IPC®

BUILD ELECTRONICS BETTER

INTERCONNECTING AMERICA'S ECONOMY:

THE ECONOMIC IMPACTS OF THE U.S. ELECTRONICS MANUFACTURING SECTOR

2020

FOREWORD

Sir Arthur Charles Clarke wrote, "Any sufficiently advanced technology is indistinguishable from magic." One look around and it is easy to see that the electronics manufacturing sector makes "magical" things possible, from ubiquitous connectivity to safer autos and airplanes to miraculous medical equipment.

The way most modern machines and systems are designed, their users never see the electronics inside. They may not know what the components are, where they came from, or how they were put together. People just expect their machines and devices to work. And they do work, thanks to electronics manufacturers.

Our lives and our communities depend on electronics. And that reliance is only going to grow as systems become smarter. We are moving toward a world of self-driving vehicles, immersive virtual experiences, and automated environments. All of these innovations will be fueled by electronics manufacturers.

In addition to influencing how we live, work, and play on a daily basis, electronics manufacturers comprise a significant component of the nation's industrial base. To update and deepen our knowledge of the industry, IPC worked with INFORUM (Interindustry Forecasting at the University of Maryland) to measure the contributions of electronics manufacturers to the U.S. economy.

At each step of the electronics manufacturing supply chain, workers earn compensation, and value is added to the national economy. In addition to these direct impacts, electronics manufacturers also purchase goods and services from other domestic industries, generating indirect economic activity in those industries. Likewise, employees in the electronics manufacturing sector spend their earnings on groceries, services, and consumer goods, and those induced benefits help local and national economies in additional ways.

These direct, indirect and induced effects can be measured across employment, income, output, and contribution to economic growth. These are the tangible economic benefits of electronics manufacturing in the United States.

However, there are intangible benefits that are equally meaningful. It's the connection you feel when you reach a loved one on the phone, no matter where they are. The security you feel driving a vehicle with cutting-edge safety features. The laughter you enjoy watching the latest comedy on your connected television – or on your tablet while away from home. Or the relief you feel when medical professionals take care of your health with state-of-the-art equipment.

These intangible benefits and many more like them are the result of continuous innovation by electronics manufacturers.

John Mitchell
President and CEO
IPC

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

IPC represents more than 5,900 member-company sites around the world and brings together all of the players in the electronics manufacturing industry, including designers, printed circuit board manufacturers, contract and assembly companies, suppliers and original equipment manufacturers. In the United States, IPC represents more than 2,700 member-company sites across a diverse collection of industries that are integral parts of the economy.

In addition to summarizing the industry's direct effects, such as output and labor income, this report provides a more comprehensive view of electronics manufacturing's economic contributions.

When electronics manufacturers purchase services and goods from other sectors to use as inputs in the products they design and build, they produce economic activity in those sectors. The economic impact created in these supply chains are called indirect effects.

Likewise, employees in the electronics manufacturing sector and related supply chains spend their earnings in downstream sectors, which, in turn, produces a range of economic activities at the local and national levels. These economic contributions are called induced effects. The total economic contribution of the electronics manufacturing sector includes these direct, indirect and induced effects.[1]

This report finds:

- **Direct Effects:** In the United States, electronics manufacturers directly employ more than 1.3 million workers, contribute $165.7 billion in labor income and $307.6 billion to GDP, and produce nearly $710 billion in output. The electronics manufacturing sector plays a vital role in the national economy, accounting for 1.6 percent of GDP and 0.7 percent of jobs.
- **Indirect and Induced Effects:** Including both indirect and induced effects, U.S. electronics manufacturers support nearly 5.3 million U.S. jobs, contribute almost $408 billion in labor income each year and $714 billion to U.S. GDP, and produce $1.46 trillion in output (see Table ES-1). The direct, indirect and induced economic activity of the electronics manufacturing sector accounts for 3.7 percent of U.S. GDP and 2.8 percent of U.S. jobs.

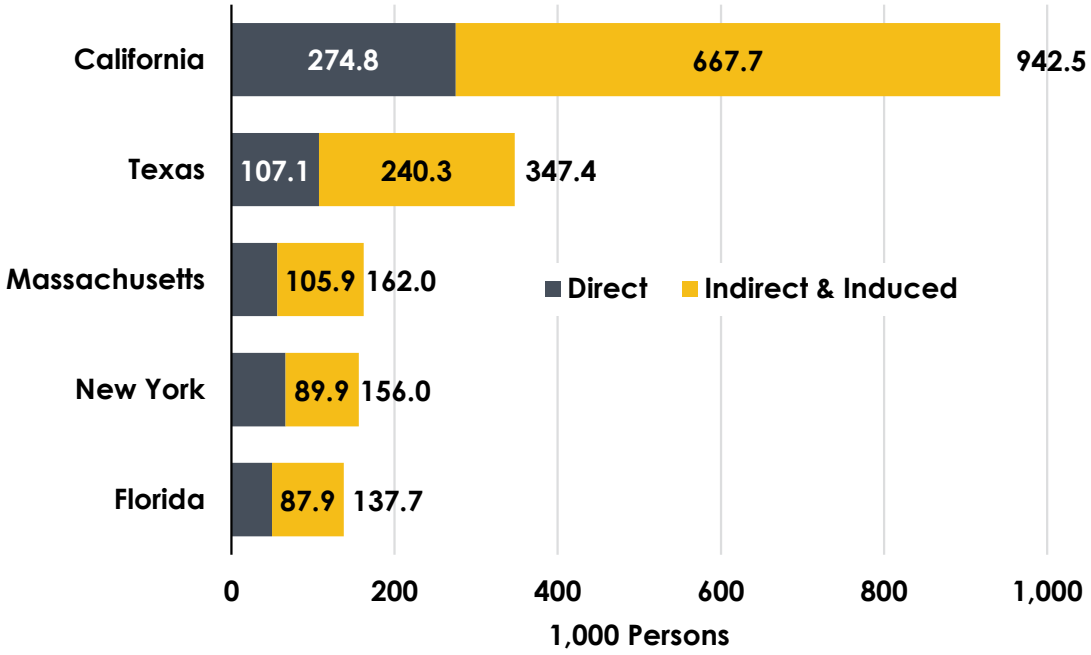
Table ES-1. U.S. Electronics Manufacturing Impacts — Overview
Units Indicated

	Employment (Thousand Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct	1,306.9	$165.7	$307.6	$709.9
Indirect	1,487.9	$111.5	$176.6	$340.8
Induced	2,480.2	$130.5	$229.7	$406.3
Total	5,275.0	$407.7	$713.8	$1,457.0

[1] All source data and results describe activity in the year 2017. Appendix B provides estimated impacts through 2019.

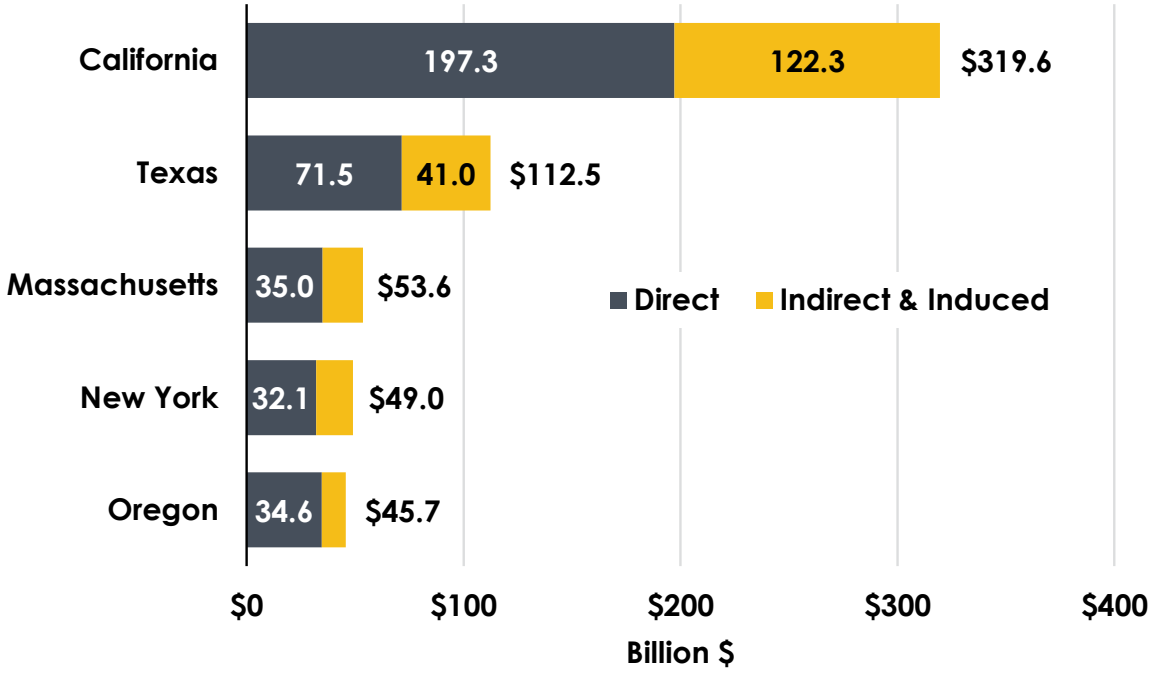
- **Multiplier Effects:** The electronics manufacturing industry has an impactful "multiplier effect." That is, every one electronics manufacturing job in the U.S. helps support over three additional jobs in the U.S. economy. Likewise, every dollar in labor income in U.S. electronics manufacturing produces another $1.46 in other sectors of the economy. Every dollar added to U.S. GDP by the electronics manufacturing sector creates $1.32 elsewhere in the economy. Additionally, every dollar in electronics manufacturing output generates $1.05 of output elsewhere in the economy.
- **State-Level Employment:** The economic impact of the electronics manufacturing sector is important in many individual states. Ten states have more than 100,000 workers each because of the electronics manufacturing sector. California's electronics manufacturers directly and indirectly employ more than 942,000 employees, followed by Texas (437,400), Massachusetts (160,000), New York (156,000) and Florida (137,000). The sector's direct employment in these five states is nearly 554,000, not to mention an additional 1.2 million indirect and induced jobs (See Figure ES-1).

Figure ES-1. Electronics Manufacturing Employment Impacts, Top Five States
Units: Thousand Persons



- **State-Level Labor Income:** The electronics manufacturing sector supports over $5 billion in total labor income in each of 15 states. In California, electronics manufacturing supports $97.6 billion in labor income each year, followed by Texas ($28.6 billion), Massachusetts ($15.8 billion), New York ($14.2 billion) and Minnesota ($11.1 billion).
- **State-Level GDP:** In terms of GDP, Oregon's electronics manufacturing sector directly accounts for nearly 10 percent of state GDP, followed by California (3.4 percent), Massachusetts (2.8 percent) and Minnesota (2.7 percent).
- **State-Level Output:** California, Texas, Massachusetts, New York and Oregon collectively account for over 52 percent of national direct electronics manufacturing output. Inclusive of indirect and induced output, California alone has over $300 billion in annual electronics manufacturing output, followed by Texas at over $110 billion. Figure ES-2 displays the top five states, ranked by total (direct + indirect + induced) electronics manufacturing output. The electronics manufacturing sector directly and indirectly produces over $20 billion in total economic activity in each of 15 states.

Figure ES-2. Electronics Manufacturing Output Impacts, Top Five States
Units: Billion Dollars



- **Higher-than-Average Wages:** The electronics manufacturing sector pays higher-than-average wages. Average annual compensation per direct job in the electronics manufacturing sector is $126,812, compared to a national average of $60,820. Electronics manufacturing employees also earn more on average than those in the overall manufacturing industry ($83,000).
- **Upstream Suppliers:** The electronics manufacturing sector is highly integrated with and vital to upstream suppliers in the United States. For every $100 billion of its own output, the electronics manufacturing sector contributes to $480 billion in output for the domestic supply chain.
- **Final Sales:** In total, the electronics manufacturing industry is responsible for over $1.0 trillion in content of final sales. Investment and inventory change ($426.6 billion) account for the greatest share, making up 40.9 percent of the total, followed by personal consumption expenditures ($306.5 billion; 29.4 percent), exports ($223.9 billion; 21.5 percent), federal defense ($37.8 billion; 3.6 percent) and other government purchases ($48.1 billion; 4.6 percent). (See Section 4 for definitions of these terms.)
- **Intermediate Goods Supplier to Other Industries:** The U.S. electronics manufacturing sector is an important intermediary supplier for other key industries in the United States. The aerospace industry sources nearly $26 billion in intermediate goods from the electronics manufacturing sector — roughly 11.3 percent of all aerospace sector intermediate expenditures. The auto industry sources nearly $20 billion in intermediate goods from the U.S. electronics manufacturing sector, representing 2.7 percent of the automotive sector's intermediate purchases.
- **Capital Equipment for Other Sectors:** Sectors in the economy purchase capital equipment and make investment expenditures in order to produce goods and services. Many of these sectors rely heavily on equipment produced by electronics manufacturers. The medical services industry sources $23.3 billion of equipment from the electronics manufacturing sector, nearly 22 percent of the sector's total annual investment. The aerospace industry sources nearly $1.3 billion in equipment, which is approximately 15.6 percent of total aerospace equipment investment spending. And the auto industry sources about $1.4 billion, roughly 7.6 percent of the automotive sector's total equipment investment expenditures.

1. INTRODUCTION

The electronics manufacturing sector is a vibrant and dynamic segment of the U.S. economy, with a long history of innovation and resiliency dating back to Lee de Forest's 1906 invention of the three-element vacuum tube. The 1940s brought the introduction of semiconductors, which spawned the modern era of computing and telecommunications.

Today the electronics manufacturing sector is the heart of innovation in every sector of the economy. Smartphones are allowing individuals to connect instantly with friends and family anywhere in the world or order groceries for home delivery. Robots are transforming warehouse and delivery industries. Cutting-edge medical diagnostic equipment is saving and improving lives. Electronics manufacturers are empowering the next wave of electric vehicles, autonomous robots, and top-secret defense technologies.

