

## Made In America: Computer and Electronic Products

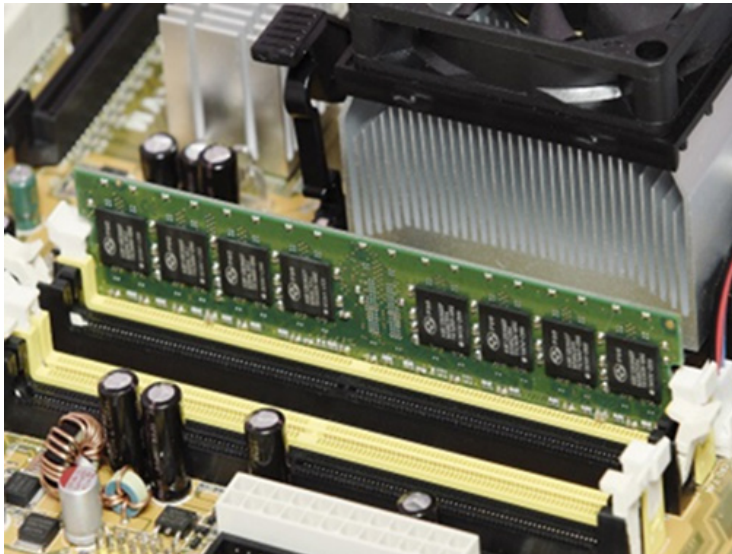
By Adjii Fatou Diagne, Pathways Economist

Edited by Jane Callen

In 2012, shipments from the U.S. manufacturing sector totaled \$5.7 trillion.<sup>1</sup> So, what do we make in the United States? This series of manufacturing profiles will answer that question one industry at a time. This seventh profile focuses on computer and electronic products.<sup>2</sup> Previous profiles focused on [machinery](#); [food, beverages and tobacco products](#); [transportation equipment \(excluding motor vehicles\)](#); [chemicals](#); [apparel, leather, and allied products](#); and [petroleum and coal products](#).

One interesting fact about the computer and electronic products industry is that it employs a higher share of engineers (16 percent) than any other manufacturing industry, resulting in products that are highly innovative and dynamic. The constant introduction of new and better technology and design has resulted in unusual price trends for the industry's products (see Box 1). Also of note, is that consumers and businesses have increasingly looked overseas to satisfy their demand for computer and electronic products, as reflected by the industry's high trade deficits: the 2014 deficit of \$241.7 billion is among the highest in U.S. manufacturing industries.

As we continue to profile the various manufacturing industries, we will deepen our understanding of what is made in America and how it affects the economy as a whole.



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## Overview

According to the North American Industry Classification System (NAICS), the computer and electronic products industry engages in the production and assembly of computers, computer peripherals (including items like printers, monitors, and storage devices), communications equipment (such as wired and wireless telephones), and similar electronic products



(including audio and video equipment and semiconductors). It also includes establishments that manufacture components for these products.<sup>3</sup>

