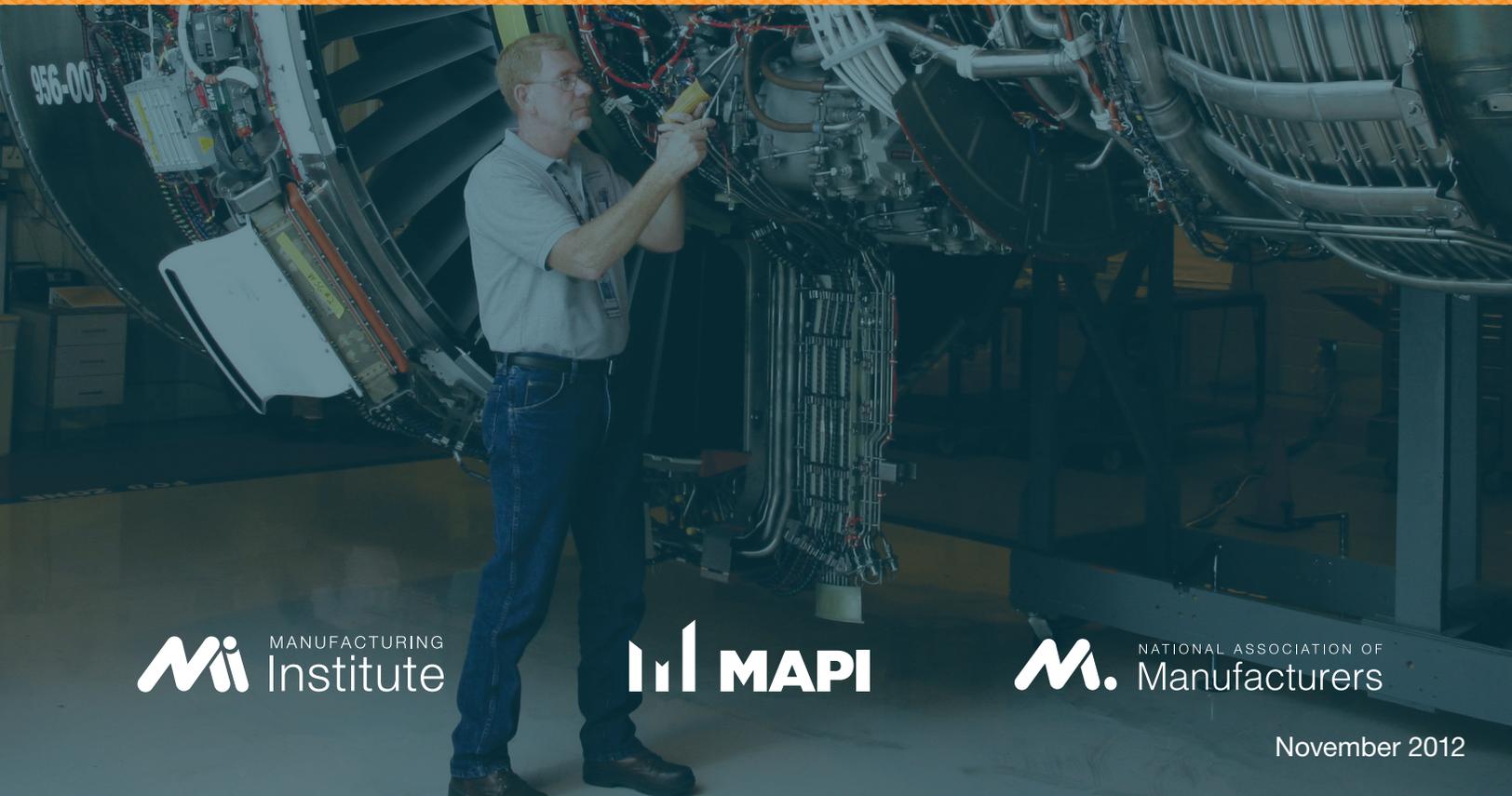




# FACTS

## About Manufacturing



# Introduction to the 9th Edition of Facts About Manufacturing

The manufacturing sector in the United States has been in the spotlight more over the past couple of years than at any point in the past half-century. The reason: It has been one of the lone bright spots in a lengthy economic recovery. But the complete story of American manufacturing is about its importance to the nation's economy and workforce and the challenges that policymakers must address for the U.S. to remain the world's leading manufacturer.

No sector creates more economic value or supports more additional jobs than manufacturing. This is reflected in the multiplier effect, and it underscores why a strong and healthy economy requires a vibrant and growing manufacturing sector. The manufacturing workforce is a direct beneficiary of a strong manufacturing sector, as employees enjoy a 19 percent compensation premium compared to individuals employed in other sectors.

Manufacturing is also vital to attracting investment from overseas. Manufacturing companies in the United States are responsible for nearly half of all U.S. exports while foreign-headquartered companies now invest nearly \$750 billion in U.S. manufacturing and employ more than 1.6 million people.

Policymakers are finally starting to understand the importance of manufacturing to economic growth and higher living standards. Leaders in both major political parties have publicly recognized the critical role manufacturing plays in creating jobs and vibrant communities. Now it is time for them to address the challenges that restrict greater growth and threaten U.S. manufacturers' ability to compete in the global market.

The most pressing challenge to U.S. manufacturers is the 20 percent structural cost burden they face compared to their global competitors. This burden raises the cost of every product that manufacturers produce and every job that companies create. It puts U.S. companies at a real disadvantage and discourages additional production, growth and entrepreneurship in the U.S.

A second, growing concern is the quality of manufacturing education in the United States. The U.S. is falling behind our major competitors in math and science achievement, graduating significantly fewer engineers and experiencing a major skills gap for production employees. This is at a time when manufacturing in the U.S. is becoming more complex, jobs require ever greater skills and the current workforce is quickly approaching retirement age. Action is needed to ensure the next generation is prepared to succeed in the manufacturing workforce.

American manufacturers are the most resilient and dynamic in the world. Despite two severe recessions in less than a decade, manufacturing in the U.S. has bounced back and, due to its productivity, innovation and sophistication, it remains the envy of the world. Now is the time to confront and solve the challenges American manufacturers face and position the United States to lead the world in manufacturing for years to come.



Jay Timmons  
President and CEO  
National Association of Manufacturers



Stephen Gold  
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Manufacturers Alliance for  
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The Manufacturing Institute

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# Section I

## The Importance of U.S. Manufacturing

Conventional wisdom holds the manufacturing industry in low esteem. The popular perception—as amplified by the media and casual observations at big-box stores—is that almost nothing gets made in the United States, and it doesn't help that the Great Recession accounted for millions of manufacturing job losses.

Yet, the facts support a different view. Industrial output continues to grow, manufactured products are globally competitive and manufacturing is leading the economic recovery. When assessing the size and importance of the U.S. manufacturing sector, it is vital to recognize that many other sectors, such as transportation, wholesale and retail trade and business services, depend on a strong manufacturing base. While U.S. manufacturing itself is the tenth-largest economy in the world, its impact on the overall U.S. economy is much larger when the “multiplier effect” is taken into account. In fact, millions of additional American jobs are a direct result of U.S. manufacturing.

This section examines five areas: Economic Growth, Innovation, Employment and Compensation, Environment and Quality of Life, and Trade and Investment. Some of the key findings include the following:

- Manufacturing is driving productivity growth in the U.S. economy, increasing at two and half times the rate of the service sector.
- Companies with fewer than 100 employees make up more than 94 percent of all U.S. manufacturers.
- U.S. manufacturers invest a far greater percentage of revenue in research and development than other industries.
- Manufacturing employees earn a higher average salary and receive greater benefits than workers in other industries.
- U.S. manufacturers have reduced energy usage and emissions to below the level from 1990.
- U.S. manufacturers are responsible for 47 percent of total U.S. exports.
- The U.S. is the number-one destination for foreign direct investment (FDI) by a wide margin.

The overall story of U.S. manufacturing is that it remains vital to our economic security and standard of living.

