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IP-Intensive Manufacturing Industries:
Driving U.S. Economic Growth

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About the Author

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Abstract

Economic data across a range of sources once again confirms innovation as a critical factor driving economic productivity and growth.

Intellectual property (IP) rights and protections foster IP-intensive manufacturing industries which have a higher R&D investment per employee than the average R&D investment per employee in all manufacturing industries and outperformed non-IP intensive industries across a range of economic measures. Workers in innovative industries disproportionately create more economic value and earn higher wages than their counterparts in other manufacturing industries.

The latest data also indicates that IP-intensive manufacturing industries are adding more jobs than other manufacturing industries.

Highlights of the Report

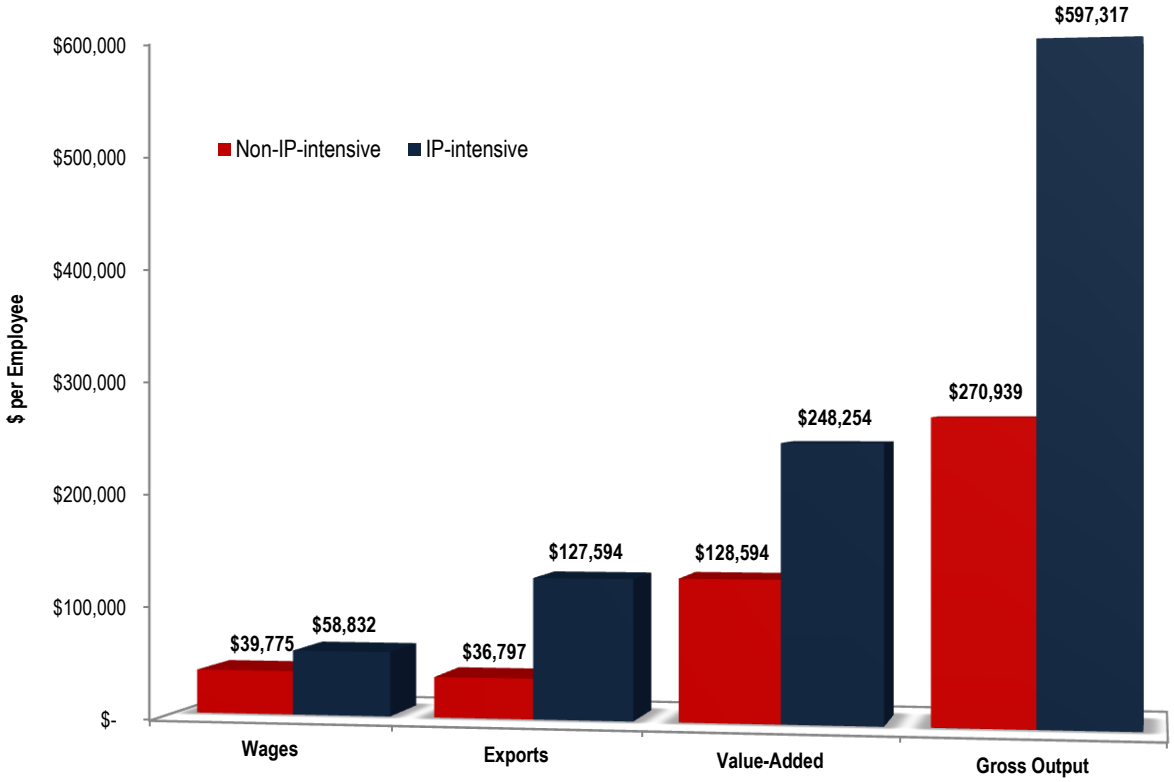
Innovative industries in the United States owe much of their success to economic returns resulting from their high levels of R&D or intellectual capital investment. IP-intensive manufacturing industries are defined in this report as those industries that have a higher R&D per employee than the average R&D per employee in all manufacturing industries. Our findings show that IP-intensive manufacturing industries outperformed non-IP-intensive manufacturing industries in all key economic measures during the past 15 years including during economic downturns, reflecting the sustainability of these industries. IP-intensive manufacturing industries invest heavily to research and develop new products and services as well as to improve or transform existing products. With higher demand for their products and services and increased revenues based on the high value of these products and services, these companies are able to build new facilities and hire additional high-wage workers in both science, technology, engineering, and mathematics (STEM) and non-STEM fields. Workers in IP-intensive manufacturing industries in turn are more productive and contribute higher economic value to the U.S. economy compared to workers in non-IP intensive industries

Key highlights of the economic performance of IP-intensive manufacturing industries during 2000-12 are:

- IP-intensive manufacturing industries invest more than 12 times in R&D per employee than non-IP-intensive manufacturing industries (approximately $30,000 compared to $2,500 per employee annually).
- IP-intensive manufacturing industries added more jobs during the most recent economic recovery period while non-IP-intensive manufacturing industries cut more jobs during the economic downturn.
- IP-intensive manufacturing industries pay 50% higher wages than non-IP-intensive manufacturing industries (approximately $60,000 compared to $40,000 per employee annually).
- While IP-intensive manufacturing industries employ nearly 30% of American manufacturing workers, they account for nearly 50% of gross output (total sales) of manufacturing industries. Gross output per employee in IP-intensive manufacturing industries is more than two times that of their counterparts in non-IP-intensive manufacturing industries (approximately $600,000 compared to $270,000 per employee annually).
- Net economic contribution (gross sales minus intermediate products or value added) per employee in IP-intensive manufacturing industries is nearly two times that of their counterparts in non-IP-intensive manufacturing industries (approximately $250,000 compared to $130,000 per employee annually).
- Annual exports per employee in IP-intensive manufacturing industries are 3.5 times greater than exports per employee in non-IP-intensive manufacturing industries (approximately $130,000 compared to $40,000 per employee annually).

Figure 1 below illustrates the economic outperformance of IP-intensive manufacturing industries compared to other non-IP-intensive manufacturing industries. During the period between 2000 and 2012, gross output (total sales), value-added (net economic contribution), exports, and wages per employee in IP-intensive manufacturing industries were all higher than that of other non-IP-intensive manufacturing industries.

Figure 1. Economic Performance per Employee, IP-Intensive and Non-IP-Intensive Industries, 2000-12



IP-intensive Manufacturing Industries: Driving U.S. Economic Growth

Nam D. Pham, Ph.D.

INTRODUCTION

Continued innovation is imperative for long-term sustainable economic growth. The research and development (R&D) process requires substantial time, effort, and resources. R&D investment enables companies to research and develop new or improved products, services, and processes that advance quality of life around the world and enable economies to grow. With advanced knowledge, innovative companies have comparative advantages to compete domestically and globally. Much of the post-World War II economic growth in the United States can be explained by increases in productivity due to technological advancement, increases in knowledge, and increased investment in human capital and R&D.[1]

Empirical studies have found evidence to support the linkage between innovation and economic growth. R&D activities help innovative companies and industries grow, which leads to employment and economic growth across the country. Indeed, innovative industries support nearly 56 million American jobs, 19 million directly and another 37 million indirectly through robust supply chain activities. Innovative domestic industries contribute to almost $6 trillion in total output, which is nearly half the total private sector output in the United States. Moreover, workers in innovative industries are highly productive, reflecting the high-skilled labor required and relative capital intensity of innovative work.[2]

In July 2013, the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce took a historic step to recognize private and public R&D investment as tangible assets. The BEA now records R&D investment figures in a category called "intellectual property products" within nonresidential gross investment. The new method recognizes "R&D" as assets used in the production process over a given time period. The revision has significant implications domestically as well as internationally. R&D activities now are recognized in a more tangible form in the national income accounts with market values that reflect the potential for generation of future income.

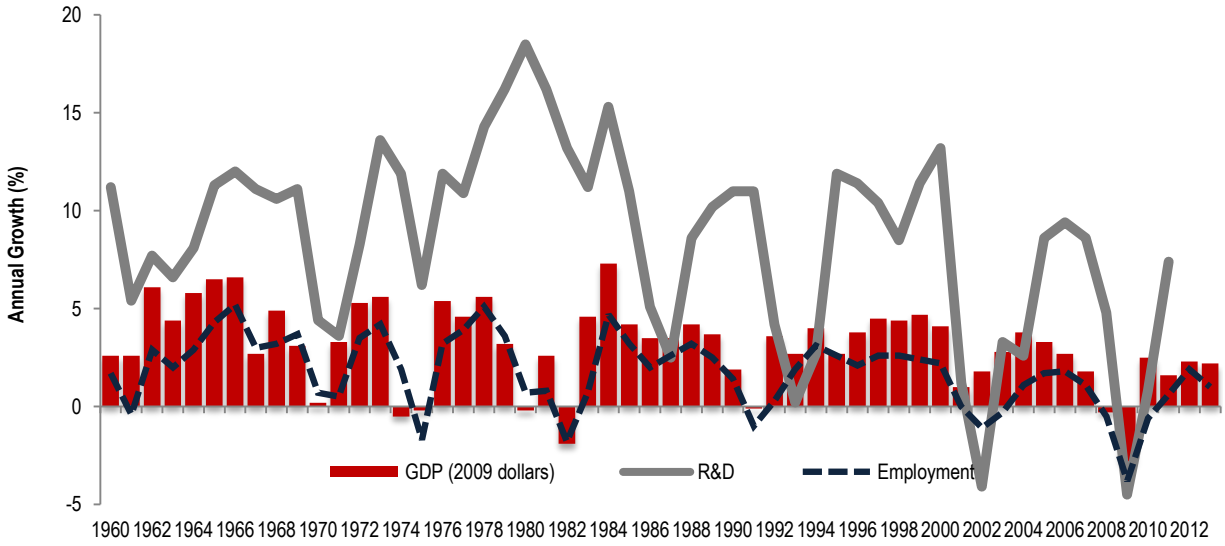
Source: Bureau of Economic Analysis, U.S. Department of Commerce.

Over the past fifty years, annual R&D investment in the United States has fluctuated with GDP growth, with significant drops during the two most recent recessions in 2000 and 2008. Approximately two-thirds of private R&D investment is spent on human capital in the form of salaries and wages, benefits, stock-based compensation, and temporary staffing, while the remaining one-third is spent on equipment, materials and supplies, lease and rental payments, and depreciation.[3] Figure 2 below tracks annual growth rates of R&D investment, GDP, and employment, in the United States since 1960.

[1] Hasan, Iftekhar, and Christopher L. Tucci. 2010. "The Innovation–Economic Growth Nexus: Global Evidence."
[2] Pham, Nam. 2012. "IP Creates Jobs for America." ndp | analytics; U.S. Department of Commerce. 2012. "Intellectual Property and the U.S. Economy: Industries in Focus."
[3] National Science Foundation: BRDIS Survey. "2008 Data Tables. Table 1, Survey item aggregates."

Figure 2. R&D, GDP, and Employment, Annual Growth Rates, 1960-2013

R&D investment correlates with GDP growth and employment levels



Sources: National Science Foundation: BRDIS Survey; Bureau of Economic Analysis: National Economic Accounts; U.S. Bureau of Labor Statistics: Current Population Survey.

Evidence of the positive correlation between innovation and economic growth can be seen in economies around the world. Research has shown that countries with higher levels of patenting activity tend to have higher economic growth rates, and that growth accelerates over time as patenting levels increase. Researchers measuring innovation across 49 developed and developing economies find a recurrent micro-level relationship between expenditures in R&D and innovation output measured by patents granted.[4] The European Patent Office found that innovative industries accounted for more than 56 million jobs, which translates to 26% of total employment in the European Union (EU). These jobs support a network of suppliers and service industry jobs that total another 20 million jobs. In total, innovative industries directly and indirectly support 76.6 million jobs, or more than 35% of total employment in the EU. These jobs pay more than 40% higher wages than non-IP-intensive manufacturing industries.[5] The success and growth of developed and developing economies hinges on the protection of proprietary research, development processes, and safeguards to the innovative ecosystem.

This report uses the latest official data to assess the economic impacts of R&D investments on U.S. manufacturing sectors during the period between 2000 and 2012. We use R&D investments as a proxy to measure the innovative intensity across industries and R&D investment per employee to identify IP-intensive (which is defined as R&D per employee above the manufacturing average) and non-IP-intensive manufacturing industries. The matrix of economic performance includes employment, wages, outputs/sales, value-added/economic contributions, and exports. The data time frame covers both economic upturn and downturn periods.

[4] Bosch, Mariano, Daniel Lederman, and William Maloney. 2005. "Patenting and Research and Development: A Global View." World Bank Policy Research Working Paper 3739.