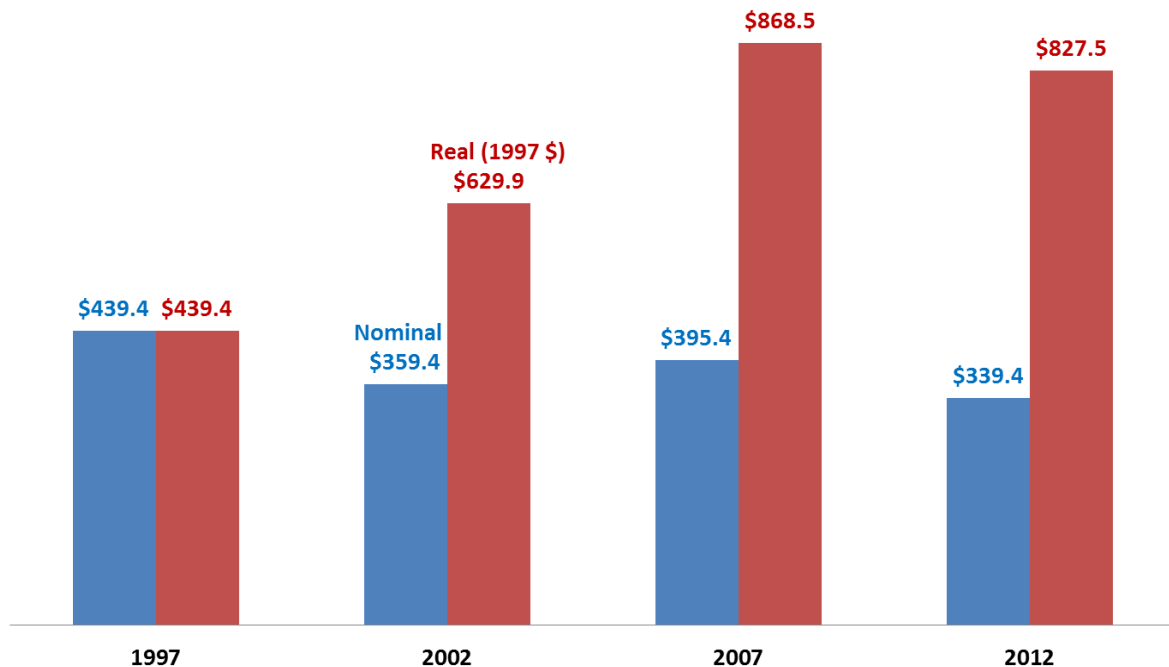
Production in this industry relies on highly innovative technology, such as specialized processes using integrated circuits, and new technology is continuously incorporated into designs to make products in this industry faster, smaller, and more powerful.<sup>4</sup> Research and development from this industry has been responsible for much of the productivity growth throughout manufacturing since the late 1990s. Electronic products other than computers account for the vast majority of current output; although U.S. factories turn out very few PCs, they are major producers of semiconductors and search and navigation equipment — including aircraft instruments, flight recorders, and navigational instruments and systems.

### Box 1: Price Trends in the Computer and Electronic Products Industry

Quality-adjusted prices for computers have declined considerably over the past few decades.<sup>5</sup> A \$500 computer today has far more computing power and is smaller, lighter, and faster than a \$500 computer a decade ago. To account for these improvements in quality we use a “hedonic price index” to measure relative price changes while holding quality and characteristics constant.<sup>6</sup> For example, a measure often included in the index for speed is the number of instructions per second performed by a computer.<sup>7</sup>

Unlike price indexes for most manufactured goods, the price indexes for computers and electronic products have declined consistently and sharply from 1997 (when data are first available) through 2012.<sup>8</sup> During this period, the nominal value of shipments decreased by 23 percent. However, because every dollar spent on a computer in 2012 bought you more computing power than it did in 1997, the real value of shipments over this time actually increased by 88 percent.