The electronics manufacturing sector includes such household names as Apple, Bosch, DuPont, Foxconn, GE Medical Systems, Honeywell, IBM, Intel, Jabil, Lockheed Martin, Northrop Grumman, and Raytheon. However, 80 percent of U.S. electronics manufacturers are small and medium-sized businesses. Economic activities by these companies drive innovation, output and jobs in adjacent industries such as aerospace, automotive, medical and defense.

This study finds that the electronics manufacturing sector directly contributes roughly $308 billion to U.S. GDP and employs over 1.3 million U.S. workers. The electronics manufacturing sector accounts for 1.6 percent of U.S. GDP and 0.7 percent of U.S. jobs. Electronics manufacturing activity, however, does not exist in isolation. Including both indirect and induced effects, U.S. electronics manufacturers support nearly 5.3 million jobs, contribute almost $408 billion in labor income each year, add $714 billion to GDP, and produce $1.46 trillion in output. The direct, indirect and induced economic activity of the electronics manufacturing sector accounts for 3.7 percent of U.S. GDP and 2.8 percent of U.S. jobs.

The following section describes the methodology used to estimate these impacts. Section 3 provides quantitative results showing electronics manufacturing's contribution at the national and state levels. Section 4 provides a quantitative analysis of where the output of U.S. electronics manufacturers goes. Appendix A contains Fact Sheets for the entire United States and the top 16 U.S. states ranked by output of electronics manufacturing.

2. METHODOLOGY AND KEY TERMS

This study defines electronics manufacturing to include the following diverse industries in the North American Industry Classification System (NAICS):

- NAICS 3341 - Computer and Peripheral Equipment Manufacturing
- NAICS 3342 - Communications Equipment Manufacturing
- NAICS 3343 - Audio and Video Equipment Manufacturing
- NAICS 3344 - Semiconductor and Other Electronic Component Manufacturing
- NAICS 3345 - Navigational, Measuring, Electromedical, and Control Instruments Manufacturing
- NAICS 3353 – Electrical Equipment Manufacturing
- NAICS 3359 - Other Electrical Equipment and Component Manufacturing
- NAICS 33632 - Motor Vehicle Electrical and Electronic Equipment Manufacturing

The calculated economic impacts presented in this study use input-output (IO) analysis to quantify the interdependencies that exist between different sectors of the economy. IO analysis can be used to estimate chains of effects that occur through the interrelationships among businesses, government and households. In this way, IO analysis enables an examination of interindustry relationships within an economy and, in turn, can characterize the effects of a change in one sector on the broader economy. This analysis uses the 2017 IMPLAN database and model. All economic impacts are in inflation-adjusted 2017 dollars (2017$). All results are for calendar year 2017.

The three types of economic impacts we derive in this study are:

- Direct Impacts—Activity generated within the focus industry. In this case, electronics manufacturing activity serves as the direct impact.
- Indirect Impacts—Activity generated in other industries as a result of purchases (materials, energy and services) by the focus industry through the supply chain. For example, an automobile manufacturing firm might purchase tires, steel and electrical components to produce its final product.
- Induced Impacts—Activity generated by purchases of households from income earned from direct and indirect production.

This report provides estimates for the direct, indirect, and induced impacts on:

- **Employment** — Employment is the people employed by an industry. Employment figures use the Bureau of Economic Analysis (BEA) and Bureau of Labor Statistics (BLS) full-time/part-time annual average for a given industry. The data covers both wage and salary employees and those who are self-employed.

- **Labor Income** — Labor income, a component of value added, is the sum of salary/wages and supplements. Supplements may take the form of employer contributions for employee pensions and insurance funds (such as health insurance). This measure also includes proprietor income.

- **Value Added** — Value added is the industry's contribution to GDP and represents the enhancement a manufacturer provides (e.g., assembly) to a product before offering it to the end consumer. Put another way, value added is the difference between total revenue of an industry and the cost of intermediate inputs. Components of value added include employee labor compensation, taxes on production and imports, and gross operating surplus (including profits).

- **Output** — Output, in economic terms, refers to the total value of all goods and services produced by an industry. This includes both intermediate demand (sales of intermediate inputs to other industries) and final demand.

IO analysis utilizes tables that show the interrelationships between industries. Looking down the column of a table, we see all the inputs of other industries used to produce that industry's product. Looking across the row of a table, we see the industries and final uses that industry sells to. We use these tables to calculate the indirect impacts of a given industry's production.

Each analysis presented in this report focuses on a region, such as the United States or one state, and examines the total contributions of the electronics manufacturing sector in that region.

Measures of output include double-counting. For example, the tire used to build a motor vehicle is counted both as output of tires and as output of motor vehicles. This is important only if both are produced in the same region. However, employment, labor income and value added are additive, that is to say, not double-counted. Many slices of value added contribute to the final value of a product or service.

In addition to analyzing the economic contribution at the national level, this report also quantifies electronics manufacturing's impact for 16 state economies. The following list represents the top 16 states ranked by output of electronics manufacturing. These states, listed here in alphabetical order, account for approximately 80 percent of national electronics manufacturing output.

1. Arizona
2. California
3. Colorado
4. Florida
5. Illinois
6. Massachusetts
7. Michigan
8. Minnesota
9. New Jersey
10. New York
11. North Carolina
12. Ohio
13. Oregon
14. Pennsylvania
15. Texas
16. Wisconsin

3. UPSTREAM ANALYSIS

Section 3.1 analyzes electronics manufacturing's contributions to the national economy. It provides a look at both direct impacts and a more comprehensive view of manufacturing's contributions to the economy by including indirect and induced impacts. Section 3.2 summarizes the sector's contributions for 16 states, which collectively account for approximately 80 percent of national electronics manufacturing output.

3.1 National-Level Impacts

Direct Impacts

Electronics manufacturers directly employ over 1.3 million people and contribute nearly $710 billion in output.

Table 1 summarizes the direct economic impacts of the electronics manufacturing sector and subsectors. The aggregate electronics manufacturing industry contributes over $307 billion in value added, accounting for 1.6 percent of U.S. GDP. Electronics manufacturers directly employ over 1.3 million people. These employees earn $165.7 billion in labor income (sum of salary/wages, supplements and proprietor income). This equates to average labor income of nearly $127,000 per worker.

Table 1. Electronics Manufacturing and Subsectors, Direct Impacts Summary
Units Indicated

NAICS Industry	Employment (Thousand Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Electronics Manufacturing	1,306.9	$165.7	$307.6	$709.9
3341 Computer and Peripheral Equipment Manufacturing	141.2	$32.2	$75.8	$180.4
3342 Communications Equipment Manufacturing	83.5	$10.3	$17.2	$39.6
3343 Audio and Video Equipment Manufacturing	21.7	$2.1	$4.0	$10.0
3344 Semiconductor and Other Electronic Component Manufacturing	335.3	$45.1	$89.3	$178.1
3345 Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	380.7	$44.9	$74.6	$161.4
3353 Electrical Equipment Manufacturing	141.8	$13.8	$19.4	$53.0
3359 Other Electrical Equipment and Component Manufacturing	142.4	$12.9	$19.4	$58.2
33632 Motor Vehicle Electrical and Electronic Equipment Manufacturing	60.2	$4.5	$8.0	$29.1

This average salary outshines those in other industries, including retail ($36,000); construction ($63,000); transportation and warehousing ($64,000); and professional, scientific and technical services ($90,000). Electronics manufacturing employees also earn more than those in the overall manufacturing industry ($83,000). Labor income earned by electronics manufacturing workers is approximately equal to those in information services ($125,000) and management industries ($127,000).

Figure 1 displays a ranking of employment at electronics manufacturing sub-industries. At a combined 716,000 direct employees, Navigational, measuring, electromedical, and control instruments manufacturing (NAICS 3345) and Semiconductor and other electronic component manufacturing (NAICS 3344) make up nearly 55 percent of total employment in the U.S. electronics manufacturing sector.

Figure 1. Electronics Manufacturing Employment by Detailed Industry
Units: Thousand Persons

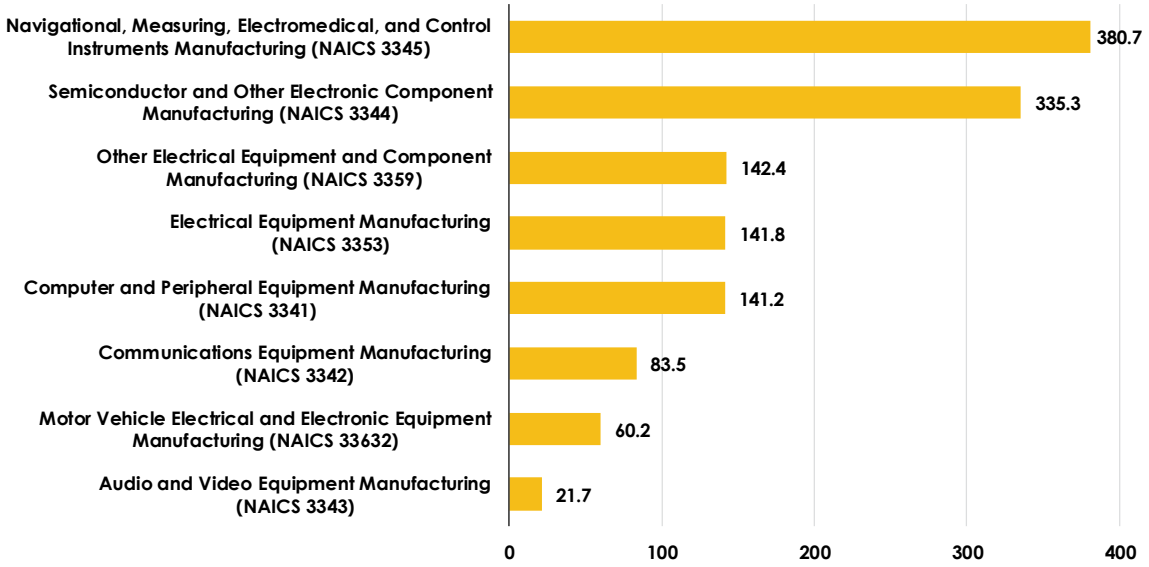
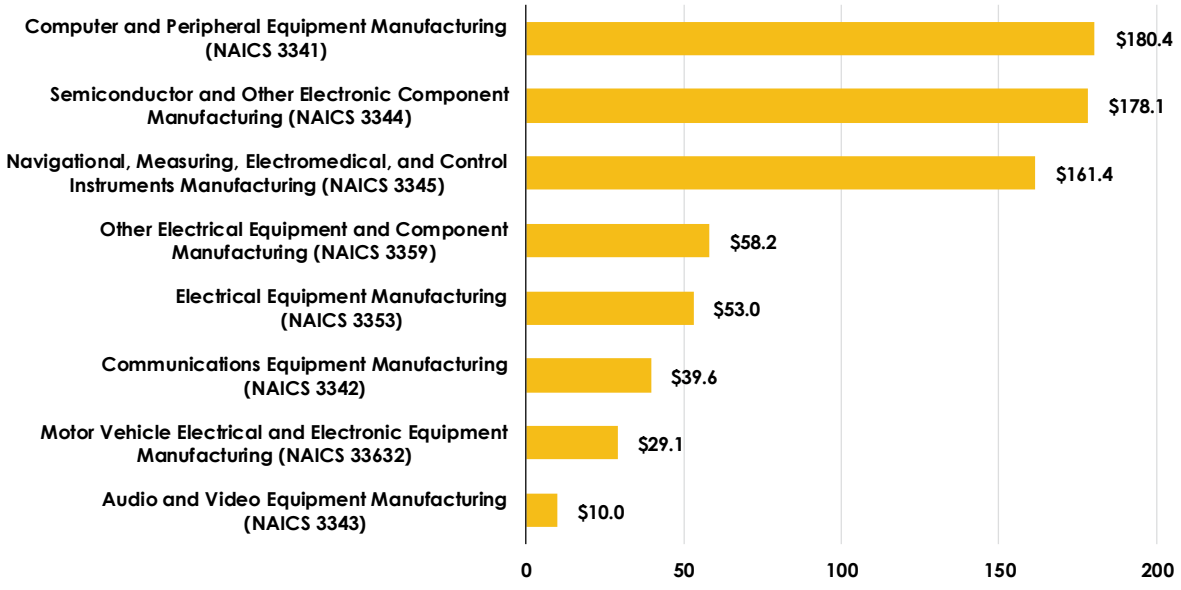


Figure 2 shows a ranking of economic output by electronics manufacturing sub-industries. The top three detailed industries (Computer and peripheral equipment manufacturing [NAICS 3341], Semiconductor and other electronic component manufacturing [NAICS 3344], and Navigational, measuring, electromedical, and control instruments manufacturing [NAICS 3345]) make up over 73 percent of the total. The rankings shown in Figures 1 and 2 are different because the sub-sectors have different employment-to-output ratios.

Figure 2. Electronics Manufacturing Output by Detailed Industry
Units: Billion $ Indirect and Induced Impacts



Indirect and Induced Impacts

The impact of the electronics manufacturing sector in the United States extends beyond the direct economic impacts described in the previous section. Output and jobs are also supported in supplier ("indirect") industries that provide components, materials, energy and various services to the electronics manufacturing sector. Additionally, individuals employed by electronics manufacturers and related suppliers earn income, a portion of which is used to purchase consumer goods and services, creating jobs and output in other industries. These economic impacts are known as "induced" effects.

Table 2 summarizes the sector's direct, indirect, and induced impacts in employment, labor income, value added, and output. Electronics manufacturers directly employ over 1.3 million people, generate over $307 billion in value added and contribute nearly $710 billion in output. This can be seen in the first row of Table 2.

In total, electronics manufacturing activity helps support 5.3 million jobs and $714 billion in value added to the national economy.

Direct economic activity by the electronics manufacturing sector also generates economic activity throughout other sectors of the country, as shown on the second row of Table 2. As a of result of annual economic activity by electronics manufacturers, upstream suppliers generate over $340 billion in output and employ nearly 1.5 million people. The supply chain adds $176.6 billion to GDP as a result of economic activity by electronics manufacturers.