[5] European Patent Office. 2013. "IPR-Intensive Industries: Contribution to Economic Performance and Employment in the European Union."

METHODOLOGY

Innovation can be measured by an input matrix, an output matrix, or a combination of input and output matrices. The input matrix, leading with R&D investment, provides the level of effort needed to produce innovation while the output matrix measures the outcomes of innovation. Depending on the type of innovation, the input and output matrices have their advantages and disadvantages as proxies of innovation. Three tangible IP outputs that are commonly used and recognized legally are patents, trademarks, and copyrights. The economic value of IP outputs depends heavily on the value of products and services that were created by the innovation process.

Definitions and Data Sources

R&D: Research and development expenses of a manufacturing sector or subsector used in the production of intellectual property published by the National Science Foundation.
Employment: Total number of employees in a manufacturing sector or subsector published by the U.S. Census Bureau.
Wages: Total wages paid to employees of a manufacturing sector or subsector published by the U.S. Census Bureau.
Gross output: Total sales of a manufacturing sector or subsector published by the U.S. Census Bureau.
Value added: the economic contributions of a manufacturing sector or subsector as measured by total sales minus intermediate inputs such as the cost of raw materials and services published by the U.S. Census Bureau.
Exports: total sales abroad of a manufacturing sector or subsector (i.e. total sales minus domestic sales) published by the U.S. International Trade Commission.

Measuring innovation by its inputs has several advantages. R&D investments are tangible and direct inputs to produce IP. Since R&D investments are recorded in terms of expenditures, they are widely used to measure the intensity of IP across industries and countries. In fact, empirical evidence shows that R&D investment is a reliable indicator of innovative capacity and is positively correlated with all measures of innovation outputs.[6] Studies also show that R&D spending is highly correlated with the number of patents in both large and small firms.[7] Evidence shows previous R&D expenditures affect subsequent R&D inputs of companies in the high-tech industries. Furthermore, successful R&D projects at previous stages tend to increase the commitments of future R&D efforts. Consequently, R&D activities positively affect innovative performance of a company, which leads to new products.[8]

Measuring IP-Intensity Across U.S. Manufacturing Industries

We follow the methodology developed in our previous reports to identify IP-intensive manufacturing industries and to quantify the economic benefits of innovation to the U.S. economy.[9] We use R&D investment as an indicator to measure the level of innovation, and R&D per employee to measure the IP intensity across manufacturing industries. We classify IP-intensive manufacturing industries are those industries that have a higher R&D per employee than the average R&D per employee in all manufacturing

[6] Mairesse, Jacques and Pierre Mohnen. 2004. "The Importance of R&D for Innovation: A Reassessment Using French Survey Data." NBER Working Paper No. 10897; Steinberg, Rolf and Olaf Arndt. 2001. "What Determines the Innovation Behavior of European Firms?" Economic Geography.
[7] For example, Chakrabarti, Alok K. and Michael R. Halperin. 1990. "Technical Performance and Firm Size: Analysis of Patents and Publications of U.S. Firms," Small Business Economics, Vol. 2, No. 3, pp. 183-190.
[8] Hagedoorn, John, and Myriam Cloodt. 2003. "Measuring Innovative Performance: Is There An Advantage In Using Multiple Indicators?" *Research Policy*, 32(8): 1365-1379.
[9] Pham, Nam. 2010. "The Impact of Innovation and the Role of Intellectual Property Rights on U.S. Productivity, Competitiveness, Jobs, Wages, and Exports." ndp | analytics.

sectors. Similarly, non-IP-intensive manufacturing industries are those industries that have R&D per employee below the manufacturing sector level.

For this report, we relied upon annual R&D data by industry (2-, 3-, and 4-digit NAICS) published by the National Science Foundation (NSF) and annual employment by industry published by the U.S. Census Bureau. Annual R&D data are from 2000 to 2010, which is the latest year of the most complete data set published by the NSF at the time of our analysis. Since the details of the 2011 R&D dataset were not available at the time of this writing, our analysis does not include 2011 R&D data. To be consistent with other economic performance per employee (i.e., output, value added, wage, and exports), we use the employment data published by the U.S. Census Bureau to calculate the R&D per employee by manufacturing industry. Note that the Census Bureau publishes employment data by industry at the establishment level and therefore is expected to be lower than the employment data at the company level compiled by the NSF. To assess the robustness of our IP classifications, we also use the employment number at the company level published by the NSF to calculate the R&D per employee. Although the level of R&D investment per employee is different, the IP-industry classification remains unchanged.

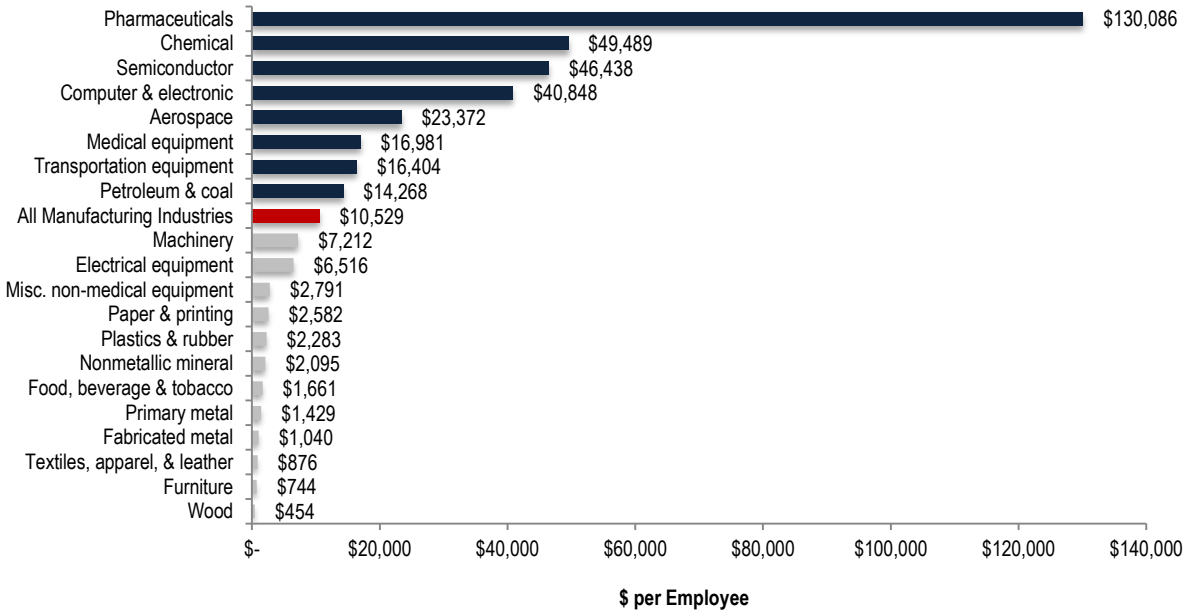
Annual R&D investment across the U.S. manufacturing sectors averaged $10,529 per employee during the period between 2000 and 2010. Among 21 subsectors (3-digit NAICS) that make up the U.S. manufacturing sector (2-digit NAICS), five subsectors have higher R&D investment than the manufacturing sector average.[10] Annual R&D investment of these five IP-intensive subsectors averaged $30,375 per employee during 2000-2010: $14,268 per employee in petroleum and coal product manufacturing (NAICS 324), $16,404 per employee in transportation equipment manufacturing (NAICS 336), $16,981 per employee in medical equipment manufacturing (NAICS 3391), $40,848 per employee in computer and electronic product manufacturing (NAICS 334), and $49,489 per employee in chemical manufacturing (NAICS 325).

We also calculate R&D investment per employee of disaggregated industries (4-digit NAICS) within the three largest manufacturing subsectors (3-digit NAICS) by R&D investment. All three largest subsectors (computer & electronic products, chemical, and transportation equipment) are also IP-intensive industries. Furthermore, R&D investment per employee of the largest industry (4-digit NAICS) within each of the three IP-intensive subsectors is also higher than the manufacturing sector level, reflecting its IP-intensity. As shown in Figure 3 below, the three industries with the highest amount of R&D investment per employee were pharmaceutical and medicine manufacturing, semiconductor manufacturing, and aerospace manufacturing. Note that this report uses the term industry and subsector interchangeably.

[10] NAICS refers to the North American Industry Classification System (NAICS). The system uses the term sector for 2-digit NAICS, subsector for 3-digit, and 4-digit for industry.

Figure 3. Annual Average R&D Investment per Employee, by Industry, 2000-10

IP-intensive industries, led by the pharmaceutical industry, invest twelve times more R&D per employee than non-IP-intensive industries



Sources: National Science Foundation: BRDIS Survey; U.S. Census Bureau: County Business Patterns.

Assessing Economic Performance between IP-Intensive and non-IP-Intensive Manufacturing Industries

This report uses annual data of employment, wages, gross output, value added (net economic contribution), and exports by manufacturing industry from the U.S. Census Bureau and the U.S. International Trade Commission. Our economic dataset covers the period from 2000 to 2012, which includes economic upturn and downturn periods. We calculate output, value added, wage, and export per employee in order to compare the economic performance across IP-intensive and non-IP-intensive manufacturing industries. We also calculate annual growth rates of the economic activities to compare the economic performance across industries during the economic upturn and downturn periods. We divide the period 2000-12 into three sub-periods: 2000-04 (upturn), 2005-08 (downturn), and 2009-12 (upturn).

ECONOMIC IMPACTS OF INTELLECTUAL PROPERTY PRODUCTS ON U.S. MANUFACTURING INDUSTRIES

IP-intensive manufacturing industries consistently outperform non-IP-intensive manufacturing industries

IP-intensive manufacturing industries outperformed non-IP-intensive manufacturing industries in all key economic measures during the past 15 years, including during both economic upturn and downturn periods. IP-intensive industries invest heavily in R&D to produce and improve their products and services. Adopting new technology from their R&D activities, these U.S. companies create innovative products and services at home to offer to consumers both domestically and internationally. With higher demand for their

products and services and rising revenues, these companies are able to hire additional workers and pay wage premiums to attract talent. Workers in IP-intensive manufacturing industries are shown to have higher economic contributions to the U.S. economy.

Key economic measurements are summarized in Table 1 below along with the IP-intensive multiple showing the factor by which IP-intensive industries exceeds non-IP intensive industries across each key measurement.

Table 1. Economic Performance per Employee
IP-Intensive versus Non-IP-Intensive Manufacturing Industries, 2000-12

	R&D Investment	Wages	Exports	Value-Added	Gross Output
IP-intensive	$30,375	$58,832	$127,594	$248,254	$597,317
Non-IP-intensive	$2,480	$39,775	$36,797	$128,594	$270,939
Difference	$27,895	$19,057	$90,797	$119,660	$326,377
(multiple)	12.2	1.5	3.5	1.9	2.2

Source: National Science Foundation: BRDIS Survey; U.S. Census Bureau: Annual Survey of Manufactures, County Business Patterns, and Economic Census; U.S. International Trade Commission: DataWeb.

