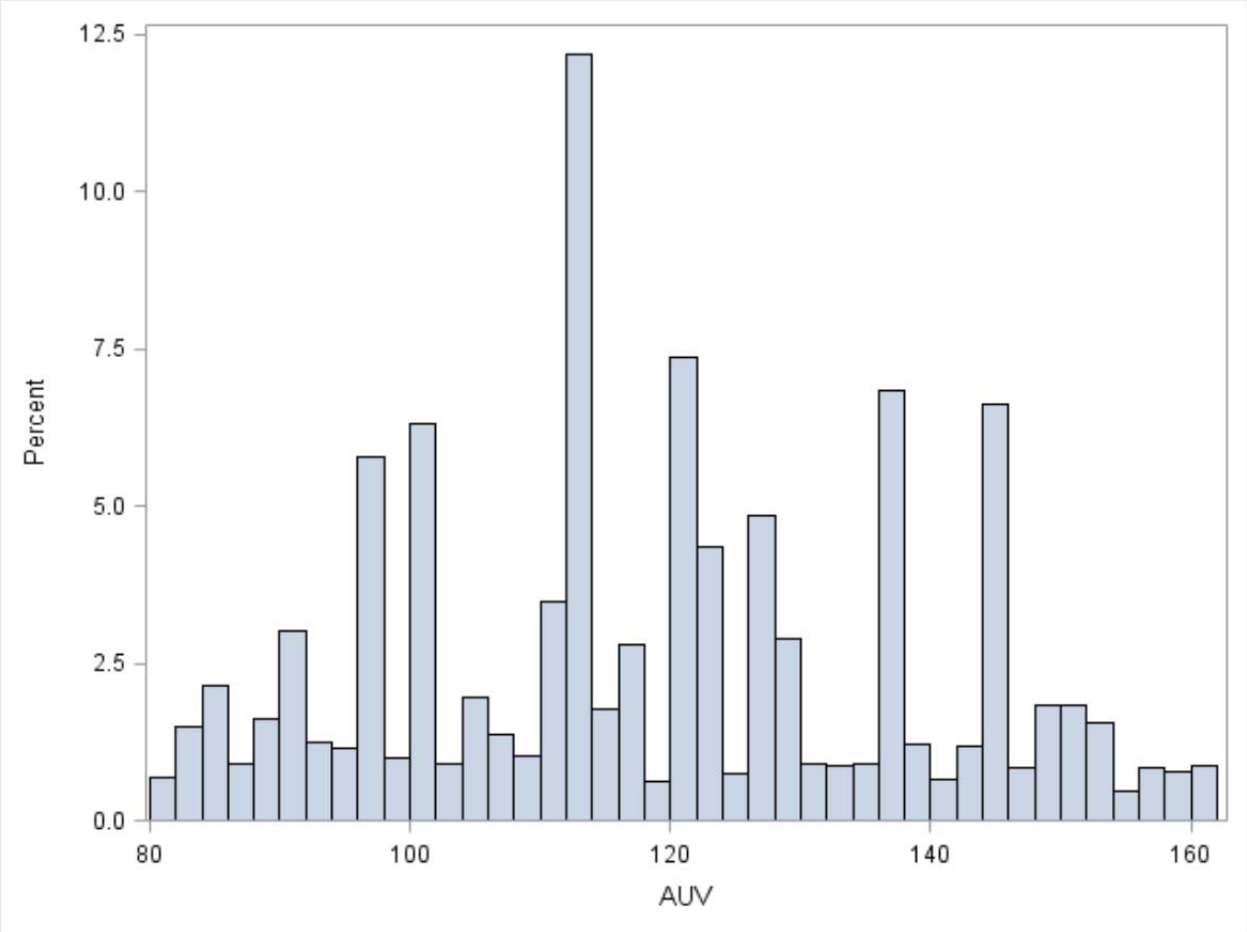
[a]Represents shipments of U.S. exports with average unit values less than or equal to $138.70 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.29 Summary of U.S. Census export data, flat-screen monitors

Schedule B export codes:		8528510000						
	Unit value $		No. of shipments	No. of units	Value of shipments $	% of total value	% shipments to OECD	% shipments to non-OECD
Total exports	avg.	174.65	36,086	4,900,761	855,934,016	100	75.6	24.4
Lowest 50%	≤	160.87	18,184	3,592,045	420,963,247	49	81.3	18.7
Lowest 25%	≤	117.67	9,022	1,877,624	191,517,983	22	79.5	20.5
Lowest 10%	≤	100.00	4,392	934,067	86,367,834	10	78.5	21.5

Source: U.S. Census Bureau, unpublished export data, 2011.

