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An Examination of the U.S. Computer and Electronics Sector[1]

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Abstract

The purpose of this paper is to examine the extent to which the recovery or "onshoring" of manufacturing to the United States—reported in a number of recent articles and publications—occurred during 2009–13. The paper examines this question by considering changes in shipment and investment statistics in three critical industry groups—manufacturers of computer and peripheral, communications, and audio and video equipment—within the computer and electronic products manufacturing subsector. Supplementing these quantitative data is a qualitative analysis of publicly announced and reported changes in production capacity in the United States, and an examination of the reasons why these firms have invested in U.S. production. The results indicate that, following the end of the recession (2009–13), forecasts of widespread onshoring have failed to materialize within any of the three industry groups. For most of the metrics observed in this report, recent levels have failed to reach pre-recession highs, and U.S. firms have continued to lose market share.

Nevertheless, within the three industry groups, several large firms have made significant investments since 2009, often through contract manufacturers as opposed to in-house production. The reasons that firms give for onshoring reflect a few common themes, including manufacturing in close proximity to their customers, which facilitates quick delivery and product customization; being able to maintain smaller inventories, thereby lowering supply chain costs; locating production near headquarters, research and development labs, and engineering staff to rapidly make product design changes and improve quality control; and cutting transportation costs. The investments in U.S. production by these firms, however, have not necessarily translated into a reduced manufacturing presence overseas.

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[1] This paper represents solely the views of the authors and is not meant to represent the views of the U.S. International Trade Commission or any of its commissioners. The invaluable assistance of Michael Anderson, David Coffin, Peg Hausman, Myles Hungerford, Karen Laney, Deb McNay, and Monica Reed is gratefully acknowledged.
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Introduction

For much of the past 15 years, the computer and electronic products manufacturing sector[2] in the United States has witnessed significant job losses as firms increasingly shifted production and sourcing to foreign locations. Job losses and production declines were particularly significant during 2000–10 for various reasons, including economic recessions during 2001 and in 2007–09; the increased relocation of domestic production to overseas markets, or "offshoring;" and the use of contractors abroad to conduct business operations of domestic firms, or "outsourcing." All these factors contributed to a large decline in U.S. employment and production.[3] China, meanwhile, significantly increased its share of global value added in the high-tech sector, and by 2010 had passed the United States, formerly the global leader.

Yet, in the three years since the end of the recession, widespread media reports have suggested a possible resurgence of domestic manufacturing, or "onshoring," in many sectors, including computers and electronic products. Though various definitions of onshoring exist, this paper defines it as the expansion of U.S. manufacturing, through opening new plants or expanding production at existing plants, in industry sectors in which there has been a past trend toward moving manufacturing outside the United States or sourcing a much larger share of products from outside the United States.[4] This includes investment by U.S. and non-U.S.-based firms. A detailed analysis of several computer and electronic product industry groups indicates that there is anecdotal evidence of onshoring in these industry groups and that several factors, such as increased product customization and poor quality control in some foreign plants, may be leading a subset of firms to see advantages in U.S. production. However, there has not been a reversal of the trend toward declining U.S. production in these industry groups, and output remains below pre-recession levels.[5]

The purpose of this paper is to investigate the extent to which onshoring claims have materialized by looking beyond employment statistics and considering changes in shipments and investment in three critical industry groups—manufacturers of computer and peripheral, communications, and audio and video equipment—within the computer and electronic products manufacturing subsector (box 1).[6]

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[2] For the purposes of analysis, this paper considers three of the six industry groups which comprise the computer and electronic products manufacturing industry, as defined by the North American Industry Classification System (NAICS). The three groups are computer and peripheral equipment manufacturing, communications equipment manufacturing, and audio and video equipment manufacturing.

[3] Booth, "Here, There and Everywhere," February 19, 2013.

[4] Expansion is defined here as significant investment in the physical expansion of production capacity (e.g., expanding a building or making substantial investments in equipment to increase capacity), and excludes expansion that is only related to the hiring of new employees. The latter type of expansion is excluded because it is difficult to track and may be less likely to represent long-term changes in production capacity.

[5] The results of this analysis are not generalizable to other manufacturing subsectors, as there may be substantial differences across subsectors in the factors that influence plant location decisions.

[6] Semiconductors and other electronic components were not included in this analysis because these products are inputs to the finished products in NAICS 3341–3343 and because the dynamics in this industry—such as production location decisions—are different from those for the final products.

Box 1 North American Industry Classification System (NAICS) definitions of sectors, industry groups, and industries

Level	Code	Example	Description
Sector	XX	33	Manufacturing
Subsector	XXX	334	Computer and electronic product manufacturing
Industry group	XXXX	3342	Communications equipment manufacturing
NAICS industry	XXXXX	33422	Radio and television broadcasting and wireless communications
U.S. industry	XXXXXX	3342220	Radio and television broadcasting and wireless communications equipment manufacturing

Recent analyses of the potential onshoring of U.S. manufacturing indicate several subsectors in which onshoring is likely to occur, but of the durable goods subsectors, computer and electronic products manufacturing was the only one to register declines in both shipments and market share in the 10 years preceding the 2007–09 recession. Further, this subsector has been identified by various sources as the most heavily outsourced category and is believed to be one of the leading candidates for onshoring in the future.

This paper first briefly surveys more than 25 media publications that have discussed the extent of onshoring of U.S. manufacturing industry since the recent recession. The paper next discusses the methodology behind selecting the computers and electronic products manufacturing subsector and explains the approach used to analyze the extent to which onshoring has occurred since 2009 in several industry groups within this subsector.

The following section summarizes some of the global activities of each of the three manufacturing industry groups and discuss the performance of these groups in the pre-recession period (1997–2007) and during the most recent recession (2007–09). The paper then discusses onshoring since 2009, first with a quantitative analysis of trends in production and investment, and then through a discussion of notable examples of recent or announced investments in U.S. manufacturing by firms in the three industry groups. It concludes with a discussion of the factors that are leading some U.S. firms to invest in U.S. production.

Survey of Onshoring Publications

Starting around 2011, some of the literature on U.S. manufacturing suggested that U.S. manufacturing's cost competitiveness was rising in comparison to China and indicated that this cost competitiveness—combined with factors such as the need to protect intellectual property (IP) and the benefits of being in close proximity to markets—was leading to the onshoring of manufacturing in the United States in certain industries. The various industry surveys and consulting reports on onshoring have discussed the extent to which onshoring is occurring in

the United States and generally suggest that any increased investment in production facilities by multinationals constitutes evidence of onshoring, using employment as the principal metric for gauging this trend. This paper reviews the findings from over 25 publications, including 6 consulting firm reports, 5 surveys of business, and numerous media articles, as well as private and government websites focused on manufacturing. [7]

The incidence—present and future—of onshoring in the United States yielded different interpretations from the various sources consulted. For instance, the Boston Consulting Group (BCG) suggested in 2011 that 48 percent of large firms they had surveyed—those with sales above $10 billion—are onshoring, while 37 percent of firms with annual sales above $1 billion are considering onshoring by relocating production from China to America.[8] The Hackett Group suggested that onshoring can be expected to grow from an estimated 9 percent of manufacturing capacity during 2009–11 to 19 percent during 2012–14.[9] Similarly, a 2012 study by the MIT Forum for Supply Chain Innovation revealed that 34 percent of responding U.S. manufacturing firms were considering onshoring production.[10]

Several other sources, however, were skeptical of the reports of onshoring's rise. Jan Hatzius of Goldman Sachs, for instance, recently suggested that recent gains in U.S. manufacturing since the recession reflected cyclical improvements and were not evidence of a larger trend.[11] A 2013 Morgan Stanley report, which surveyed 266 U.S. manufacturers in several industries, noted that there was "little real evidence" of a resurgence in U.S. manufacturing and that increased capital expenditures within the United States over the next five years will likely occur in response to currently depressed rates of capital spending.[12]

Among the accounts which predicted increased onshoring, the reasons focused on the following trends:

- *Narrowing wage gap*. Wages in China and India rose by 10–20 percent each year over the past decade, while remaining relatively stagnant in the United States and Europe, according to Tamzin Booth of the *Economist*.[13] As a result, low wages in developing countries are no longer the leading reason for manufacturing in emerging markets. By 2015, manufacturing costs in the United States will be as much as it would be in China for many industries, such as computers and electronics manufacturing.[14]

[7] The definition of onshoring used in these publications may differ from that used in this paper.
[8] Sirkin, "The U.S. Manufacturing Renaissance," October 7, 2011; Sirkin, Zinser, and Hohner, "Made in America, Again," August 2011.
[9] Janssen, *Reshoring Global Manufacturing*, 2012.
[10] MIT, *U.S. Re-shoring*, 2012.
[11] Mackenzie, "Productivity," April 8, 2013.
[12] Real Time Economics, "The Myth of the Manufacturing Renaissance," April 30, 2013.
[13] Booth, "Here, There and Everywhere," January 19, 2013.
[14] Booth, "Here, There and Everywhere," January 19, 2013; Sirkin, "The U.S. Manufacturing Renaissance," October 7, 2011; Fishman, "The Insourcing Boom," November 28, 2012; TD Economics, *Offshoring,* October 15, 2012.