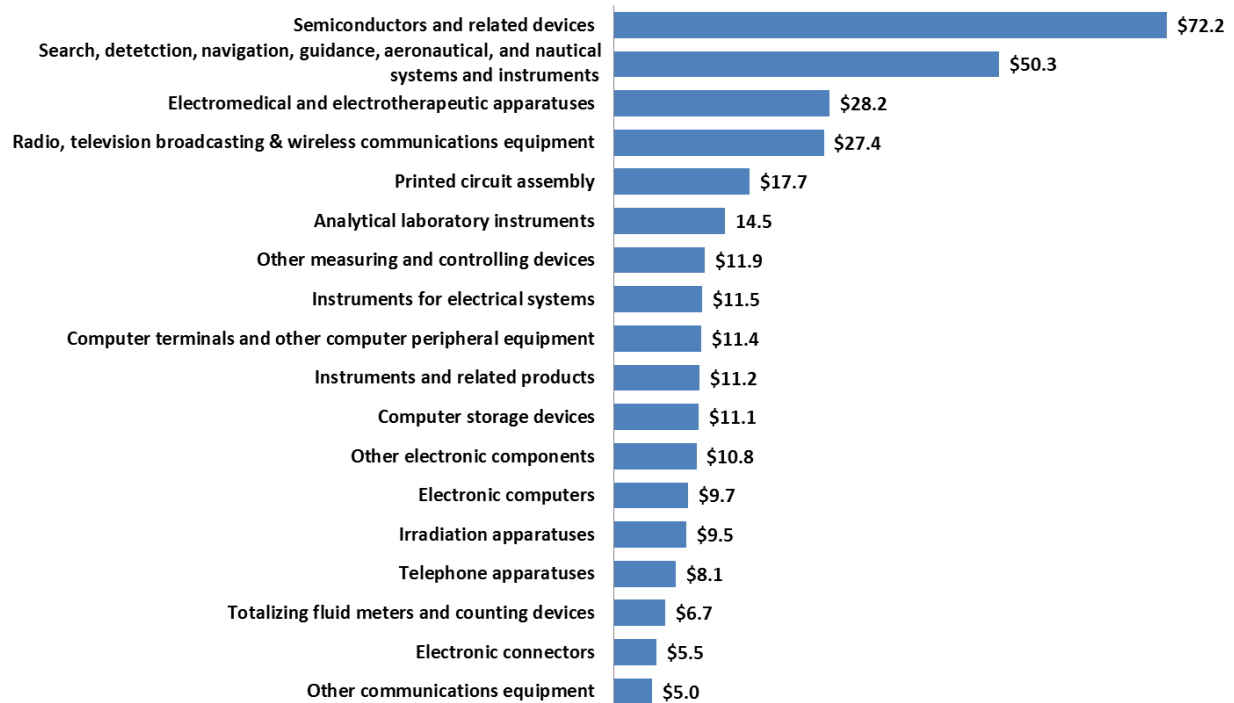
**Box Figure 1. Value of Shipments in Computer and Electronic Product Manufacturing, Nominal and Real (1997 \$) (billions)**



Note: BEA chain-type price index for gross output by industry used to calculate real value of shipments as reported by the Economic Census.  
Source: Economics and Statistics Administration analysis of data from the Census Bureau and the Bureau of Economic Analysis.