Finally, a portion of the labor income earned by workers in electronics manufacturing and related suppliers is spent on goods and services in other sectors of the economy. This activity, shown in the third row of Table 2, supports nearly 2.5 million jobs and generates over $400 billion in output.

In total, the electronics manufacturing sector helps support approximately 5.3 million U.S. jobs; produces nearly $408 billion in labor income; contributes $714 billion to U.S. GDP; and drives $1.5 trillion in U.S. output.

Economic multipliers illustrate the impact one sector has on the broader economy. In mathematical terms, economic multipliers describe the ratio of the sum of indirect and induced impacts to direct impacts. The data shown in Table 2 and Figure 3 indicate that one electronics manufacturing job helps support 3.0 other jobs in the national economy.[2] Additionally, one dollar in electronics manufacturing output generates $1.05 of output elsewhere in the economy.[3] Additional information on electronics manufacturing's contributions can be found in Fact Sheet #1 of Appendix A.

Table 2. U.S. Electronics Manufacturing Impacts
Units Indicated

	Employment (Thousand Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct	1,306.9	$165.7	$307.6	$709.9
Indirect	1,487.9	$111.5	$176.6	$340.8
Induced	2,480.2	$130.5	$229.7	$406.3
Total	5,275.0	$407.7	$713.8	$1,457.0

[2] Employment multiplier = (Indirect Employment + Induced Employment) / Direct Employment = (1,487.9 + 2,480.2) / 1,306.9 = 3.0

[3] Output multiplier = (Indirect Output + Induced Output) / Direct Output = (340.8+406.3) / 709.9 = 1.05

Figure 3. U.S. Electronics Manufacturing Impacts
Units Indicated

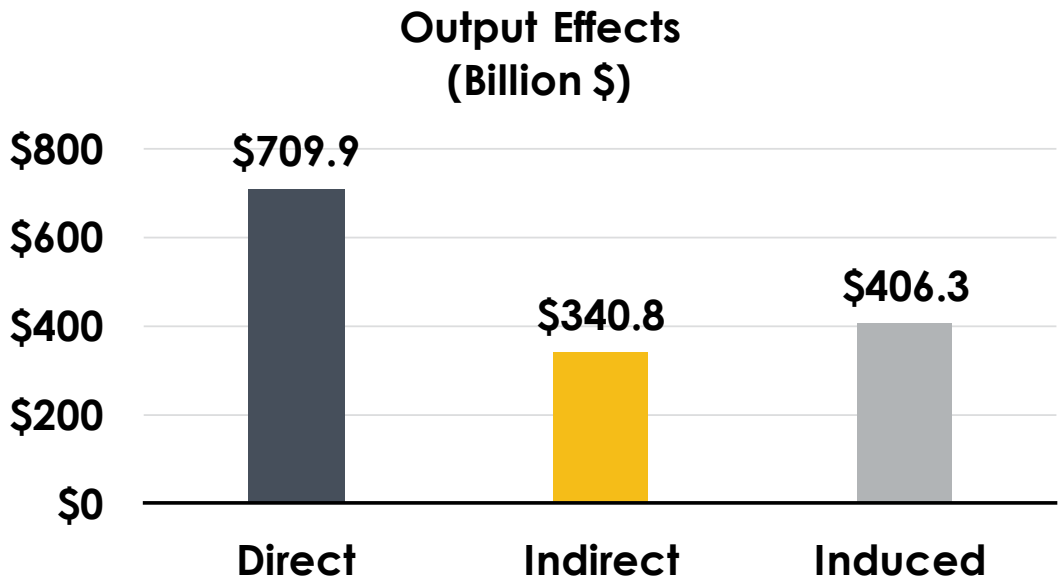


Table 3 provides additional information on the indirect employment impacts in other industries. For example, the electronics manufacturing sector's direct economic activity helps support nearly 219,000 jobs in the wholesale trade industry (NAICS 42); 111,000 jobs in the management of companies industry (NAICS 55); and over 58,000 employment services jobs (NAICS 5613). Other top beneficiary industries include truck transportation, machine shops, and investigation and security services. The top 10 industries listed in Table 3 represent roughly 43 percent of the 1.5 million jobs that the electronics manufacturing industry indirectly supports.

Table 3. Top 10 Indirect Employment Impacts by Industry
Units: Thousand Persons

Rank	NAICS Industry	Thousand Persons
1	42 Wholesale trade	218.6
2	55 Management of companies and enterprises	111.0
3	5613 Employment services	58.2
4	484 Truck transportation	45.2
5	5614 Business support services	43.6
6	56171-2, 56174-9 Services to buildings	39.8
7	33271 Machine shops	33.5
8	54161 Management consulting services	32.7
9	531 Real estate	32.0
10	5616 Investigation and security services	29.5

Table 4 highlights the indirect output impacts in other industries. The wholesale trade and management industries rank first and second, respectively. Electronics manufacturing also generates output of copper rolling, drawing, extruding and alloying ($9.1 billion); lessors of nonfinancial intangible assets ($6.6 billion); and petrochemical manufacturing ($4.9 billion). The top 10 industries listed in Table 4 account for nearly 39 percent of the $341 billion in output indirectly generated by the electronics manufacturing industry.

Table 4. Top 10 Indirect Output Impacts by Industry
Units: Billion $

Rank	NAICS Industry	Billion $
1	42 Wholesale trade	$52.9
2	55 Management of companies and enterprises	$27.5
3	33142 Copper rolling, drawing, extruding and alloying	$9.1
4	484 Truck transportation	$7.2
5	531 Real estate	$6.7
6	22112 Electric power transmission and distribution	$6.6
7	533 Lessors of nonfinancial intangible assets	$6.6
8	33111 Iron and steel mills and ferroalloy manufacturing	$5.8
9	5614 Employment services	$4.9
10	32511 Petrochemical manufacturing	$4.9

3.2 State-Level Impacts

This section analyzes the electronics manufacturing sector's economic contributions to selected states. Impacts measure activity wholly within the state boundaries. As with the previous section, economic impacts fall into three categories: direct, indirect and induced. However, for simplicity of presentation, indirect and induced impacts are combined in the charts. Additional details are provided in state-specific Fact Sheets in Appendix A.

Employment

Table 5 lists electronics manufacturing's employment impacts by state. Regions are ranked by total (direct + indirect + induced) employment levels. The 16 states listed represent 75 percent of direct electronics manufacturing jobs and 54 percent of total (direct + indirect + induced) employment impacts.

In total, electronics manufacturing helps support 942,500 jobs in California.

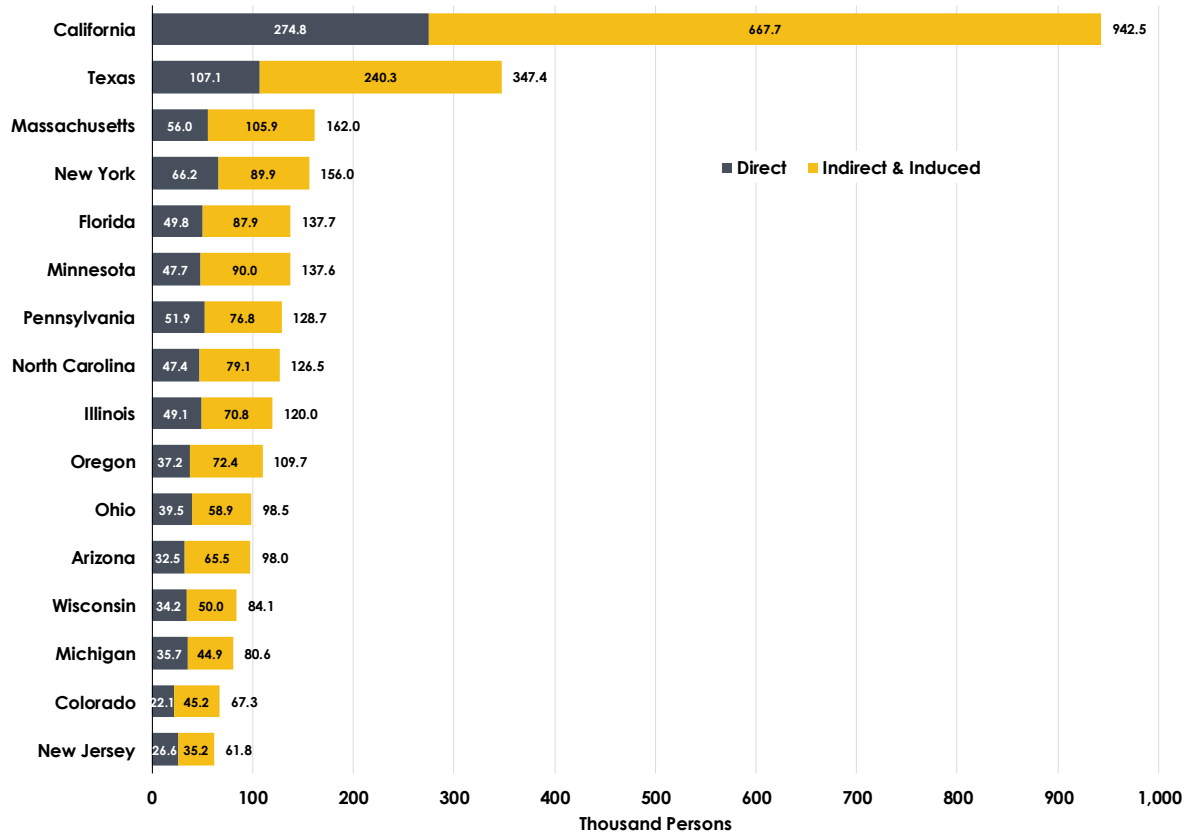
California accounts for 21 percent (274,800 jobs) of the nation's 1.3 million direct electronics manufacturing jobs. When indirect and induced jobs are included, electronics manufacturing helps support 942,500 jobs in California.

Texas is also an important hub for electronics manufacturing employment, directly employing over 107,100 people and in total supporting nearly 350,000 jobs.

Table 5. State-Level Employment Impacts
Units: Thousand Persons

Region	Direct	Indirect	Induced	Total
United States	1,306.9	1,487.9	2,480.2	5,275.0
California	274.8	264.0	403.7	942.5
Texas	107.1	101.8	138.5	347.4
Massachusetts	56.0	40.3	65.6	162.0
New York	66.2	39.4	50.4	156.0
Florida	49.8	36.8	51.1	137.7
Minnesota	47.7	35.7	54.3	137.6
Pennsylvania	51.9	30.1	46.7	128.7
North Carolina	47.4	32.9	46.3	126.5
Illinois	49.1	27.0	43.9	120.0
Oregon	37.2	27.6	44.8	109.7
Ohio	39.5	24.9	34.0	98.5
Arizona	32.5	24.2	41.3	98.0
Wisconsin	34.2	20.5	29.5	84.1
Michigan	35.7	21.1	23.8	80.6
Colorado	22.1	18.1	27.1	67.3
New Jersey	26.6	13.3	21.9	61.8

Figure 4. State-Level Employment Impacts
Units: Thousand Persons



Labor Income

Table 6 displays electronics manufacturing's labor income impacts by state. Regions are ranked by total labor income levels. California's direct labor income ($53.2 billion) accounts for 32 percent of the country's ($165.7 billion) direct electronics manufacturing labor income. When indirect and induced impacts are included, electronics manufacturing helps support $97.6 billion in labor income in California.

> *Electronics manufacturing firms provide well-paying jobs for American workers. Employees average nearly $127,000 in total annual labor income.*

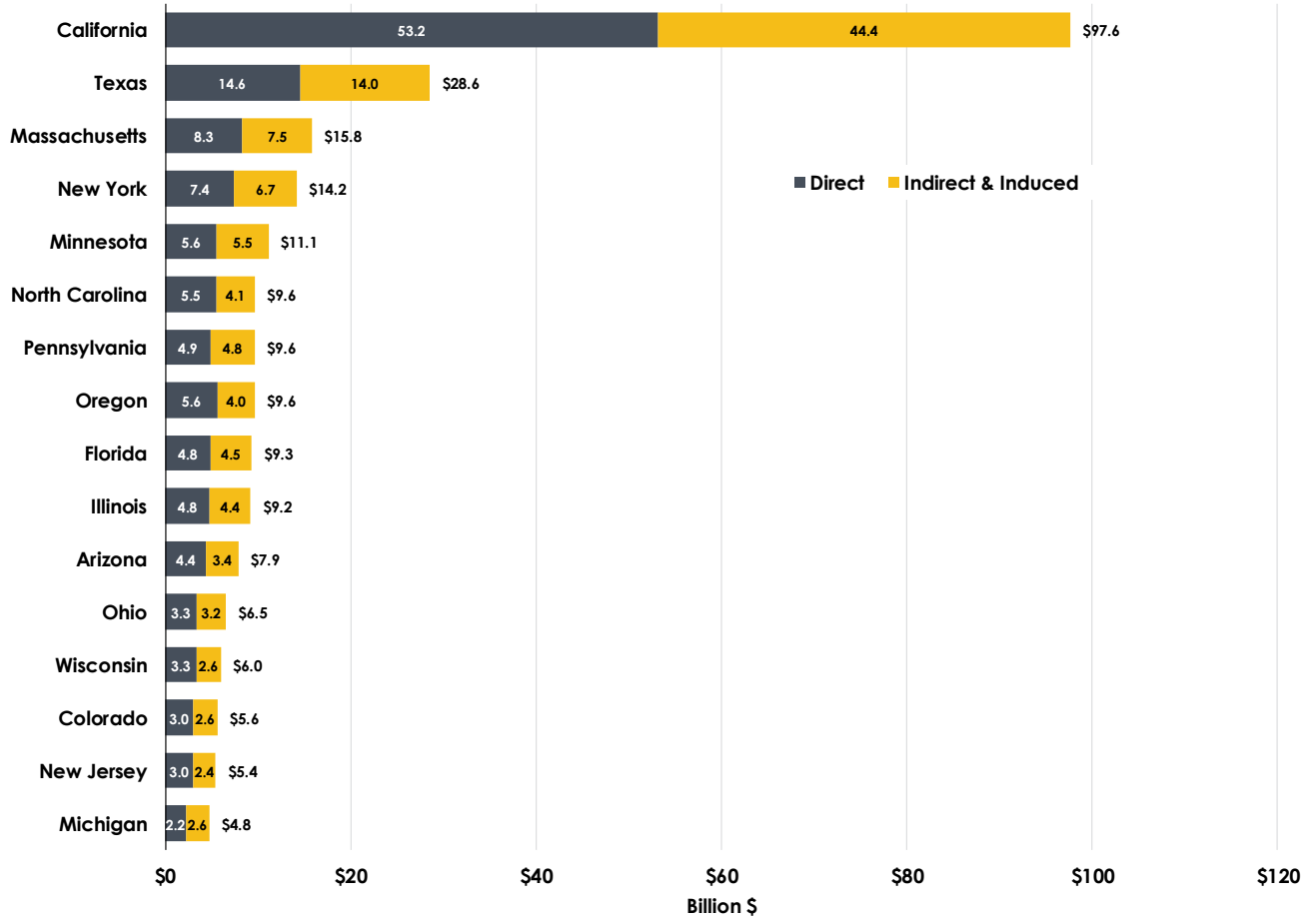
For direct electronics manufacturing, average labor income per worker ranges from about $61,000 in Michigan to $194,000 in California. The average labor income per worker across the 16 states analyzed was approximately $118,000. This variety is related to the types of industry present in each state and cost-of-living differences among them.