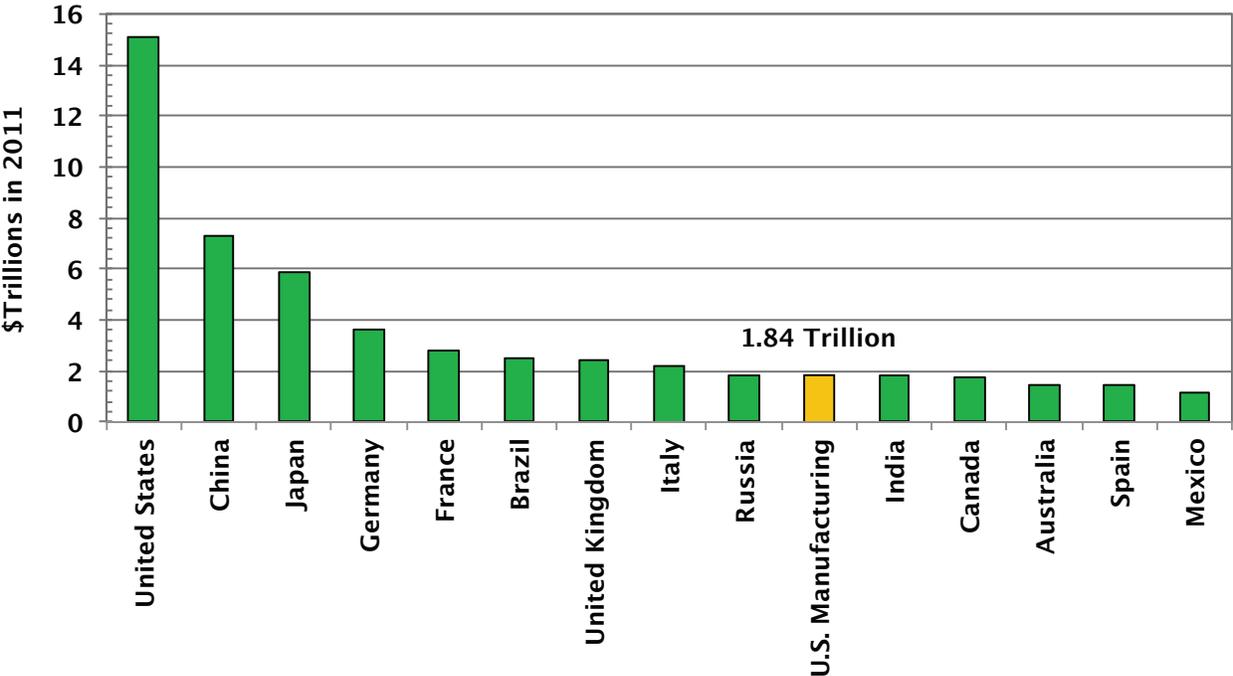
# Economic Growth

## The U.S. Manufacturing Sector Is the Tenth Largest Economy

In 2011, manufacturers generated \$1.84 trillion worth of value-added. Some sectors, such as electronics, computers and related hardware, expanded at a very fast clip. Others lost ground to changing tastes and technology. In the 20 years ending in 2011, manufacturing output increased more than 55 percent.

The U.S. manufacturing sector is so huge that if it were its own country, it would rank as the tenth-largest world economy. The United States produces the most goods and services overall as measured by GDP and is far ahead of second place China. Other countries, such as Japan and Germany, showed less growth buoyancy over the past decade compared with the United States. On the other hand, emerging economies, such as Brazil, India and Mexico, grew very quickly and are catching up with the developed world. Still, American manufacturers account for a larger volume of production than the entire GDP of India, Canada or Korea.

Figure 1 – The U.S. Manufacturing Sector Is the Tenth-Largest Economy



Source(s): International Monetary Fund, U.S. Bureau of Economic Analysis and MAPI

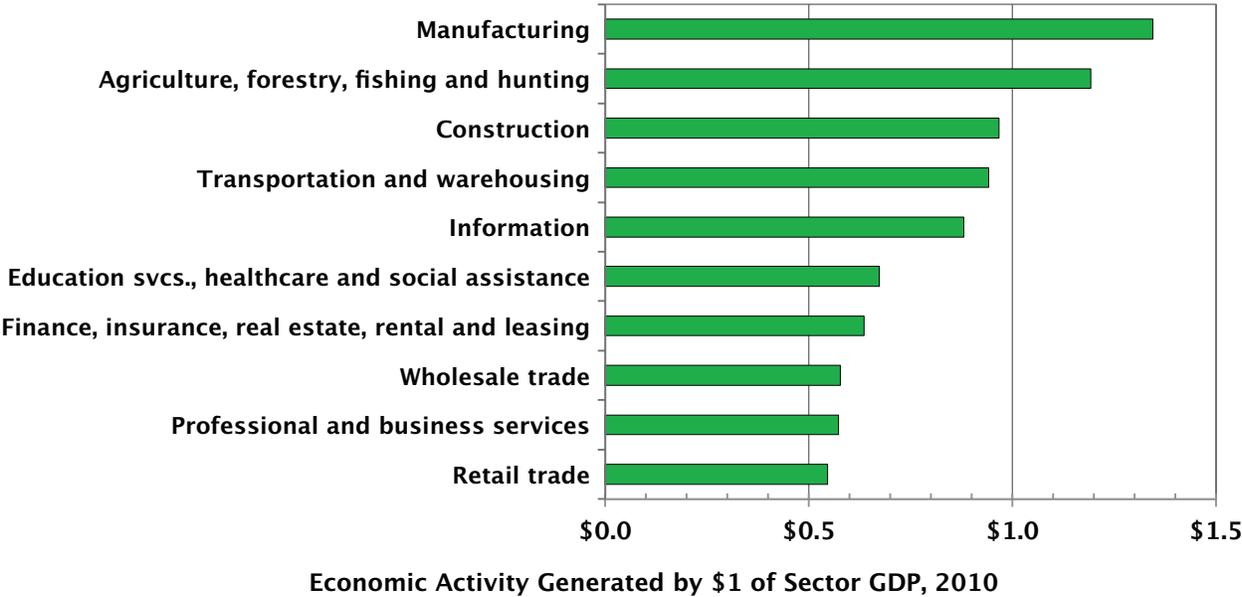
# Manufacturing’s Multiplier Effect Is Stronger Than Other Sectors’

Manufacturing is complex, and its production processes increase the demand for raw materials, energy, construction and services from a broad array of supplying industries. Additionally, many functions previously completed within manufacturing companies—from back-office operations and accounting to some types of logistics—are now contracted to other service providers and hence not counted as part of the manufacturing sector.

A measure of the breadth of the supply chain is the backward linkage in the input-output structure of the economy. For an industry with a larger backward linkage, growth in its output induces more production—both directly and indirectly—from other sectors. A mapping of relationships in the economy reveals that manufacturing has the highest backward linkage among the major sectors. As the demand for manufacturing grows, it in turn spurs the creation of jobs, investments and innovations elsewhere.

The backward linkage (or multiplier effect) shows how much additional output is generated by a dollar’s worth of final demand for each industry. Every dollar in final sales of manufactured products supports \$1.34 in output from other sectors—this is the largest multiplier of any sector. The retail and wholesale trade sectors have much lower multipliers, generating only 55 cents and 58 cents, respectively, in other additional inputs for every dollar of economic activity they generate. Manufacturing plants, therefore, have a powerful and positive impact on economic development.