Measuring R&D Investment

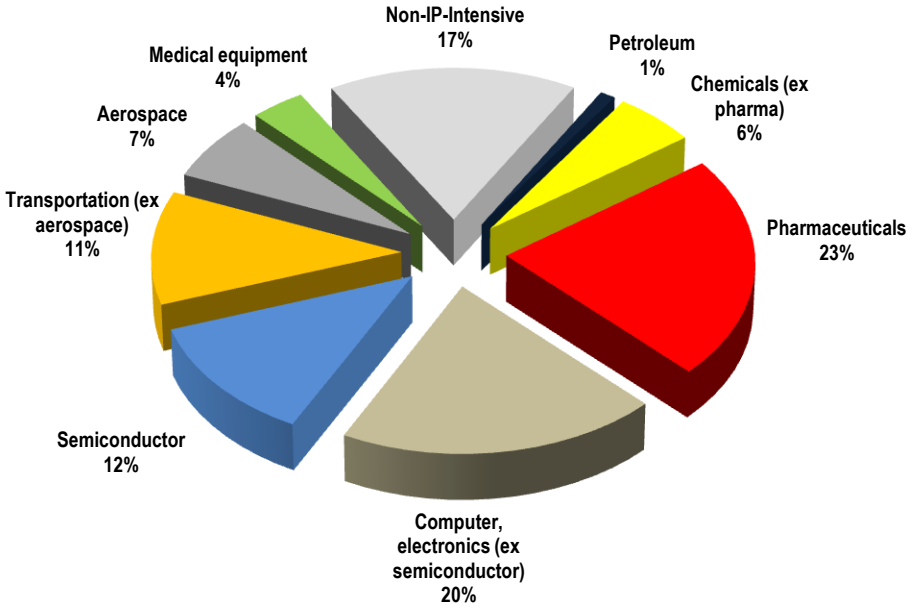
Expenditures to produce intellectual property have become important and significant enough to be a separate item on the national accounts. After launching R&D satellite accounts to explore investment in R&D and its larger economic effects, the Bureau of Economic Analysis (BEA) in 2013 expanded its coverage of intellectual property products in the measurement of U.S. national accounts. The BEA has been working in conjunction with the National Science Foundation to measure innovative activity and the Bureau of Labor Statistics to construct a deflator for R&D to estimate real investment in R&D. Starting on July 31, 2013, the BEA recorded expenditures of R&D, software, entertainment, literacy, and artistic originals as fixed investment in the national accounts. The BEA estimates that intellectual property expenditures accounted for one-third of nonresidential fixed investment in 2013.[11]

During the period 2000-10, R&D investment in U.S. manufacturing sectors averaged $140.3 billion per year. Five IP-intensive subsectors accounted for 83% of total R&D investment while a combined R&D investment of all other non-IP-intensive industries was only 17%. At the 3-digit NAICS level, the computer and electronic manufacturing subsector had the highest share (32%) of total R&D investment, followed by the chemical manufacturing subsector (28%) and transportation equipment manufacturing subsector (18%). At the 4-digit NAICS level, the pharmaceutical industry of the chemical subsector had the highest share (23%) of total R&D investment, followed by the semiconductor industry of the computer and electronic subsector (12%) and the aerospace industry of the transportation equipment subsector (7%) as shown in Figure 4.

[11] Aizcorbe, Anna M., Carol E. Moylan, and Carol A. Robbins. 2009. "Toward Better Measurement of Innovation and Intangibles." BEA Briefing, Survey of Current Business; Bureau of Economic Analysis. 2013. "Preview of the 2013 Comprehensive Revision of the National Income and Product Accounts – Changes in Definitions and Presentations."

Figure 4. Composition of R&D Investment, by Industry, Average 2000-10

IP-intensive manufacturing industries account for 83% of manufacturing R&D investment in the U.S.



Sources: National Science Foundation: BRDIS Survey.

R&D investment in U.S. manufacturing industries grew 50% since 2000

Manufacturing R&D investment grew by more than 50% from $113 billion in 2000 to $170 billion in 2010, averaging $140.3 billion a year and a 4.2% annual growth rate. R&D investment in IP-intensive manufacturing industries grew by 53% and an average 4.3% per year, compared to 34% and an average 3.2% per year in non-IP-manufacturing intensive industries. During the period 2000-10, the pharmaceutical manufacturing industry and the aerospace industry registered double-digit annual growth rates, 14.4% and 10.9%, respectively (Table 2).

Table 2. R&D Investment and Growth Rates, by Industry, 2000-10

	R&D Average 2000-10 ($ billions)	Average Annual Growth (%)			
		2000-10	2009-10	2005-08	2000-04
All Manufacturing Industries	**$140.3**	**4.2%**	**-0.8%**	**7.0%**	**3.9%**
IP-Intensive	***$116.7***	***4.3%***	***-0.9%***	***7.0%***	***4.4%***
Petroleum & coal	1.5	4.1%	9.4%	-2.1%	8.0%
Chemical	39.4	10.8%	-0.2%	10.4%	17.1%
Pharmaceutical & medicine	31.6	14.4%	1.4%	11.2%	25.2%
Computer & electronic	45.2	1.9%	-1.7%	8.2%	-2.2%
Semiconductor & other	17.1	5.5%	-1.3%	6.2%	8.2%
Transportation equipment	25.4	-0.1%	-3.9%	-1.4%	3.2%
Aerospace	9.3	10.9%	-0.9%	4.8%	24.1%
Medical equipment & supplies (misc)	5.2	5.1%	9.4%	11.6%	-3.0%

Non-IP-Intensive	***$23.6***	***3.2%***	***0.0%***	***6.8%***	***1.4%***
Food, beverage, & tobacco	2.7	7.5%	9.4%	-1.1%	15.8%
Textiles, apparel, & leather	0.5	6.2%	-22.9%	9.4%	20.9%
Wood	0.2	8.9%	-4.9%	15.8%	9.7%
Paper, printing, & support	2.8	2.3%	9.4%	5.2%	-3.8%
Plastics & rubber	1.9	2.4%	8.0%	-0.9%	2.9%
Nonmetallic mineral	0.9	4.0%	-9.3%	18.1%	-1.9%
Primary metal	0.6	0.4%	-4.6%	-0.7%	4.2%
Fabricated metal	1.6	-0.1%	-18.1%	13.2%	-2.6%
Machinery	8.1	4.2%	-0.9%	11.6%	-0.3%
Electrical equipment & appliances	2.9	-0.5%	3.0%	3.9%	-6.2%
Furniture	0.4	2.8%	-11.6%	4.1%	9.3%
Misc non-medical equipment	1.0	9.9%	9.4%	-1.5%	22.9%

Sources: National Science Foundation: BRDIS Survey.

R&D investment per employee in IP-intensive manufacturing industries averaged more than 12 times that of non-IP-intensive manufacturing industries during 2000-10

We calculate R&D investment per employee to estimate and to compare the IP-intensity across manufacturing industries. During the period between 2000 and 2010, annual R&D investment in manufacturing sectors averaged $10,529 per employee. Annual R&D investment per employee in IP-intensive manufacturing industries was 12.2 times that of non-IP-intensive manufacturing industries, $30,375 compared to $2,480. The pharmaceutical manufacturing industry invested $130,086 per employee, the highest level among all manufacturing industries. In contrast, the wood product manufacturing industry spent only $454 per employee during the same period (Table 3).

Table 3. Annual Average R&D Investment per Employee, by Industry, 2000-10

	R&D ($ billions)	Employment (persons)	R&D per Employee ($)
All Manufacturing Industries	**$140.3**	**13,725,743**	**$10,529**
IP-Intensive	***$116.7***	***3,952,159***	***$30,375***
Petroleum & coal	1.5	102,504	14,268
Chemical	39.4	813,556	49,489
Pharmaceutical & medicine	31.6	242,100	130,086
Computer & electronic	45.2	1,160,593	40,848
Semiconductor & other	17.1	401,613	46,438
Transportation equipment	25.4	1,570,189	16,404
Aerospace	9.3	402,550	23,372
Medical equipment & supplies (misc)	5.2	305,317	16,981
Non-IP-Intensive	***$23.6***	***9,773,584***	***$2,480***
Food, beverage, & tobacco	2.7	1,616,808	1,661
Textiles, apparel, & leather	0.5	688,746	876
Wood	0.2	512,310	454

Paper, printing, & support	2.8	1,117,670	2,582
Plastics & rubber	1.9	877,797	2,283
Nonmetallic mineral	0.9	460,655	2,095
Primary metal	0.6	464,379	1,429
Fabricated metal	1.6	1,552,929	1,040
Machinery	8.1	1,143,445	7,212
Electrical equipment & appliances	2.9	446,854	6,516
Furniture	0.4	526,295	744
Misc non-medical equipment	1.0	365,696	2,791

Sources: National Science Foundation: BRDIS Survey; U.S. Census Bureau: County Business Patterns.

R&D investment per employee in IP-intensive manufacturing industries grew faster than for non-IP-intensive industries during recent economic upturns and downturns

We calculate the growth rates of R&D investment in three sub-periods, including during economic upturns and downturns. R&D investment per employee in IP-intensive manufacturing industries grew faster than that in non-IP-intensive manufacturing industries during the economic upturn in 2000-04 and also during the economic downturn in 2005-08. We do not have adequate R&D investment data for the current economic recovery. However, the limited two years of R&D investment data shows a 7.7% annual growth in IP-intensive manufacturing industries compared to a 10.2% annual growth in non-IP-intensive manufacturing industries (Table 4).

Table 4. Annual Average R&D Investment per Employee and Growth Rates, by Industry, 2000-10

	R&D Average 2000-10 ($)	Average Annual Growth (%)			
		2000-10	2009-10	2005-08	2000-04
All Manufacturing Industries	**$10,529**	**8.6%**	**8.9%**	**8.4%**	**8.6%**
IP-Intensive	***$30,375***	***8.5%***	***7.7%***	***8.4%***	***9.1%***
Non-IP-Intensive	***$2,480***	***7.7%***	***10.2%***	***8.2%***	***6.0%***

Sources: National Science Foundation: BRDIS Survey; U.S. Census Bureau: County Business Patterns.

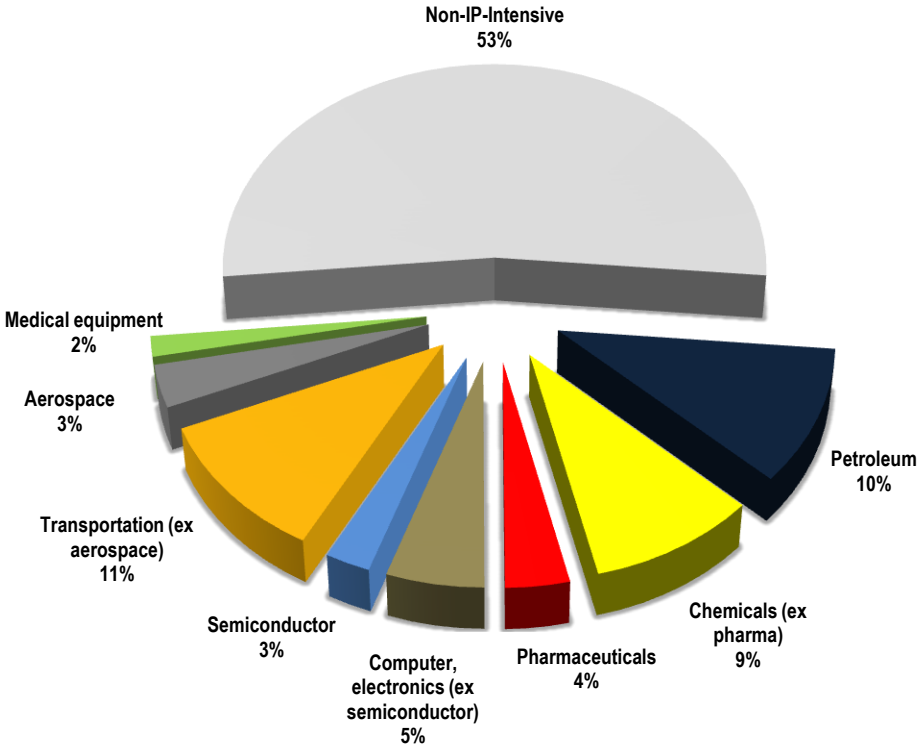
IP-intensive manufacturing industries are a growing share of gross output

Gross output (gross revenues, or total sales) of U.S. manufacturing industries increased more than 36% from $4.2 trillion in 2000 to $5.7 trillion in 2012. The annual manufacturing gross output averaged $4.7 trillion with an annual growth rate of 2.6% during 2000-12. Led by the transportation equipment and chemical industries (including the aerospace and the pharmaceutical industries), the share of IP-intensive manufacturing industries has been growing to account for nearly half of gross output of U.S. manufacturing sectors by the end of 2012, even though IP-intensive manufacturing industries represent only 30% of U.S. manufacturing employment. Indeed, gross output of IP-intensive manufacturing industries grew two times faster than non-IP-intensive manufacturing industries. Industries with the fastest growth since 2000 are the petroleum and coal manufacturing industry (262%), the chemical manufacturing industry (77%), the

medical equipment manufacturing industry (69%), the aerospace manufacturing industry (67%), and the pharmaceutical manufacturing industry (64%) (Figure 5).

Figure 5. Composition of Gross Output, by Industry, 2000-12

Although accounting for 29% of manufacturing employment, IP-intensive manufacturing industries account for 47% of manufacturing output



Sources: U.S. Census Bureau: Annual Survey of Manufactures and Economic Census.

Gross output per employee in IP-intensive manufacturing industries was more than double that of non-IP-intensive manufacturing industries during 2000-12

During 2000-12, gross output of IP-intensive manufacturing industries averaged $597,317 per employee per year compared to $270,939 per employee in non-IP-intensive manufacturing industries. With one exception of an extremely high sales per employee in the petroleum and coal manufacturing industry (nearly $4.9 million per year), the chemical manufacturing industry including pharmaceuticals has the highest gross output per employee in the U.S. manufacturing sector ($782,314 per person per year). Except in the medical equipment manufacturing industries, gross output per employee in all IP-intensive manufacturing industries was higher than the manufacturing average (Table 5).