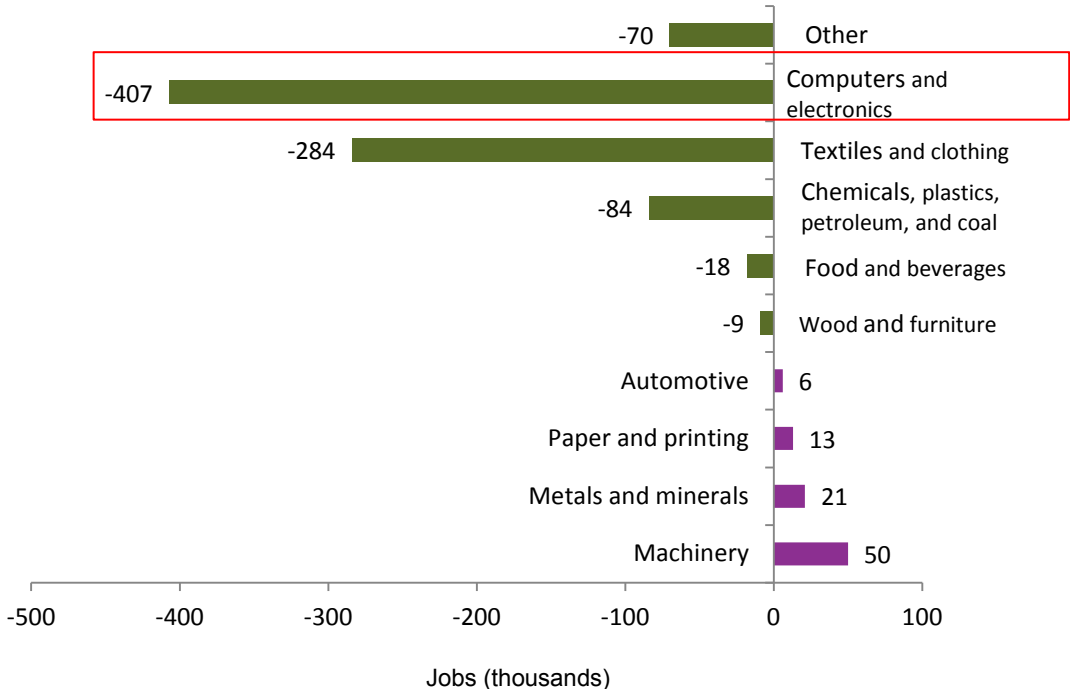
- *Increased transportation costs*. TD Economics, the *Atlantic*, and several other sources singled out higher transportation costs as a principal consideration leading firms to onshore; oil prices are currently three times what they were in 2000, and overall shipping costs grew tenfold between 2002 and 2008.[15]
- *Proximity to markets.* The ability to deliver customized products quickly to satisfy changing demands means that proximity to the market is critical, especially for products with short life cycles, such as computers and other electronics. Moreover, ever-shorter innovation cycles, the use of high-technology inputs, and a highly competitive global industry make time to market critical to success, according to the *Economist*, the *Atlantic*, and BCG.[16]
- *IP protection.* The rapid innovation cycle and consistent demand for new products, especially within the highly competitive computers and electronics manufacturing industry, has increased the need for production to be close to research and development (R&D) labs, which have commonly remained in the United States.[17] In a 2012 Hackett Group survey, 57 percent of the respondents said that they considered IP protection a "very important" consideration in deciding to onshore, trailing only product quality and manufacturing costs.[18]

Computers and Electronics: A Leading Onshoring Candidate

Most sources suggesting that significant onshoring was likely to occur, including TD Economics and BCG, stated that the computers and electronics manufacturing industry was a leading candidate for onshoring.[19] The industry's relatively high capital intensity was the most commonly cited reason for onshoring. Capital-intensive industries are associated with lower employment than labor-intensive industries, which limits one benefit of outsourcing to countries with lower wages. Notably, the projected job gains within this subsector are not expected to replace the jobs lost during 2000–10, a decade in which the computers and electronics category lost more jobs than any other industry (figure 1).

[15] Fishman, "The Insourcing Boom," November 28, 2012; TD Economics, *Offshoring,* October 15, 2012.
[16] Economist, *Here, There and Everywhere*, January 19, 2013; Sirkin, "The U.S. Manufacturing Renaissance," October 7, 2011; Fishman, "The Insourcing Boom," November 28, 2012.
[17] Foroohar. "Is the U.S. Manufacturing Renaissance Real?" March 28, 2013.
[18] Janssen, *Reshoring Global Manufacturing*, 2012.
[19] BCG indicates that the following sectors are likely to be onshored: (1) computers and electronics, (2) home appliances and electrical equipment, (3) machinery, (4) furniture, (5) fabricated metals, (6) plastics and rubber, (7) transportation goods. BCG projects that the "vast majority of computer and electronics manufacturing that moves from China will go to the United States," while in a sector like transportation a large share of the production moved from China will go to Mexico. Sirkin, Rose, and Zinser, *The U.S. Manufacturing Renaissance*, November 5, 2012, 591–625.

Figure 1 The computers and electronics manufacturing industry was the most heavily outsourced U.S. manufacturing industry when measured by the change in jobs (thousands) during 2000–10



Source: Booth, "Here, There and Everywhere," January 19, 2013.

Outsourcing Likely to Continue

Despite their focus on onshoring, many of the reports recognized that outsourcing will still remain a popular strategy. For example, the Hackett Group suggested that continued offshoring would more than offset the activities being onshored; 35 percent of the manufacturers surveyed remain committed to outsourcing capacity to developing countries, while only 20 percent are currently onshoring capacity in the United States.[20] However, a few reports, including that of TD Economics, suggested that the rapid pace of outsourcing observed during 2000–10 has slowed, especially within the computers and electronics industry, as U.S. production has risen to match the growth of domestic imports in recent years.[21]

Employment Unlikely to Benefit from Onshoring

Due to the increasingly automated mode of production and other productivity improvements associated with capital intensive industries, such as computers and electronics manufacturing, most of the sources consulted suggested that employment is unlikely to benefit from onshoring. For instance, according to a 2013 report by Marc Levinson of the Congressional Research Service, the 20 percent increase in manufacturing output since the two-decade low in June 2009 has corresponded to only a 2 percent increase in manufacturing employment.[22]

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[20] Janssen, *Reshoring Global Manufacturing*, 2012.
[21] TD Economics, *Offshoring,* October 15, 2012.
[22] Levinson, *Job Creation*, June 19, 2013.

Further, as the *Economist* and BCG contended, China's extensive supply chains for the production of inputs, along with the country's burgeoning market for manufactured goods, will likely encourage U.S. firms to keep a sizable manufacturing presence in the country.[23] Moreover, TD Economics recognized that although capital-intensive industries are likely to benefit the most from the onshoring trend, these gains are not likely to be reflected in employment; the majority of the lost jobs will probably not return to the United States.[24]

Methodology

Selection of Industry Groups

The first step in selecting sectors for analysis was identifying manufacturing subsectors in which U.S. production has declined and a larger share of production shifted overseas. Many of the subsectors that have been cited as potential candidates for onshoring have actually experienced an increase in U.S. shipments over time, making it difficult to discern whether any investment in a new manufacturing plant is "onshoring" or a continuation of a long-term trend toward investment in that sector (box 2). This paper, therefore, assesses the industry groups that have been among the most affected by foreign competition (using the metrics described below), before conducting an analysis to determine whether onshoring is occurring. This paper examined durable goods,[25] and considers data at the industry group level. The industry groups were chosen for analysis based on two criteria: (1) a decline in the nominal value of U.S. shipments during 1997–2007,[26] and (2) a decline in U.S. market share during the same time period. U.S. market share was used to ensure that the decline in shipments was not due to a decline in the overall market for the products.

The selection criteria used in this paper exclude employment, one of the most commonly used metrics of offshoring, because production in U.S. manufacturing production has generally risen even as employment has decreased, as shown in box 2. The selection criteria do not take into account what is happening below the industry group level. It is possible that some U.S. industries in the group are losing production and market share even as the industry group as a whole is growing. However, as a set of closely related industries and firms, the industry group is a useful basis for analysis. Finally, by singling out industry groups which have suffered a decline in the nominal value of shipments and a loss of market share, the paper examines only those sectors more affected by foreign competition and—if there is a trend toward investment in U.S. manufacturing—sectors that may be slowest to recover.

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[23] Booth, *Here, There and Everywhere*, January 19, 2013; Sirkin, "The U.S. Manufacturing Renaissance," October 7, 2011.

[24] TD Economics, *Offshoring,* October 15, 2012.

[25] Durable goods are "those that can be stored or inventoried and that have an average life of at least 3 years"; nondurable goods "are all other commodities that can be stored or inventoried." Seskin and Parker, "A Guide to the NIPA's," March 1998.

[26] 2007 was used as the endpoint for the analysis so that the data would not be affected by the recession, while 1997 was selected as the starting point, as that was the year in which the NAICS went into effect.

Among the durable goods manufacturing subsectors, only one—computer and electronic product manufacturing—experienced a decline in both shipments and market share (table 1).[27] Within this subsector there are six industry groups. In five of the six industry groups U.S. producers experienced both a decline in shipments and a decline in U.S. market share. Three of these industry groups—computer and peripheral equipment manufacturing (NAICS 3341); communications equipment manufacturing (NAICS 3342); and audio and video equipment manufacturing (NAICS 3343)—were selected for analysis (box 3).[28]

[27] There were some individual industry groups that also experienced both a decline in shipments and a decline in market share. However, since the first selection criterion was examining changes at the 3-digit industry subsector level, these industry groups will not be discussed in this paper.

[28] Manufacturing and reproducing magnetic and optical media were excluded from the analysis because the market for these products is rapidly contracting. Semiconductors and other electronic components were also not included in this analysis because these products are inputs to the finished products in NAICS 3341–3343 and the dynamics in some segments of this industry group—such as decisions on siting production—are very different from those for the final products. For example, semiconductor firms have long-term planning horizons for capacity additions, and new plants may take several years to build. Further, as noted earlier, semiconductors and electronic components are inputs into the final products in other computer and electronic product industry groups. Therefore, due to the differences between this group and other industry groups in computer and electronic component manufacturing, it is not included in this analysis. Economic Census data from USDOC, Census Bureau, American Fact Finder database (accessed February–March 2013); USITC DataWeb/USDOC (accessed February–March 2013).

Box 2 The U.S. manufacturing industry and onshoring

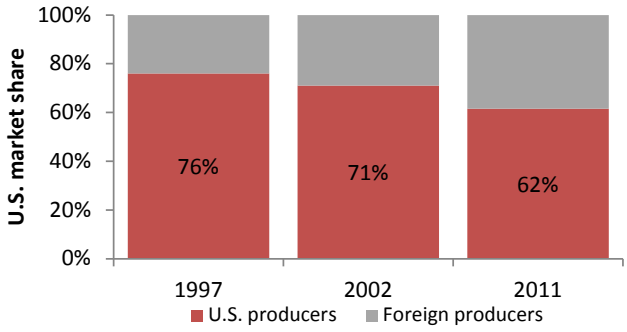
The onshoring discussion has focused on the return of U.S. manufacturing, but in many industries U.S. shipments have risen (rather than declined) in the last decade. U.S. shipments of manufactured goods (NAICS 31–33, durable and nondurable goods) rose from $3.9 trillion in 2002 to almost $5.5 trillion in 2008 (figure B2.1). They fell to $4.4 trillion in 2009 due to the U.S. recession, but by 2011 had recovered to almost $5.5 trillion again. Overall, shipments rose by 40 percent, or $1.6 trillion, during 2002–11. Firms also invested heavily in manufacturing during this period. Total capital spending (new and used) rose from $123.1 billion in 2002 to a peak of $166.1 billion in 2008. It declined to a post-recession low of $127.6 billion in 2010, but by 2011 had recovered to $146.7 billion. In sharp contrast, employment declined during the period, falling by 27 percent (4 million) during 2002–11. Employment fell more steeply during the recession, dropping by 2.9 million during 2007–10.

U.S. durable goods[a] shipments have also grown over time, generally expanding or contracting with demand during 1997–2013—though U.S. producers did lose some market share as discussed below (figure B2.2). In 2013, U.S. shipments of durable goods exceeded pre-recession levels by 3 percent.

U.S. durable goods trade has expanded more rapidly than shipments over time, and both imports and exports reached 116 percent of pre-recession 2007 levels by 2013. While starting from a different base, exports have been expanding at roughly the same pace as imports.