## Shipments

**Figure 1: Shipments in Computer and Electronic Products Manufacturing, 2012**  
(billions of dollars)

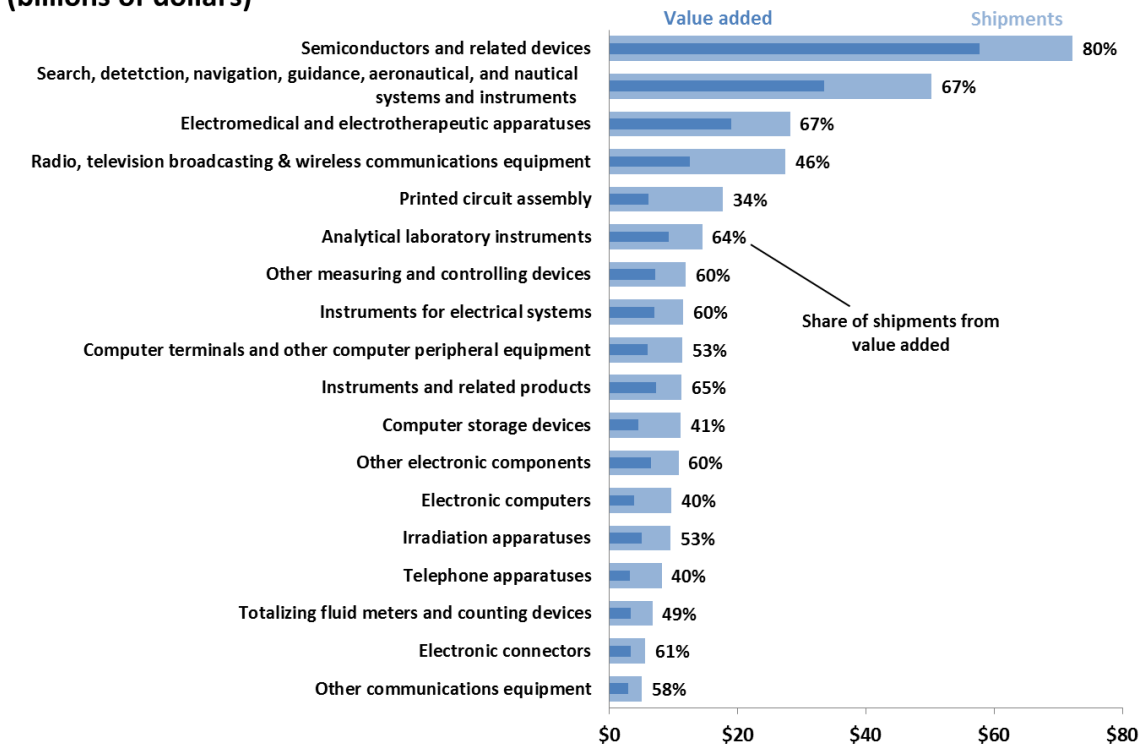


Note: Industries with less than \$5 billion in shipments for 2012 are not included in this chart.  
Source: Census Bureau, Economic Census

- Computer and electronic product manufacturing shipments totaled \$339.4 billion in 2012 and accounted for 5.9 percent of total U.S. manufacturing shipments.<sup>9</sup> Shipments of semiconductor and related devices, such as integrated circuits, memory chips, microprocessors, diodes, transistors, solar cells and other optoelectronic devices, totaled \$72.2 billion or one-fifth of industry output that year. Search, detection, navigation, guidance, aeronautical systems and instruments—which are a major component for the domestic and foreign aerospace industry—accounted for another \$50.3 billion in shipments, or 15 percent of the industry total.