**Figure 2 – Manufacturing’s Multiplier Effect Is Stronger Than Other Sectors’**



Source(s): U.S. Bureau of Economic Analysis, Annual Input-Output Tables

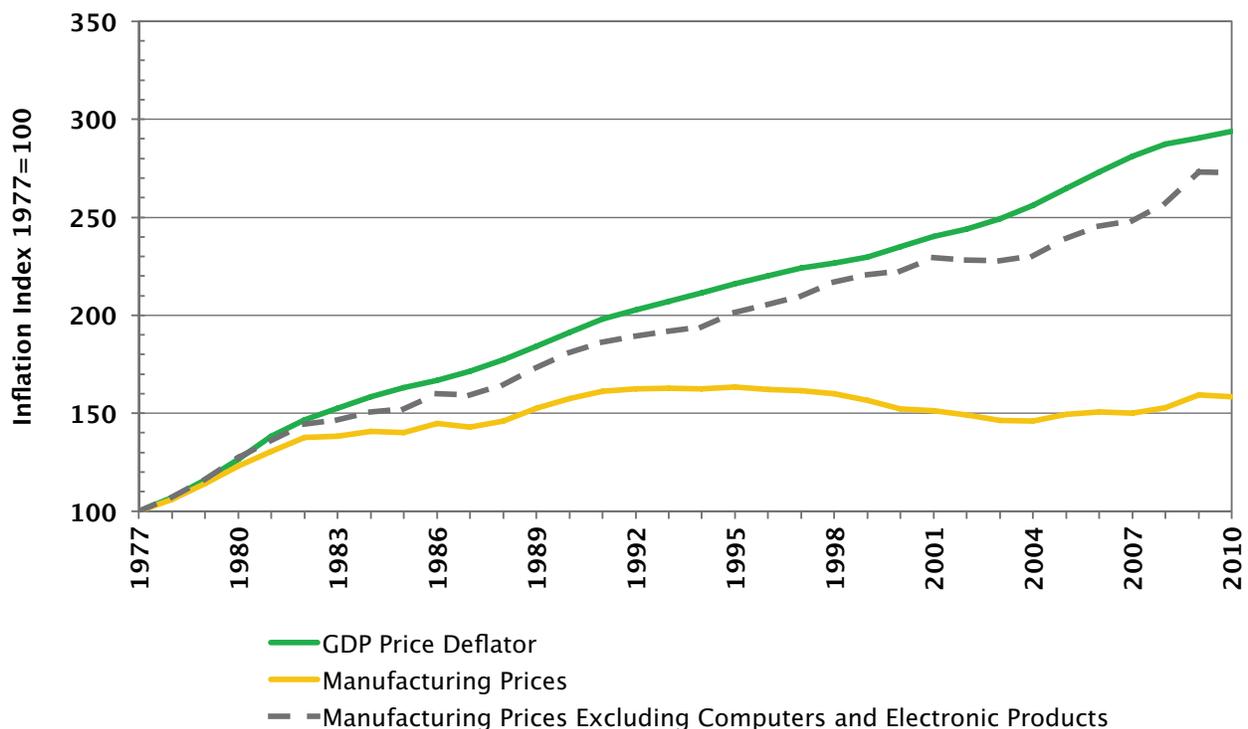
## Manufacturing Has Improved Living Standards

Manufacturing has substantially increased American consumers' standard of living. Strong productivity gains, rapid advances in innovation and international competition have led to deflation in manufactured goods, caused primarily by the dramatic quality improvement in computers and a corresponding reduction in prices of electronics. Between 1995 and 2010, manufacturing prices decreased by 3 percent as the overall price level increased by 36 percent. Inflation in manufacturing excluding computers and electronic products, however, increased 35 percent over the past 15 years.

Americans have long benefited from the trend of lower prices for computers and electronic goods as consumer budgets continued to grow. For example, prices for these goods were 92.3 percent less in 2010 than 15 years earlier, with prices declining 16 percent annually. High-tech manufacturing provides consumers with more goods for fewer financial resources. Because Americans can purchase their goods so cheaply, they can spend more on other items.

Massive deflation in computers and electronic manufactured goods also explains why manufacturing's share of GDP falls over time. The value of the industry's output is the price of manufactured goods multiplied by the physical quantity of goods manufactured. Although the physical units of all manufactured goods have increased at about the same rate as overall GDP when computers and electronic products are included, dollar prices of the goods have not kept pace with overall inflation, so mathematically, manufacturers' share of the total economy must fall.

**Figure 3 – Manufacturing Has Improved Living Standards**



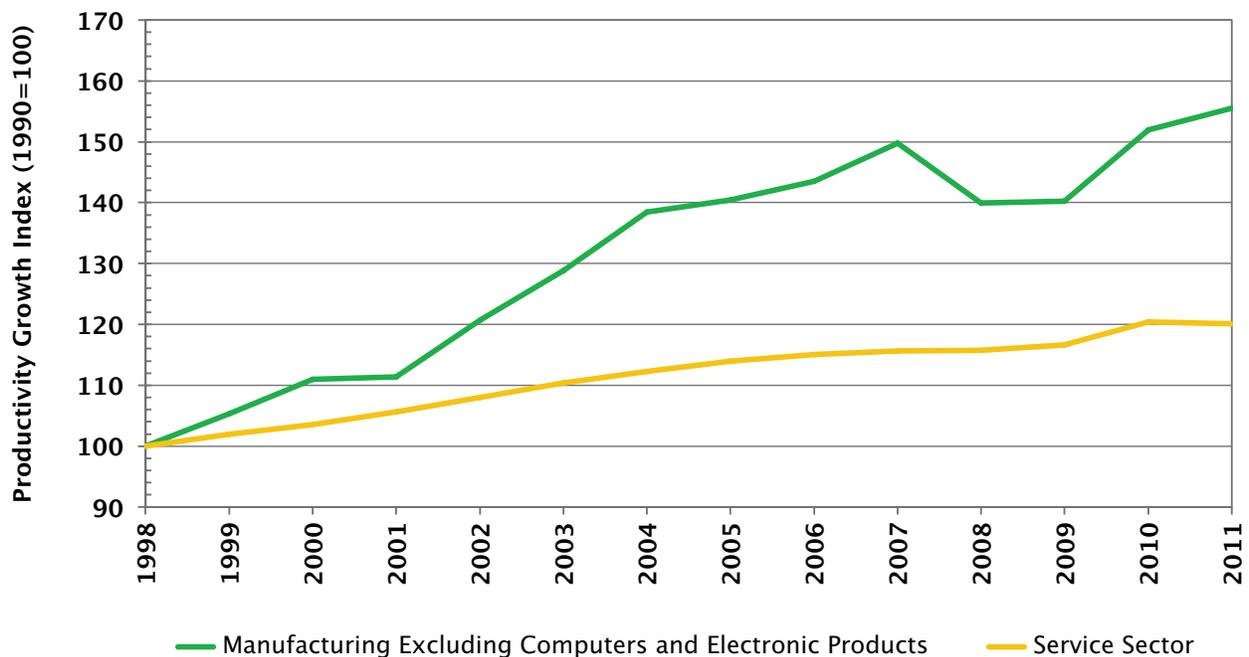
Source(s): U.S. Bureau of Economic Analysis

## Manufacturing Drives Productivity Growth

Federal Reserve Chairman Ben Bernanke said that productivity is “perhaps the single most important determinant of average living standards.”<sup>1</sup> Manufacturing productivity (excluding computers) consistently outpaces such growth in other sectors; between 1998 and 2011, it grew at an average annual rate of 3.5 percent. In contrast, service sector productivity grew by 1.4 percent. Higher productivity means that we can produce more with our stock of resources (labor and capital), and it is the basis for higher wages and living standards. Rising productivity is one reason prices of manufactured goods have risen at a slower rate than the overall price level.

Sustainable long-term economic growth is the result of increases in the size and quality of the labor force, investment in capital equipment and technological improvements. The trend in the size of the labor force is largely determined by demographic factors and immigration. Investments in capital equipment, technology and education, however, are sensitive to policy decisions. The manufacturing sector is the most intensive user of capital equipment and technology, which explains why it is the nation’s productivity powerhouse. Continued growth in productivity requires an increasingly skilled labor force, something that can be addressed by policies directing more investment in education to provide students with the technical skills required in today’s factories.

**Figure 4 – Manufacturing Drives Productivity Growth**



Source(s): U.S. Bureau of Economic Analysis and MAPI

<sup>1</sup> Federal Reserve Board Chairman Ben Bernanke’s 2006 commencement address at MIT.