R&D investment is the crucial element for companies to be innovative. The U.S. manufacturing sector invested an average 3% of their gross output in R&D during 2000-10. R&D investment accounted for 5.4% of their gross output in IP-intensive manufacturing industries while a mere 1.0% in non-IP-intensive manufacturing industries. The pharmaceutical and medicine industry has the highest R&D investment intensity across U.S. manufacturing sectors, accounting for 18.3% of their gross output (Table 5).

Table 5. Annual Average Output per Employee and Shares of R&D, by Industry, 2000-12

	Gross Output ($ billions)	Output per Employee ($)	R&D as % of Gross Output (%)
All Manufacturing Industries	**$4,734.8**	**$365,518**	**3.0%**
IP-Intensive	***$2,232.0***	***$597,317***	***5.4%***
Petroleum & coal	497.5	4,896,056	0.4%
Chemical	616.0	782,314	6.5%
Pharmaceutical & medicine	168.8	704,164	18.3%
Computer & electronic	377.1	345,209	11.9%
Semiconductor & other	119.9	327,967	14.6%
Transportation equipment	666.5	443,796	3.9%
Aerospace	155.5	387,328	6.2%
Medical equipment & supplies (misc)	74.9	248,765	7.3%
Non-IP-Intensive	***$2,503.1***	***$270,939***	***1.0%***
Food, beverage, & tobacco	690.1	430,366	0.4%
Textiles, apparel, & leather	102.5	167,631	0.5%
Wood	89.5	186,364	0.3%
Paper, printing, & support	259.5	248,006	1.1%
Plastics & rubber	192.0	231,980	1.0%
Nonmetallic mineral	103.4	236,655	0.9%
Primary metal	206.2	478,710	0.3%
Fabricated metal	294.4	195,729	0.6%
Machinery	312.1	282,519	2.7%
Electrical equipment & appliances	115.0	277,813	2.5%
Furniture	73.9	152,764	0.5%
Misc non-medical equipment	64.5	188,374	1.5%

Sources: National Science Foundation: BRDIS Survey. R&D as % of output (2000-10); U.S. Census Bureau: Annual Survey of Manufactures, County Business Patterns and Economic Census.

The growth rate of output per employee in IP-intensive manufacturing industries outpaced non-IP-intensive manufacturing industries during the economic upturn as well as downturn periods

The growth rate of output per employee in IP-intensive industries outpaced the growth rates in non-IP-intensive manufacturing industries. During 2000-12, output per employee grew an averaged 6.7% in IP-intensive manufacturing industries compared to 5.2% in non-IP-intensive manufacturing industries. Furthermore, output per employee in IP-intensive manufacturing industries consistently grew faster than the growth rates in non-IP-intensive manufacturing industries during the economic upturn and downturn periods (Table 6).

Table 6. Annual Average Output per Employee and Growth Rates, 2000-12

	Annual Average Output per employee 2000-12 ($)	Average Annual Growth per Employee (%)			
		2000-12	2009-12	2005-08	2000-04
All Manufacturing Industries	**$365,518**	**6.0%**	**5.3%**	**7.6%**	**5.1%**
IP-Intensive	***$597,317***	***6.7%***	***5.3%***	***9.2%***	***5.5%***
Non-IP-Intensive	***$270,939***	***5.2%***	***4.8%***	***6.2%***	***4.8%***

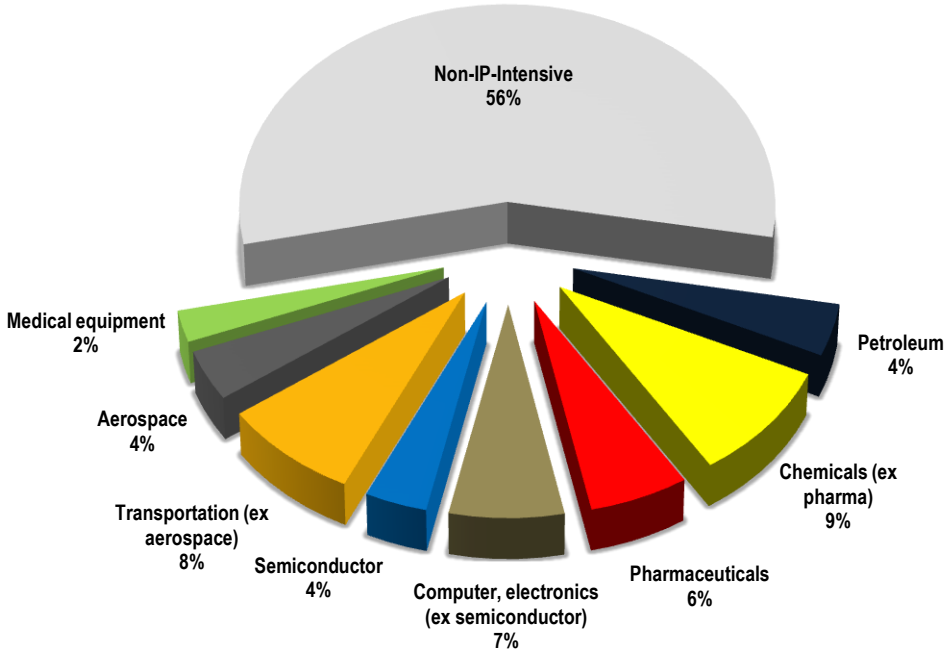
Sources: U.S. Census Bureau: Annual Survey of Manufactures, County Business Patterns, and Economic Census.

IP-intensive manufacturing industries accounted for 44% of net value of economic contributions of the manufacturing sectors to the U.S economy

While gross output includes values of intermediate materials, the value added measurement excludes values of intermediate products to measure the net value of economic contributions of the industry to the economy. The net value of economic contributions, commonly referred to as value-added, is calculated as gross output minus intermediate products. The net value of economic contributions of the U.S. manufacturing sectors increased nearly 20% from $2.0 trillion in 2000 to $2.4 trillion in 2012, averaging $2.1 trillion per year and a 1.5% annual growth rate during 2000-12.

IP-intensive manufacturing industries accounted for 44% of net value of economic contributions of the manufacturing sectors to the U.S economy. The chemical manufacturing industry, including the pharmaceutical and medicine manufacturing industry, is the largest contributor to the U.S. economy across manufacturing sectors. During the period 2000-12, the chemical subsector (including the pharmaceutical industry) accounted for 15% of manufacturing contributions. The transportation equipment subsector (including the aerospace industry) and computer subsector (including the semiconductor industry) accounted for 12% and 10%, respectively. The petroleum and coal manufacturing subsector added 4% and the medical equipment industry added another 2% (Figure 6).

Figure 6. Composition of Value-Added (Net Economic Contributions), by Industry, Average 2000-12
IP-intensive industries employ 29% of manufacturing workers, who account for 44% of the economic value added of manufacturing



Sources: U.S. Census Bureau: Annual Survey of Manufactures and Economic Census.

The value added per employee in IP-intensive manufacturing industries is two times that on non-IP-intensive manufacturing industries

During 2000-12, manufacturing workers contributed an average $163,254 per employee annually to the U.S. economy. Workers in IP-intensive manufacturing industries contributed $248,254 per employee annually, compared to $128,594 per employee in non-IP-intensive manufacturing industries. The petroleum manufacturing industry and the pharmaceutical manufacturing industry have the largest net economic contributions per employee (Table 7).

R&D investment averaged 6.7% of value-added of the U.S. manufacturing sectors, 12.7% in IP-intensive manufacturing industries and only 2.0% in non-IP-intensive manufacturing industries. The pharmaceutical manufacturing industry has the largest R&D investment compared to the industry's net economic contributions (Table 7).

Table 7. Annual Average Value-Added and Share of R&D, by Industry, 2000-12

	Value-Added ($ billions)	Value-Added per Employee ($)	R&D as % of Value-Added (%)
All Manufacturing Industries	**$2,125.5**	**$163,254**	**6.7%**
IP-Intensive	***$932.7***	***$248,254***	***12.7%***
Petroleum & coal	86.9	854,413	2.1%

Chemical	316.1	400,717	12.5%
Pharmaceutical & medicine	123.4	514,268	24.9%
Computer & electronic	219.8	202,900	20.5%
Semiconductor & other	77.3	213,245	22.9%
Transportation equipment	257.1	171,825	10.0%
Aerospace	84.0	209,337	11.6%
Medical equipment & supplies (misc)	52.7	175,089	10.3%
Non-IP-Intensive	***$1,192.7***	***$128,594***	***2.0%***
Food, beverage, & tobacco	309.0	192,478	0.9%
Textiles, apparel, & leather	45.9	75,128	1.1%
Wood	35.8	74,668	0.6%
Paper, printing, & support	134.5	128,260	2.1%
Plastics & rubber	92.7	111,407	2.1%
Nonmetallic mineral	57.9	132,231	1.6%
Primary metal	73.8	169,924	0.9%
Fabricated metal	158.8	105,508	1.0%
Machinery	151.0	136,562	5.6%
Electrical equipment & appliances	56.5	136,069	5.1%
Furniture	40.4	83,203	0.9%
Misc non-medical equipment	36.5	106,657	2.7%

Sources: National Science Foundation: BRDIS Survey. R&D as % of value added (2000-10); U.S. Census Bureau: Annual Survey of Manufactures, County Business Patterns and Economic Census.

Like gross output, value added per employee in IP-intensive manufacturing industries outpaced other manufacturing industries during the economic upturn and downturn periods

During the period 2000-12, the growth of net economic contributions per manufacturing employee averaged 4.8% per year. Like gross output, the growth rates of net economic contribution per employee in IP-intensive manufacturing industries outperformed the growth rates in non-IP-intensive manufacturing industries during the economic upturn as well as economic downturn periods (Table 8).

Table 8. Annual Average Value-Added per Employee and Growth Rates, 2000-12

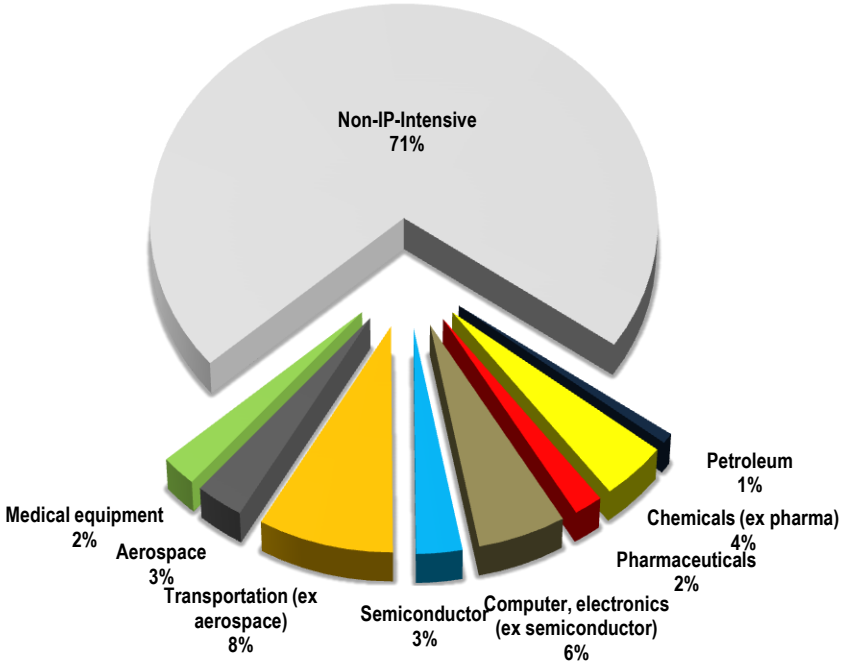
	Annual Average Value Added per employee 2000-12	Average Annual Growth per Employee (%)			
		2000-12	2009-12	2005-08	2000-04
All Manufacturing Industries	**$163,254**	**4.8%**	**5.1%**	**4.0%**	**5.4%**
IP-Intensive	***$248,254***	***5.3%***	***5.4%***	***4.4%***	***6.0%***
Non-IP-Intensive	***$128,594***	***4.5%***	***4.6%***	***3.7%***	***5.2%***

Sources: U.S. Census Bureau: Annual Survey of Manufactures, County Business Patterns, and Economic Census.