While these data are an important counterpoint to narratives that U.S. manufacturing has been in continual decline, they should not be overstated. In real terms, U.S. shipments of durable goods grew 22 percent from 1992 to 2007, but this primarily reflects gains in the 1990s; such shipments rose a mere 0.4 percent from 1997 to 2007.[b] Further, U.S. producers have lost significant market share in the durable goods sector over time. The domestic market share of U.S. producers in this sector declined from 76 percent in 1997 to 62 percent in 2011 (figure B2.4).

Figure B2.4 U.S. durable goods producers lost market share during 1997–2011



[a] Durable goods are "those that can be stored or inventoried and that have an average life of at least 3 years"; nondurable goods "are all other commodities that can be stored or inventoried." Seskin and Parker, "A Guide to the NIPA's," March 1998.

[b] Census Bureau, "Manufacturers' Shipments, Inventories, and Orders," historical time series Excel spreadsheet (accessed September 4, 2013).

Figure B2.1 U.S. shipments and value added rose during 1997–11, while employment fell (NAICS 31–33)

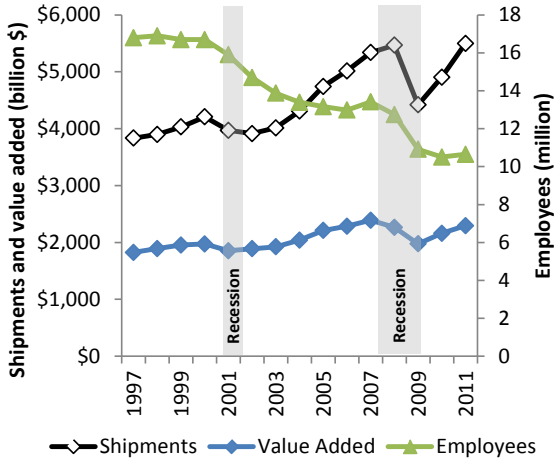


Figure B2.2 U.S. durable goods shipment trends reflected demand during 2002–11

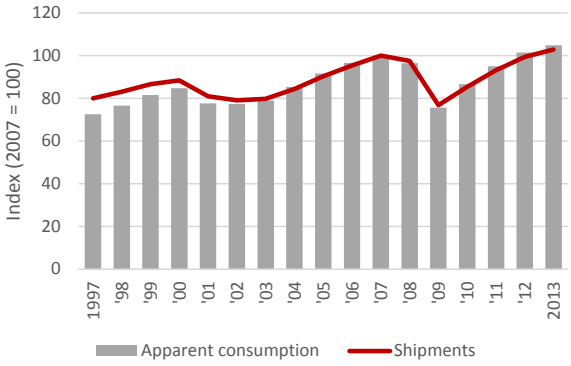


Figure B2.3 U.S. exports and imports of durable goods substantially increased during 1997–2013

Chart and text sources (unless otherwise noted): Economic Census and Annual Survey of Manufacturers data from Census Bureau, American Fact Finder database, http://factfinder2.census.gov (accessed July–September 2013); Census Bureau, *Statistics for Industry Groups and Industries: 2001*, January 2013, 2; Census Bureau, "Manufacturers' Shipments, Inventories, and Orders," (accessed January–March 2014); USITC DataWeb/USDOC (accessed March 2014).

Table 1 Change in shipments and market share, select manufacturing sectors, 1997–2007

Sector	Industry group		Change 1997–2007	
			Shipments (billion $)	Market share[a] (%)
321	Wood product manufacturing		13.6	-3
327	Nonmetallic mineral product manufacturing		41.6	-3
331	Primary metal manufacturing		89.2	-10
332	Fabricated metal product manufacturing		102.6	-5
333	Machinery manufacturing		80.8	-10
334	Computer and electronic product manufacturing		-36.4	-18
	3341	Computer and peripheral equipment manufacturing	-44.4	-25
	3342	Communications equipment manufacturing	-17.0	-43
	3343	Audio and video equipment manufacturing	-0.7	-11
	3344	Semiconductor and other electronic component manufacturing	-16.2	-5
	3345	Navigational, measuring, electromedical, and control instruments manufacturing	45.1	-10
	3346	Manufacturing and reproducing magnetic and optical media	-3.2	-5
335	Electrical equipment, appliance, and component manufacturing		17.6	-18
336	Transportation equipment manufacturing		169.6	-9
337	Furniture and related product manufacturing		21.2	-13
339	Miscellaneous manufacturing		48.6	-12

Source: Economic Census data from Census Bureau, American Fact Finder database, http://factfinder2.census.gov (accessed February¬–March 2013); USITC DataWeb/USDOC (accessed February¬–March 2013).
Note: [a]Market share in 2007 minus market share in 1997. Market share based on apparent consumption, i.e., imports plus production minus exports.

Box 3 Industry coverage

The following industry groups are covered in this paper:

Computer and peripheral equipment manufacturing (NAICS 3341): Includes desktop computers, notebook computers, servers, and related equipment and components such as hard drives, DVD drives, displays, keyboards, and printers. It also includes products such as automated teller machines (ATMs) and point-of-sale terminals.

Communications equipment manufacturing (NAICS 3342): Encompasses products ranging from cellphones to the infrastructure that allows devices to communicate over cellular networks, satellite networks, and the Internet. Examples of such network equipment include routers, switches, modems, base stations, and optical network equipment. Radio and television broadcast equipment, communications satellites, and global positioning systems (GPSs) also fall within this industry group.

Audio and video equipment manufacturing (NAICS 3343): Includes products known as "consumer electronics." This category encompasses audio amplifiers; audio recorders and players (e.g., CD recorders and players, audiocassette recorders and players); car audio systems; headphones/headsets; home and portable audio systems; home theater audio and video equipment; jukeboxes; loudspeakers and speaker systems; microphones; public address systems and equipment; table, clock, and portable radios and combinations; television receivers; video cameras and camcorders; and video recorders and players (e.g., DVD recorders and players, and videotape recorders and players).

For more information on the NAICS, see the Census Bureau website, http://www.census.gov/cgi-bin/sssd/naics/naicsrch.

Analytical Approach

This paper uses two approaches to analyze the extent to which onshoring is occurring in the three industry groups selected for analysis. First, since many of the recent narratives of onshoring published are based on anecdotes or surveys of a small number of U.S. firms, this paper takes a more comprehensive approach by examining manufacturing and trade data from the U.S. Census Bureau (Census), Department of Commerce, and Federal Reserve that indicate trends across the entirety of the industry groups examined. Specifically, the paper uses these data—on shipments, exports, imports, production capacity, and capital expenditures—to quantitatively assess whether there has been a significant change in the three selected industry groups since the end of the recession. As noted earlier, employment is not used as a metric for assessing onshoring in this paper, since rising productivity could lead to significant increases in production that would not be reflected in employment data.

The main datasets used in this approach are (1) shipment data from Census Bureau's Annual Survey of Manufactures, Economic Census, and "Manufacturers' Shipments, Inventories, and Orders"; (2) the Federal Reserve's Industrial Production and Capacity Utilization (G.17) data series, which includes recent production capacity data; (3) official trade data taken from the USITC DataWeb/U.S. Department of Commerce; and (4) capital expenditures data from the Census's Annual Survey of Manufactures and its Economic Census. These data provide a fairly comprehensive picture of the current state of U.S. manufacturing. However, since onshoring, if it exists, may be a fairly new trend, these data may offer only a limited picture of onshoring trends. Moreover, these data do not indicate if domestic manufacturing production will increase in the next few years.

Second, the authors of this paper gathered information on recently opened and expanded manufacturing plants, as well as on announced investments in plants, in order to assess the possible longer-term trajectory of manufacturing in the selected industry groups. This information was assembled through discussions with industry representatives, a review of sources such as press releases, news articles, and websites, and queries of three databases for manufacturing plants that opened in 2009 or later: Manufacturers' News, Orbis, and fDi Markets. This information provides detail on the extent to which firms are starting to invest in U.S. production, and enables an analysis of the reasons that firms are investing in U.S. production.

Industry Background: The Global Computer and Electronics Value Chain

Global computer and electronics manufacturing is dominated by firms from the United States and Asia, with these locations accounting for more than three-quarters of manufactured value added. The subsector is characterized by high innovation, with firms commonly contributing between 25 and 33 percent of value added to R&D.[29] The fast product cycles mean that innovation, especially in the initial product development and design steps of the value chain, is critical. Innovative designs can influence a consumer's purchasing decision and are frequently

[29] McKinsey, *Manufacturing the Future*, November 2012.

patented by leading firms within these industry groupings.[30] For instance, Apple, one of the world's leading manufacturers in the computer and peripherals industry group, is believed to have sustained its leadership in the tablet computing market due to its innovative design and high performance, attributes which have fostered significant customer loyalty.[31] Additionally, the industry is highly capital intensive, ranking among the top five most capital-intensive industries worldwide in a recent McKinsey survey.[32]

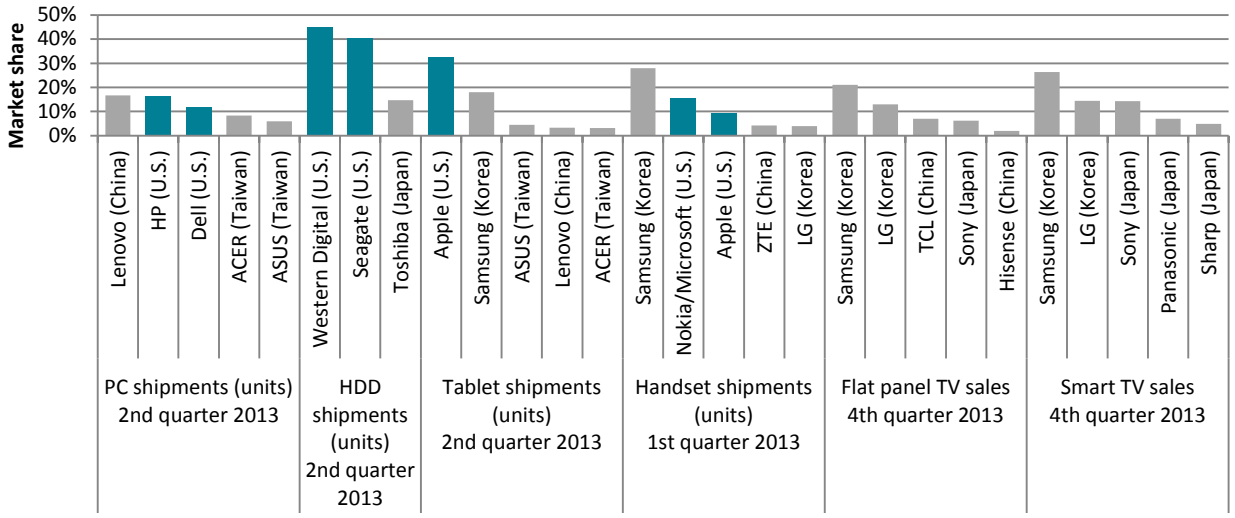
Multinationals Lead the Global Industry

Global production of the key products in the three selected industry groups tends to be dominated by U.S. and Asian multinational companies, particularly Chinese, Japanese, Korean, and Taiwanese firms (figure 2). These industries tend to be somewhat concentrated, with the top five firms accounting for at least 59 percent of the market in key segments such as computers, hard disk drives, tablets, cellphones, and flat panel TVs.[33] The market share data in figure 2 also likely underrepresent the presence of Chinese firms in these industries. For example, in addition to ZTE, the sixth- and ninth-largest suppliers of cellphones are Chinese firms (Huawei and Lenovo), and Chinese firms are rapidly increasing their share of the flat panel TV market both within and outside of China.[34]