The 16 states listed in Table 6 and illustrated in Figure 5 account for 81 percent of direct electronics manufacturing labor income and 62 percent of total (direct + indirect + induced) electronics-manufacturing-related labor income in the United States.

Table 6. State-Level Labor Income Impacts
Units: Billion $

Region	Direct	Indirect	Induced	Total
United States	$165.7	$111.5	$130.5	$407.7
California	$53.2	$21.4	$23.0	$97.6
Texas	$14.6	$7.2	$6.8	$28.6
Massachusetts	$8.3	$3.7	$3.9	$15.8
New York	$7.4	$3.7	$3.0	$14.2
Minnesota	$5.6	$2.8	$2.7	$11.1
North Carolina	$5.5	$2.1	$2.0	$9.6
Pennsylvania	$4.9	$2.4	$2.4	$9.6
Oregon	$5.6	$1.9	$2.1	$9.6
Florida	$4.8	$2.3	$2.2	$9.3
Illinois	$4.8	$2.1	$2.3	$9.2
Arizona	$4.4	$1.5	$1.9	$7.9
Ohio	$3.3	$1.7	$1.5	$6.5
Wisconsin	$3.3	$1.3	$1.3	$6.0
Colorado	$3.0	$1.3	$1.3	$5.6
New Jersey	$3.0	$1.2	$1.2	$5.4
Michigan	$2.2	$1.5	$1.1	$4.8

Figure 5. State-Level Labor Income Impacts
Units: Billion $ Value Added



Value Added

Table 7 and Figure 6 show the value-added impacts of electronics manufacturing in the United States and the 16 states studied. Recall that value added is the industry's contribution to GDP and represents the enhancement an electronics manufacturer provides to a product on top of the value of inputs. Table 7 ranks the regions by total value added.

Electronics manufacturing directly accounts for nearly 10 percent of Oregon's GDP.

Figure 7 ranks electronics manufacturing's share of GDP by region. This is calculated as the ratio of manufacturing direct value added to the region's GDP. Oregon's (direct) electronics manufacturing sector, while relatively small compared to California's in level terms, plays a significant role in its economy, accounting for nearly 10 percent of state GDP. Other states which have GDP contributions exceeding the national average include California, Massachusetts, Minnesota, North Carolina, Arizona, Texas, Wisconsin and Colorado.

Table 7. State-Level Value Added Impacts
Billion $

Region	Direct	Indirect	Induced	Total	% of State GDP (Direct)
United States	$307.6	$176.6	$229.7	$713.8	1.6%
California	$93.4	$32.4	$41.7	$167.4	3.4%
Texas	$32.2	$11.8	$11.8	$55.9	1.9%
Oregon	$22.8	$2.8	$3.6	$29.2	9.8%
Massachusetts	$15.2	$5.2	$6.3	$26.7	2.8%
New York	$11.3	$5.6	$5.3	$22.2	0.7%
North Carolina	$12.2	$3.3	$3.7	$19.1	2.2%
Minnesota	$9.8	$4.1	$4.6	$18.5	2.7%
Florida	$8.3	$3.6	$4.1	$16.0	0.9%
Pennsylvania	$7.9	$3.6	$4.0	$15.5	1.0%
Illinois	$8.0	$3.4	$4.0	$15.4	1.0%
Arizona	$7.2	$2.4	$3.4	$13.0	2.2%
Colorado	$5.6	$2.0	$2.4	$10.0	1.6%
Ohio	$4.6	$2.6	$2.7	$9.9	0.7%
Wisconsin	$5.5	$2.0	$2.3	$9.9	1.7%
Michigan	$5.1	$2.2	$1.9	$9.2	1.0%
New Jersey	$4.9	$1.8	$2.1	$8.8	0.8%

Figure 6. State-Level Value Added Impacts
Units:Billion $

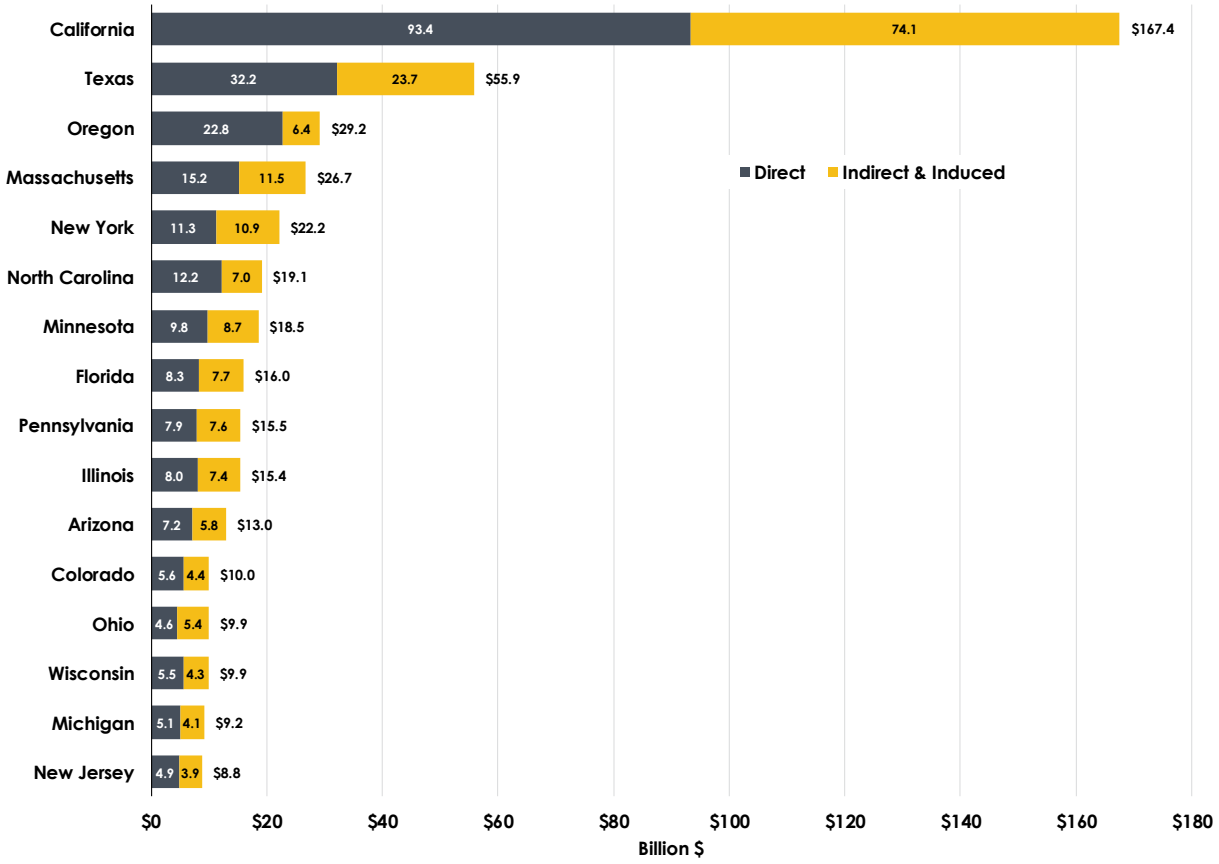
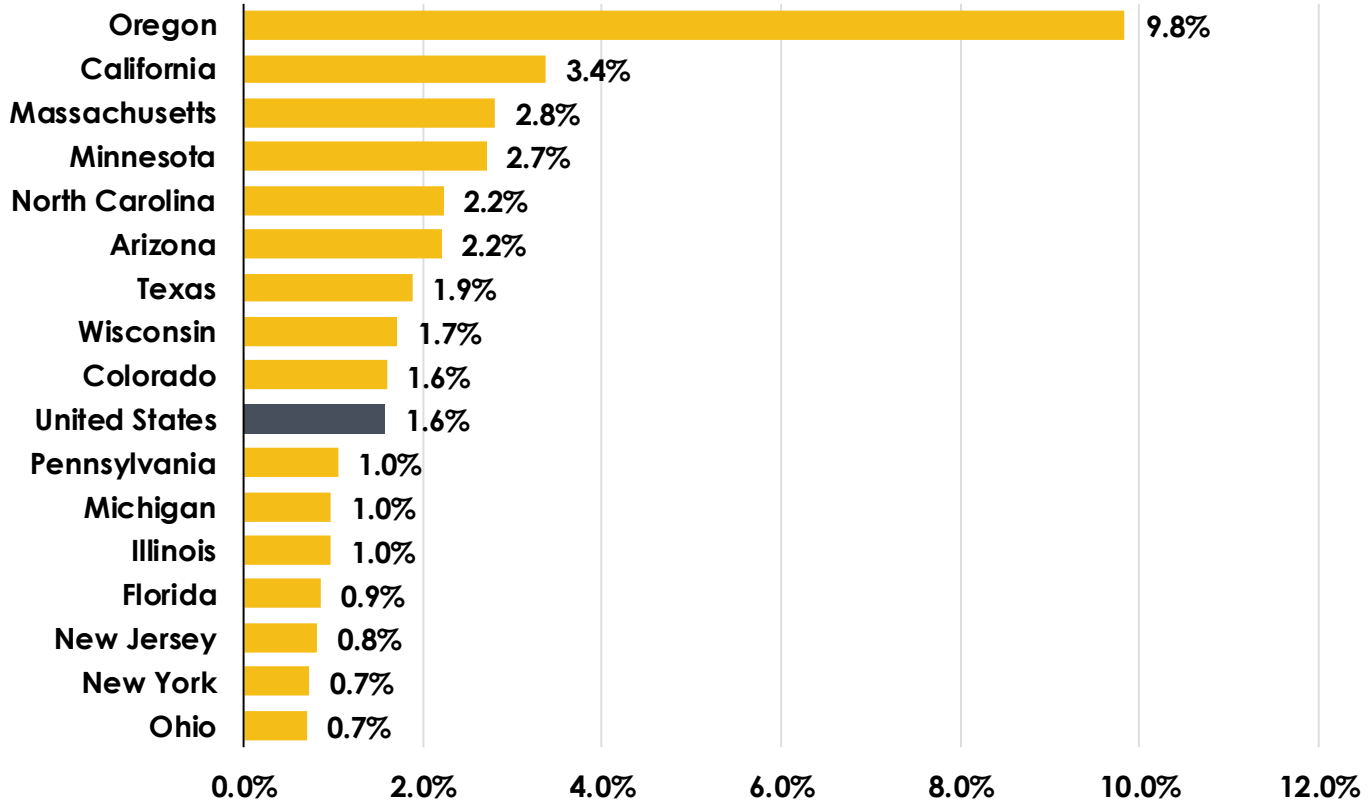


Figure 7. Electronics Manufacturing Share of Regional GDP
Units: Percentage of Region GDP



Output

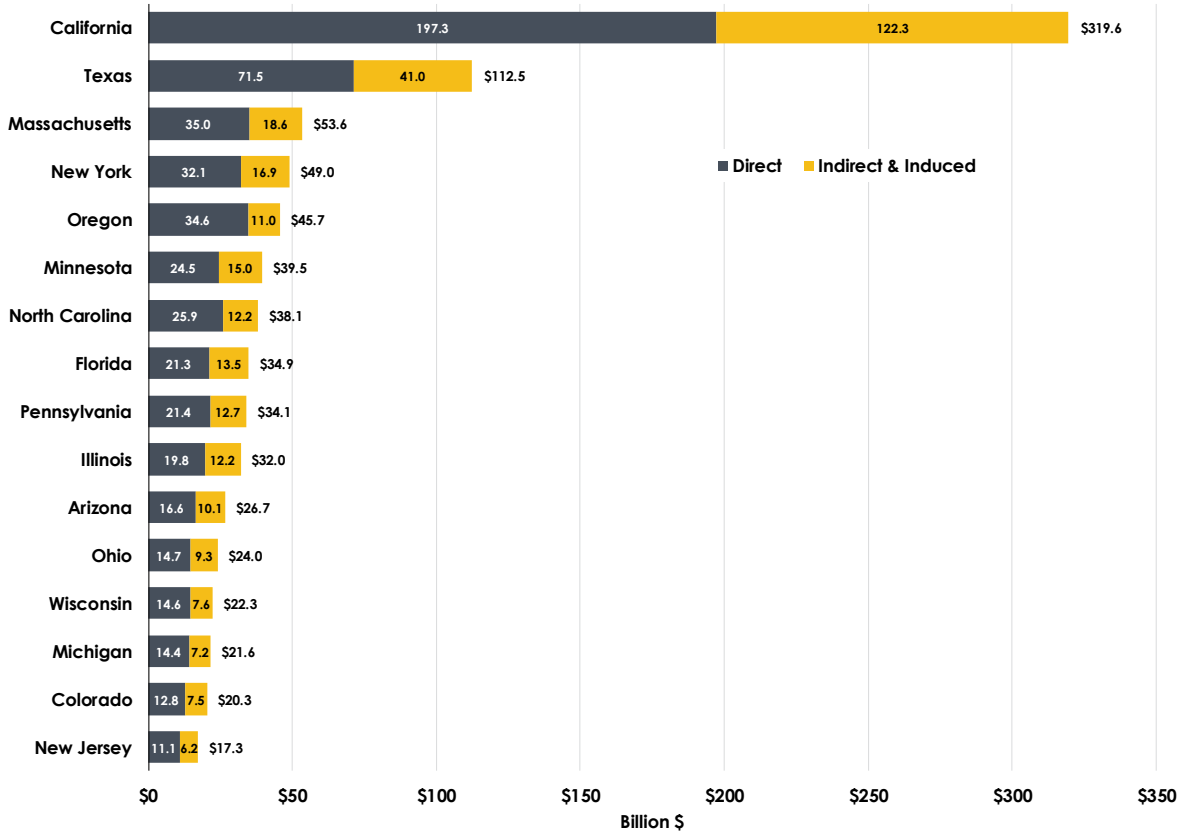
Output is the total value of all goods and services produced in an industry, including both intermediate and final goods. Table 8 and Figure 8 show electronics manufacturing's direct, indirect and induced output by state. California's total output totals $320 billion. Direct output made up 62 percent of the total; indirect output accounted for 23 percent; and induced output comprised the remaining 21 percent. In other words, roughly 23 percent of the total value created by electronics manufactures is produced in the upstream supply chain, while an additional 21 percent is created elsewhere in the economy. These shares are roughly similar for all states analyzed.