- Electronic computers accounted for 11 percent of shipments in 2007 but just 3 percent in 2012, as shipments plunged from \$42.7 billion in 2007 to \$9.7 billion in 2012. This decline was mostly due to a reduction in the value of personal computer shipments, including desktop computers and notebooks.<sup>10</sup>
- In 2012, businesses purchased 60 percent of all the computers and electronics sold in the United States, while consumers purchased 28 percent, and the government purchased 12 percent.<sup>11</sup>

## Value added

**Figure 2. Value Added in Computer and Electronic Products Manufacturing, 2012  
(billions of dollars)**



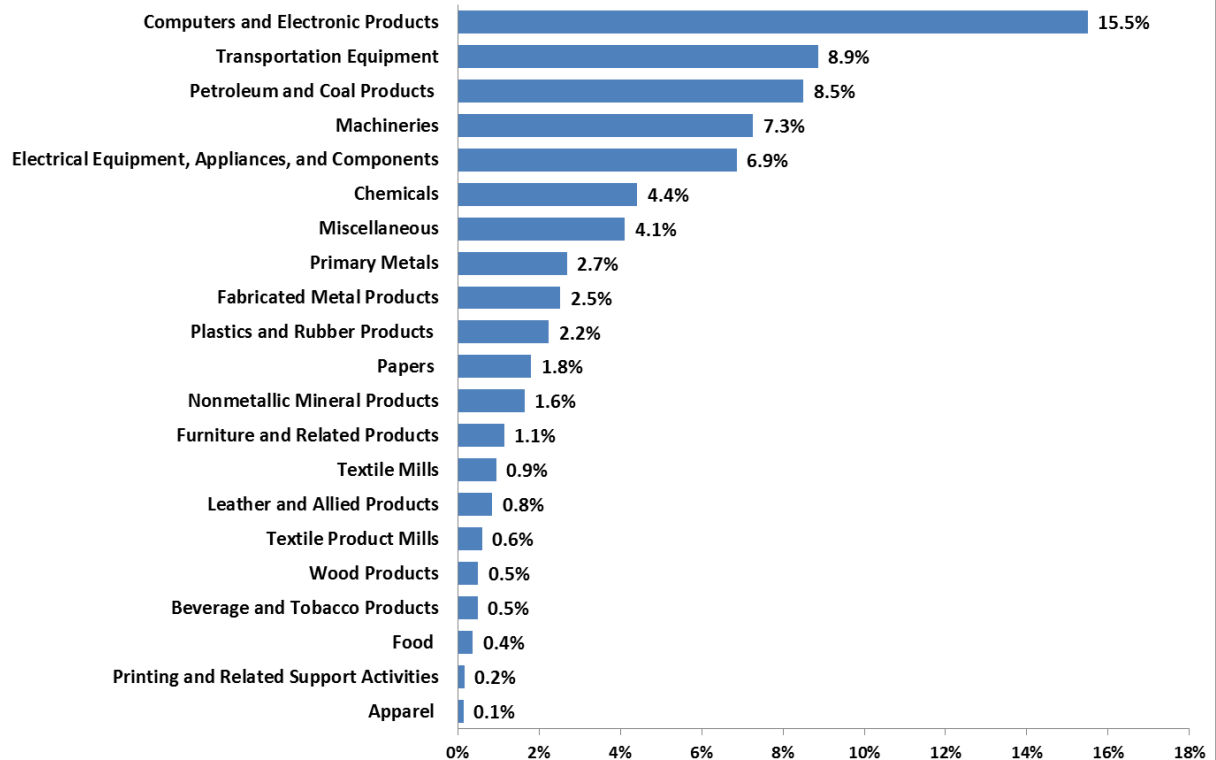
Note: Industries with less than \$5 billion in shipments for 2012 are not included in this chart.