Even within an industry group, such as communications equipment, there can be significant variations in where the leading firms are headquartered. For example, in contrast to the cellphone industry—where only two U.S. firms are among the top 10 suppliers—many of the leading global wired network equipment providers are headquartered in the United States, including Cisco, HP, Juniper Networks, Ciena, and Infinera. Other industry leaders include Ericsson (headquartered in Sweden), Huawei (China), ZTE (China), Nokia Solutions and Networks (Finland), and Alcatel Lucent (France), all of which have varying competitive positions in different sub-products such as mobile, fixed, and optical network equipment.[35]

[30] WIPO, *World Intellectual Property*, 2012.
[31] Cathers, *Computers*, October 25, 2012.
[32] McKinsey, *Manufacturing the Future*, November 2012.
[33] Gartner, "Gartner Says," July 10, 2013; Fierce Wireless, "Analyzing the World's 12 Biggest," May 28, 2013; NPD DisplaySearch, "Global LCD TV Shipments," March 21, 2013; Microsoft, "Microsoft to Acquire," September 2013; IDC, "Tablet Shipments," August 5, 2013; Trendfocus, "HDD Shipments," August 2, 2013; Briel, Samsung Global Market Share," February 18, 2014.
[34] NPD DisplaySearch, "Global LCD TV Shipments," March 21, 2013; Gartner, "Gartner Says Worldwide PC Shipments," July 10, 2013; Fierce Wireless, "Analyzing the World's 12 Biggest," May 28, 2013; NPD DisplaySearch, "Global LCD TV Shipments," March 21, 2013; Microsoft, "Microsoft to Acquire," September 2013; IDC, "Tablet Shipments," August 5, 2013; Trendfocus, "HDD Shipments," August 2, 2013.
[35] IDC, "Top Global Telecom Networking Vendors," January 22, 2013.

Figure 2 The leading firms in each of the market segments account for a large share of the global market



Sources: Gartner, "Gartner Says," July 10, 2013; Fierce Wireless, "Analyzing the World's," May 28, 2013; Microsoft, "Microsoft to Acquire," September 2013; IDC. "Tablet Shipments," August 5, 2013; Trendfocus, "HDD Shipments," August 2, 2013; Briel, "Samsung Global Market Share," February 18, 2014.
Notes: HDD: Hard disk drives. U.S. firms are in blue, Asian firms in gray. PC data include desktop PCs and notebooks, but not tablets. In September 2013, Microsoft announced its acquisition of Nokia's devices and services business. Market share data presented here are prior to the acquisition.

Common Use of Contract Manufacturers

The use of electronic manufacturing services (EMS) firms (contract manufacturers) is common in some market segments of the three industry groups discussed here, though the extent of outsourcing can vary even within industry groups. In the communications equipment industry group, for example, many of the leading original equipment manufacturers (OEMs) outsource assembly of cellphones to contract manufacturers, such as Foxconn and Flextronics. These contract manufacturers may even produce the cellphones for different OEMs within the same facilities. Among global wired network equipment providers—another segment of the communications industry group—much of the manufacturing by multinationals is done by contract manufacturers,[36] though more sophisticated, customized, and higher-end products may be produced in-house.[37]

The largest EMS firms are primarily headquartered in Taiwan and the United States. Of the 16 EMS firms with at least $2 billion in revenue in 2012, nine were based in Taiwan and five in the United States. The largest firms in 2012 were Foxconn (headquarters in Taiwan, $106.0 billion in revenue), Quanta (Taiwan, $32.7 billion), Pegatron (Taiwan, $29.7 billion), Flextronics (United

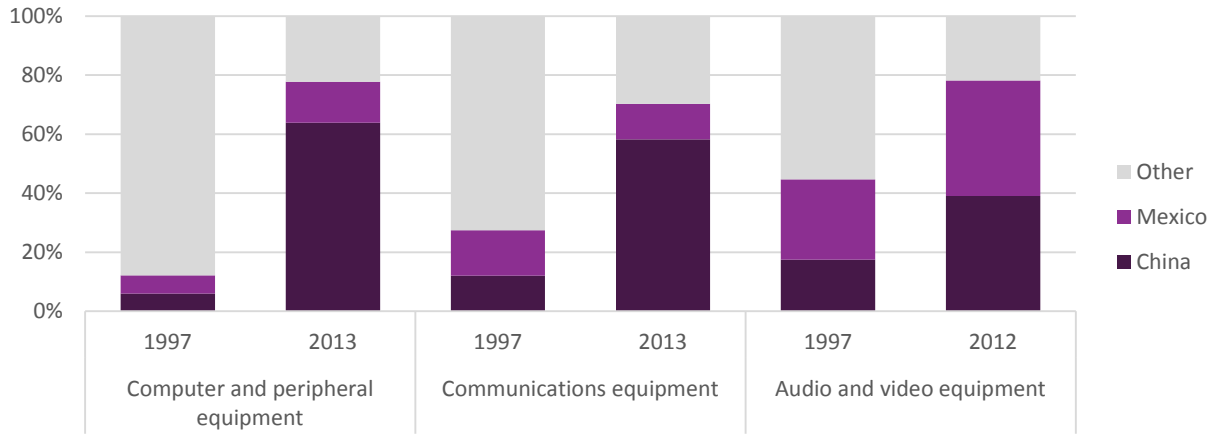
[36] Cisco, for example, does not directly manufacture, but relies on contract manufacturers to produce its products. Mahapatra, "Cisco to Set Up Center in India," December 6, 2006; Cisco, "10-K," year ending September 2012.
[37] Cohen, "Telecommunication Networking Equipment," May 2013.

States, $23.2 billion), Compal (Taiwan, $22.8 billion), Wistron (Taiwan, $22.0 billion), and Jabil Circuit (United States, $17.4 billion).[38]

Production in Low-cost Locations

Despite the presence of U.S.-headquartered firms among the leading OEMs and EMS firms, production in Asia and, for some products, Mexico, is common. In the computer and peripherals industry group, for example, companies have shifted production capacity from the United States, Japan, and Taiwan to China and, increasingly, India and Southeast Asia.[39] Within the communications equipment industry group, production tends to be concentrated in China, with a growing presence in Mexico as well, reflecting both the relatively lower labor costs of these countries and their proximity to large markets. More sophisticated higher-end network equipment, however—i.e., high-margin, customized products—may be produced in the headquarters country.[40] Most audio and video equipment is produced in Asia, with substantial production for the U.S. market also taking place in Mexico.[41] The strong and generally increasing presence of China and Mexico in manufacturing in the three industry groups is reflected in U.S. imports, with China and Mexico combined accounting for more than two-thirds of U.S. imports in all three industry groups in 2013 (figure 3).[42]

Figure 3 U.S. imports in the three industry groups are primarily from China and Mexico



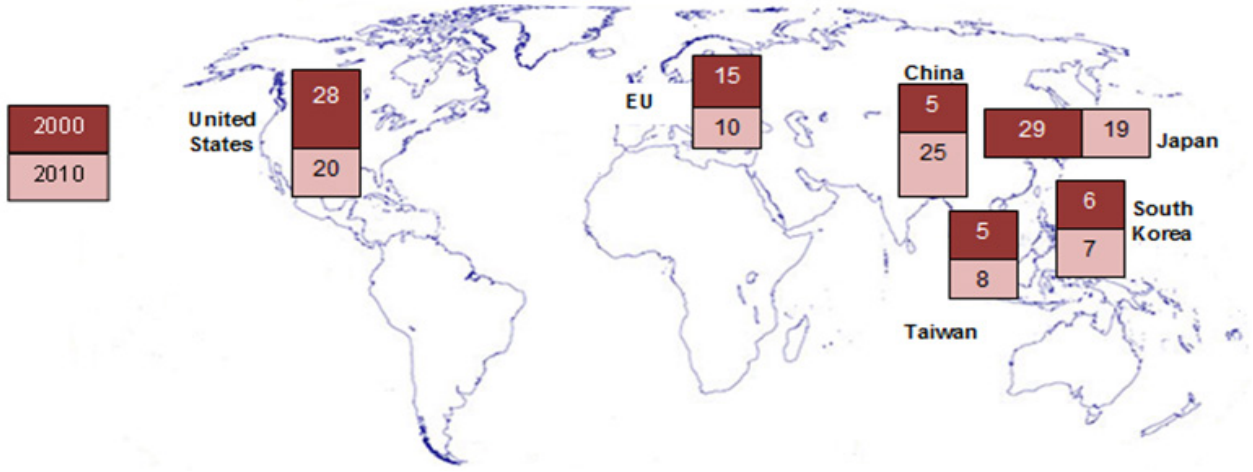
Source: USITC DataWeb/USDOC (accessed November 23, 2013).
Note: U.S. imports in NAICS 3341, 3342, and 3343.

[38] Revenue is not specific to the three industry groups discussed in this paper and may be derived from a wide range of industries. Buetow, "Bend, Don't Break," April 2013, 39.
[39] IBISWorld, "Global Computer Hardware Manufacturing," March 2013.
[40] Cohen, "Telecommunication Networking Equipment," May 2013.
[41] Cheng, "The Era of Japanese Consumer Electronics," November 9, 2012; USITC DataWeb/USDOC (accessed November 23, 2013).
[42] USITC DataWeb/USDOC (accessed November 23, 2013).

China Ascends the Value Chain

The United States' sizable advantage over China with respect to value-added production eroded over the decade from 2000 to 2010 (figure 4). In 2000 the United States accounted for 28 percent of global value added in global computer and electronic equipment manufacturing, but by 2010 the United States' share had declined to 20 percent and China's increased to 25 percent.[43] China's gains reflect the country's ascension up the value chain of production from low-value-added, labor-intensive goods, such as textiles and toys, to computers and electronics. This shift is reflected in the trade data as well; while textiles and toys once dominated U.S. imports from China, they are now nearly equaled by imports of computers and electronics.[44]

Figure 4 The U.S. ranked second in value-added production behind China in the global computers and electronic equipment manufacturing industry in 2010



Source: National Science Foundation, Science and Engineering Indicators 2012 (accessed September 24, 2013).
Note: These data include computer and electronic products industry groups that are not included in this paper.