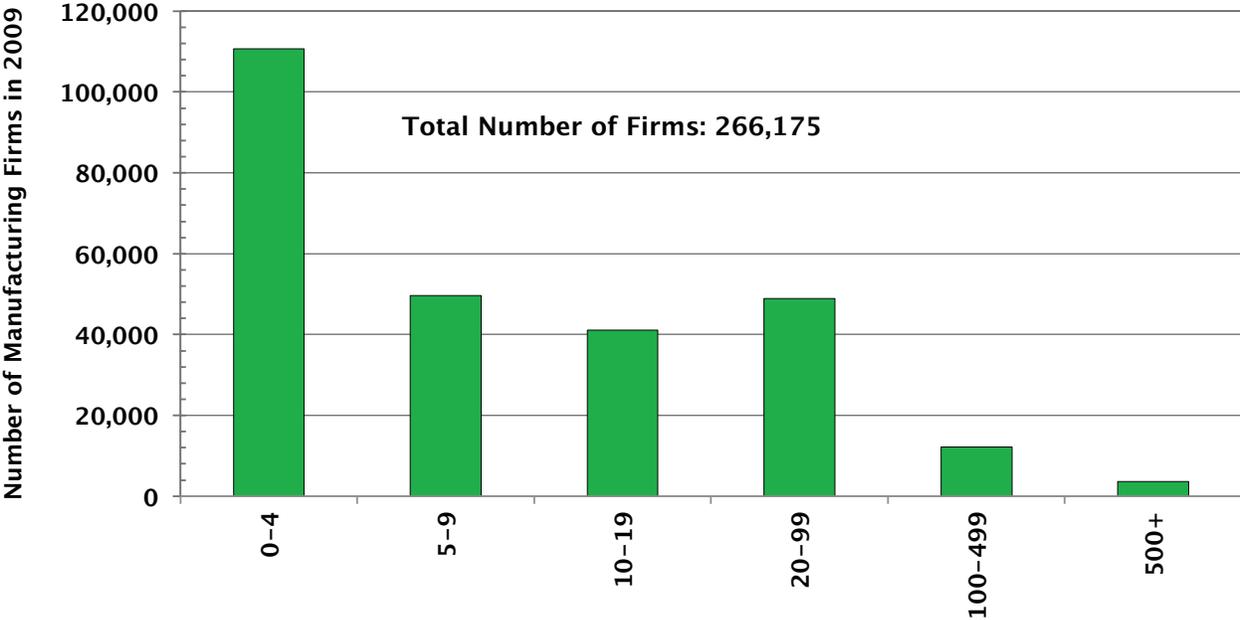
# Small Companies Dominate the Industrial Landscape

The system of “creative destruction” denotes constant births and disappearances of companies across time and technologies, as new ideas spur entrepreneurs to set up shop to meet changing consumer needs. This process is a sign of innovation and dynamism. The American economy is characterized by a great number of small firms, which shows that entrepreneurship holds up well. Not only is there no stigma attached to modest size, but smaller companies tend to react quickly to a changing economic environment and may offer better opportunities for internal advancement for their workforce. Over time, the expansion of markets and improvements in productivity allow companies to grow in size. Some will die young while others will join the ranks of medium-sized entities.

The largest cohort of manufacturing firms (with a count of more than 100,000 workers) is composed of those employing up to four people. Next in the ranking are companies with 5–9 workers and 20–99 workers. By far, the smallest cohort is made up of the largest companies (i.e., those employing more than 500 people).

Small size does have its downsides; for example, undersized companies tend to offer fewer benefits to workers and are less likely to export.

**Figure 5 – Small Companies Dominate the Industrial Landscape**



Source(s): U.S. Census Bureau and MAPI

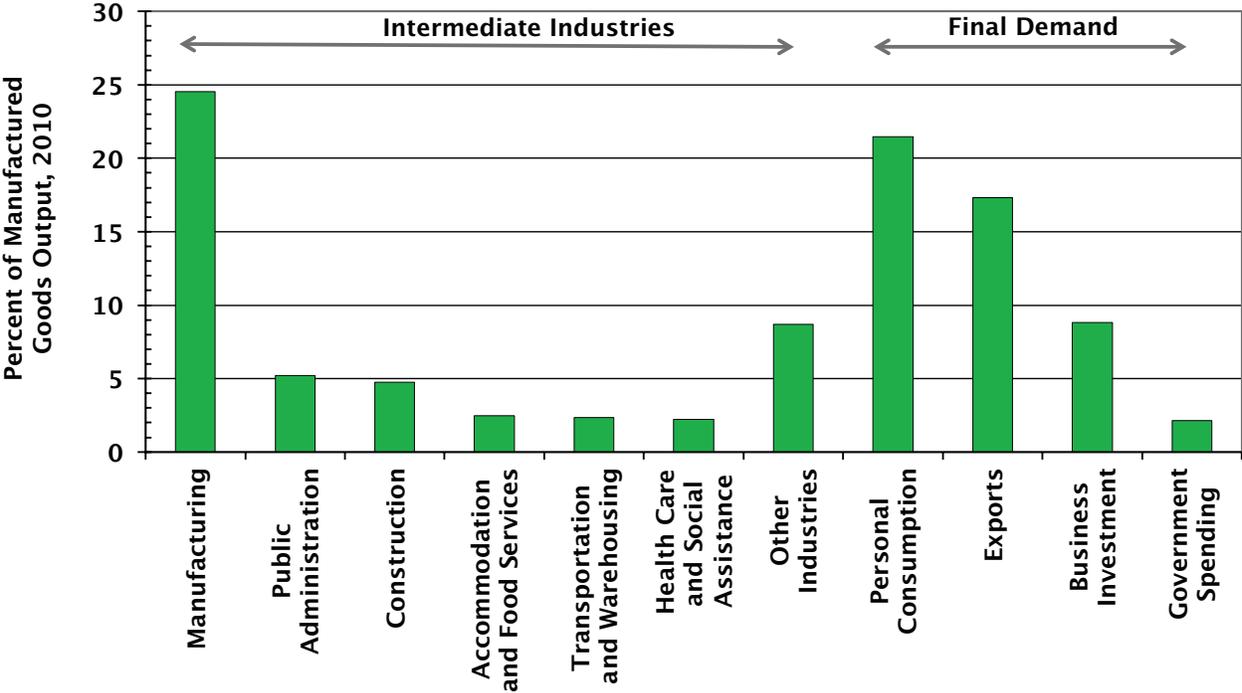
# Domestically Manufactured Goods Are Used Throughout the U.S. Economy

Domestically manufactured goods are used throughout the economy, flowing through the goods and services sectors as intermediate materials and then to final purchases via consumers, businesses, government and exports.

The below figure shows the proportion of total manufacturing commodity purchases occurring in each major sector of the economy, illustrating where manufacturing goods are used. Intermediate consumption occurs in the industry sectors because this is where manufactured materials are made into parts and components that are then incorporated into final goods. For example, steel is produced by its own industry and is transformed into auto parts by other manufacturers, and then the metal parts are sold to motor vehicle assemblers. In this scenario, the multiple sales of manufactured goods are all within the manufacturing industry and double count steel—once when sold to auto parts manufacturers and again in the parts sold to assemblers.

The ultimate goal is to sell the goods for final use. An automobile sold to a consumer is classified as a personal consumption. When a car is sold to a business, it is an investment expenditure. Similarly, motor vehicles sold to federal, state and local governments are sales to government purchasers. The only other option for a final use is for the vehicle to be exported. The sum of intermediate and final uses equals the total supply for manufacturing commodities.