About 29% of manufacturing jobs, or 3.3 million jobs, are located in IP-intensive manufacturing industries

U.S. manufacturing sectors employ nearly 11.2 million persons across all industries. For industry comparison purposes, this report uses employment data published by the Census Bureau that is based on establishments. As discussed earlier, the employment numbers of establishments are substantially lower than the employment numbers of the whole company. About 29% of manufacturing jobs, or 3.3 million jobs, are located in IP-intensive manufacturing industries. The allocation of jobs in the IP-intensive manufacturing industries is: 11% in the transportation equipment subsector (including the aerospace industry), 9% the computer and electronics subsector (including the semiconductor industry), 6% in the chemical subsector (including the pharmaceutical industry), 2% in the medical equipment industry, and 1% in the petroleum and coal manufacturing subsector (Figure 7).

Figure 7. Composition of Employment, by Industry, Average 2000-12
IP-intensive manufacturing industries employ 29% of manufacturing workers



Sources: U.S. Census Bureau: County Business Patterns and Economic Census.

While overall manufacturing jobs declined by one-third, there were fewer manufacturing job losses in IP-intensive sectors

After a decade of job declines, U.S. manufacturing sectors started adding new jobs in the summer of 2010. During the past decade, U.S. manufacturing sectors lost nearly 5.3 million jobs and approximately one-third of total jobs. Non-IP-intensive manufacturing industries lost 3,872,398 jobs, the equivalent of 33.0% of its 2000 level. Industries hit hardest were textile manufacturing (69.2%), furniture manufacturing (46.6%), electrical equipment manufacturing (43.6%), wood products manufacturing (43.5%), and paper products manufacturing (40.7%) (Table 9).

IP-intensive manufacturing industries also suffered job losses, although with a smaller effect. By the end of 2012, IP-intensive industries lost 1,424,886 jobs, or 30.1% of its 2000 level. While job losses range between 53.6% in semiconductor industry and 5.3% in the aerospace industry, jobs in the pharmaceutical and medicine industry remain unchanged from its 2000 level (Table 9).

Table 9. Employment, by Industry, 2000-12[12]

	Average 2000-12	2000	2012	Job Creation/ Losses (+/-)	% Change in 2000 Level
All Manufacturing Industries	**13,318,788**	**16,473,994**	**11,176,710**	**(5,297,284)**	**-32.2%**
IP-Intensive	***3,846,180***	***4,729,343***	***3,304,457***	***(1,424,886)***	***-30.1%***
Petroleum & coal	102,054	109,223	100,751	(8,472)	-7.8%
Chemical	799,530	885,848	719,486	(166,362)	-18.8%
Pharmaceutical & medicine	239,879	227,461	227,434	(27)	0.0%
Computer & electronic	1,114,628	1,557,087	846,176	(710,911)	-45.7%
Semiconductor & other	382,077	571,377	265,356	(306,021)	-53.6%
Transportation equipment	1,527,815	1,872,630	1,354,470	(518,160)	-27.7%
Aerospace	402,282	446,243	422,645	(23,598)	-5.3%
Medical equipment & supplies (misc)	302,153	304,555	283,574	(20,981)	-6.9%
Non-IP-Intensive	***9,472,607***	***11,744,651***	***7,872,253***	***(3,872,398)***	***-33.0%***
Food, beverage, & tobacco	1,608,142	1,637,484	1,547,176	(90,308)	-5.5%
Textiles, apparel, & leather	637,659	1,134,057	349,165	(784,892)	-69.2%
Wood	485,968	597,684	337,833	(259,851)	-43.5%
Paper, printing, & support	1,073,012	1,367,332	811,274	(556,058)	-40.7%
Plastics & rubber	849,225	1,056,507	700,128	(356,379)	-33.7%
Nonmetallic mineral	442,938	523,698	352,158	(171,540)	-32.8%
Primary metal	451,747	601,627	391,666	(209,961)	-34.9%
Fabricated metal	1,523,099	1,790,817	1,385,932	(404,885)	-22.6%
Machinery	1,123,508	1,377,950	1,060,863	(317,087)	-23.0%
Electrical equipment & appliances	429,187	589,406	332,356	(257,050)	-43.6%
Furniture	497,381	640,444	341,789	(298,655)	-46.6%
Misc non-medical equipment	350,740	427,645	261,913	(165,732)	-38.8%

Sources: U.S. Census Bureau: County Business Patterns and Economic Census.

Non-IP-intensive manufacturing industries cut more jobs during the most recent economic downturn while IP-intensive manufacturing industries added more jobs over the same period

Job losses were higher in non-IP-intensive manufacturing industries than in IP-intensive manufacturing industries over the past 15 years. From 2000-12, non-IP-intensive manufacturing industries cut nearly 3.3% of their workforce per year, versus 2.9% per year in IP-intensive manufacturing industries.

[12] As noted, we use employment data published by the Census Bureau that is based on the establishment data. Since a manufacturing company may have establishments outside of manufacturing industries, our analyses underestimate the employment counts.

U.S. manufacturing industries have continued to add jobs since 2011. Over two years, IP-intensive manufacturing industries increased their workforce by 1.8% compared to 1.3% in non-IP-intensive manufacturing industries (Table 10).

Table 10. Annual Average Employment and Annual Changes, 2000-12

	Annual Average Employment 2000-12	Annual Change in Employment (%)		
		2000-12	2010-12	2000-09
All Manufacturing Industries	**13,318,788**	**-3.2%**	**1.4%**	**-4.1%**
IP-Intensive	***3,846,180***	***-2.9%***	***1.8%***	***-3.9%***
Non-IP-Intensive	***9,472,607***	***-3.3%***	***1.3%***	***-4.2%***

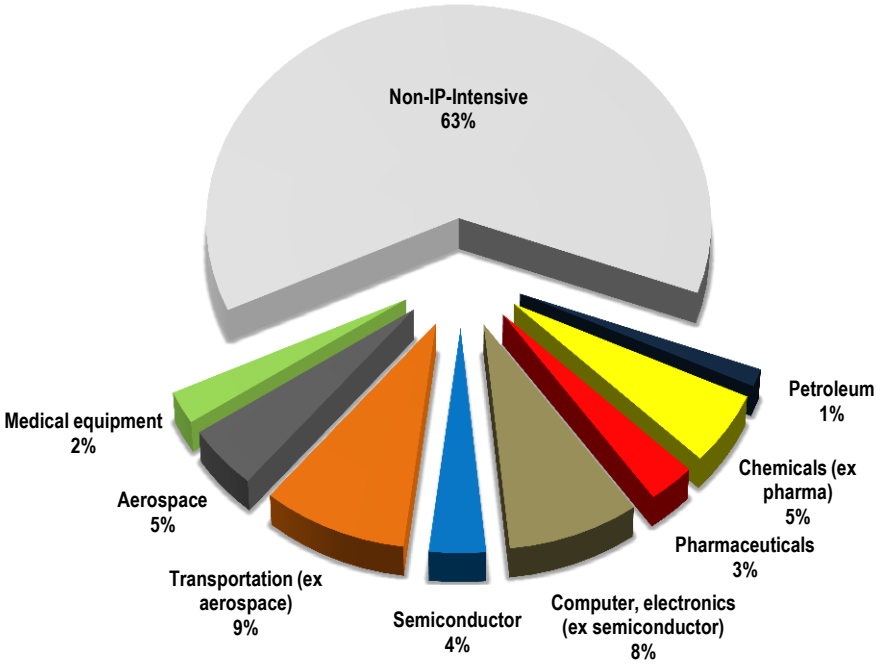
Sources: U.S. Census Bureau: County Business Patterns and Economic Census.

Employee wages comprise 10% of manufacturing revenues in the United States

Wages paid to workers account for around 10% of manufacturing gross output in the United States. During 2000-12, U.S. manufacturing industries paid an average $595.7 billion in wages per year. About 37% of manufacturing wages are paid to workers in IP-intensive manufacturing industries and 63% of wages are paid to workers in non-IP-intensive manufacturing industries (Figure 8).

Figure 8. Composition of Total Wages, by Industry, Average 2000-12

29% of manufacturing workers in IP-intensive industries earn 37% of total manufacturing wages



Sources: U.S. Census Bureau: County Business Patterns and Economic Census.

Wages of workers in IP-intensive manufacturing industries are 50% higher than those in non-IP-intensive manufacturing industries.

Workers in IP-intensive manufacturing industries earn higher wages than their counterparts in non-IP-intensive manufacturing industries. During 2000-12, American manufacturing sector workers made an average $45,289 per year. Among them, workers in IP-intensive manufacturing industries made $58,832 per year. Their annual wages were about 50% higher than wages of workers in non-IP-intensive manufacturing industries. IP-intensive manufacturing industries with the highest wages were the petroleum and coal manufacturing industry ($76,645 per employee) and the pharmaceutical and medicine industry ($73,669 per employee). In contrast, the textile and wood product industries had the lowest pay, $28,305 and $32,095 per employee per year, respectively (Table 11).

R&D investment is positively correlated with wages. R&D investment averaged 23.5% of wages in the U.S. manufacturing sector. R&D investment was more than half of total wages paid in IP-intensive manufacturing industries compared to only 6.3% of total wages paid in non-IP-intensive manufacturing industries. Led by the pharmaceutical and medicine industry, R&D investment was nearly 174% of wages paid. In contrast, R&D investment in the wood product industry was only 1.4% of wages paid (Table 11).

Table 11. Annual Average Wages per Employee and Shares of R&D, by Industry, 2000-12

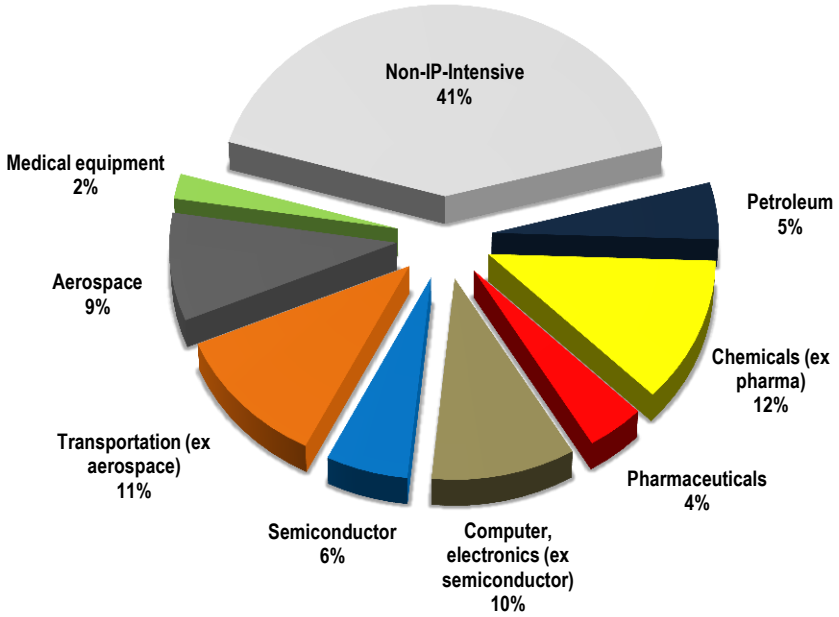
	Wages ($ billions)	Wages per Employee ($)	R&D as % of Wages (%)
All Manufacturing Industries	**$595.7**	**$45,289**	**23.5%**
IP-Intensive	***$223.7***	***$58,832***	***52.2%***
Petroleum & coal	7.8	76,645	19.2%
Chemical	49.5	62,246	79.3%
Pharmaceutical & medicine	17.7	73,669	173.7%
Computer & electronic	70.3	64,343	64.1%
Semiconductor & other	21.1	56,348	82.6%
Transportation equipment	81.8	54,131	31.0%
Aerospace	27.5	68,585	34.5%
Medical equipment & supplies (misc)	14.3	47,481	41.4%
Non-IP-Intensive	***$372.0***	***$39,775***	***6.3%***
Food, beverage, & tobacco	56.9	35,459	4.7%
Textiles, apparel, & leather	17.4	28,305	3.1%
Wood	15.4	32,095	1.4%
Paper, printing, & support	45.3	42,723	6.1%
Plastics & rubber	31.9	38,053	6.1%
Nonmetallic mineral	18.3	41,793	5.0%
Primary metal	22.1	49,760	2.9%
Fabricated metal	62.5	41,401	2.6%
Machinery	54.1	48,601	15.1%
Electrical equipment & appliances	18.4	43,724	15.4%
Furniture	15.9	32,440	2.3%
Misc non-medical equipment	13.8	39,715	7.2%

Source: National Science Foundation: BRDIS Survey. R&D as % of wages (2000-10); U.S. Census Bureau: County Business Patterns and Economic Census.