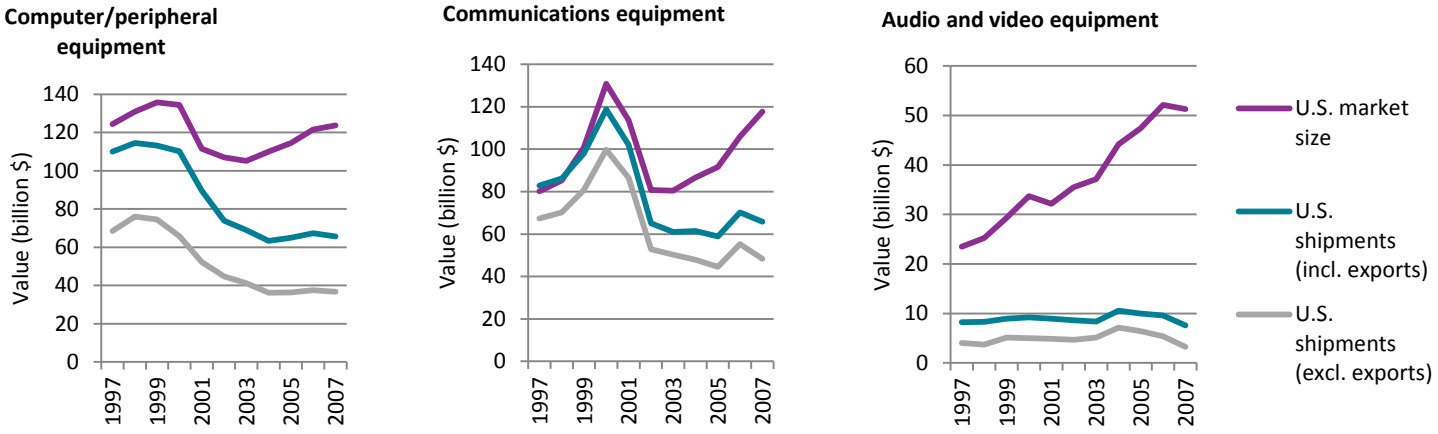
U.S. Production Did Not Recover from the 2001 Recession

U.S. shipments in all three computer and electronic product industry groups fell along with demand around the time of the 2001 recession, but did not recover following the end of the recession (figure 5). In all three industry groups, imports gained significant U.S. market share during 2002–07 as the gap between U.S. shipments and the size of the market widened.[45] The relatively poor performance of U.S. firms during this time period reflects a number of factors, including a shift in production and sourcing to Mexico and Asia; the downsizing and the closing of U.S. manufacturing plants; technology changes, such as the shift from cathode ray tubes to

[43] These data include computer and electronic products industry groups that are not included in this paper. McKinsey, *Manufacturing the Future*, November 2012.
[44] TD Economics, *Offshoring*, October 15, 2012.
[45] Economic Census and Annual Survey of Manufactures data from Census Bureau, American Fact Finder database, http://factfinder2.census.gov (accessed July–September 2013); Census Bureau, *Statistics for Industry Groups and Industries: 2001*, January 2013, 37–38; USITC DataWeb/USDOC (accessed September 22, 2013).

flat screen televisions; and—in the communications industry—the aftereffects of the telecom bubble.[46]

Figure 5 Shipments in the three industry groups remained well below levels prevailing before the 2001 recession



Sources: Economic Census and Annual Survey of Manufactures data from Census Bureau, American Fact Finder database, http://factfinder2.census.gov (accessed July–September 2013) and Census Bureau, Statistics for Industry Groups and Industries: 2001, January 2013, 37–38; USITC DataWeb/USDOC (accessed September 22, 2013).
Notes: Incl: including. Excl: excluding. U.S. shipments are of U.S.-produced goods. The difference between the blue and maroon lines is the market share of imports.

The Recent Recession Led to Substantial Declines in Shipments

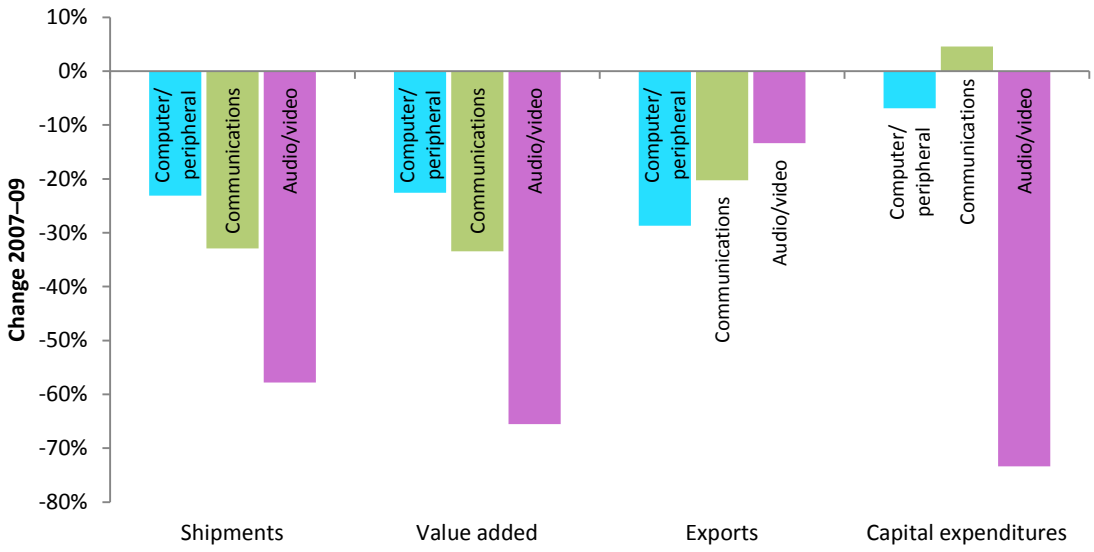
The 2007–09 recession generally led to further declines in shipments, value added,[47] capital investment, and exports across all three industry groups (figure 6). From 2007 to 2009, the

[46] In the telecom industry, regulatory changes and expanded demand growth from technology changes led to overinvestment and overcapacity. The subsequent bankruptcy of a number of telecom companies and factors such as large inventories of telecom equipment seriously damaged equipment suppliers. Neff, "Orion to Shut Down," May 2, 2006; Komo News, "Vancouver's Panasonic Plant," January 29, 2008; *Greenville Sun*, "Five Rivers' Equipment," April 1, 2009; Rees, "Hitachi to Lay Off," December 3, 2003; Mursch, "Hitachi Laying Off," November 30, 2006; *IBEW Journal*, "800 IBEW Members," January/February 2005; Prince and Plank, "A Short History," December 6, 2012; Starr, "The Great Telecom Implosion," September 9, 2002; Pounds, "Motorola to Close," January 23, 2004; *Amarillo Globe-News*, "Nokia to Shift Production," February 3, 2001; Fitchard, "Nokia to Close," October 16, 2006; Blumenstein, "For Telecom Workers, Burst Of Bubble Takes Heavy Toll," August 19, 2002; Couper, Hejkal, and Wolman, "Boom and Bust in Telecommunications," Fall 2003, 1–2.

[47] According to the Census Bureau, value added "is derived by subtracting the cost of materials, supplies, containers, fuel, purchased electricity, and contract work from the value of shipments (products manufactured plus receipts for services rendered). The result of this calculation is adjusted by the addition of value added by merchandising operations (i.e., the difference between the sales value and the cost of merchandise sold without further manufacture, processing, or assembly) plus the net change in finished goods and work-in-process between the beginning- and end-of-year inventories. For those industries where value of production is collected instead of value of shipments, value added is adjusted only for the change in work-in-process inventories between the beginning and end of year. For those industries where value of work done is collected, the value added does not include an adjustment for the change in finished goods or work-in-process inventories. 'Value added' avoids the duplication in the figure for value of shipments that results from the use of products of some establishments as materials by others." Census Bureau website, http://www.census.gov/manufacturing/asm/definitions/ (accessed November 12, 2014).

decline in shipments, value added, and exports was at least 20 percent in all three industry groups.[48] Capital expenditures also fell in computer and peripheral equipment. In communications equipment manufacturing, capital expenditures increased 58 percent from 2007 to 2008, then declined 34 percent in 2009. Many manufacturers closed U.S. plants in the three industry groups, in some cases bringing to an end all U.S. production of particular products. For example, several large plants producing desktop computers were closed during 2008–10, and in 2008–09 the last U.S. television receiver manufacturers closed their U.S. factories.[49]

Figure 6 The 2007–09 recession led to large decreases in U.S. economic activity in all three industry groups



Source: Annual Survey of Manufactures data from Census Bureau, American Fact Finder database (accessed July–September 2013).

Limited Onshoring in U.S. Computer and Electronic Product Manufacturing Post-Recession

There has not yet been a broad return of manufacturing in the computer and electronic industry groups analyzed. For these groups, aggregate post-recession trends mirror those that followed the 2001 recession—a sharp recession-induced drop in production followed by small production increases (in some sectors), with overall production remaining below pre-recession levels.[50] In 2013, U.S. shipments in these three industry groups combined were 43 percent

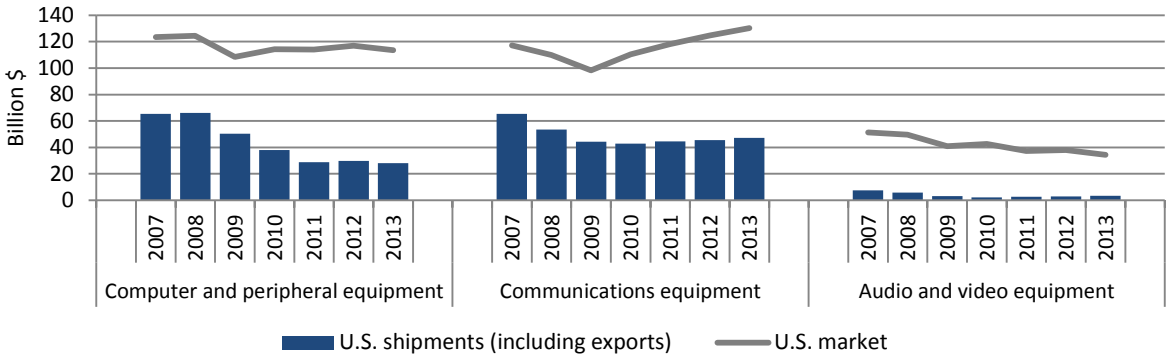
[48] Annual Survey of Manufactures data from Census Bureau, American Fact Finder database (accessed July–September 2013).
[49] Hachman, "Dell to Close," April 1, 2008; *Austin Business Journal*, "Dell Closes," September 13, 2010; Semmes, "Sony to Close," December 9, 2008; Komo News, "Vancouver's Panasonic Plant," January 29, 2008.
[50] For example, 48 months after the last month of the 2001 recession, combined U.S. shipments in the three industry groups remained 42 percent below shipment levels in the last month before the start of the recession. Shipments 48 months after the last month of the Great Recession were 39 percent lower. Based on seasonally adjusted data. Census, "Manufacturers' Shipments, Inventories, and Orders," historical time series Excel spreadsheet (accessed January 10, 2014).

below 2007 levels, and combined U.S. exports were 17 percent lower.[51] However, certain companies, including Apple and Lenovo, have made notable investments in new plants in the United States. Further, some already-noted emerging trends are contributing to onshoring among these groups, including the benefits of being in close proximity to customers as well as to the company's headquarters, R&D facilities, and engineering staff. When manufacturing is coming back to the United States, it is often through contract manufacturers. For example, Apple's Mac Pro desktop computer is being assembled in Texas by Flextronics.