**Figure 6 – Domestically Manufactured Goods Are Used Throughout the U.S. Economy**



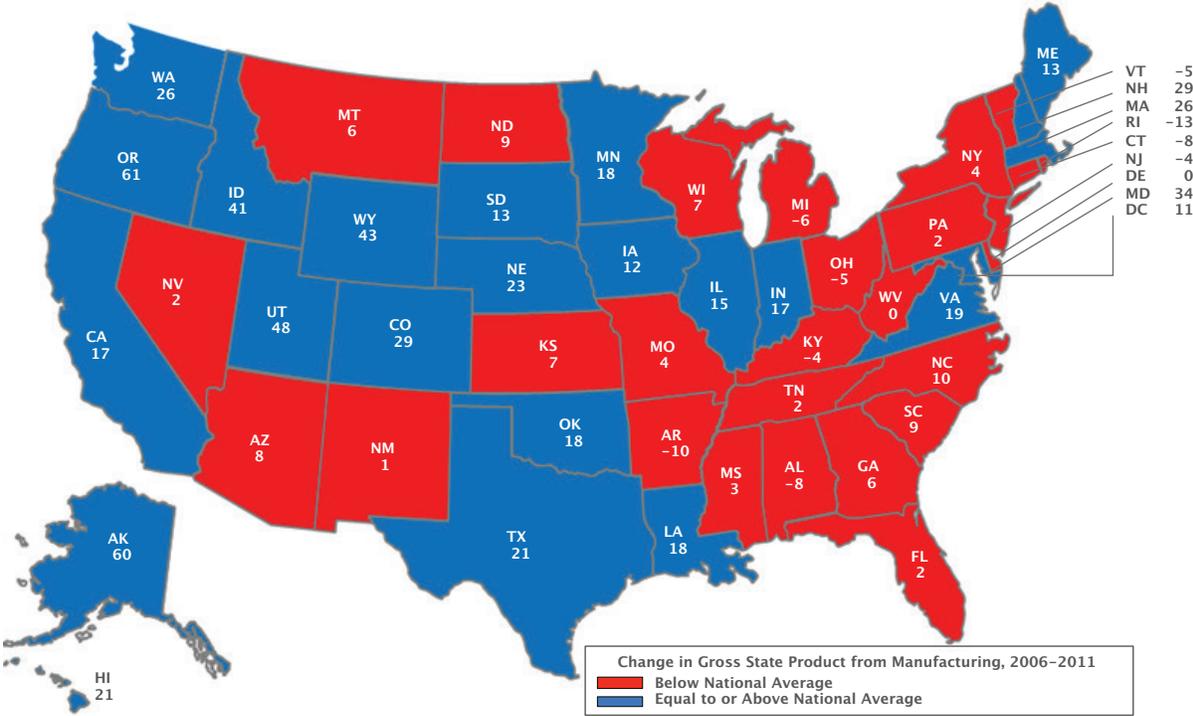
Source(s): U.S. Bureau of Economic Analysis and MAPI

# Manufacturing Makes a Positive Contribution to Most State Economies

In the past quarter-century, the geographic distribution of manufacturing has shifted, and in some cases quite dramatically. While it was once concentrated in the Northeast and Midwest, manufacturing is now more broadly distributed.

Between 2006 and 2011, gross state product accounted for by manufacturing rose 11 percent. The 27 states that saw manufacturing’s contribution to economic growth decline most significantly are clustered in the eastern half of the country. In Michigan, Ohio, Kentucky and Alabama, gross state product attributable to manufacturing declined as the automotive industry dealt with the impact of the Great Recession. States in which manufacturing increased its contribution to economic growth are primarily in the West and Southwest.

**Figure 7 – Manufacturing Makes a Positive Contribution to Most State Economies**  
 Percentage Change in Gross State Product from Manufacturing, 2006–2011

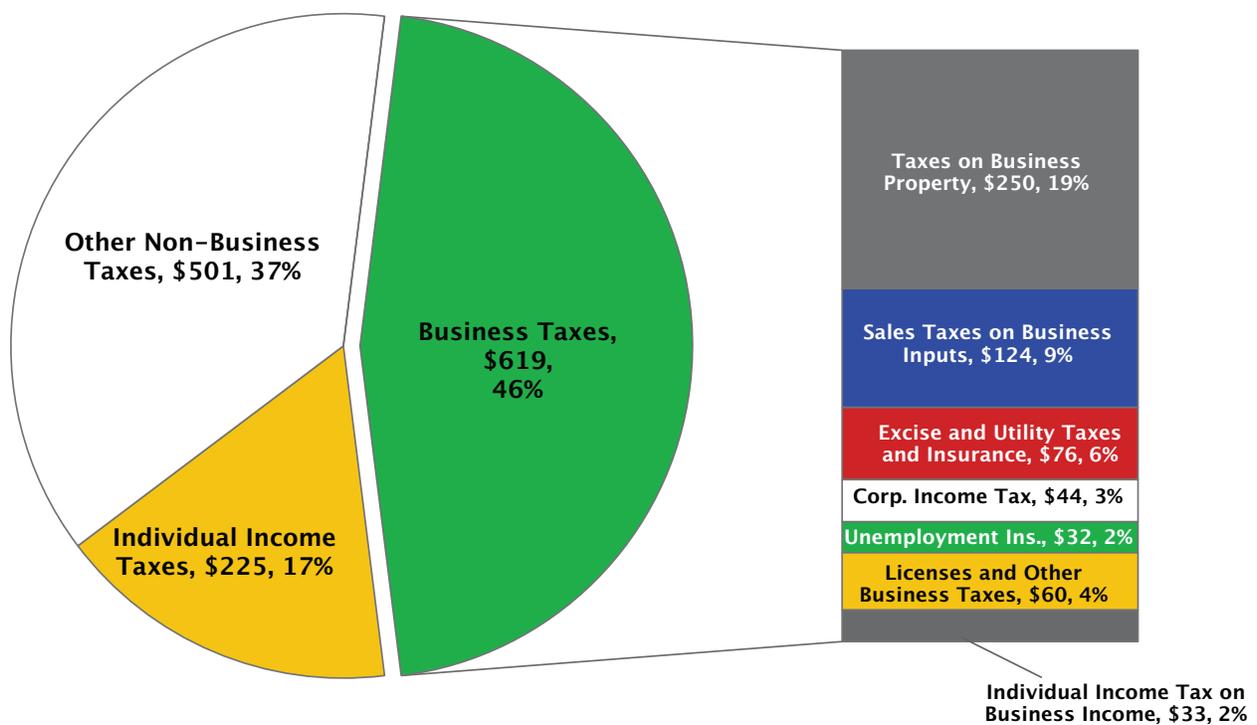


## Business Is the Largest Source of State and Local Funding

Businesses pay the bulk of all state and local taxes, and among major industries, the tax payments of manufacturers rank a close second behind the much larger services sector. Between FY 2005 and FY 2010, total state and local taxes paid by manufacturers rose 31 percent. Of the more than \$619 billion in business tax revenues collected by local and state governments in FY 2010, nearly \$72 billion was derived from manufacturing firms. That is more than the tax revenues collected from the food service and communications sectors combined.

**Figure 8 – Business Is the Largest Source of State and Local Funding**

Total State and Local Taxes FY 2010 (\$Billions)