IP-intensive manufacturing industries accounted for nearly 60% of total manufacturing exports between 2000 and 2012

Across U.S. manufacturing sectors, an average of $806.2 billion in goods and services was exported a year between 2000 and 2012. IP-intensive manufacturing industries accounted for nearly 60% of total manufacturing exports. The top exporters across IP-intensive industries were the transportation equipment manufacturing (20%), the chemical manufacturing including the pharmaceutical industry (16%), the computer and electronic manufacturing including the semiconductor industry (16%), the petroleum and coal manufacturing (5%), and the medical equipment manufacturing (2%) (Figure 9).

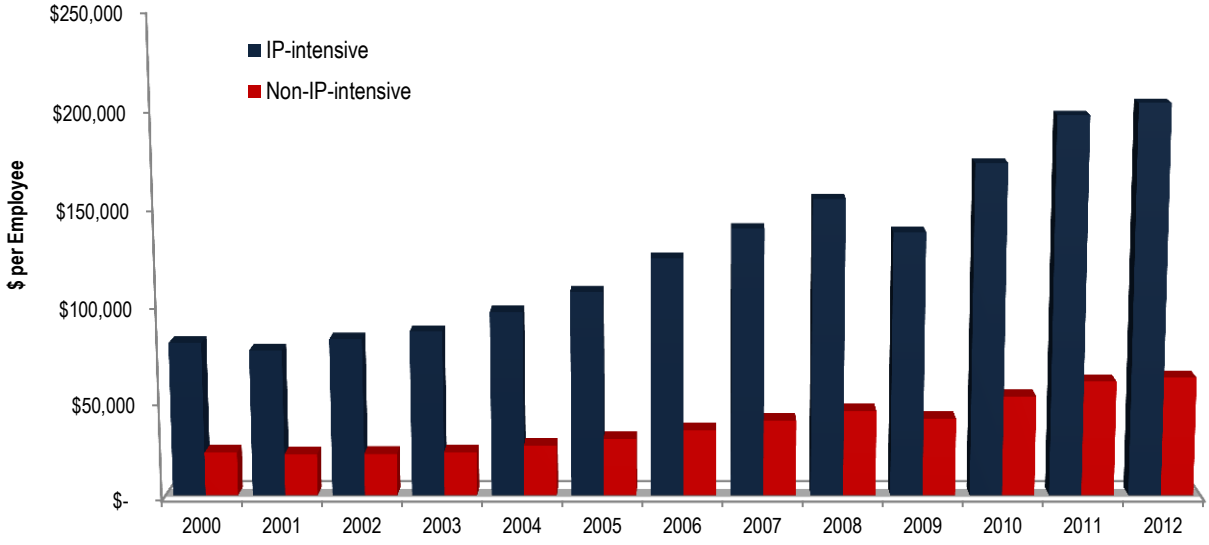
Figure 9. Composition of Exports, by Industry, Average 2000-12
IP-intensive industries account for 59% of manufacturing export sales



Sources: U.S. Census Bureau: County Business Patterns and Economic Census; U.S. International Trade Commission: DataWeb.

Export sales in IP-intensive manufacturing industries more than doubled between 2000 and 2012, rising from $80,228 per employee in 2000 to $203,616 per employee in 2012. Exports averaged $127,594 per employee in IP-intensive manufacturing industries during 2000-12, 3.5 times the average $36,797 per employee in non-IP-intensive manufacturing industries (Figure 10).

Figure 10. Annual Average Exports per Employee in IP- and Non-IP-Intensive Industries, 2000-12
Exports in IP-intensive manufacturing industries more than doubled between 2000 and 2012



Sources: U.S. Census Bureau: County Business Patterns and Economic Census; U.S. International Trade Commission: DataWeb.

CONCLUSION

A range of key measures confirm the significant contributions of IP-intensive industries to the U.S. economy. IP-intensive manufacturing industries consistently outperform non-IP-intensive manufacturing industries in all key economic measures. Both gross output per employee and net value of economic contribution per employee in the IP-intensive manufacturing industries was twice that of other manufacturing industries. Workers in IP-intensive manufacturing industries earn approximately 50% higher wages than their counterparts in non-IP-intensive manufacturing industries. Non-IP-intensive manufacturing industries cut more jobs during the downturn period while IP-intensive manufacturing industries added more jobs during the upturn period.

The outperformance of innovative industries owes much to the return on investments in R&D and human capital. Indeed, the cumulative benefits of R&D investment are far reaching. Technological innovation occurs in firms that invest heavily in R&D, spawning new ideas, products, and industries well beyond the original intent. Public policies that encourage innovation and economic growth are crucial for future prosperity, particularly policies that protect the rights of intellectual property generated through R&D investments.

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Appendix

Table A.1. Economic Performance per Employee in 26 IP-Intensive and Non-IP-Intensive Industries, 2000-12

	R&D Investment	Wages	Exports	Value-Added	Gross Output
IP-Intensive	•	•	•	•	•
Petroleum & coal	•	•	•	•	•
Chemical	•	•	•	•	•
Basic chemical	•	•	•	•	•
Resin, synthetic rubber, fiber	•	•	•	•	•
Pharmaceutical & medicine	•	•	•	•	•
Computer & electronic	•	•	•	•	
Computer & peripheral equipment	•	•	•	•	•
Communications equipment	•	•	•	•	•
Semiconductor & other	•	•	•	•	
Navigational, measure, electromed	•	•	•	•	
Transportation equipment	•	•	•	•	•
Motor vehicles, trailers	•	•	•	•	•
Aerospace product	•	•	•	•	•
Medical equipment & supplies (miscellaneous)	•	•		•	
Non-IP-Intensive					
Food, beverage & tobacco				•	•
Textiles, apparel, & leather					
Wood					
Paper, printing, & support					
Plastics & rubber					
Nonmetallic mineral					
Primary metal		•	•	•	•
Fabricated metal					
Machinery		•	•		
Electrical equipment & appliances			•		
Furniture					
Misc non-medical equipment					

"•" indicates that performance is above the average of all sub-sectors and industries

Table A.2. Industrial R&D Investment, by Industry, 2000-10 ($ millions)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
All Manufacturing Industries	**113,173.0**	**112,733.0**	**101,344.0**	**108,079.0**	**131,887.0**	**142,555.0**	**155,230.0**	**169,307.0**	**172,653.0**	**166,319.0**	**169,972.0**
IP-Intensive	***93,124.0***	***90,421.0***	***82,670.0***	***88,977.0***	***110,688.0***	***119,395.0***	***129,809.0***	***142,887.0***	***145,088.9***	***138,093.9***	***142,421.8***
Petroleum & coal	1,172.0	1,057.0	1,233.0	1,308.0	1,595.0	1,442.0	1,431.0	1,718.0	1,467.9	1,873.6	1,755.6
Chemical	20,768.0	17,713.0	20,395.0	22,693.0	39,070.0	42,826.0	46,119.0	55,319.0	58,053.0	53,121.0	57,858.0
Basic chemical	2,050.0	1,835.0	1,710.0	1,991.0	2,312.0	2,179.0	2,054.0	3,158.0	-	-	-
Resin, syn rubber, fiber	2,842.0	2,745.0	2,413.0	2,390.0	2,080.0	2,280.0	1,963.0	951.0	-	-	-
Pharmaceutical & medicine	12,793.0	10,137.0	14,186.0	15,949.0	31,444.0	34,798.0	38,813.0	47,624.0	47,994.0	44,823.0	49,316.0
Computer & electronic	44,526.0	44,744.0	33,411.0	32,495.0	40,691.0	42,463.0	48,251.0	49,760.0	55,818.0	51,226.0	53,940.0
Computer & peripheral equip	5,162.0	3,165.0	3,015.0	2,561.0	5,707.0	4,902.0	7,289.0	6,869.0	-	-	-
Communications equip	16,156.0	18,721.0	9,524.0	8,932.0	8,433.0	9,660.0	10,911.0	11,435.0	-	-	-
Semiconductor & other	12,787.0	14,210.0	11,871.0	12,607.0	17,524.0	18,602.0	18,534.0	18,315.0	22,324.0	19,900.0	21,756.0
Navigational, measure, electromed	10,114.0	7,565.0	8,549.0	7,834.0	7,882.0	8,325.0	10,440.0	12,262.0	11,825.0	10,534.0	10,655.0
Transportation equipment	22,917.0	21,004.0	21,452.0	26,111.0	26,019.0	28,321.0	30,010.0	30,974.0	24,611.0	25,314.0	22,722.0
Motor vehicles, trailers	18,306.0	16,089.0	15,199.0	16,874.0	15,610.0	16,025.0	16,562.0	16,034.0	13,475.0	12,284.0	11,790.0
Aerospace product	3,895.0	4,083.0	5,349.0	8,203.0	9,224.0	10,928.0	11,995.0	13,397.0	11,136.0	13,030.0	10,933.0
Medical equipment & supplies (misc)	3,741.0	5,903.0	6,179.0	6,370.0	3,313.0	4,343.0	3,998.0	5,116.0	5,138.9	6,559.3	6,146.2
Non-IP-Intensive	***20,048.0***	***22,313.0***	***18,674.0***	***19,101.0***	***21,200.0***	***23,159.0***	***25,421.0***	***26,419.0***	***27,564.0***	***28,224.9***	***27,550.0***
Food, beverage & tobacco	1,562.0	1,970.0	2,204.0	2,160.0	2,804.0	3,249.0	3,263.0	2,939.0	2,682.3	3,423.6	3,208.0
Textiles, apparel, & leather	266.0	255.0	248.0	309.0	568.0	811.0	583.0	796.0	815.0	424.0	484.0
Wood	105.0	181.0	132.0	138.0	152.0	218.0	192.0	202.0	273.0	512.0	247.0
Paper, printing, & support	2,700.0	2,664.0	2,620.0	2,909.0	2,308.0	2,451.0	2,793.0	2,596.0	2,824.5	3,605.1	3,378.1
Plastics & rubber	1,675.0	2,245.0	1,508.0	1,729.0	1,879.0	1,747.0	2,217.0	2,072.0	1,813.0	2,441.0	2,113.0
Nonmetallic mineral	845.0	978.0	420.0	470.0	783.0	889.0	936.0	1,112.0	1,523.0	1,082.0	1,253.0
Primary metal	598.0	479.0	461.0	518.0	705.0	609.0	638.0	886.0	686.0	826.0	624.0
Fabricated metal	1,631.0	1,545.0	1,251.0	1,329.0	1,465.0	1,323.0	1,432.0	1,594.0	2,403.0	2,021.0	1,613.0
Machinery	6,539.0	6,337.0	6,366.0	6,224.0	6,473.0	8,422.0	9,743.0	9,796.0	10,042.0	8,988.0	9,857.0
Electrical equipment & appliances	3,390.0	4,680.0	1,978.0	2,002.0	2,622.0	2,322.0	2,215.0	2,617.0	3,052.0	3,264.0	3,236.0
Furniture	284.0	301.0	251.0	275.0	406.0	400.0	371.0	581.0	477.0	396.0	373.0
Misc non-medical equipment	453.0	678.0	1,235.0	1,038.0	1,035.0	718.0	1,038.0	1,228.0	973.2	1,242.2	1,164.0

Sources: National Science Foundation: BRDIS Survey.