The U.S. Computer, Communications, and Audio and Video Industries Have Not Recovered From the Recession

In the three industry groups, U.S. shipments have seen little improvement during the recovery (figure 7). In 2013, U.S. shipments of computer and peripheral equipment were down 57 percent from 2007; communications equipment, 28 percent; and audio and video equipment, 55 percent. While shipments of communications equipment and audio and video equipment have rebounded somewhat from their lowest production levels during 2007–13, shipments of computer and peripheral equipment continue to decline. This continued decline likely reflects, at least in part, the closure of U.S. manufacturing plants during the recession (as noted earlier) and decreasing U.S. demand. U.S. production of computers (NAICS U.S. industry 334111) fell by 86 percent during 2007–13. This was somewhat offset by computer storage device manufacturing (NAICS U.S. industry 334112), in which U.S. shipments increased 41 percent during 2007–13.

Figure 7 U.S. shipments remain below pre-recession levels

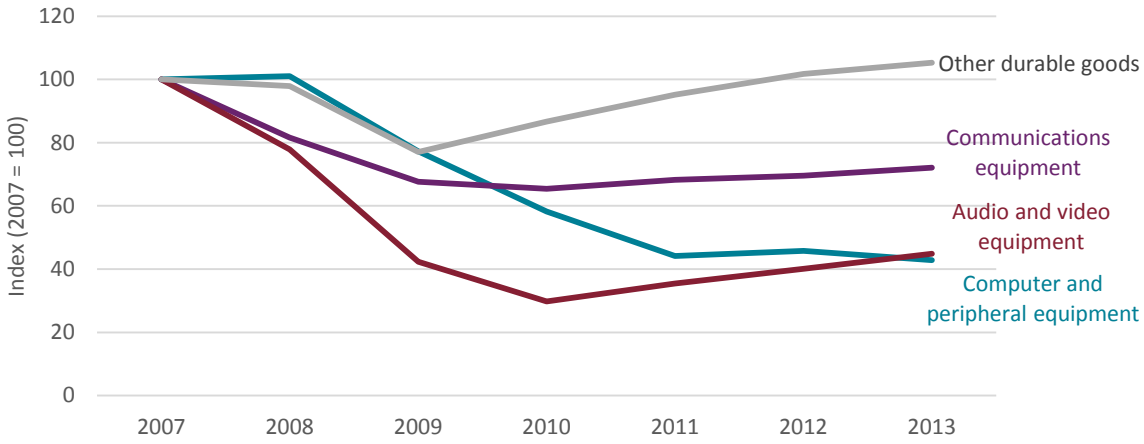


Source: Census, "Manufacturers' Shipments, Inventories, and Orders," (accessed January–February 2014); USITC DataWeb/USDOC (accessed January 10, 2014 and February 16, 2014).
Note: All values are nominal. Annual shipment data are the sum of monthly (not seasonally adjusted) value.

[51] The substantial decline in shipments by these three industry groups combined during 2007–13 contrasts with the trend in the durable goods sector overall, where 2013 shipments exceeded 2007 levels. Census, "Manufacturers' Shipments, Inventories, and Orders," historical time series Excel spreadsheet (accessed January 10, 2014 and February 16, 2014).

U.S. shipments in these three industry groups have also performed worse than total shipments of all other durable goods (figure 8).[52] U.S. shipments in all other durable goods industry groups combined exceeded pre-recession levels by 2012. Shipments of computer and peripheral equipment, communications equipment, and audio and video equipment, however, remain well below pre-recession levels.[53]

Figure 8 U.S. shipments in these industry groups have performed worse than other durable goods industries

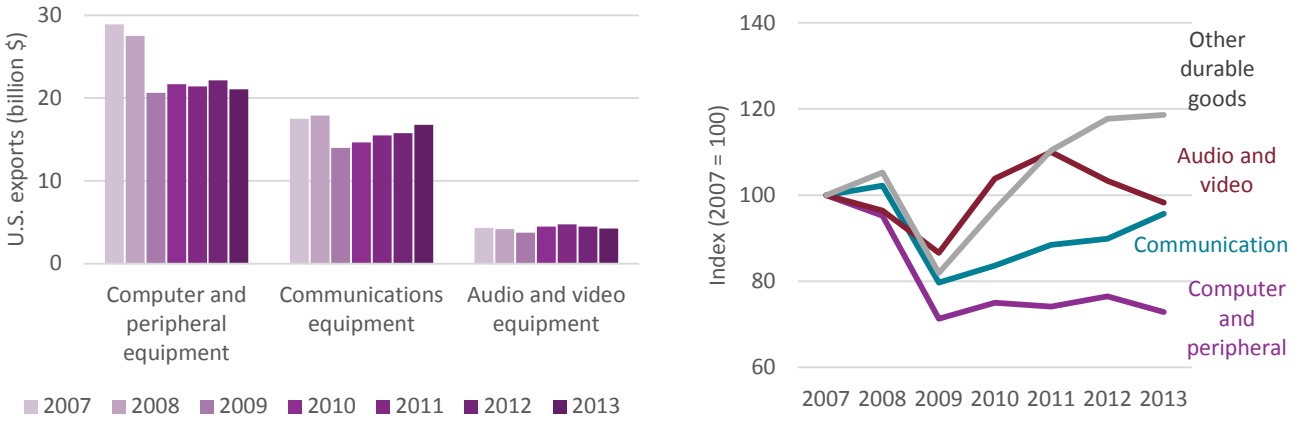


Source: Census, "Manufacturers' Shipments, Inventories, and Orders," (accessed January–March 2014).
Note: "Other durable goods" includes all durable goods except those in NAICS 3341, 3342, and 3343.

Similarly, U.S. exports of products in these three industry groups generally remain low compared to pre-recession levels (figure 9). U.S. computer and peripheral equipment exports in 2013 were 27 percent below 2007 levels, and have declined every year except 2012. Communications equipment exports were 4 percent lower in 2013 than in 2007, but have gradually increased since their 2009 low. Audio and video equipment exports in 2010 surpassed pre-recession levels, but subsequently declined annually and in 2013 were 2 percent below 2007 levels. Export trends in these industry groups are different from those in all other durable goods combined, which were up 19 percent from pre-recession levels.[54]

[52] References to other durable goods are to all durable goods except those in 3341, 3342, and 3343 that are the subject of this paper.
[53] Census, "Manufacturers' Shipments, Inventories, and Orders," (accessed January–March 2014).
[54] USITC DataWeb/USDOC (accessed November–March 2014).

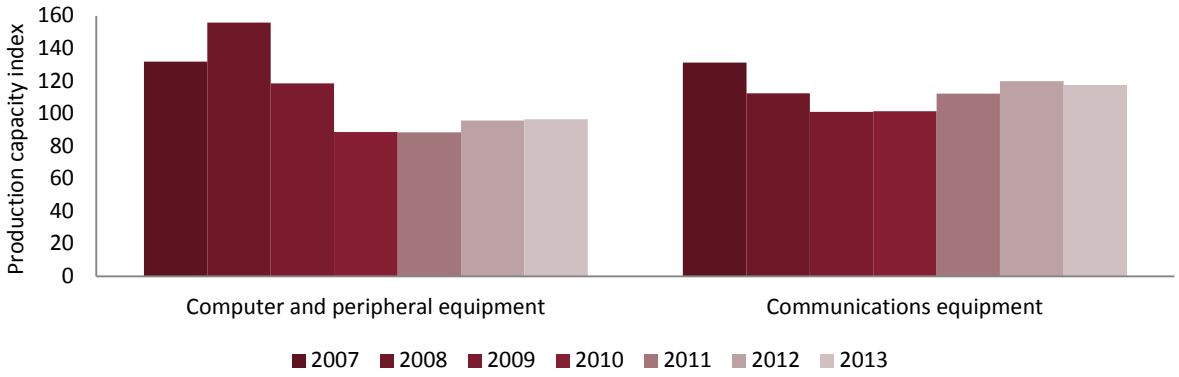
Figure 9 U.S. exports of computer and peripheral equipment and communications equipment in 2013 were below pre-recession levels



Source: USITC DataWeb/USDOC (accessed November–March 2014).\

Production capacity for computer and peripheral equipment and communications equipment manufacturers has increased since the end of the recession, but remains below pre-recession levels (figure 10). In the computer and peripheral equipment industry group, 2013 capacity was 27 percent below 2007 levels, reflecting in part the closure of manufacturing plants, as noted earlier. In the communications equipment group, production capacity in 2013 was down 10 percent from 2007, but increased during 2009–13 to above 2008 levels.[55]

Figure 10 Production capacity is slowly increasing from lows during the recession



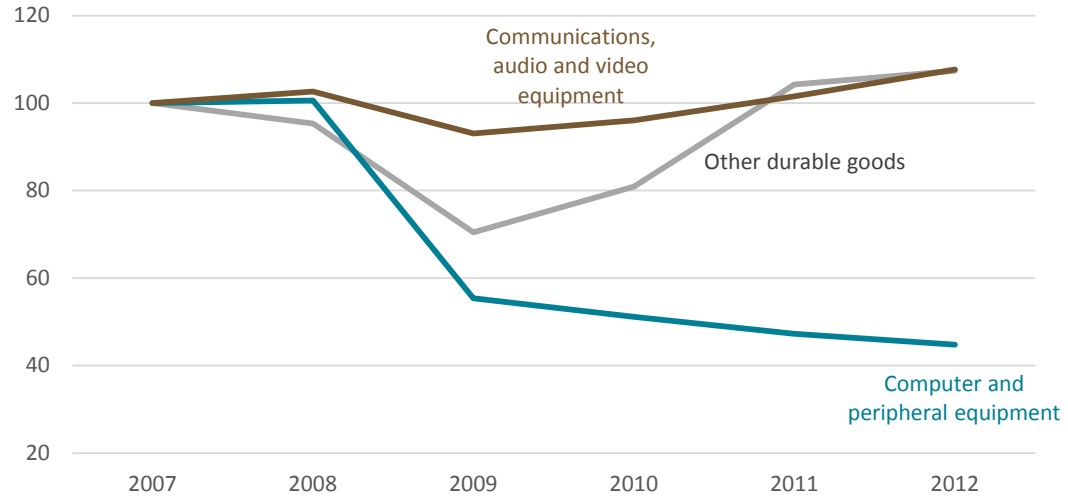
Source: Federal Reserve, "G.17—Industrial Production and Capacity Utilization" (accessed November 3, 2013 and February 16, 2014).