FIGURE H.8 Flat screen monitors, Schedule B code 8528510000: Percent distribution of shipments in the bottom 50 percentile based upon unit value



Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011.

TABLE H.30 Flat-screen monitors: U.S. exports with unit values in lowest 10 percent of shipments, 2011

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	93.46	635,786	3,332	59,423,672	69
Colombia	90.07	44,213	150	3,982,304	5
Brazil	89.09	36,451	156	3,247,329	4
Chile	89.82	30,648	74	2,752,792	3
Venezuela	89.78	28,150	54	2,527,198	3
Argentina	91.40	26,113	98	2,386,829	3
Peru	90.77	22,879	70	2,076,717	2
Paraguay	91.55	12,197	27	1,116,622	1
Ecuador	88.63	12,184	35	1,079,814	1
Costa Rica	91.67	10,782	66	988,366	1
All other	90.89	74,664	330	6,786,191	8
OECD countries	93.28	673,610	3,446	62,834,674	73
Developing countries	90.35	260,457	946	23,533,160	27
Total	92.46	934,067	4,392	86,367,834	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B code: 8528510000).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $100.00 (see chapter 2).

TABLE H.31 Flat-screen monitors: U.S. exports with unit values in lowest 25 percent of shipments, 2011

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	([b])	([b])	([b])	([b])	([b])
Colombia	99.72	85,287	269	8,504,511	4
Brazil	97.62	64,975	314	6,342,772	3
Chile	94.82	41,901	137	3,973,239	2
Argentina	97.60	39,976	206	3,901,628	2
Venezuela	94.69	36,845	74	3,488,774	2
Ecuador	101.83	33,353	90	3,396,324	2
Peru	94.31	30,498	113	2,876,400	2
Costa Rica	102.67	26,478	147	2,718,478	1
Paraguay	97.35	18,153	38	1,767,263	1
All other	98.56	129,691	695	12,782,101	7
OECD countries	103.17	1,430,335	7,176	147,571,469	77
Developing countries	98.25	447,289	1,846	43,946,514	23
Total	102.00	1,877,624	9,022	191,517,983	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B code: 8528510000).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $117.67 (see chapter 2).
[b]Data suppressed to protect confidentiality.

TABLE H.32 Flat-screen monitors: U.S. exports with unit values in lowest 50 percent of shipments, 2011

	AUV $	No. of units	No. of shipments	Export value $	Share of total value %
Mexico	([b])	([b])	([b])	([b])	([b])
Colombia	115.00	175,128	508	20,139,449	5
Brazil	111.32	104,787	674	11,665,346	3
Venezuela	112.52	89,927	119	10,118,963	2
Chile	106.60	59,178	261	6,308,228	1
China	127.16	45,417	56	5,775,091	1
Ecuador	111.11	49,357	168	5,483,887	1
Argentina	106.41	51,340	295	5,463,154	1
Peru	107.48	46,658	196	5,014,996	1
Costa Rica	112.37	38,855	261	4,365,963	1
All other	116.93	236,945	1,595	27,704,864	7
OECD countries	118.54	2,831,602	14,775	335,659,036	80
Developing countries	112.18	760,443	3,409	85,304,211	20
Total	117.19	3,592,045	18,184	420,963,247	100

Source: USITC calculations based on U.S. Census Bureau, unpublished export data, 2011 (Schedule B code: 8528510000).

[a]Represents shipments of U.S. exports with average unit values less than or equal to $160.87 (see chapter 2).
[b]Data suppressed to protect confidentiality.