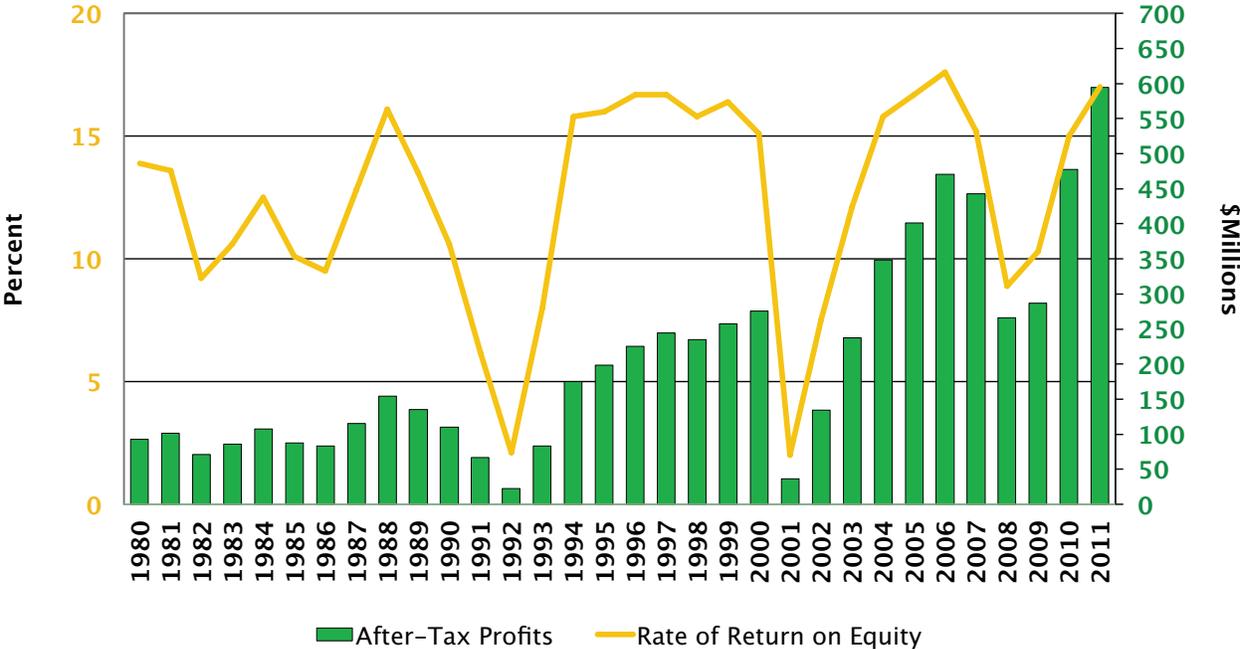


Source(s): Ernst & Young and Council on State Taxation

# Manufacturing Sector Profitability Is Cyclical

Not surprisingly, manufacturing sector profitability is affected by cyclical movements in the economy. Profits as a percentage of stockholders' equity fell in the four recessions experienced between 1980 and 2011. Nonetheless, aggregate profits and the rate of profitability rebounded with subsequent economic recoveries. Over this period, the rate of manufacturing sector profitability averaged 12.5 percent, and aggregate profits reached a record high in 2011. This indicates that most manufacturing industries are presently in sound financial condition.

Figure 9 – Manufacturing Sector Profitability Is Cyclical



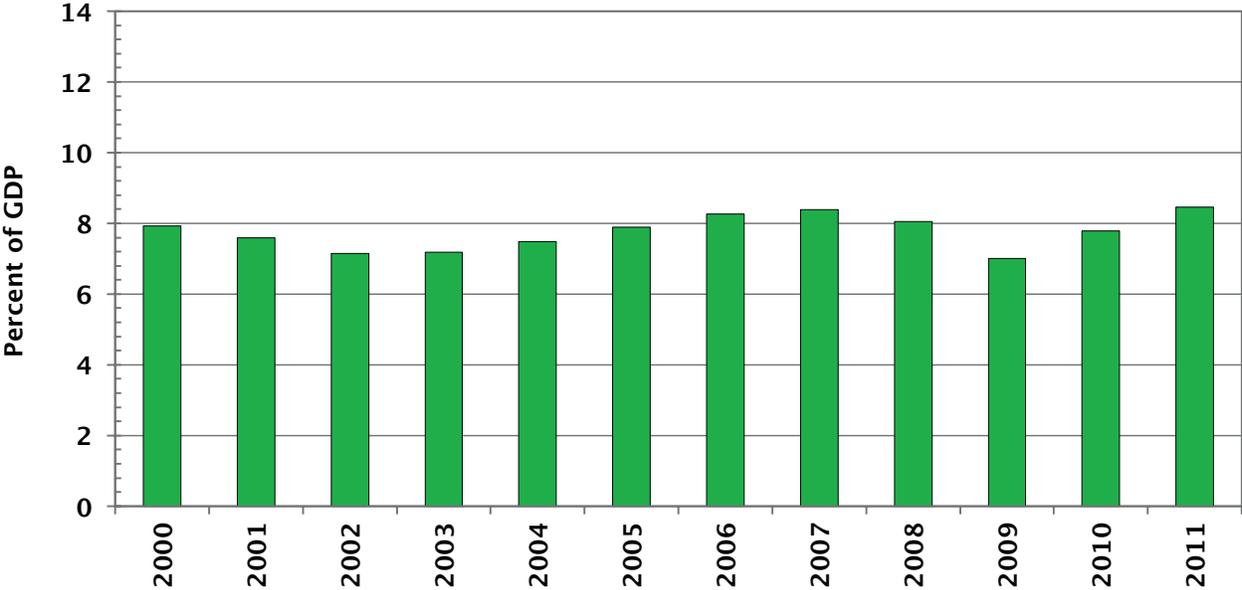
Source(s): U.S. Bureau of Economic Analysis

# Investment in Equipment and Software Drives Demand for Manufacturing

Investment in equipment and software totaled \$1.1 trillion in 2011, representing 8.5 percent of GDP (as measured in inflation-adjusted dollars). Inflation-adjusted investment in this area grew by an average annual rate of 5.4 percent from 1995 through 2011, greatly outpacing the average GDP growth rate of 2.4 percent.

The strong growth in investment in equipment and software helps explain why productivity growth in the manufacturing sector has been strong. It also provides evidence that the U.S. manufacturing sector is not withering away and will instead continue expanding.

**Figure 10** – Investment in Equipment and Software Drives Demand for Manufacturing

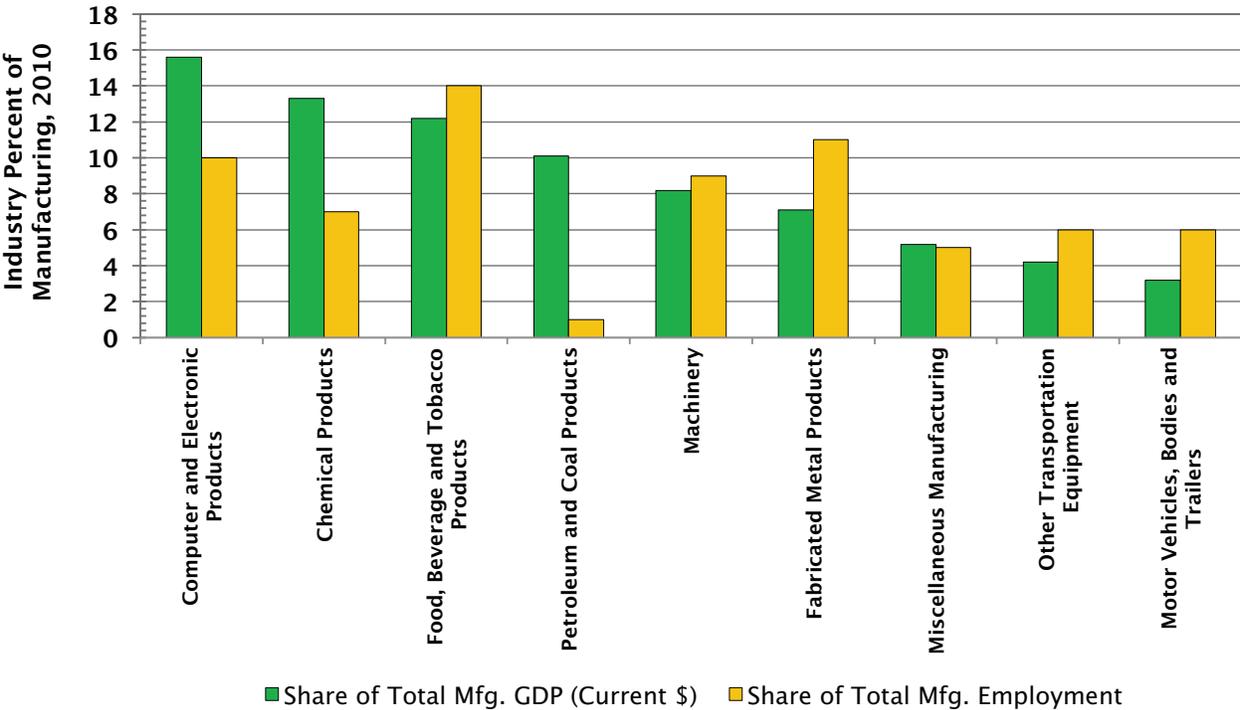


Source(s): U.S. Bureau of Economic Analysis

# Electronics Lead Manufacturing in Terms of Output but Not Employment

The four largest manufacturing industries—computers and electronics; chemicals; food, beverages and tobacco; and petroleum and coal—account for about 51 percent of manufacturing GDP. The top nine sectors constitute approximately 79 percent of manufacturing GDP and include both durable and nondurable sectors. These sectors accounted for 68 percent of total manufacturing employment in 2010.