Note: Production capacity index is based on the percent of production in 2007, with 2007 production equal to 100. Production is the estimated value added. For more details on the Federal Reserve's methodology, see http://www.federalreserve.gov/releases/G17/About.htm. The Federal Reserve data set does not include data on production capacity for audio and video equipment.

[55] Production capacity data for the audio and video equipment industry group are not available. Federal Reserve, "G.17—Industrial Production and Capacity Utilization" (accessed September 18, 2013, and November 3, 2013).

Data on capital expenditures presents a mixed picture of investment trends in these industry groups (through 2012) (figure 11). In the computer and peripheral equipment industry group, capital expenditures fell in 2009 and have continued to decline. In the communications and audio and video equipment industry groups combined, capital expenditures fell less precipitously than in other durable goods during the recession. In 2011 and 2012, combined capital expenditures in these two industry groups exceeded pre-recession levels, and were comparable to other durable goods industry groups.[56]

Figure 11 Computer and peripheral equipment capital expenditures are falling, while communications and audio and video equipment capital expenditures are rising



Source: Census, Annual Capital Expenditures Survey (accessed March 2014).

Notes: Total capital expenditures, including expenditures on new and used structures and equipment. Separate data are not available from this survey for communications and audio and video equipment manufacturing. "Other durable goods" includes all durable goods except those in NAICS 3341, 3342, and 3343.

Some Firms are Investing in U.S. Production

There is some evidence of increasing manufacturing activity in the three computer and electronic product industry groups moving forward, based on recently opened and expanded manufacturing plants and announced investments. It is unlikely, though, that the investments announced so far will offset the decline discussed in the prior section for the three industry groups.[57] As mentioned earlier, among the firms that have announced new investments in U.S.

[56] "Other durable goods" in this paragraph refers to all durable goods except those in NAICS 3341, 3342, and 3343. Census, Annual Capital Expenditures Survey (accessed March 2014).

[57] This section discusses investments in U.S. manufacturing, but does not discuss firms that have decided to shutter U.S. production and/or open new plants in foreign locations rather than the United States. Therefore, it does not try to assess the net change in manufacturing production (whether more production is moving into the United States than is being offshored). The purpose of this section is to examine whether firms are investing in U.S. production and, if so, discuss the types of plants that are being opened. Further, this section is meant to be more forward looking than the previous section as many announced manufacturing investments may not yet be reflected in production data, and will set up the discussion in the next section on why firms have invested in U.S. production.

production are large companies such as Apple and Lenovo. Two notable trends distinguish the companies locating new production in the United States: (1) the majority of investments are by U.S.-headquartered companies, and (2) many of the companies are making widespread use of contract manufacturing. Of the 11 firms investing in U.S. production that are discussed here, 9 are U.S.-headquartered, and many are starting production at least in part through contract manufacturers rather than in-house production. It should also be noted that these firms' decisions to produce in the United States do not necessarily mean that they are lessening their production activities overseas.[58]

The remainder of this section discusses recently opened and expanded manufacturing plants to assess the extent to which firms are investing in U.S. manufacturing. This qualitative analysis is included to supplement the quantitative analysis above as these investments may not have been captured in more recent production data. This section only includes plant openings and not any plant closings in the same industry, therefore it does not assess whether investments in new plants exceeds the pace of plant closures or capacity reductions.

In the computer and peripheral equipment industry group, new investments by HP, Lenovo, and Apple are especially prominent. These investments mean that three of the four largest suppliers of personal computers to the United States now have U.S. production, though they will likely continue to source a large share of production from overseas.[59] Apple contract manufacturer Flextronics started producing the Apple Mac Pro desktop computer in Texas in 2013 (table 2). Apple expected investment in the plant to total $100 million, and Flextronics indicated that it would hire more than 800 workers.[60] Lenovo invested $2 million in a production line in North Carolina, starting production in January 2013 and employing 300 people as of January 2014. As of June 2013, Lenovo expected to produce desktop computers, notebook computers, and a tablet, with server production to be added by the end of the year, and a goal of producing several hundred thousand units in the first year. Lenovo has indicated that it could further scale up production at this plant.[61] HP currently makes domestically 36

[58] For example, NCR moved its production of ATMs for the U.S. market from China, India and Hungary to the United States in 2009. NCR indicates that its current approach is to serve large markets from local plants. The firm indicates that demand in China is growing faster than demand in the United States, and as of 2012 was planning to increase production capacity at its China plant (which also serves other countries in the Asia-Pacific region). Similarly, Hon Hai Precision Industry Co. indicated that its new plant in Pennsylvania for telecommunications equipment components will not replace Chinese production. Hon Hai is also "expanding manufacturing in lower-cost inland China, building facilities in the central and western provinces of Chengdu, Wuhan and Zhengzhou," and is also reportedly considering significant manufacturing investments in Indonesia. Lenovo, which has started U.S. production, is also expanding production in inland areas of China. In December 2013, "Lenovo opened its new hub for research, development and production of smartphones and tablets in the central Chinese city of Wuhan, after it spent $800 million to build the 200,000 square-meter facility." Boris, Tung, and Qiu, "Companies Have Home Thoughts," July 11, 2012; Wingfield and Varghese, "Apple Supplier Foxconn," November 22, 2013; Osawa and Mozur, "The Rise of China's Innovation Machine," January 16, 2014; Luk, "Hon Hai Profit Rises," March 28, 2014; Otto, "Foxconn Takes a Shine to Jakarta," February 7, 2014.

[59] Gartner, "Gartner Says Worldwide PC Shipments," October 9, 2013.

[60] UPI, "Apple Picks Texas," May 22, 2013; Owens, May, and Wolverton, "Apple's 'Made in the USA Model,'" June 10, 2013; Zehr, "Apple Confirms Mac Pro Production has Started in Austin," December 18, 2013.

[61] Stern, "Lenovo Paves," June 5, 2013; Craver, "After Dell's Departure," June 11, 2013; Lani, "Lenovo Announces Restructuring," January 28, 2014.

percent of the commercial desktop PCs and all of the workstation PCs that it sells in the United States. The company has indicated that it has brought back at least a small share of personal computer manufacturing to North America—though it did not specify whether it was brought back to the United States.[62]

Table 2 Opened and announced new computer and peripheral equipment plants, United States, 2009–March 2014

Company	Company HQ location	Contract manufacturer	Plant location	Product	Planned opening/ start of production
AMD/SeaMicro	Santa Clara, CA	NBS	Santa Clara, CA	Servers	2011
Apple	Fremont, CA	Flextronics	Austin,TX	Mac Pro desktop	2013
Chassis Plans	San Diego, CA	None	Scripps Ranch, CA	Rackmount computer	2009
Google[(a)]	Mountain View, CA	Foxconn	Santa Clara, CA	Google Glass	2013
Hon Hai Precision Industry Co. (Foxconn)	New Taipei City, Taiwan	[(b)]	Harrisburg, PA	Components for Internet servers	[(c)]
Lenovo	China	None	Whitsett, NC	Notebook and desktop PCs, tablets, and servers	2013
NCR	Duluth, GA	None	Columbus, GA	ATM	2009
Xerox	Norwalk, CT	None	Canandaigua, NY	Document scanners	2014

Source: Compiled by USITC staff; Fontevacchia, "Google Glass Ray-Bans?" March 25, 2014; Luxottica, "Google and Luxottica Announce," March 24, 2014.

Notes:

[a] In March 2014, Google announced an agreement with Luxottica to "establish a team of experts devoted to working on the design, development, tooling and engineering of Glass products…" Google further indicated that Luxottica would "have a significant role in the manufacturing of Glass-related frames." There is no information available as to whether these products will be made in the United States and whether Google will continue to make Google Glass products domestically.

[b] Hon Hai has indicated that its production in Pennsylvania is not for a particular firm.

[c] Not available.

[62] HP website, http://h30507.www3.hp.com/t5/Data-Central/HP-PCs-Built-in-the-USA/ba-p/127945#.UkCtnT-8QoM (accessed September 23, 2013); Crothers, "HP to Apple," December 7, 2012.

There have also been investments in production in the computer and peripheral equipment industry group by firms other than the large suppliers of personal computers. Xerox announced in December 2013 that it would "relocate capital equipment used in the manufacturing of advanced document scanning equipment from China" to a facility in New York and hire 100 workers.[63] Chassis Plans opened a manufacturing plant in San Diego in 2009. This facility, which is larger than its previous plant, makes rackmount computers and liquid-crystal display (LCD) products that Chassis Plans sells to industrial and military customers.[64]

Similarly, in the communications equipment industry group,[65] Hon Hai is also establishing U.S. production of telecommunications equipment components (table 3). The company is planning to invest $30 million in a plant in Pennsylvania that will focus on "high-precision, high- tech, high value-added manufacturing."[66] At least one smaller communications equipment company, U.S.-based HM Electronics, brought operations from China and Mexico back to the United States in 2009, and produces the majority of its equipment in-house.[67]

Table 3 Opened and announced new communications equipment plants, United States, 2009–March 2014

Company	Company HQ location	Contract manufacturer	Plant location	Product	Planned open/ start of production
HM Electronics	Poway, CA	None	CA	Headsets, intercom devices	[a]
Hon Hai Precision Industry Co. (Foxconn)	New Taipei City, Taiwan	[b]	Harrisburg, PA	Components for telecommunications equipment	[a]

Source: Compiled by USITC staff.
[a] Not available.
[b] Hon Hai has indicated that its production in Pennsylvania is not for a particular firm.