Of the states examined, Ohio had the largest output multiplier. One dollar of electronics manufacturing output produced in the state generates $0.64 elsewhere in Ohio's economy.

Table 8. State-Level Output Impacts
Billion $

Region	Direct Effect	Indirect Effect	Induced Effect	Total Effect
United States	$709.9	$340.8	$406.3	$1,457.0
California	$197.3	$54.9	$67.4	$319.6
Texas	$71.5	$20.5	$20.5	$112.5
Massachusetts	$35.0	$8.5	$10.1	$53.6
New York	$32.1	$8.8	$8.1	$49.0
Oregon	$34.6	$4.9	$6.2	$45.7
Minnesota	$24.5	$7.1	$7.9	$39.5
North Carolina	$25.9	$5.8	$6.4	$38.1
Florida	$21.3	$6.3	$7.2	$34.9
Pennsylvania	$21.4	$6.1	$6.6	$34.1
Illinois	$19.8	$5.6	$6.6	$32.0
Arizona	$16.6	$4.2	$6.0	$26.7
Ohio	$14.7	$4.7	$4.7	$24.0
Wisconsin	$14.6	$3.6	$4.0	$22.3
Michigan	$14.4	$3.9	$3.3	$21.6
Colorado	$12.8	$3.5	$4.0	$20.3
New Jersey	$11.1	$2.8	$3.5	$17.3

Figure 8. State-Level Output Impacts
Units: Billion $



4. END-USE ANALYSIS

Section 3 described the upstream supply-chain effects of the electronics manufacturing industry. Section 4 changes focus and addresses where manufactured electronics ultimately end up. This report describes five types of end use as well as the total category:

1. **Personal Consumption Expenditures** — These are goods and services purchased by individuals for private use.
2. **Investment & Inventory Change** — Investment includes all purchases of equipment, structures, and intellectual property purchased by private businesses. Inventory change describes the change in physical volume of inventories owned by businesses from one period to another.
3. **Government: Federal Defense** — This category includes both consumption expenditures and investment made by the federal government for defense purposes.
4. **Government: All Other** — The remainder of government activity is contained in this category. It includes all non-defense expenditures at the federal, state and local levels.
5. **Exports** — Exports are goods and services sold by domestic businesses to foreign individuals, private businesses and governments.
6. **Final Sales** — This is defined as the sum of personal consumption expenditures, investment and inventory change, government spending and exports.

The impacts presented show the electronics manufacturing content in all categories of final sales. This would include, for example, semiconductors in personal motor vehicles or electronic components in communication equipment or in other defense-related equipment bought by the U.S. Defense Department.

In total, the electronics manufacturing industry is responsible for over $1.0 trillion in content of final sales.

Given their wide variety of applications, electronic goods are well represented in each of the categories listed above. Figure 9 illustrates the total end-use content by each of these five categories. Investment and inventory change account for the greatest share, making up 40.9 percent ($426.6 billion) of the total. The next largest share of electronic goods, 29.4 percent ($306.5 billion), end up in personal consumption expenditures. Finally, exports ($223.9 billion; 21.5 percent), federal defense ($37.8 billion; 3.6 percent) and other government purchases ($48.1 billion; 4.6 percent) make up the remainder. In total, the electronics manufacturing industry is responsible for over $1.0 trillion in content of final sales.

Figure 9. End-Use Impacts Summary
Units: Billion $

Table 9 provides additional details on end uses in the electronics manufacturing industry's sub-sectors. Most of these sub-sectors share the characteristics of the overall sector, with investment and inventory change comprising the bulk of the total, and personal consumption expenditures ranking second. A few sectors diverge from this pattern, however. Audio and video equipment (NAICS 3343) is overwhelmingly dominated by personal consumption expenditures ($70.5 billion). Semiconductors and other electronic components, meanwhile, are heavily reliant on export markets, with nearly 32 percent of total sales shipped overseas.

Table 9. End-Use Impacts by Major NAICS Source Industry
Billion $

	Personal Consumption Expenditures	Investment & Inventory Change	Government - Federal Defense	Government - Other	Exports	Final Sales
NAICS 3341 - Computer and Peripheral Equipment Manufacturing	53.7	65.9	0.8	3.2	14.7	138.3
NAICS 3342 - Communications Equipment Manufacturing	56.0	104.3	11.4	11.4	33.0	216.1
NAICS 3343 - Audio and Video Equipment Manufacturing	26.1	11.6	0.5	0.5	2.4	41.2
NAICS 3344 - Semiconductor and Other Electronic Component Manufacturing	70.5	54.8	6.9	11.0	67.2	210.4
NAICS 3345 - Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	32.2	104.5	12.1	7.6	53.3	209.6
NAICS 3353 - Electrical Equipment Manufacturing	18.6	35.6	1.6	4.7	20.2	80.7
NAICS 3359 - Other Electrical Equipment and Component Manufacturing	31.3	35.4	2.2	8.1	24.7	101.8
NAICS 33632 - Motor Vehicle Electrical and Electronic Equipment Manufacturing	18.0	14.5	2.2	1.7	8.3	44.7
Total	306.5	426.6	37.8	48.1	223.9	1,042.8

Table 10 combines the sources shown in Table 9 and examines end use at a more granular level, displaying the top 20 sectors ranked by total final sales. Note that the bottom row of Table 10 matches the totals shown in Figure 9 and Table 9. The 20 sectors listed account for nearly 64 percent of total sales ($1,042.8 billion).

At $143 billion, broadcast and wireless communications equipment accounts for the largest amount of electronics content in total final sales. Of this, $88.5 billion ends up used as equipment investment by private businesses. Ranking second, final sales of electronics in computers totals $83.6 billion. Automobiles account for the third largest share of electronics in total final sales. During recent decades, electronics have accounted for an increasingly larger share of the total value of new vehicles.

Table 10. Detailed End-Use Impacts, Ranked by Final Sales
Billion $

Rank	Detailed Sector	Personal Consumption Expenditures	Investment & Inventory Change	Government - Federal Defense	Government - Other	Exports	Final Sales
1	Broadcast and wireless communications equipment	19.5	88.5	8.3	5.5	21.3	143.0
2	Computers	27.0	49.6	0.1	1.0	5.8	83.6
3	Automobiles	29.5	33.3	4.1	0.6	6.3	73.8
4	Computer terminals and other computer peripherals	15.6	15.1	0.1	0.3	5.7	36.8
5	Electromedical and electrotherapeutic apparatus	3.8	24.8	0.0	0.2	5.7	34.5
6	Search, detection, and navigation instruments	0.1	18.9	7.3	2.9	5.3	34.3
7	Audio and video equipment	23.4	8.2	0.0	0.2	1.7	33.5
8	Aircraft	0.2	9.6	5.2	0.0	11.2	26.2
9	Analytical laboratory instruments	0.0	16.8	0.0	0.0	7.8	24.5
10	Semiconductors and related devices	0.0	-0.2	0.0	0.0	23.8	23.7
11	Other electronic components	1.0	0.0	0.9	0.1	17.6	19.6
12	Carbon and graphite and miscellaneous electrical equipment	0.6	11.5	0.2	0.2	6.2	18.6
13	Watch, clock, and other measuring and controlling devices	8.0	6.8	0.1	0.0	3.3	18.3
14	State and local general government	0.0	0.0	0.0	15.4	0.0	15.4
15	Industrial process variable instruments	0.0	9.4	0.0	0.1	5.8	15.3
16	Computer storage devices	5.2	6.0	0.1	0.0	2.6	13.9
17	Wholesale trade	7.0	3.6	0.3	0.3	2.4	13.5
18	Irradiation apparatus manufacturing	0.0	9.7	0.0	0.2	3.2	13.1
19	Electricity and signal testing instruments	0.0	5.5	0.3	0.0	6.6	12.4
20	Switchgear and switchboard apparatus	0.1	9.1	0.3	0.5	2.0	12.1
	All other industries	165.6	100.5	10.5	20.6	79.4	376.6
	Total	306.5	426.6	37.8	48.1	223.9	1,042.8

Manufactured electronics are especially important to several sectors in the domestic economy. For example, Table 11 shows the end-use breakout in automotive and related final sales, which total $92.1 billion. Over two-thirds of the total final sales are accounted for by personal consumption expenditures and investment and inventory change. Additionally, motor vehicle parts are responsible for $8.7 billion in exports.

Table 11. End-Use Impacts, Focus on Automobiles and Related
Billion $

	Personal Consumption Expenditures	Investment & Inventory Change	Government - Federal Defense	Government - Other	Exports	Final Sales
Automobiles	29.5	33.3	4.1	0.6	6.3	73.8
Heavy duty trucks	0.0	0.8	1.0	1.6	0.6	4.0
Motor vehicle bodies	0.0	0.6	0.0	0.0	0.0	0.6
Truck trailer manufacturing	0.0	0.5	0.1	0.0	0.1	0.7
Motor homes, trailers and campers	1.0	0.1	0.0	0.0	0.1	1.2
Motor vehicle parts	2.1	0.4	0.6	0.0	8.7	11.9
Total	32.6	35.7	5.8	2.3	15.7	92.1

Another important sector for manufactured electronics is the aerospace industry, as shown in Table 12. This sector includes aircraft, missiles and all related parts. This sector is responsible for $44.7 billion in final sales and is uniquely weighted toward federal defense and export end uses.

Table 12. End-Use Impacts, Focus on Aerospace and Related
Billion $ Electronics Investment by End-Use Sectors

	Personal Consumption Expenditures	Investment & Inventory Change	Government - Federal Defense	Government - Other	Exports	Final Sales
Aircraft	0.2	9.6	5.2	0.0	11.2	26.2
Aircraft engines and engine parts	0.0	0.5	0.2	0.0	8.3	9.0
Other aircraft parts and auxiliary equipment	0.0	0.0	0.1	0.0	1.9	2.0
Guided missiles and space vehicles	0.0	3.5	1.7	0.5	1.2	6.8
Propulsion units and parts for space vehicles and guided missiles	0.0	0.0	0.2	0.1	0.3	0.7
Total	0.2	13.5	7.4	0.7	22.9	44.7

Electronics Investment by End-Use Sectors

Equipment investment helps end-use industries maintain or improve their capabilities. In many industries, electronics play a vital role in ensuring that those firms remain competitive. This section provides a detailed examination of these equipment expenditures by three major consumers of manufactured electronics in 2017: the automotive, aerospace, and medical services sectors.

Table 13 and Figure 10 show investment expenditures made by the automotive sector. At roughly $750 million, the automobiles industry ranks as the largest industry for investment in electronic equipment. About two-thirds of this investment was devoted to NAICS 3345, which includes products that measure and test electrical signals (NAICS 334515), motor vehicle gauges (NAICS 334514), and emissions testing equipment (NAICS 334519). IPC-related products represented roughly 7.6 percent of the automotive sector's total equipment investment expenditures in 2017.