**Figure 11 – Electronics Lead Manufacturing in Terms of Output but Not Employment**



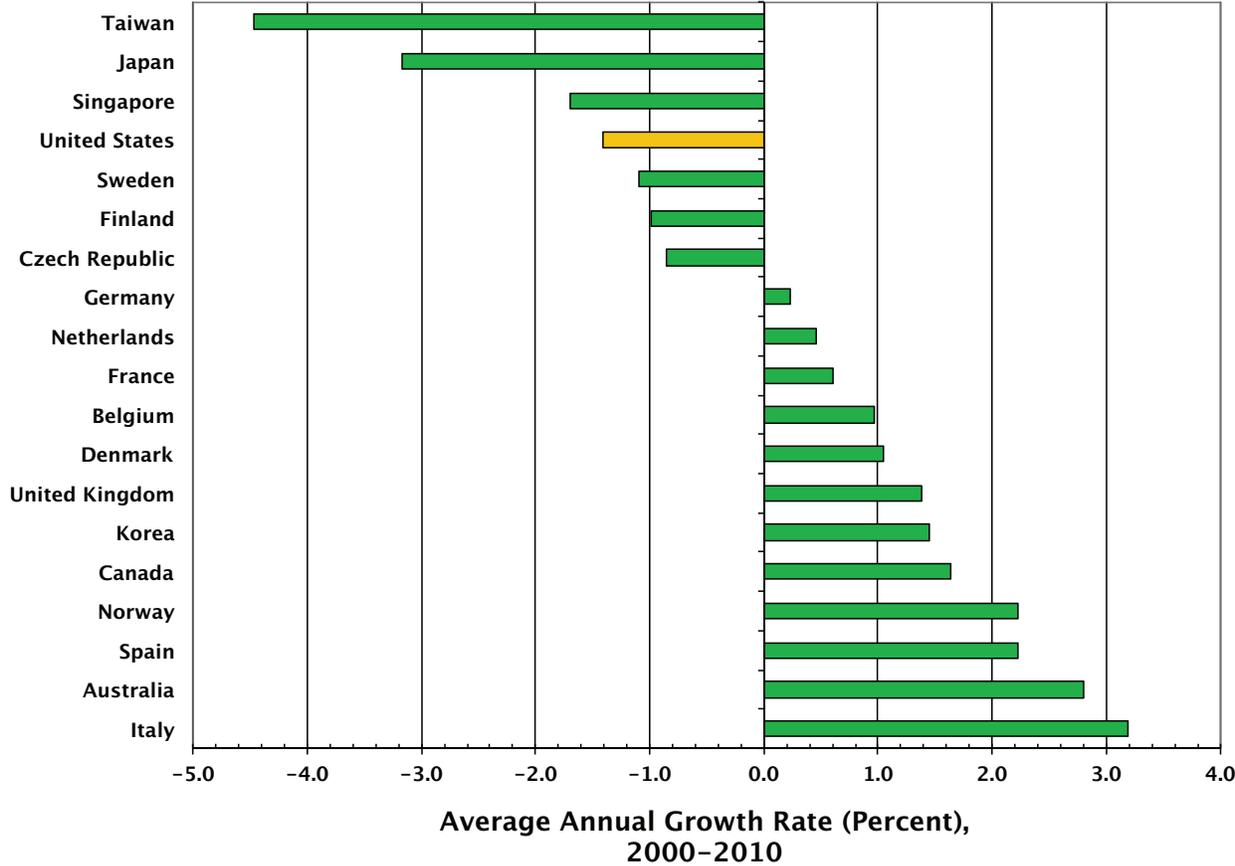
Source(s): MAPI calculations from U.S. Bureau of Economic Analysis data

# Manufacturing Sector's Falling Unit Labor Costs Increase Global Competitiveness

Investment in equipment and software totaled \$1.1 trillion in 2011, representing 8.5 percent of GDP (as measured in inflation-adjusted dollars). Inflation-adjusted investment in this area grew by an average annual rate of 5.4 percent from 1995 through 2011, greatly outpacing the average GDP growth rate of 2.4 percent.

The strong growth in investment in equipment and software helps explain why productivity growth in the manufacturing sector has been strong. It also provides evidence that the U.S. manufacturing sector is not withering away and will instead continue expanding.

**Figure 12 – Manufacturing Sector's Falling Unit Labor Costs Increase Global Competitiveness**



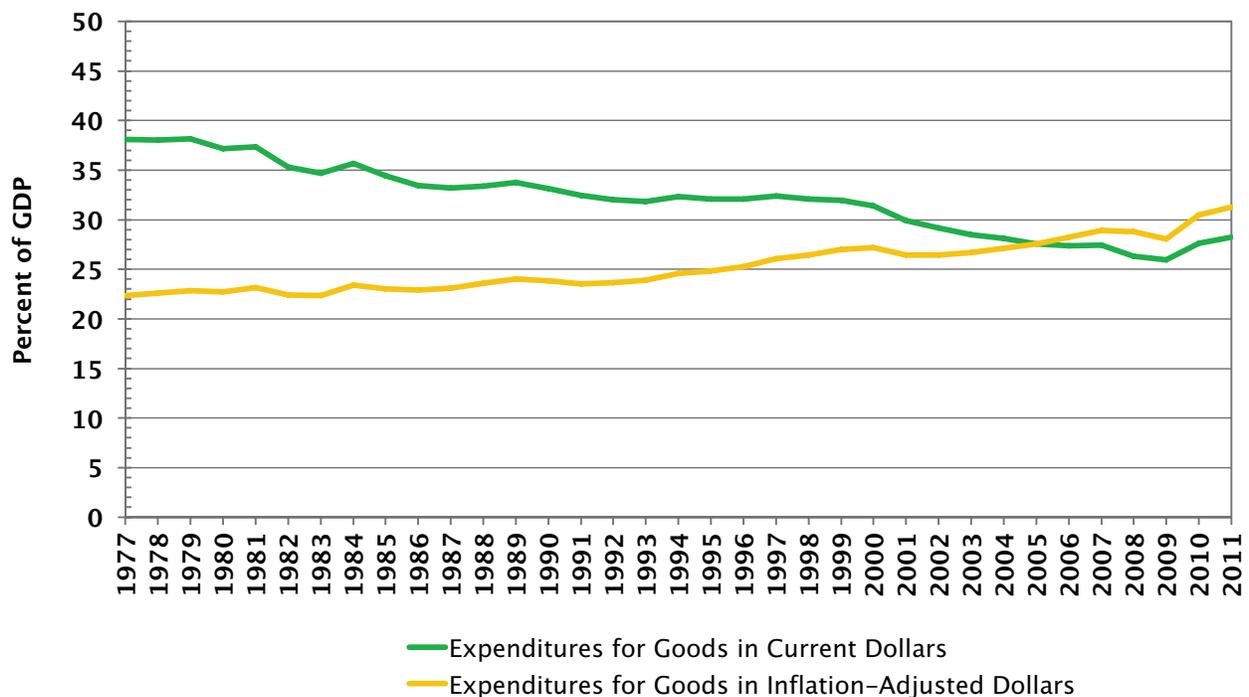
Source(s): U.S. Bureau of Labor Statistics

## The Trend in Spending on Goods Depends on the Measure

GDP is the sum of final expenditures in an economy; these final expenditures are classified into three major types of products—goods, services and structures. Examining the trend in the share of goods expenditures in total economy-wide spending helps gauge trends in the purchase of manufactured goods. It is important to note that there is a difference between expenditures on goods and manufacturing sales in the United States; the measures are related but not the same. Expenditures for goods are greater than the manufacturing value because expenditures include transportation margins and wholesale and retail margins that get the goods into consumers' hands. Manufacturing sales are primarily just business-to-business transactions.