One high profile example of onshoring was the assembly in Texas (by Flextronics) of Motorola Mobility's Moto X cellphone.[68] The new assembly operation was expected to create around 2,000 jobs in 2013.[69] Motorola Mobility also intended to encourage suppliers to relocate to the United States to increase domestic content, as well as to achieve other benefits such as supply chain cost reductions, shorter time to market, and a more rapid pace of product innovation.[70] In May 2014, however, it was announced that the plant would close, with company officials

[63] Spector, "Xerox to Move," December 18, 2013.
[64] Chassis Plans had revenue of $11.3 million in 2012. Inc. website, Inc. 5000, http://www.inc.com/profile/chassis-plans (accessed September 24, 2013); Chassis Plans, "Chassis Plans Opens," December 21, 2009.
[65] In addition to the plants discussed here, Chinese company Wirelessor announced plans in January 2014 to open a manufacturing plant and distribution center in Nevada for cell phone chargers. However, these products may be classified in a different NAICS code. Barris, "Wireless Charger Maker," January 14, 2014.
[66] Wingfield and Varghese, "Apple Supplier Foxconn," November 22, 2013; Luk, "Hon Hai Considers Investment," November 22, 2013.
[67] Malloy, "Some Local Manufacturers," December 1, 2009; HM Electronics Web site, http://www.hme.com/qsr/location/ (accessed September 23, 2013).
[68] MacMillan, "Google's Motorola," May 30, 2013.
[69] Svensson, "Motorola Unveils," August 1, 2013.
[70] Industry representative, telephone interview by USITC staff, September 16, 2013.

citing the low sales volumes for the phone and high production costs due to high labor and shipping costs and a lack of economies of scale.[71]

The audio and video equipment industry group has likely seen the lowest level of post-recession investment in U.S. production, though even in this sector there is some anecdotal evidence of new plants coming online (table 4). Element Electronics, through contract manufacturer Lotus International, began producing LCD television receivers 46 inches and larger in Michigan in 2012.[72] Element Electronics has opened a $7.5 million television receiver plant in South Carolina that reportedly will employ 250 people in the first year, though no information is available on whether this will supplement or replace production in Michigan.[73] Hon Hai is reportedly considering opening a television receiver assembly plant in Arizona, but has not announced a final decision.[74] In addition, U.S. company Sleek Audio brought back production of audio earphones from China to a contract manufacturer in Florida in 2010.[75]

Table 4 Opened and announced new audio and video equipment plants, United States, 2009–March 2014

Company	Company HQ location	Contract manufacturer	Plant location	Product	Planned opening/ start of production
Element Electronics[a]	Minneapolis, MI	Lotus International Co.[b]	Canton, MI	LCD television receivers	2012
			Winnsboro, SC	LCD television receivers	2013[c]
Sleek Audio	Bradenton, FL	Dynamic Innovations	Palmetto, FL	Earphones	2010

Source: Compiled by USITC staff.

Notes:

[a]It is not clear if Element Electronics' plant in South Carolina will be in addition to its plant in Michigan or will replace this plant.

[b]No information is available on whether this plant will be operated by a contract manufacturer.

[c]Planned opening date.

Reasons for Investment in U.S. Manufacturing Plants

There are several reasons why companies have chosen to expand production and invest in the United States. First, firms perceive advantages in being close to the market, including the ability to customize products for individual consumers and deliver them more quickly to customers; lower supply chain costs due to the need to maintain less inventory; and their ability to market products as made in the United States. Second, firms see advantages in locating production close to engineering, headquarters, and centers of innovation in order to quickly incorporate changes in design into their products and maintain better control of quality and the supply

[71] It is not clear if the pending sale of Motorola Mobility from Google to Lenovo was also a factor. Cho, "Motorola Smartphone Factory," May 30, 2014.

[72] Berezowsky, "Element Electronics," January 26, 2012; Himango and Tibbles, "Assembled in America," April 25, 2012.

[73] Crumbo, "TV Manufacturer," August 24, 2013.

[74] Luk, "Hon Hai May Make TVs," November 10, 2013.

[75] Koerner, "Made in America," February 28, 2011.

chain. Third, producing in the United States reduces transportation costs, though it is not clear whether it cuts them enough to lower product costs overall.

Proximity to the Market

A primary reason why firms are investing in U.S. production is the ability to customize products and rapidly deliver them to customers. Lenovo, for instance, indicated that its new manufacturing plant in North Carolina will produce customized products that will be delivered to customers faster. The firm said that the speed with which it can deliver these customized products to customers is an important competitive factor, and that shipping by boat can take up to six weeks.[76] HP also makes its commercial desktop and workstation PCs in Indianapolis because they tend to be customized, higher-value computers. By producing domestically, HP stated that it can address customers' preferences more effectively and deliver the products more quickly.[77] Some of the smaller companies that have expanded production in the United States also make highly customized products. Chassis Plans, as mentioned earlier, makes customized rackmount computers for its military and industrial customers.[78]

Reducing the time to market can also be an important consideration for firms that do not customize products. Sleek Audio, which moved production of audio headphones from China to the United States in 2010, stated that it sought to lower inventory costs by minimizing the time for shipping from factory to customer.[79]

Firms may also seek to realize a benefit from being able to label their product as made in the United States. For example, Lenovo has indicated that its ability to market products as made in the United States will give it a competitive advantage.[80] Motorola Mobility closed its U.S. plant, but also sought to benefit from selling products domestically produced products, launching a a marketing campaign touting the fact that the phone was "designed, engineered, and assembled in the USA."[81]

Proximity to Engineering, Headquarters, and R&D

Firms are increasingly producing in the United States to locate production close to engineering, which facilitates rapid changes in design or production. For example, AMD subsidiary SeaMicro located its server production (which is done by NBS) nearby, at least in part to be able to quickly incorporate innovations into products. This closeness also enables SeaMicro to rapidly address problems or make changes to the manufacturing process.[82] Deciding to take advantage

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[76] Booth, "Here, There, Everywhere," January 19, 2013; Stern, "Lenovo Paves," June 5, 2013; Craver, "After Dell's Departure," June 11, 2013; Inge, "First U.S. Assembly Plant," June 6, 2013.
[77] HP website, http://h30507.www3.hp.com/t5/Data-Central/HP-PCs-Built-in-the-USA/ba-p/127945#.UkCtnT-8QoM (accessed September 23, 2013); Crothers, "HP to Apple," December 7, 2012.
[78] Chassis Plans website, http://www.chassis-plans.com/ (accessed September 25, 2013).
[79] Koerner, "Made in America," February 28, 2011.
[80] Stern, "Lenovo Paves," June 5, 2013.
[81] Industry representative, telephone interview by USITC staff, September 16, 2013; Chen, "Motorola Ad," July 2, 2013.
[82] SeaMicro also indicates that producing products close to its headquarters enables them to customize products for purchasers more quickly. Metz, "As Apple Toils in China," February 13, 2012.

of proximity is also common with early-stage or prototype products, where engineers may make changes in the initial stage production runs. For example, the *Financial Times* has reported that one of the reasons that Google will produce its Google Glass close to the company's headquarters is so that engineers can make changes in response to any problems that arise.[83] For NCR, proximity to customers (as discussed above), engineering, and suppliers are all interrelated, as all this allows customers and suppliers to have input into the design process and for NCR to then make these changes and get products to customers more quickly.[84]

At least one non-U.S. firm, Hon Hai, is also investing in the United States to be closer to U.S. R&D facilities. Hon Hai is investing in Pennsylvania, according to the *Wall Street Journal*, "to improve its profitability by making more high-end technology products."[85] Hon Hai is also seeking to increase the level of automation in its plants generally, and is funding $10 million in automation R&D at Carnegie Mellon, which is part of a robotics cluster in the Pittsburgh area. It is likely that the presence of the robotics cluster is encouraging Hon Hai's investments in Pennsylvania.[86]

Firms have also relocated production to the United States in an effort to improve quality control and to better manage the supply chain. For instance, Sleek Audio brought production of audio headphones to the United States in part to alleviate problems with missing production deadlines, leading to the need for air freight delivery, and to alleviate quality control issues by moving the factory closer to management, where quality could more easily be monitored.[87] HM Electronics brought most of its production back to the United States from China and Mexico in order to have better control of materials and inputs.[88]

Costs

Transportation costs appear to be a consideration for firms in choosing to locate production in the United States. For example, the CEO of Element Electronics has stated that it is more cost effective to produce TVs 46 inches and larger in the United States due to transportation costs and tariffs.[89]

For the companies examined here, information on production costs is limited and sometimes contradictory. Thomas Looney, general manager of Lenovo's North American operations, stated in June 2013 that "[w]hile we [the United States] have not totally closed the cost gap versus other countries, we're now in range."[90] *China Daily,* however, summarized reasons given by

[83] Bradshaw, "Google Glass," March 27, 2013.
[84] Georgia Department of Economic Development, "How NCR Consolidated," November 2010; Davidson, "Some Manufacturing," August 6, 2010.
[85] Luk, "Hon Hai Considers," November 22, 2013.
[86] Wingfield and Varghese, "Apple Supplier Foxconn," November 22, 2013; Luk, "Hon Hai Considers," November 22, 2013; Mozur and Dou, "Robots May Revolutionize," September 24, 2013; Holstein, *The Next American Economy,* n.d., location 570-585.
[87] Koerner, "Made in America," February 28, 2011.
[88] Malloy, "Some Local Manufacturers," December 1, 2009.
[89] Himango and Tibbles, "Assembled in America," April 25, 2012; Berezowsky, "Element Electronics," January 26, 2012.
[90] Craver, "After Dell's Departure," June 11, 2013.

Lenovo Chairman and CEO Yang Yuanqing for locating production in the United States as the fact that the "'long-term strength' and growth potential of the PC market in the United States outweighed the relatively high labor cost in domestic manufacturing."[91] According to Flextronics, the cost of labor at its cellphone plant in Texas was about $12 to $14 per hour, compared to $4 per hour in China.[92] Motorola Mobility announced in May 2014 that it would close its U.S. plant, citing—in part—the high production costs due to high labor and shipping costs and a lack of economies of scale since resulting from low sales volume.[93] Sleek Audio's earphones cost 50 cents more to make in the United States than in China, according to media reports, but following its shift of audio headphone production from China to the United States in 2010, it projected 2011, the first full year for U.S. production, to be its most profitable.[94]

Conclusion

There is little evidence of onshoring in computer and electronic equipment manufacturing during 2009–13. For most of the metrics examined in this paper, including shipments and investment, levels have generally failed to reach those achieved before the recession, despite rebounding somewhat in recent years. Nevertheless, within the three industry groups discussed in this paper, several large manufacturing firms—especially in the computer and peripheral equipment industry group—have made notable investments since 2009, sometimes through contract manufacturers as opposed to in-house production. The reasons for onshoring cluster around a few strategic drivers, including manufacturing in close proximity to customers, which facilitates quick delivery and product customization; reducing supply chain costs in order to maintain smaller inventories; locating production near engineers and management to quickly implement design changes and achieve better quality control; and lowering total transportation costs. However, to date, these investments have not necessarily translated into a reduced presence overseas. Additional research is needed to shed more light on whether these investments are the start of a new trend that reverses years of offshoring and outsourcing, or merely reflect a limited post-recession rebound.

[91] Zhang, "Lenovo Adds PC Production," October 4, 2012.
[92] Oreskovic, "Motorola Now Shipping," September 10, 2013.
[93] Cho, "Motorola Smartphone Factory," May 30, 2014.
[94] Koerner, "Made in America," February 28, 2011.

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