Table 13. Investment by Automobiles and Related Industries
Million $

	3341 - Computer and Peripheral Equipment Manufacturing	3342 - Communications Equipment Manufacturing	3343 - Audio and Video Equipment Manufacturing	3344 - Semiconductor and Other Electronic Component Manufacturing	3345 - Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	3353 - Electrical Equipment Manufacturing	3359 - Other Electrical Equipment and Component Manufacturing	IPC Industry Total
Automobiles	21.8	13.2	0.4	67.4	484.7	101.9	58.2	747.8
Heavy duty trucks	0.2	0.2	0.0	0.8	5.5	1.2	0.7	8.5
Motor vehicle bodies	0.3	0.2	0.0	1.0	7.1	1.5	0.9	11.0
Truck trailer manufacturing	0.3	0.2	0.0	0.9	6.8	1.4	0.8	10.4
Motor homes, trailers and campers	0.2	0.1	0.0	0.8	5.5	1.2	0.7	8.5
Motor vehicle parts	18.1	11.0	0.3	56.0	402.5	84.6	48.4	620.9
Autos & Related Total	41.1	24.9	0.8	126.8	912.1	191.8	109.6	1,407.0

Figure 10. Investment by Automobiles and Related Industries
Units: Million $

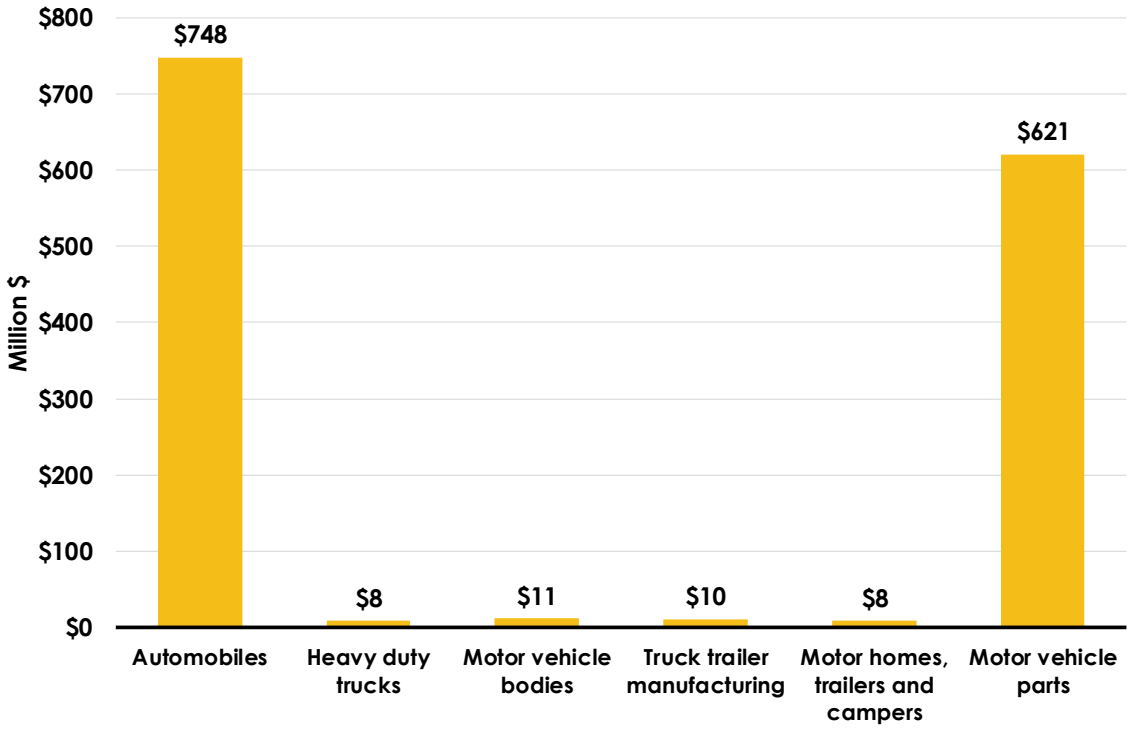
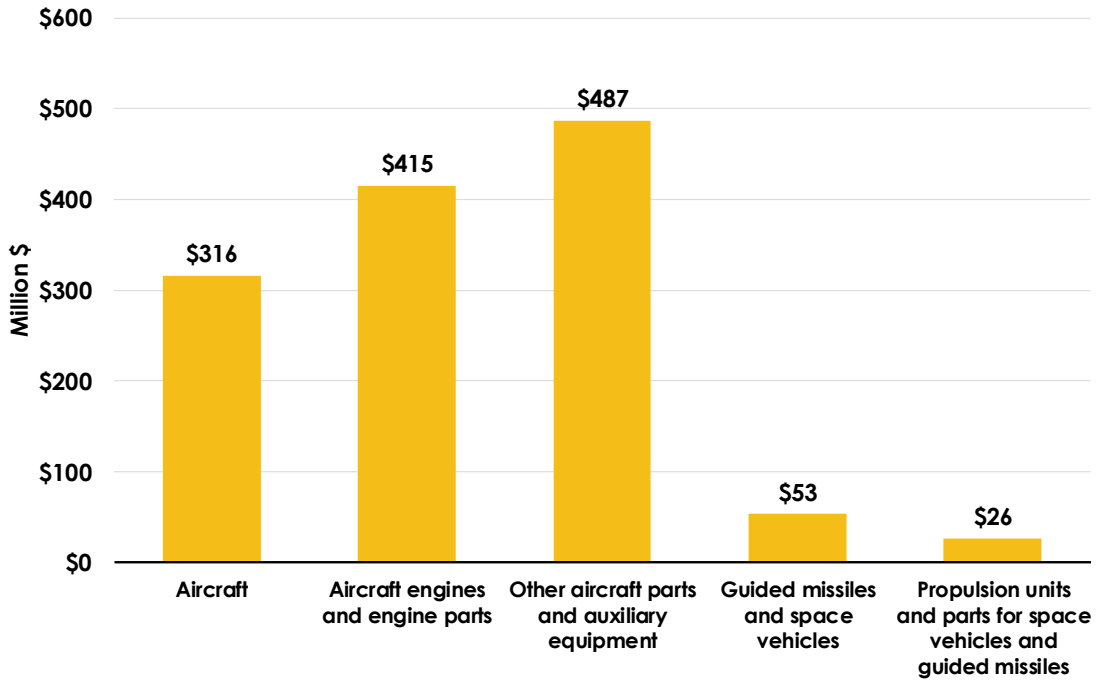


Table 14 and Figure 11 provides similar data for the aerospace sector in 2017. In this sector, aircraft parts (excluding engines) was the largest industry for electronics-related equipment, investing almost $500 million. These funds were primarily focused in NAICS 3345. Relevant goods might include navigation systems (NAICS 334511) and other measuring devices (NAICS 334519). IPC-related products make up approximately 15.6 percent of total aerospace equipment investment spending.

Table 14. Investment by Aerospace and Related Industries
Million $

	3341 - Computer and Peripheral Equipment Manufacturing	3342 - Communications Equipment Manufacturing	3343 - Audio and Video Equipment Manufacturing	3344 - Semiconductor and Other Electronic Component Manufacturing	3345 - Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	3353 - Electrical Equipment Manufacturing	3359 - Other Electrical Equipment and Component Manufacturing	IPC Industry Total
Aircraft	4.1	24.3	0.1	31.3	231.8	11.2	13.2	316.0
Aircraft engines and engine parts	5.4	31.9	0.1	41.1	304.2	14.8	17.3	414.6
Other aircraft parts and auxiliary equipment	6.4	37.5	0.1	48.3	357.3	17.3	20.3	487.1
Guided missiles and space vehicles	0.7	4.1	0.0	5.3	39.2	1.9	2.2	53.5
Propulsion units and parts for space vehicles and guided missiles	0.3	2.0	0.0	2.6	19.2	0.9	1.1	26.1
Aerospace & Related Total	16.9	99.8	0.2	128.5	951.7	46.2	54.0	1,297.3

Figure 11. Investment by Aerospace and Related Industries
Units: Million $

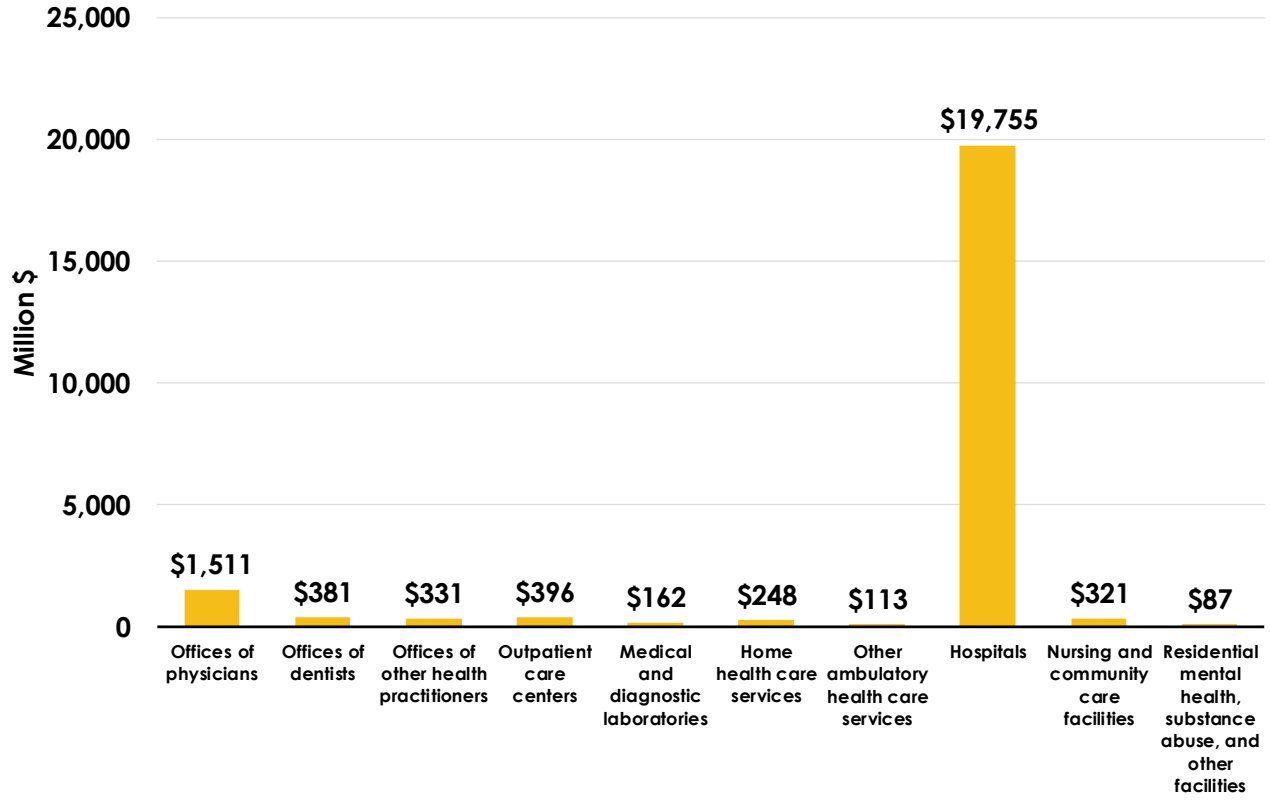


Finally, Table 15 and Figure 12 shows investments made by the medical services sector. At nearly $20 billion, the hospitals industry made the largest amount of investment in electronic equipment. Again, the bulk of these expenditures were traced to NAICS 3345. Pertinent medical investments could include MRI machines, ultrasonic scanning devices and dialysis equipment (NAICS 334510). Electronics are an important component of medical services' equipment investment, making up 21.9 percent of the sector's total in 2017.

Table 15. Investment by Medical Services and Related Industries
Million $

	3341 - Computer and Peripheral Equipment Manufacturing	3342 - Communications Equipment Manufacturing	3343 - Audio and Video Equipment Manufacturing	3344 - Semiconductor and Other Electronic Component Manufacturing	3345 - Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	3353 - Electrical Equipment Manufacturing	3359 - Other Electrical Equipment and Component Manufacturing	IPC Industry Total
Offices of physicians	34.0	31.7	2.0	66.6	1,332.2	12.3	32.6	1,511.4
Offices of dentists	8.6	8.0	0.5	16.8	335.7	3.1	8.2	380.9
Offices of other health practitioners	7.5	7.0	0.4	14.6	292.0	2.7	7.1	331.3
Outpatient care centers	8.9	8.3	0.5	17.5	349.4	3.2	8.6	396.4
Medical and diagnostic laboratories	3.6	3.4	0.2	7.1	142.5	1.3	3.5	161.6
Home health care services	5.6	5.2	0.3	10.9	218.5	2.0	5.3	247.9
Other ambulatory health care services	2.5	2.4	0.2	5.0	99.3	0.9	2.4	112.7
Hospitals	232.4	168.7	11.2	591.8	18,317.4	163.5	270.5	19,755.4
Nursing and community care facilities	13.8	25.1	3.5	24.0	215.6	12.4	27.0	321.3
Residential mental health, substance abuse, and other facilities	3.7	6.8	1.0	6.5	58.7	3.4	7.4	87.4
Medical Services & Related Total	320.6	266.6	19.9	760.8	21,361.2	204.7	372.7	23,306.4

Figure 12. Investment by Medical Services and Related Industries
Units: Million $



Intermediate Expenditures on Electronics by End-Use Sectors

In addition to investments in equipment, many industries make sizable purchases of intermediate electronic inputs. These inputs are goods and services required to produce the product which is ultimately sold to final-demand markets.

Table 16 and Figure 13 show purchases of intermediate electronic inputs in the automotive sector in 2017. Within this sector, the automobiles and motor vehicle parts industries comprised the vast majority of intermediate expenditures of electronic goods. In both of these sub-sectors, the main inputs being purchased are semiconductors and other electronic components (NAICS 3344). Purchases of IPC-related goods accounted for roughly 2.7 percent of the automotive sector's intermediate purchases.

Table 17 and Figure 14 show purchases of intermediate electronic inputs by the aerospace sector. The aircraft sub-sector spent over $14 billion on such purchases in 2017, and the overall sector spent close to $26 billion. IPC-related products comprised 11.3 percent of all aerospace sector intermediate expenditures in 2017.

Finally, Table 18 and Figure 15 display purchases of intermediate electronic inputs by the medical services sector in 2017. The aggregate medical services sector spends in excess of $10 billion in intermediate purchases of electronics. Over half of this was devoted to NAICS 3345 (which includes electromedical equipment), while another large share was traced to NAICS 3344 (semiconductors and other electronic components). IPC-related products make up a relatively small share (0.4 percent) of medical services' intermediate inputs.