Source: Census Bureau, Economic Census

- In 2012, value added accounted for 65 percent of the total dollar amount of computer and electronic product shipments. Within this industry, semiconductor and related device manufacturers' value added accounted for 80 percent of their shipments, with the purchased inputs accounting for the remaining 20 percent. At the other end of the spectrum, the dollar value of the output of printed circuit assembly manufacturers was 34 percent value added and 66 percent purchased components.<sup>12</sup>
- Over time, value added as a share of shipments has been rising in the computer and electronic products industry, with this increase reflecting a rise in labor productivity and percentage of industry inputs employed. This phenomenon reflects the importance, if not quality, of U.S. input in the value of the final computer and electronic product. In other words, regardless of the source of the raw materials, a U.S. semiconductor is increasingly a U.S.-made product, with value added coming from U.S. workers.
- Value added is split principally into returns to labor (or employee compensation) and returns to capital. In 2012, employee compensation accounted for 52 percent of value added and returns to capital accounted for another 46 percent.<sup>13</sup>
- The employee compensation translates into a median hourly wage of \$29.88 (in May 2014), which was 63 percent higher than the overall median hourly wage of \$18.34 in the U.S. manufacturing sector.

## Jobs

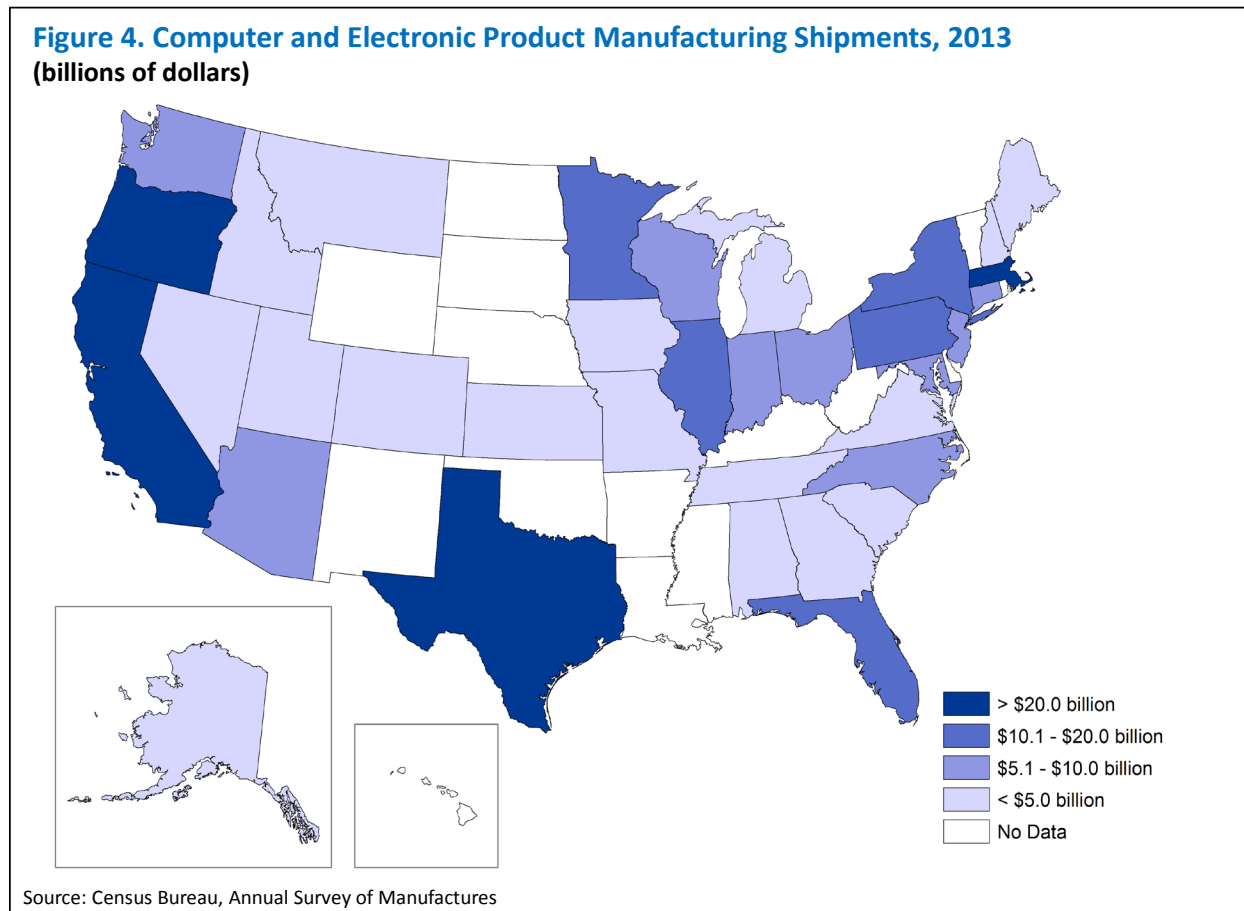
**Figure 3. Engineers as a Share of Employment by Manufacturing Industry, 2014**



Source: Bureau of Labor Statistics, Occupational Employment Statistics (OES) Survey

- Production occupations make up the largest portion of employment in this industry (29 percent), closely followed by architecture and engineering occupations (22 percent).
- To achieve constant evolution in product design, this industry employs a sizable number of engineers. In 2014, there were 162,140 engineers or 16 percent of total employment, higher than any other manufacturing industry; engineers fill 4.7 percent of jobs in U.S. manufacturing as a whole. This share is nearly 7 percentage points higher than that of the transportation equipment manufacturing industry and 7 points higher than petroleum and coal products. The apparel manufacturing industry has the lowest share of engineers, at just .1 percent.
- Across industries, engineers' pay slightly varies. In 2014, petroleum and coal products led the sector with a median hourly wage of \$52.64. This rate is \$6.2 higher than that of the succeeding industry, computers and electronic products. The lowest paid engineers were those in the furniture and related product manufacturing industry with a median hourly wage of \$31.95.