Table A.3. Gross Output, by Industry, 2000-12 ($ billions)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
All Manufacturing Industries	**4,208.6**	**3,967.7**	**3,914.7**	**4,015.4**	**4,309.0**	**4,742.1**	**5,015.6**	**5,338.3**	**5,468.1**	**4,436.2**	**4,905.4**	**5,498.6**	**5,733.1**
IP-Intensive	***1,888.7***	***1,747.2***	***1,733.8***	***1,808.7***	***1,965.6***	***2,224.5***	***2,372.2***	***2,565.7***	***2,649.5***	***2,084.4***	***2,380.5***	***2,731.4***	***2,863.4***
Petroleum & coal	235.1	219.1	215.5	247.1	330.4	475.8	546.8	615.5	769.7	497.9	627.1	836.8	850.6
Chemical	449.2	438.4	462.5	487.7	540.9	610.9	657.1	724.1	738.7	628.9	697.8	776.8	794.7
Basic chemical	115.7	104.4	109.4	120.7	146.2	172.0	195.0	227.7	242.1	175.4	226.1	267.4	277.1
Resin, syn rubber, fiber	68.4	60.6	60.3	64.7	73.9	92.0	94.3	100.9	99.2	72.1	94.9	104.0	109.6
Pharmaceutical & medicine	118.0	130.0	143.0	151.9	157.6	169.2	180.9	188.8	192.1	191.4	182.0	195.7	193.7
Computer & electronic	510.6	429.5	357.3	352.3	365.5	372.9	390.8	403.0	383.9	328.0	331.3	337.9	339.4
Computer & peripheral equip	110.2	89.5	73.8	69.1	63.3	65.0	67.4	65.7	66.0	52.5	38.1	28.9	32.1
Communications equip	118.7	102.0	65.1	60.9	61.4	58.9	70.2	65.9	53.9	45.2	42.8	44.6	40.6
Semiconductor & other	166.7	124.2	110.2	113.2	116.2	119.4	117.7	122.9	118.5	96.5	115.1	123.5	114.2
Navigational, measure, electromed	97.1	97.2	92.0	93.1	106.2	112.0	119.0	134.6	133.1	125.1	129.8	135.3	146.5
Transportation equipment	639.9	602.5	636.7	655.9	662.0	690.7	699.0	744.9	672.8	545.0	636.8	690.4	787.7
Motor vehicles, trailers	471.2	427.2	469.6	491.7	494.6	501.5	500.2	500.2	413.2	301.7	400.7	445.3	506.8
Aerospace product	127.6	134.9	124.7	121.0	121.0	137.3	143.0	178.2	183.9	178.9	174.9	183.3	213.3
Medical equipment & supplies (misc)	53.9	57.8	61.8	65.7	66.8	74.2	78.5	78.1	84.4	84.6	87.4	89.5	91.0
Non-IP-Intensive	***2,319.9***	***2,223.3***	***2,180.9***	***2,206.7***	***2,343.3***	***2,517.6***	***2,643.3***	***2,772.6***	***2,818.6***	***2,351.8***	***2,525.0***	***2,767.2***	***2,869.7***
Food, beverage & tobacco	546.9	570.2	563.7	597.6	626.1	656.5	661.0	718.1	775.0	748.4	779.9	847.3	881.0
Textiles, apparel, & leather	155.8	141.1	125.4	118.4	113.2	114.9	108.4	94.8	83.2	66.6	68.6	72.0	70.3
Wood	93.7	87.3	89.0	92.1	104.1	112.1	112.4	102.0	87.8	65.4	69.6	70.6	77.9
Paper, printing, & support	269.7	256.6	249.4	243.7	249.0	258.9	268.8	279.5	277.9	245.7	252.5	258.6	263.2
Plastics & rubber	178.2	170.7	174.7	178.3	184.7	200.3	211.3	210.4	203.7	171.2	188.8	204.5	218.6
Nonmetallic mineral	97.3	94.9	95.1	96.9	102.9	114.8	126.3	128.1	115.5	90.4	90.1	93.0	98.5
Primary metal	156.6	138.2	139.4	138.3	181.6	203.3	234.4	257.3	282.6	168.3	232.8	280.2	267.5
Fabricated metal	268.2	253.1	246.8	245.3	261.1	289.4	317.2	345.4	358.3	281.3	293.9	326.8	339.8
Machinery	291.5	266.6	255.3	257.4	272.1	302.7	326.6	351.5	355.6	287.6	317.7	365.7	407.4
Electrical equipment & appliances	125.4	114.1	102.8	99.9	105.1	112.0	119.4	129.7	130.3	106.7	110.0	120.0	119.9
Furniture	75.1	72.1	75.8	75.3	78.3	84.2	85.6	85.5	79.8	60.8	59.0	62.0	66.7
Misc non-medical equipment	61.4	58.4	63.4	63.6	65.1	68.5	72.0	70.2	69.0	59.4	62.1	66.6	58.8

Sources: U.S. Census Bureau: Annual Survey of Manufactures and Economic Census.

Table A.4. Value-Added, by Industry, 2000-12 ($ billions)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
All Manufacturing Industries	**1,973.6**	**1,853.9**	**1,889.3**	**1,923.4**	**2,041.4**	**2,210.3**	**2,285.9**	**2,390.6**	**2,266.4**	**1,978.0**	**2,160.7**	**2,295.2**	**2,362.3**
IP-Intensive	***829.1***	***765.5***	***789.7***	***822.4***	***877.2***	***985.7***	***1,013.4***	***1,076.3***	***989.5***	***890.5***	***977.7***	***1,035.6***	***1,072.7***
Petroleum & coal	43.8	47.3	37.1	48.3	66.4	118.0	125.8	126.0	89.7	78.6	94.0	126.2	128.8
Chemical	232.7	226.6	256.2	267.3	297.2	331.7	340.0	365.3	352.4	328.9	349.9	374.9	386.2
Basic chemical	46.5	37.6	45.7	47.8	61.8	75.2	82.7	84.4	82.8	66.7	89.3	100.3	109.5
Resin, syn rubber, fiber	25.9	22.1	22.6	24.0	29.3	34.6	31.5	33.6	26.4	27.2	32.4	29.9	33.2
Pharmaceutical & medicine	81.5	91.7	104.3	115.0	118.6	127.6	134.1	142.1	141.5	140.6	131.8	139.8	135.5
Computer & electronic	280.1	223.7	200.3	203.2	217.0	227.1	230.8	238.2	228.4	193.2	200.5	208.0	207.4
Computer & peripheral equip	43.5	34.4	34.4	30.3	31.8	34.0	35.0	34.1	36.4	26.0	17.8	13.0	14.4
Communications equip	62.6	50.8	32.4	30.9	32.1	31.8	36.9	36.3	29.8	24.9	20.9	21.2	18.7
Semiconductor & other	105.6	71.3	69.2	73.4	77.5	81.3	76.5	75.9	74.8	58.4	77.3	86.1	78.0
Navigational, measure, electromed	60.5	60.0	56.3	60.3	68.3	73.3	75.8	85.2	81.8	79.4	81.2	84.5	92.8
Transportation equipment	234.4	227.7	253.4	256.4	250.1	256.6	260.9	291.7	258.3	229.6	270.9	264.5	288.2
Motor vehicles, trailers,	156.0	137.1	167.5	166.7	165.3	161.2	160.0	160.0	124.6	100.4	137.1	126.8	140.4
Aerospace product	59.5	71.8	64.2	61.8	62.7	72.1	75.9	100.6	99.4	99.2	104.0	105.5	114.8
Medical equipment & supplies (misc)	38.1	40.2	42.7	47.1	46.5	52.4	55.9	55.1	60.6	60.2	62.5	61.9	62.1
Non-IP-Intensive	***1,134.5***	***1,098.5***	***1,098.5***	***1,101.0***	***1,164.2***	***1,224.6***	***1,272.6***	***1,314.3***	***1,276.8***	***1,087.5***	***1,183.0***	***1,259.7***	***1,289.6***
Food, beverage & tobacco	256.4	271.0	270.2	284.8	298.5	315.8	312.6	321.6	322.8	329.6	340.0	348.0	345.6
Textiles, apparel, & leather	67.7	60.7	54.8	54.7	50.6	53.5	51.2	44.2	36.3	29.4	31.1	31.9	30.4
Wood	36.1	33.1	35.1	37.1	43.7	44.8	44.3	41.2	34.5	25.9	28.9	28.7	31.8
Paper, printing, & support	141.4	133.5	134.6	129.8	131.9	134.1	140.3	145.5	139.1	127.0	128.3	130.5	132.8
Plastics & rubber	91.2	86.6	92.6	92.3	93.2	96.2	99.5	99.2	90.9	82.3	89.3	91.7	99.9
Nonmetallic mineral	55.5	53.2	54.8	55.2	59.3	65.0	72.1	72.6	61.8	48.9	49.2	50.9	54.1
Primary metal	63.3	53.1	57.2	53.6	73.8	75.5	84.3	89.7	91.7	48.2	83.8	97.9	86.9
Fabricated metal	138.8	148.9	138.7	137.5	145.0	155.8	169.3	184.8	189.1	146.9	156.9	173.0	180.4
Machinery	146.1	131.1	129.2	126.7	133.9	143.5	154.5	166.4	167.3	133.1	154.5	177.5	199.2
Electrical equipment & appliances	62.9	56.3	52.9	51.3	52.9	54.7	57.5	62.0	60.8	50.5	54.7	58.5	58.9
Furniture	41.8	39.8	42.9	42.2	43.7	46.5	46.4	47.0	43.5	32.2	31.1	32.7	35.6
Misc non-medical equipment	33.4	31.2	35.8	35.9	37.6	39.1	40.6	40.2	39.0	33.5	35.2	38.3	34.1

Sources: U.S. Census Bureau: Annual Survey of Manufactures and Economic Census.

Table A.5. Exports, by Industry, 2000-12 ($ millions)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
All Manufacturing Industries	**644,442.4**	**597,100.5**	**562,833.8**	**577,175.5**	**642,472.5**	**710,534.0**	**820,524.0**	**909,478.0**	**998,331.0**	**801,821.0**	**952,261.0**	**1,102,401.0**	**1,161,610.0**
IP-Intensive	***379,425.4***	***353,004.0***	***337,188.7***	***348,278.8***	***383,107.4***	***418,758.0***	***485,094.0***	***534,645.0***	***582,494.0***	***468,393.0***	***551,688.0***	***636,349.0***	***672,840.0***
Petroleum & coal	8,861.8	8,214.0	7,897.0	9,348.6	12,568.8	17,788.0	25,959.0	30,846.0	58,273.0	41,551.0	61,010.0	100,681.0	109,980.0
Chemical	77,649.1	76,837.4	78,049.5	88,384.1	105,083.3	114,214.0	129,504.0	147,364.0	165,805.0	145,526.0	170,992.0	187,101.0	188,057.0
Basic chemical	27,768.3	26,270.1	26,019.1	30,277.6	36,835.8	38,995.0	45,010.0	51,631.0	55,887.0	44,302.0	56,355.0	65,311.0	64,099.0
Resin, syn rubber, fiber	16,227.5	15,340.1	15,774.5	17,051.9	20,570.7	23,797.0	27,329.0	31,500.0	33,921.0	26,830.0	34,924.0	39,387.0	38,225.0
Pharmaceutical & medicine	15,668.4	18,117.6	18,708.2	22,487.8	27,147.2	29,104.0	32,161.0	36,664.0	41,726.0	45,983.0	46,580.0	45,160.0	48,444.0
Computer & electronic	161,635.5	134,395.5	116,333.3	115,948.0	122,174.9	124,071.0	135,025.0	136,294.0	136,443.0	107,077.0	121,586.0	124,224.0	123,821.0
Computer & peripheral equip	44,457.3	37,290.8	29,150.3	27,788.6	27,122.6	28,633.0	29,780.0	28,908.0	27,526.0	20,618.0	21,675.0	21,431.0	22,110.0
Communications equip	18,977.8	15,550.1	12,262.2	10,680.0	13,521.4	14,391.0	14,995.0	17,514.0	17,896.0	13,962.0	14,659.0	15,498.0	15,766.0
Semiconductor & other	65,202.4	49,829.2	44,719.5	47,204.6	47,592.3	45,570.0	49,826.0	47,834.0	47,867.0	34,819.0	42,525.0	40,693.0	37,983.0
Navigational, measure, electromed	27,106.1	26,338.0	24,988.6	25,682.6	29,138.8	30,485.0	34,895.0	37,089.0	38,522.0	33,544.0	37,893.0	41,573.0	43,091.0
Transportation equipment	121,773.5	123,008.1	123,969.5	122,245.8	129,668.5	147,244.0	177,990.0	202,165.0	201,986.0	154,057.0	176,326.0	201,054.0	226,490.0
Motor vehicles, trailers,	66,846.2	63,149.7	66,774.0	68,510.3	71,342.4	77,561.0	89,803.0	101,307.0	102,176.0	68,308.0	93,167.0	109,443.0	120,211.0
Aerospace product	51,498.8	55,281.0	53,459.3	49,674.9	53,407.8	63,915.0	81,194.0	92,635.0	91,035.0	79,401.0	76,003.0	84,035.0	97,360.0
Medical equipment & supplies (misc)	9,505.4	10,549.0	10,939.4	12,352.3	13,612.0	15,441.0	16,616.0	17,976.0	19,987.0	20,182.0	21,774.0	23,289.0	24,492.0
Non-IP-Intensive	***265,016.9***	***244,096.5***	***225,645.1***	***228,896.7***	***259,365.1***	***291,776.0***	***335,429.0***	***374,835.0***	***415,837.0***	***333,426.0***	***400,573.0***	***466,053.0***	***488,770.0***
Food, beverage & tobacco	30,534.6	30,820.4	28,733.7	30,442.8	29,542.3	32,249.0	36,048.0	42,937.0	53,282.0	48,277.0	56,272.0	64,907.0	70,317.0
Textiles, apparel, & leather	19,671.4	17,842.8	16,781.6	16,395.2	16,948.7	17,178.0	17,320.0	16,347.0	16,146.0	13,341.0	15,875.0	17,832.0	17,540.0
Wood	4,853.9	3,944.2	3,776.8	3,817.6	4,233.9	4,445.0	4,913.0	4,960.0	5,036.0	3,977.0	5,075.0	5,574.0	5,943.0
Paper, printing, & support	20,408.1	18,912.3	18,149.5	18,670.9	20,089.4	22,060.0	23,783.0	25,947.0	28,152.0	24,758.0	28,847.0	30,709.0	30,326.0
Plastics & rubber	16,970.1	15,745.4	15,383.0	15,660.6	17,264.2	18,787.0	20,575.0	22,259.0	23,764.0	20,545.0	24,538.0	27,490.0	28,874.0
Nonmetallic mineral	7,830.0	7,378.2	6,024.8	6,069.2	6,577.4	6,911.0	7,766.0	8,588.0	9,095.0	7,469.0	9,226.0	10,071.0	10,137.0
Primary metal	20,125.7	18,149.9	15,370.8	17,877.1	21,092.4	27,423.0	37,079.0	44,592.0	54,733.0	38,228.0	49,773.0	71,994.0	74,279.0
Fabricated metal	21,658.1	19,524.5	18,855.7	18,814.7	20,731.7	23,254.0	27,238.0	29,800.0	32,459.0	27,730.0	32,690.0	37,026.0	40,153.0
Machinery	84,779.5	76,307.7	70,087.1	69,220.1	85,999.8	96,615.0	109,364.0	122,392.0	133,699.0	103,326.0	124,792.0	141,915.0	149,359.0
Electrical equipment & appliances	25,401.4	22,764.2	20,586.7	20,632.0	23,558.2	26,551.0	31,360.0	33,463.0	34,649.0	27,339.0	32,280.0	35,635.0	38,238.0
Furniture	2,882.0	2,418.9	2,158.0	2,348.7	2,622.4	2,829.0	3,158.0	3,494.0	3,986.0	3,137.0	3,560.0	3,887.0	4,405.0
Misc non-medical equipment	9,902.0	10,288.1	9,737.3	8,947.6	10,704.8	13,474.0	16,825.0	20,056.0	20,836.0	15,299.0	17,645.0	19,013.0	19,199.0