Table 16. Intermediate Expenditures by Automobiles and Related Industries
Million $

	3341 - Computer and Peripheral Equipment Manufacturing	3342 - Communications Equipment Manufacturing	3343 - Audio and Video Equipment Manufacturing	3344 - Semiconductor and Other Electronic Component Manufacturing	3345 - Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	3353 - Electrical Equipment Manufacturing	3359 - Other Electrical Equipment and Component Manufacturing	IPC Industry Total
Automobiles	115.7	90.4	233.4	4,644.5	1,515.4	278.4	1,828.7	8,706.4
Heavy duty trucks	8.6	8.0	3.4	307.8	127.8	47.1	202.4	705.2
Motor vehicle bodies	1.0	3.0	0.2	71.2	10.7	7.7	135.6	229.4
Truck trailer manufacturing	0.5	2.5	0.0	69.3	8.4	9.2	21.4	111.2
Motor homes, trailers and campers	1.4	5.9	0.2	179.8	49.9	33.0	310.1	580.1
Motor vehicle parts	16.4	86.0	0.4	6,321.5	175.2	403.7	2,136.7	9,140.0
Autos & Related Total	143.6	195.8	237.6	11,594.1	1,887.3	779.2	4,634.8	19,472.4

Figure 13. Intermediate Expenditures by Automobiles and Related Industries
Units: Million $

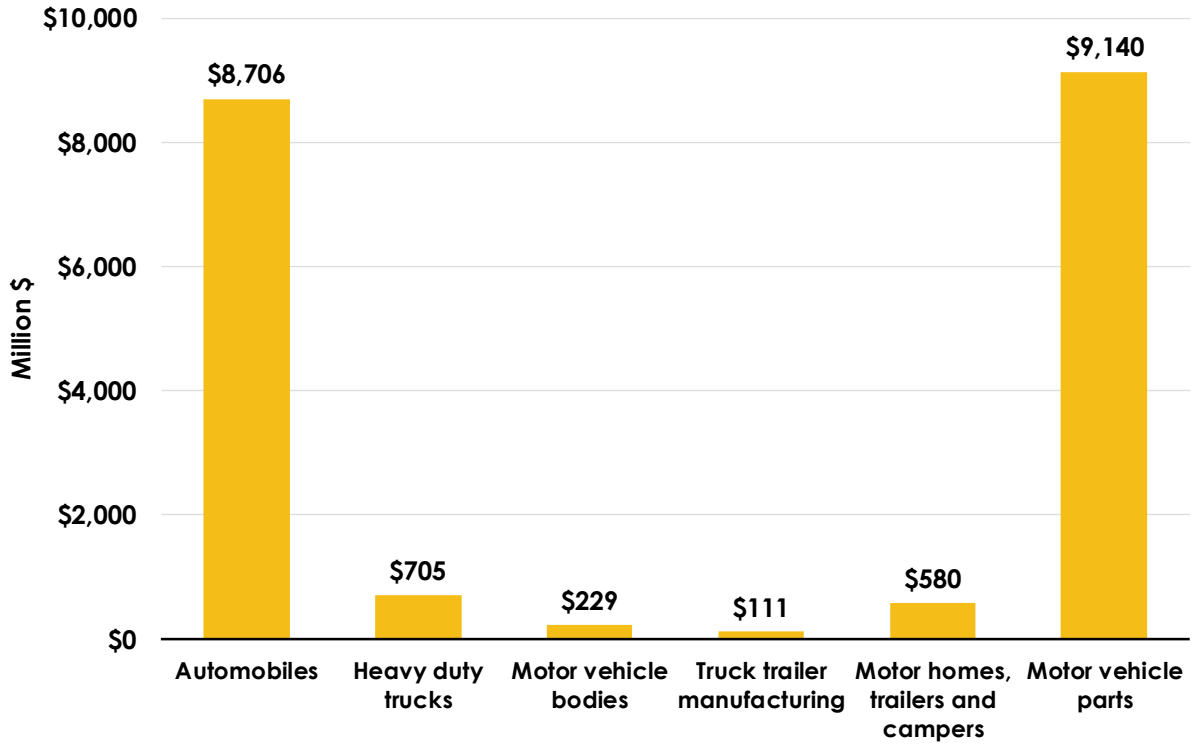


Table 17. Intermediate Expenditures by Aerospace and Related Industries
Million $

	3341 - Computer and Peripheral Equipment Manufacturing	3342 - Communications Equipment Manufacturing	3343 - Audio and Video Equipment Manufacturing	3344 - Semiconductor and Other Electronic Component Manufacturing	3345 - Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	3353 - Electrical Equipment Manufacturing	3359 - Other Electrical Equipment and Component Manufacturing	IPC Industry Total
Aircraft	7.5	538.9	0.1	2,971.5	9,023.3	74.2	1,544.4	14,160.0
Aircraft engines and engine parts	3.0	21.6	0.0	207.1	6,479.5	15.8	44.9	6,771.9
Other aircraft parts and auxiliary equipment	1.5	92.6	0.0	189.5	33.9	11.9	252.8	582.3
Guided missiles and space vehicles	2.3	470.4	0.0	450.9	2,971.0	37.7	25.0	3,957.3
Propulsion units and parts for space vehicles and guided missiles	0.4	59.4	0.0	73.1	371.7	6.3	4.4	515.4
Aerospace & Related Total	14.7	1,183.0	0.2	3,892.1	18,879.4	146.0	1,871.5	25,986.8

Figure 14. Intermediate Expenditures by Aerospace and Related Industries
Units: Million $

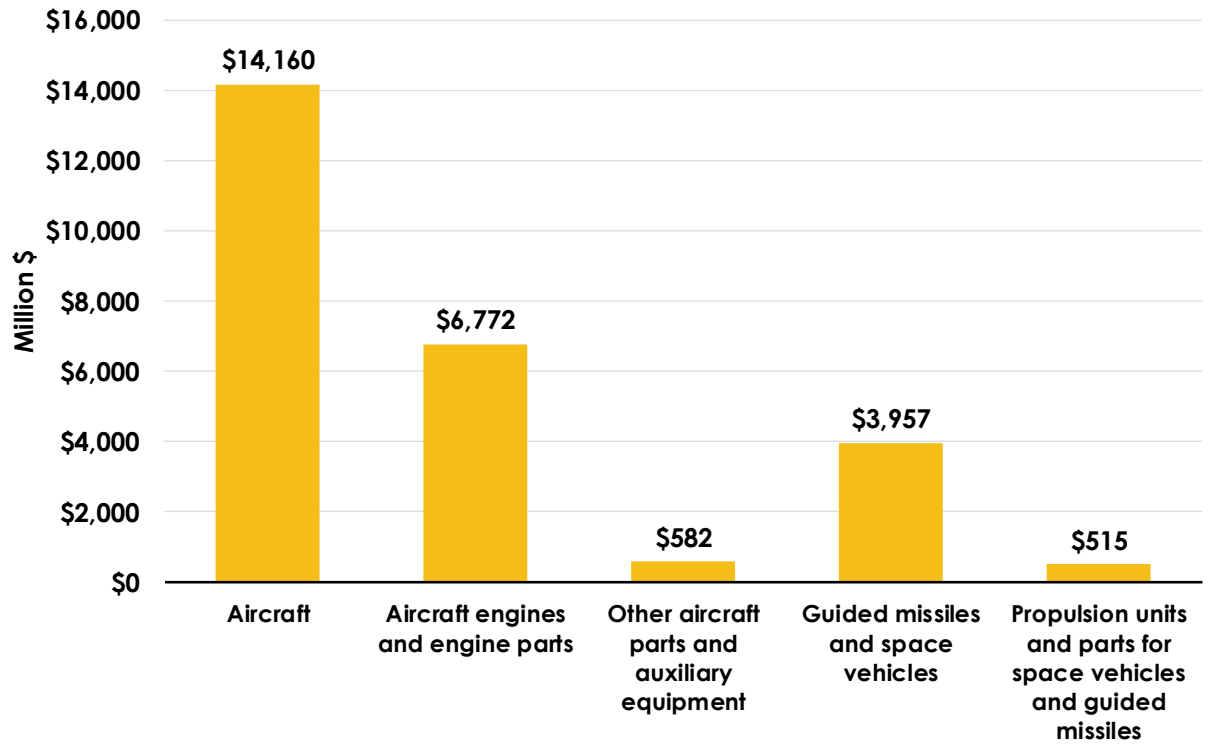
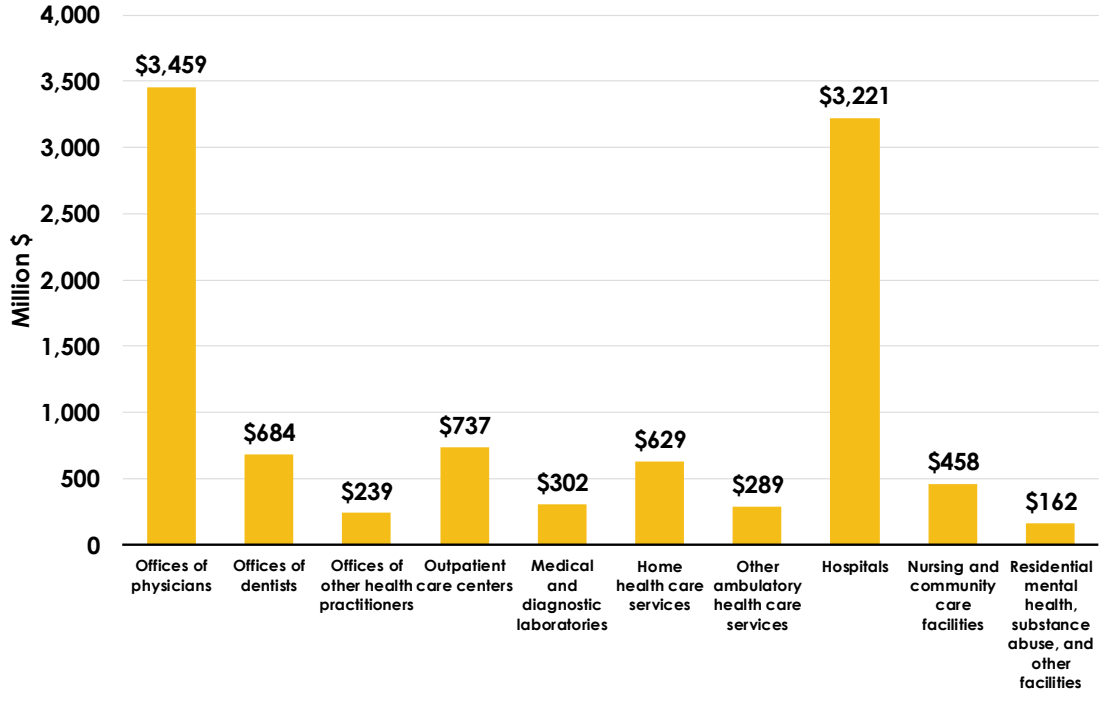


Table 18. Intermediate Expenditures by Medical Services Industries
Million $

	3341 - Computer and Peripheral Equipment Manufacturing	3342 - Communications Equipment Manufacturing	3343 - Audio and Video Equipment Manufacturing	3344 - Semiconductor and Other Electronic Component Manufacturing	3345 - Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	3353 - Electrical Equipment Manufacturing	3359 - Other Electrical Equipment and Component Manufacturing	IPC Industry Total
Offices of physicians	49.2	256.2	0.5	396.6	2,472.7	98.8	185.2	3,459.2
Offices of dentists	7.0	35.4	0.1	117.9	454.3	24.0	44.7	683.5
Offices of other health practitioners	9.5	28.3	0.1	55.5	100.6	14.7	30.0	238.6
Outpatient care centers	8.4	38.9	0.1	105.5	493.0	31.3	59.5	736.8
Medical and diagnostic laboratories	7.4	14.1	0.1	63.1	185.9	11.7	19.9	302.2
Home health care services	14.4	25.5	0.1	68.4	466.7	19.8	34.4	629.3
Other ambulatory health care services	5.9	14.6	0.0	46.1	184.3	10.0	27.8	288.6
Hospitals	85.5	290.2	1.2	1,333.0	661.8	309.5	540.2	3,221.4
Nursing and community care facilities	17.5	56.9	0.3	183.5	54.4	51.5	94.3	458.4
Residential mental health, substance abuse, and other facilities	2.6	12.6	0.0	39.8	75.8	11.0	20.2	162.0
Medical Services & Related Total	207.3	772.7	2.5	2,409.3	5,149.4	582.5	1,056.2	10,180.0

Figure 15. Intermediate Expenditures by Medical Services Industries
Units: Million $



5. CONCLUSIONS

The electronics manufacturing sector fills many critical roles in the U.S. economy, and in dozens of adjacent industries, including transportation, aerospace and defense, and medical services, among many others.

While its goods and services are generally hidden out of sight, the industry designs, builds, tests, and services thousands of intermediate and final products used billions of times per day by consumers around the world.

The many positive economic impacts of electronics manufacturing in the United States include millions of jobs, and hundreds of billions of dollars' worth of labor income and value-added.

The benefits are most pronounced in 16 states that account for approximately 80 percent of national electronics manufacturing output; but the benefits are also generated in and shared across all 50 states and U.S territories.

And while this report does not delve into the implications of this industry's value to the economy, it is clear that the industry has thrived in the United States due to that nation's longtime strengths in education, workforce, research, innovation, and business environment.

To the extent those historic strengths may be at risk in today's world, the United States risks its future world leadership and prosperity. Leaders in United States and all nations who are interested in future prosperity should give high priority to creating a positive policy and business environment for the electronics manufacturing industry.

IPC will continue to foster and promote industry standards to help ensure superior quality of electronics products and services, environmentally friendly operations, and intellectual property protection. We will continue to operate the industry's leading training and worker certifications to help provide the workforce of today and tomorrow. We will conduct and publish unique industry research to help all parties make more informed decisions. And we will continue to advocate for pro-growth, pro-innovation, science-based policies in all nations.

APPENDIX A – NATIONAL AND STATE FACT SHEETS

Appendix A contains Fact Sheets which summarize information for the entire United States and 16 specific states. All data was sourced from IMPLAN and applies to the year 2017.