## Which States Make Computer and Electronic Products?

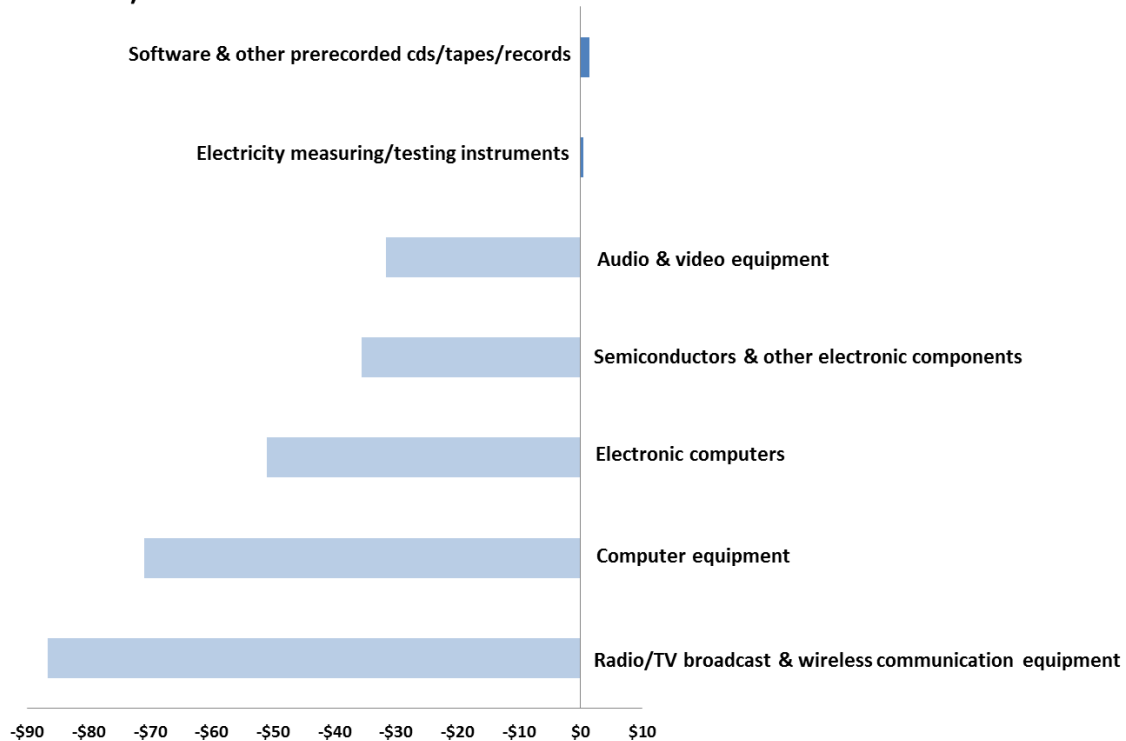


- California accounted for 21 percent, or \$68.1 billion, of all of the computer and electronic products made in the United States in 2013, the year for which the latest statewide data are available, and one-quarter (263,567) of jobs in 2014.<sup>14</sup>
- Texas came in second in output and employment with \$26.6 billion in shipments and 60,053 (8 percent) of jobs, less than half that of California.
- Rounding out the top five in shipments were Massachusetts (\$23.9 billion) Oregon (\$20.1 billion), and New York (\$13.8 billion). In jobs, there were 52,501 in Massachusetts, 40,631 in New York, and 39,181 in Minnesota.
- For the United States overall, computer and electronic product shipments accounted for 6 percent of total manufacturing shipments in 2013. In some states, computer and electronic products comprised a much larger share of total manufacturing activity; particularly noteworthy are Oregon (32 percent), Massachusetts (29 percent), and New Hampshire (20 percent).

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## Satisfying Demand for Computer and Electronic Products Here and Abroad

**Figure 4. Top Surpluses and Deficits in U.S. Computer and Electronic Product Manufacturing Trade, 2014 (billions of dollars)**