Sources: U.S. International Trade Commission: DataWeb.

Table A.6. Employment, by Industry, 2000-12 (thousands)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
All Manufacturing Industries	**16,474.0**	**15,950.4**	**14,393.6**	**14,132.0**	**13,822.0**	**13,667.3**	**13,631.7**	**13,320.2**	**13,096.2**	**11,633.0**	**10,862.8**	**10,984.4**	**11,176.7**
IP-Intensive	***4,729.3***	***4,624.5***	***4,101.1***	***4,041.8***	***3,969.8***	***3,917.2***	***3,902.1***	***3,831.5***	***3,766.1***	***3,402.7***	***3,187.6***	***3,222.1***	***3,304.5***
Petroleum & coal	109.2	103.6	100.4	98.3	103.9	101.5	103.0	103.6	103.9	100.4	99.7	98.4	100.8
Chemicals	885.8	869.8	827.4	841.4	823.0	810.4	805.1	793.7	810.8	759.3	722.5	725.3	719.5
Basic chemicals	192.0	183.2	173.0	170.6	165.2	162.8	161.3	165.0	164.9	151.1	147.0	153.0	149.7
Resin, syn rubber	113.6	107.9	96.8	100.3	93.9	93.1	86.3	88.6	99.4	87.0	84.8	86.2	87.0
Pharmaceutical, med	227.5	233.5	237.9	251.9	246.3	247.8	249.7	241.3	253.3	242.8	231.0	227.9	227.4
Computer & electronic	1,557.1	1,593.3	1,300.4	1,189.5	1,108.3	1,059.0	1,057.5	1,043.3	1,014.5	965.2	878.3	877.5	846.2
Computers & periph.	193.9	199.6	155.1	170.3	125.9	107.0	102.6	99.1	91.4	90.6	71.0	67.5	58.7
Comm. equip	256.5	269.5	206.3	167.4	151.2	139.2	152.7	151.8	120.5	143.2	113.6	115.7	100.8
Semiconductors	571.4	603.2	458.9	386.8	373.7	362.2	365.4	362.9	351.2	299.0	283.1	283.9	265.4
Navig, electromed	461.5	453.5	417.6	403.7	401.3	396.5	384.9	385.0	410.8	397.2	383.0	387.5	394.7
Transportation equip	1,872.6	1,753.4	1,578.7	1,606.7	1,625.7	1,636.1	1,622.5	1,574.1	1,526.9	1,273.2	1,202.0	1,235.0	1,354.5
Motor vehic, trailers	1,198.1	1,087.6	988.4	1,032.5	1,049.7	1,033.2	1,007.9	941.7	879.4	662.1	627.6	667.3	736.2
Aerospace product	446.2	449.4	391.3	375.2	372.6	387.2	397.9	408.1	415.3	401.2	383.6	379.0	422.6
Misc medical equip	304.6	304.4	294.2	305.9	308.8	310.3	314.0	316.8	309.9	304.6	285.1	285.9	283.6
Non-IP-Intensive	***11,744.7***	***11,325.9***	***10,292.5***	***10,090.3***	***9,852.2***	***9,750.1***	***9,729.6***	***9,488.7***	***9,330.1***	***8,230.3***	***7,675.2***	***7,762.2***	***7,872.3***
Food, bev & tobacco	1,637.5	1,641.0	1,607.2	1,651.2	1,637.0	1,624.0	1,613.8	1,595.4	1,624.5	1,581.1	1,572.4	1,573.8	1,547.2
Textile, apparel, leath	1,134.1	1,012.8	850.1	790.1	719.3	656.6	598.2	551.2	494.0	401.5	368.3	364.2	349.2
Wood products	597.7	557.5	534.0	524.0	534.8	555.9	576.5	527.6	491.3	385.8	350.3	344.3	337.8
Paper, printing	1,367.3	1,317.8	1,202.4	1,182.5	1,138.2	1,111.7	1,082.4	1,056.9	1,039.5	931.0	864.7	843.5	811.3
Plastics & rubber	1,056.5	1,002.5	925.6	921.4	908.1	902.1	900.8	855.5	822.1	693.5	667.6	684.0	700.1
Nonmetallic mineral	523.7	524.2	475.5	467.6	472.1	469.2	482.5	472.1	456.1	380.3	344.0	338.8	352.2
Primary metals	601.6	572.5	501.0	479.7	451.1	450.8	449.9	438.9	432.0	378.3	352.3	372.9	391.7
Fabricated metal	1,790.8	1,761.4	1,582.4	1,518.3	1,514.6	1,519.8	1,563.7	1,565.9	1,588.1	1,401.5	1,275.8	1,332.1	1,385.9
Machinery	1,378.0	1,332.9	1,166.2	1,129.1	1,087.9	1,107.3	1,126.7	1,137.5	1,149.7	1,034.0	928.7	966.9	1,060.9
Elec equipment	589.4	575.4	502.4	460.0	439.1	426.8	419.7	406.3	403.9	363.2	329.2	331.7	332.4
Furniture & related	640.4	619.2	575.1	564.4	555.4	547.9	543.3	517.4	489.2	388.3	348.7	334.9	341.8
Misc non-med equip	427.6	408.7	370.6	402.0	394.6	378.0	372.1	364.1	339.8	292.0	273.2	275.1	261.9

Sources: U.S. Census Bureau: County Business Patterns and Economic Census.

Table A.7. Employment Wages, by Industry, 2000-12 ($ billions)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
All Manufacturing Industries	**644.0**	**617.7**	**580.4**	**576.1**	**592.8**	**600.7**	**620.2**	**626.5**	**622.3**	**549.6**	**550.4**	**574.8**	**589.2**
IP-Intensive	***243.3***	***233.5***	***216.3***	***215.2***	***211.6***	***224.3***	***231.7***	***235.5***	***231.4***	***210.8***	***210.6***	***220.1***	***223.9***
Petroleum & coal	6.4	6.3	6.5	6.5	7.8	8.2	8.2	8.5	8.4	8.3	8.4	8.8	9.3
Chemicals	45.6	46.4	46.4	48.5	48.8	49.2	51.1	51.5	53.0	49.7	49.8	51.8	51.1
Basic chemicals	10.9	10.8	10.5	10.6	10.6	10.8	11.0	11.6	11.7	10.5	10.8	11.9	12.0
Resin, syn rubber	6.0	5.7	5.3	5.5	5.2	5.4	5.2	5.6	5.9	5.3	5.5	5.9	6.0
Pharmaceutical, med	13.3	14.6	15.9	17.4	17.7	18.1	19.4	18.9	19.6	19.2	18.7	19.0	18.0
Computer & electronic	90.4	84.5	71.7	66.6	66.3	65.6	69.8	72.8	69.7	65.1	63.2	66.1	62.0
Computers & periph.	11.8	11.4	9.5	9.4	8.1	7.0	6.9	7.4	7.0	6.5	4.9	5.0	4.5
Comm. equip	17.4	16.2	13.3	10.6	9.7	9.5	12.3	13.9	9.0	11.1	9.2	10.2	8.4
Semiconductors	31.9	28.3	21.9	19.4	20.2	20.1	21.0	21.4	21.3	16.6	18.0	18.8	16.0
Navig, electromed	26.5	26.1	24.3	24.8	26.0	26.5	27.2	28.0	30.3	28.9	29.5	31.0	31.8
Transportation equip	88.6	83.4	78.8	80.0	85.1	86.0	86.5	85.9	83.6	71.4	73.1	76.8	84.8
Motor vehic, trailers	55.3	49.0	47.5	49.7	52.3	51.1	49.5	47.0	42.4	31.7	33.3	35.5	39.3
Aerospace product	25.0	26.2	23.3	22.3	24.4	26.0	27.7	28.7	30.0	29.2	29.7	30.9	34.5
Misc medical equip	12.3	12.8	12.9	13.6	3.6	15.2	16.1	16.8	16.8	16.3	16.2	16.5	16.6
Non-IP-Intensive	***400.6***	***384.2***	***364.1***	***360.9***	***381.2***	***376.4***	***388.6***	***391.0***	***390.9***	***338.9***	***339.8***	***354.7***	***365.4***
Food, bev & tobacco	51.1	51.3	51.6	53.7	54.8	55.7	57.8	58.8	60.4	60.2	61.0	61.8	62.1
Textile, apparel, leath	27.0	24.2	22.1	20.7	19.9	18.0	17.2	16.4	14.5	11.8	11.5	11.7	11.3
Wood products	16.5	15.8	15.9	15.9	17.2	18.2	18.6	17.5	15.8	12.4	12.0	12.1	12.5
Paper, printing	51.6	49.6	46.9	46.7	46.6	46.6	47.0	47.0	46.5	40.6	39.9	39.8	39.9
Plastics & rubber	34.1	32.6	32.0	32.1	33.2	33.4	34.1	33.5	32.0	27.7	28.7	29.9	31.0
Nonmetallic mineral	19.1	19.3	18.1	18.1	19.0	19.7	20.6	20.4	19.7	16.3	15.7	15.9	16.4
Primary metals	25.5	23.6	21.6	20.9	21.5	22.1	22.8	22.9	23.0	18.5	20.1	21.9	23.2
Fabricated metal	64.2	61.8	57.7	55.8	58.6	60.7	64.9	67.4	70.7	59.6	59.7	64.4	67.5
Machinery	58.4	54.7	50.1	49.0	50.5	52.7	55.3	56.8	59.1	50.5	50.9	55.6	60.0
Elec equipment	21.9	20.9	18.8	17.6	17.8	17.9	18.4	18.5	18.9	16.7	16.6	17.3	17.3
Furniture & related	18.0	17.4	16.8	16.8	17.2	17.6	17.9	17.5	16.6	13.0	12.2	12.3	12.9
Misc non-med equip	13.2	12.8	12.3	13.7	25.1	13.8	14.1	14.4	13.6	11.6	11.6	12.1	11.3

Sources: U.S. Census Bureau: County Business Patterns and Economic Census.

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