Fact Sheets are provided for the following states:

1. Arizona
2. California
3. Colorado
4. Florida
5. Illinois
6. Massachusetts
7. Michigan
8. Minnesota
9. New Jersey
10. New York
11. North Carolina
12. Ohio
13. Oregon
14. Pennsylvania
15. Texas
16. Wisconsin

At the top of each fact sheet are general facts about the region. These pertain to the entire economy, helping to give perspective to the electronics manufacturing impacts listed underneath.

The second block summarizes the industry's direct economic effects in terms of employment, labor income, value added, and output. The chart also shows electronics manufacturing's share of regional GDP, calculated by dividing direct value-added by the gross regional product. Labor income per worker is derived by dividing electronics manufacturing labor income by employment.

The third block in each table describes electronics manufacturing's direct impacts, the impacts of upstream suppliers (indirect), and associated income-related (induced) effects.

Next, two different multipliers are provided. Economic multipliers describe the ratio of the sum of indirect and induced impacts to direct impacts. For employment multipliers, take the sum of indirect and induced employment and divide it by direct employment. Similarly, output multipliers can be calculated by adding indirect and induced output together and dividing it by direct output.

Fact Sheet 1. United States

United States, 2017

Region Facts

- Population: 325.7 million
- Gross Domestic Product: $19.5 trillion
- Employment: 195.8 million
- Labor Income : $11.9 trillion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
1,306.9	$165.7	$307.6	$709.9

Share of National GDP	Average Labor Income
1.6%	$126,812

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	1,306.9	165.7	307.6	709.9
Indirect [3]	1,487.9	111.5	176.6	340.8
Induced [4]	2,480.2	130.5	229.7	406.3
Total	5,275.0	407.7	713.8	1,457.0

Employment Multiplier

One electronics manufacturing job helps support 3.0 other jobs in the national economy.

Output Multiplier

One dollar in electronics manufacturing output generates $1.05 elsewhere in the national economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 2. Arizona

Arizona , 2017

Region Facts

- Population: 7.0 million
- Gross Domestic Product: $324.9 billion
- Employment: 3.7 million
- Labor Income : $292.1 billion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
32.5	$4.4	$7.2	$16.6

Share of State GDP	Average Labor Income
2.21%	$136,508

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	32.5	4.4	7.2	16.6
Indirect [3]	24.2	1.5	2.4	4.2
Induced [4]	41.3	1.9	3.4	6.0
Total	98.0	7.9	13.0	26.7

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 2.0 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.61 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 3. California

California , 2017

Region Facts

- Population: 39.5 million
- Gross Domestic Product: $2.8 trillion
- Employment: 23.6 million
- Labor Income : $2.3 trillion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
274.8	$53.2	$93.4	$197.3

Share of State GDP

3.37%

Average Labor Income

$193,693

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	274.8	53.2	93.4	197.3
Indirect [3]	264.0	21.4	32.4	54.9
Induced [4]	403.7	23.0	41.7	67.4
Total	942.5	97.6	167.4	319.6

Employment Multiplier

One electronics manufacturing job helps support 2.4 other jobs in the state economy.

Output Multiplier

One dollar in electronics manufacturing output generates $0.62 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 4. Colorado

Colorado, 2017

Region Facts

- Population: 5.6 million
- Gross Domestic Product: $353.0 billion
- Employment: 3.7 million
- Labor Income : $300.0 billion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
22.1	$3.0	$5.6	$12.8

Share of State GDP	Average Labor Income
1.59%	$134,317

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	22.1	3.0	5.6	12.8
Indirect [3]	18.1	1.3	2.0	3.5
Induced [4]	27.1	1.3	2.4	4.0
Total	67.3	5.6	10.0	20.3

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 2.1 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.59 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 5. Florida

Florida , 2017

Region Facts

- Population: 20.9 million
- Gross Domestic Product: $969.6 billion
- Employment: 11.9 million
- Labor Income : $983.3 billion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
49.8	$4.8	$8.3	$21.3

Share of State GDP	Average Labor Income
0.86%	$96,992

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	49.8	4.8	8.3	21.3
Indirect [3]	36.8	2.3	3.6	6.3
Induced [4]	51.1	2.2	4.1	7.2
Total	137.7	9.3	16.0	34.9

Employment Multiplier

One electronics manufacturing job helps support 1.8 other jobs in the state economy.

Output Multiplier

One dollar in electronics manufacturing output generates $0.63 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 6. Illinois

Illinois, 2017

Region Facts

- Population: 12.8 million
- Gross Domestic Product: $825.1 billion
- Employment: 7.9 million
- Labor Income : $676.0 billion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
49.1	$4.8	$8.0	$19.8

Share of State GDP	Average Labor Income
0.97%	$97,520

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	49.1	4.8	8.0	19.8
Indirect [3]	27.0	2.1	3.4	5.6
Induced [4]	43.9	2.3	4.0	6.6
Total	120.0	9.2	15.4	32.0

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 1.4 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.62 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 7. Massachusetts

Massachusetts, 2017

Region Facts

- Population: 6.9 million
- Gross Domestic Product: $541.6 billion
- Employment: 4.8 million
- Labor Income : $452.0 billion

IPC BUILD ELECTRONICS BETTER

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
56.0	$8.3	$15.2	$35.0

Share of State GDP	Average Labor Income
2.81%	$148,189

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	56.0	8.3	15.2	35.0
Indirect [3]	40.3	3.7	5.2	8.5
Induced [4]	65.6	3.9	6.3	10.1
Total	162.0	15.8	26.7	53.6

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 1.9 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.53 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 8. Michigan

Michigan , 2017

Region Facts

- Population: 10.0 million
- Gross Domestic Product: $517.6 billion
- Employment: 5.7 million
- Labor Income : $450.8 billion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
35.7	$2.2	$5.1	$14.4

Share of State GDP	Average Labor Income
0.98%	$61,315

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	35.7	2.2	5.1	14.4
Indirect [3]	21.1	1.5	2.2	3.9
Induced [4]	23.8	1.1	1.9	3.3
Total	80.6	4.8	9.2	21.6

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 1.3 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.50 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 9. Minnesota

Minnesota, 2017

Region Facts

- Population: 5.6 million
- Gross Domestic Product: $361.7 billion
- Employment: 3.8 million
- Labor Income : $295.8 billion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
47.7	$5.6	$9.8	$24.5

Share of State GDP	Average Labor Income
2.70%	$116,951

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	47.7	5.6	9.8	24.5
Indirect [3]	35.7	2.8	4.1	7.1
Induced [4]	54.3	2.7	4.6	7.9
Total	137.6	11.1	18.5	39.5

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 1.9 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.61 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 10. New Jersey

New Jersey, 2017

Region Facts

- Population: 9.0 million
- Gross Domestic Product: $592.9 billion
- Employment: 5.4 million
- Labor Income : $563.3 billion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
26.6	$3.0	$4.9	$11.1

Share of State GDP	Average Labor Income
0.82%	$113,042

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	26.6	3.0	4.9	11.1
Indirect [3]	13.3	1.2	1.8	2.8
Induced [4]	21.9	1.2	2.1	3.5
Total	61.8	5.4	8.8	17.3

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 1.3 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.56 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 11. New York

New York, 2017

Region Facts

- Population: 19.8 million
- Gross Domestic Product: $1.5 trillion
- Employment: 12.4 million
- Labor Income : $1.2 trillion

IPC BUILD ELECTRONICS BETTER

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
66.2	$7.4	$11.3	$32.1

Share of State GDP	Average Labor Income
0.73%	$112,530

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	66.2	7.4	11.3	32.1
Indirect [3]	39.4	3.7	5.6	8.8
Induced [4]	50.4	3.0	5.3	8.1
Total	156.0	14.2	22.2	49.0

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 1.4 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.53 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 12. North Carolina

North Carolina, 2017

Region Facts

- Population: 10.3 million
- Gross Domestic Product: $545.4 billion
- Employment: 5.9 million
- Labor Income : $444.9 billion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
47.4	$5.5	$12.2	$25.9

Share of State GDP	Average Labor Income
2.23%	$116,514

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	47.4	5.5	12.2	25.9
Indirect [3]	32.9	2.1	3.3	5.8
Induced [4]	46.3	2.0	3.7	6.4
Total	126.5	9.6	19.1	38.1

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 1.7 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.47 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 13. Ohio

Ohio, 2017

Region Facts

- Population: 11.7 million
- Gross Domestic Product: $651.5 billion
- Employment: 7.0 million
- Labor Income : $531.8 billion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
39.5	$3.3	$4.6	$14.7

Share of State GDP	Average Labor Income
0.70%	$84,148

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	39.5	3.3	4.6	14.7
Indirect [3]	24.9	1.7	2.6	4.7
Induced [4]	34.0	1.5	2.7	4.7
Total	98.5	6.5	9.9	24.0

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 1.5 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.64 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 14. Oregon

Oregon, 2017

Region Facts

- Population: 4.1 million
- Gross Domestic Product: $232.2 billion
- Employment: 2.5 million
- Labor Income : $192.1 billion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
37.2	$5.6	$22.8	$34.6

Share of State GDP	Average Labor Income
9.84%	$151,474

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	37.2	5.6	22.8	34.6
Indirect [3]	27.6	1.9	2.8	4.9
Induced [4]	44.8	2.1	3.6	6.2
Total	109.7	9.6	29.2	45.7

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 1.9 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.32 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 15. Pennsylvania

Pennsylvania , 2017

Region Facts

- Population: 12.8 million
- Gross Domestic Product: $759.7 billion
- Employment: 7.7 million
- Labor Income : $667.1 billion

IPC BUILD ELECTRONICS BETTER

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
51.9	$4.9	$7.9	$21.4

Share of State GDP

1.05%

Average Labor Income

$93,667

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	51.9	4.9	7.9	21.4
Indirect [3]	30.1	2.4	3.6	6.1
Induced [4]	46.7	2.4	4.0	6.6
Total	128.7	9.6	15.5	34.1

Employment Multiplier

One electronics manufacturing job helps support 1.5 other jobs in the state economy.

Output Multiplier

One dollar in electronics manufacturing output generates $0.59 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 16. Texas

Texas, 2017

Region Facts

- Population: 28.3 million
- Gross Domestic Product: $1.7 trillion
- Employment: 16.9 million
- Labor Income : $1.3 trillion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
107.1	$14.6	$32.2	$71.5

Share of State GDP	Average Labor Income
1.88%	$135,984

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	107.1	14.6	32.2	71.5
Indirect [3]	101.8	7.2	11.8	20.5
Induced [4]	138.5	6.8	11.8	20.5
Total	347.4	28.6	55.9	112.5

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 2.2 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.57 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

Fact Sheet 17. Wisconsin

Wisconsin, 2017

Region Facts

- Population: 5.8 million
- Gross Domestic Product: $324.1 billion
- Employment: 3.7 million
- Labor Income : $277.3 billion

Electronics Manufacturing's[1] Direct Economic Contribution

Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
34.2	$3.3	$5.5	$14.6

Share of State GDP	Average Labor Income
1.71%	$97,876

Direct, Indirect, & Induced Impacts

	Employment (1,000 Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct [2]	34.2	3.3	5.5	14.6
Indirect [3]	20.5	1.3	2.0	3.6
Induced [4]	29.5	1.3	2.3	4.0
Total	84.1	6.0	9.9	22.3

Employment Multiplier	Output Multiplier
One electronics manufacturing job helps support 1.5 other jobs in the state economy.	One dollar in electronics manufacturing output generates $0.52 elsewhere in the state economy.

Source: IMPLAN and INFORUM

Notes:

1. This study defines Electronics Manufacturing as NAICS 3341, 3342, 3343, 3344, 3345, 3353, 3359, and 33632. More information on NAICS is available at: https://www.census.gov/cgi-bin/sssd/naics/naicsrch
2. Direct economic impacts are the activity directly associated with the focus industry.
3. Indirect economic impacts are the upstream activity that supplies inputs to the focus industry.
4. Induced economic impacts are the economic activity associated with the spending of labor income and profits generated by direct and indirect activity.

APPENDIX B – ESTIMATED UPSTREAM IMPACTS THROUGH 2019

This section uses Census M3[4] (Manufacturers' Shipments, Inventories, and Orders) data to provide a rough estimate of upstream impacts attributed to the electronics manufacturing industry through 2019.

Table B-1. U.S. Electronics Manufacturing Impacts, 2017
Units Indicated

	Employment (Thousand Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct	1,306.9	$165.7	$307.6	$709.9
Indirect	1,487.9	$111.5	$176.6	$340.8
Induced	2,480.2	$130.5	$229.7	$406.3
Total	5,275.0	$407.7	$713.8	$1,457.0

Table B-2 shows impacts which have been inflated using the growth rate of shipments of computers and electronic products between 2017 and 2019.[5] These impacts are not based on historical data. Instead, these rough estimates assume that all upstream supply chain and consumption patterns are identical between 2017 and 2019. Additionally, it does not take into account other important factors such as productivity growth.

Table B-2. U.S. Electronics Manufacturing Impacts, 2019 (Estimated)
Units Indicated

	Employment (Thousand Persons)	Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)
Direct	1,438.6	$182.4	$338.6	$781.5
Indirect	1,637.9	$122.8	$194.3	$375.1
Induced	2,730.1	$143.6	$252.8	$447.3
Total	5,806.6	$448.8	$785.7	$1,603.9

[4] More information about the Census M3 data set can be found at https://www.census.gov/manufacturing/m3/index.html

[5] https://www.census.gov/econ/currentdata/dbsearch?program=M3&startYear=2010&endYear=2020&categories=34S&dataType=VS&geoLevel=US&adjusted=1&submit=GET+DATA&releaseScheduleId=

BUILD ELECTRONICS BETTER

3000 Lakeside Drive, Suite 105 N
Bannockburn, IL 60015 USA
+1 847-615-7100 **tel**
+1 847-615-7105 **fax**
www.**ipc**.org

IPC is the global association that helps OEMs, EMS, PCB manufacturers, cable and wiring harness manufacturers and electronics industry suppliers build electronics better. IPC members strengthen their bottom line and build more reliable, high quality products through proven standards, certification, education and training, thought leadership, advocacy, innovative solutions and industry intelligence.