Source: Census Bureau, USA Trade Online

- Computer and electronic products represent a significant portion of total U.S. manufacturing exports. In 2014, total exports in this sector were about \$123 billion, or 10 percent of total exports of manufactured goods. This share has been relatively constant over time.
- Notwithstanding their significant contribution to exports, computer and electronic products represent an even larger portion of U.S. imports. In 2014, imports totaled \$364.7 billion, or 19 percent of total imports of manufactured goods.
- As a result, the trade deficit in computer and electronic products was of \$241.7 billion, 32 percent of the total deficit for manufactured goods, more than in any other manufacturing industry.
- The United States imported \$167.9 billion of computers and electronic products made or assembled in China, with a substantial portion (38 percent) in communications equipment (e.g., telephone apparatus and radio/TV broadcast & wireless communication equipment).
- The only two industries in computer and electronic equipment manufacturing that ran trade surpluses in 2014 were electricity measuring/testing instruments (\$1.5 billion) and software and other prerecorded cds/tapes/records (\$1.5 billion).
- Only 23 percent of computers and electronic products purchased by U.S. consumers and businesses in 2012 were domestically made.<sup>15</sup>



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## Endnotes

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1. U.S. Census Bureau, 2012 Economic Census.
2. For additional information about how to measure what is made in America and for further explanation of concepts used in this report, see Economics and Statistics Administration, “What is Made in America?” available at: <http://www.esa.doc.gov/Reports/what-made-america>.
3. The computer and electronic product manufacturing subsector is categorized by the North American Industry Classification System (NAICS) as NAICS 334. Industry definition available at: <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=334&search=2012%20NAICS%20Search>. For full classification structure, see: <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2012>.
4. NAICS 334 available at <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=334&search=2012%20NAICS%20Search>
5. Baily, Martin Neil and Barry P. Bosworth. “US Manufacturing: Understanding Its Past and Its Potential.” *The Journal of Economic Perspectives* 28. 1 (2014): 3-25.
6. Landefeld, J. Steven, and Bruce T. Grimm. “A Note on the Impact of Hedonics and Computers on Real GDP.” *Survey of current business* 80.12 (2000): 17-22.
7. A hedonic price index uses a hedonic function, the relation between the price of a product and the quantities of characteristics in them. For simplicity, let’s assume a computer’s hedonic function has only one characteristic, speed. A new 100 million instructions per second (MIPS) computer in 2012 replaces the 30 MIPS computer that was previously in the price index sample in 1997. Thus, we estimate the value of the 70 MIPS increase in computer speed from period to period. For more information see Jack Triplett, *Handbook on hedonic indexes and quality adjustments in price indexes: special application to information technology products*. OECD, 2006.
8. From 1997 to 2012, the price index for industry gross output has decreased 59 percent while the price index for industry value added has decreased 89 percent. As a result, the decline in the nominal value of shipments and increase in value added for the industry is somewhat misleading. See BEA, GDP by industry data, chain price index for industry 334.
9. Shipments in 2014 totaled \$347.2 billion. The 2012 Economic Census was used as it allows us to examine the underlying component industries in greater detail.
10. See Gartner’s report on pc shipments available at <http://www.gartner.com/newsroom/id/2647517>.
11. Calculated using data on final demand from BEA’s 2012 table on The Use of Commodities by Industries, After Redefinitions (Producers’ Prices). Data are available online at BEA’s website: [http://www.bea.gov/iTable/index\\_industry\\_io.cfm](http://www.bea.gov/iTable/index_industry_io.cfm).
12. Value added considers only the new production completed at each stage of the manufacturing process—i.e., the labor and capital applied by each firm to the purchased inputs produced elsewhere. This measure of manufacturing activity is derived in the Economic Census 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.

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13. The remaining 2 percent was devoted to taxes on production and imports less subsidies. Bureau of Economic Analysis industry data available from: [www.bea.gov](http://www.bea.gov). For more information on these concepts, see “Measuring the Nation’s Economy: An Industry Perspective. A Primer on BEA’s Industry Accounts.” *Bureau of Economic Analysis*. Available at: [http://bea.gov/industry/pdf/industry\\_primer.pdf](http://bea.gov/industry/pdf/industry_primer.pdf).

14 . Calculated using data from the Bureau of Labor Statistics, Quarterly Census of Employment and Wages, third quarter 2014.

15. Economics and Statistics Administration, “What is Made in America?” See Figure 8 and associated discussion.