The trend in goods expenditures as a percent of GDP depends on whether the spending is measured in current dollars or adjusted for inflation. A completely different direction in the trend is due to the unique quality adjustment and sharply falling prices for computer and electronic products. In current dollars, the ratio of goods to GDP fell from 38 percent in 1977 to 28 percent in 2011. In other words, the economy's spending is moving toward service purchases. When adjusted for inflation (particularly the plummeting prices of computer and electronic products), however, the share of goods expenditures increases over time. Inflation-adjusted spending on goods was 22 percent of GDP in 1977 and 31 percent in 2011.

**Figure 13 – The Trend in Spending on Goods Depends on the Measure**



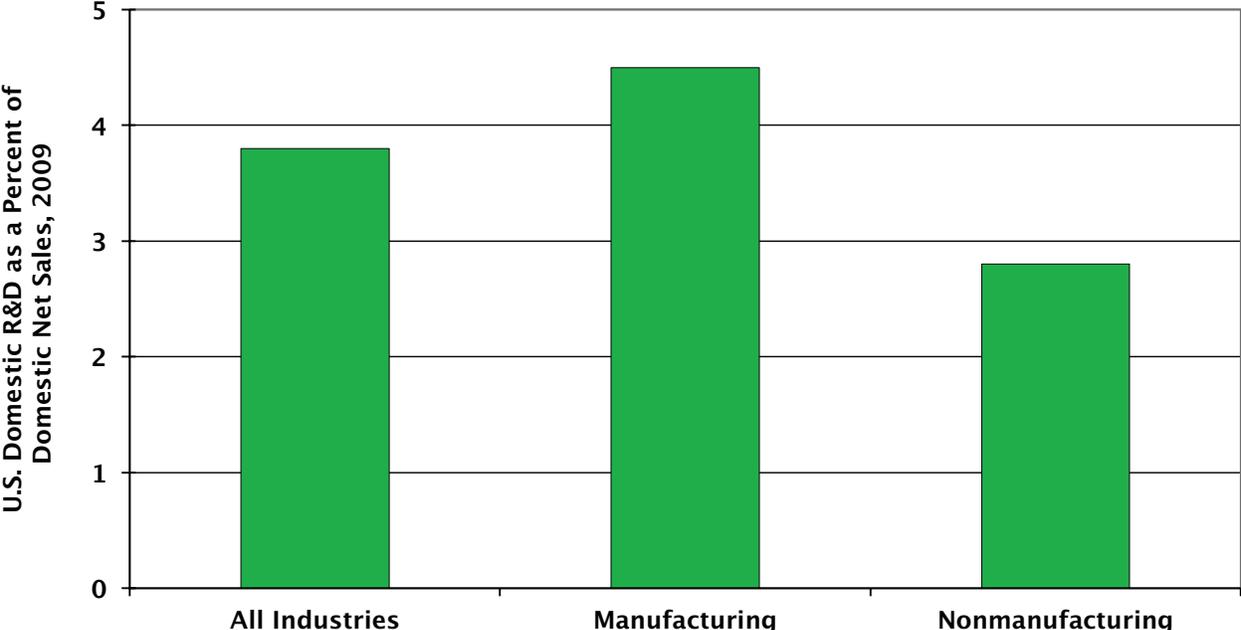
Source(s): U.S. Bureau of Economic Analysis

# Innovation

## Manufacturing Dominates U.S. Domestic Private Sector R&D Investment

While total U.S. industry domestic R&D was 3.8 percent of domestic net sales during 2009, the manufacturing ratio was 4.5 percent, well above the 2.8 percent average for nonmanufacturing industries. The well-known “spillover” impacts from productive innovation investment, where the direct and indirect benefits of new products and ideas spread from industry to industry, testify to the economy-wide benefit of the R&D-intensive manufacturing sector.

Figure 14 – Manufacturing Dominates U.S. Domestic Private Sector R&D Investment



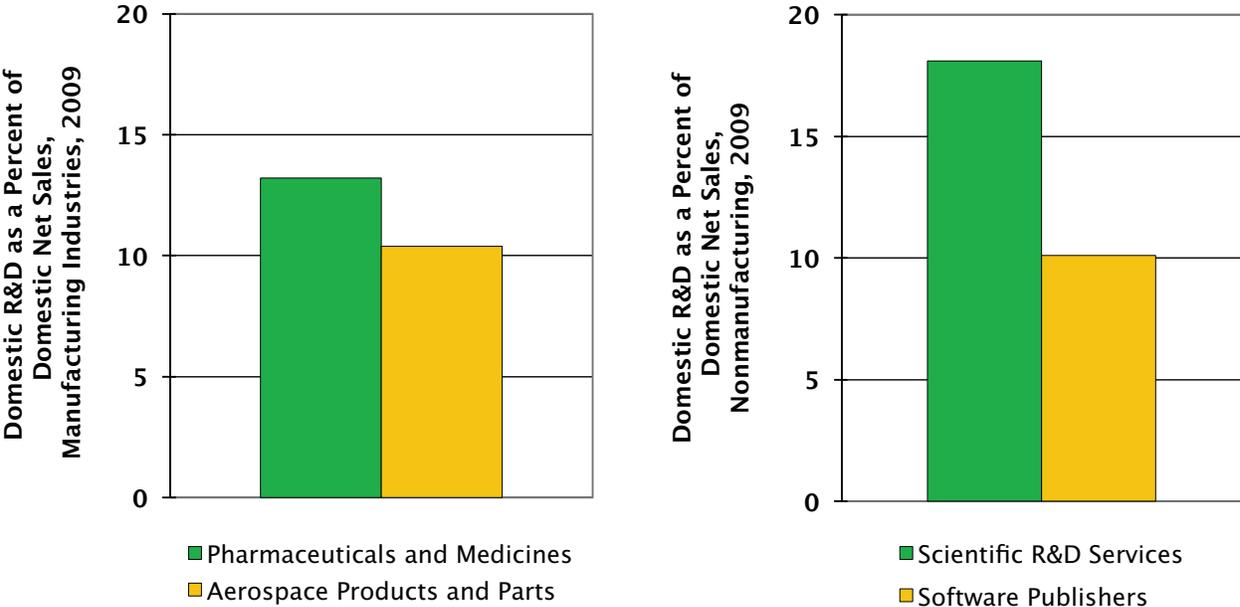
Source(s): National Science Foundation, Business R&D and Innovation Survey

# Both Manufacturing and Select Nonmanufacturing Sectors Are Critical to the U.S. R&D Picture

A number of manufacturing and nonmanufacturing sectors have outsized R&D intensities that are broadly critical to the innovative strength of the U.S. economy. Pharmaceuticals and aerospace are two manufacturing sectors with strong innovation investment propensities. During 2009, R&D investment in pharmaceuticals and medicine was 13.2 percent of domestic net sales, nearly three times the manufacturing average. In aerospace, R&D investment was 10.4 percent of domestic net sales.

While nonmanufacturing industries as a whole are not as R&D-intensive as manufacturing, certain sectors exhibit strong investment behavior and have emerged as key players. During 2009, domestic R&D was 18.1 percent of domestic net sales in scientific R&D services and 10.1 percent for software publishers. The transition to customer-responsive, lean supply chains in U.S. manufacturing as well as the implementation of scientific advancements that are changing both the product and process profile for domestic U.S. manufacturers are no doubt one motivator of research and development in these service sectors.

**Figure 15 – Both Manufacturing and Select Nonmanufacturing Sectors Are Critical to the U.S. R&D Picture**



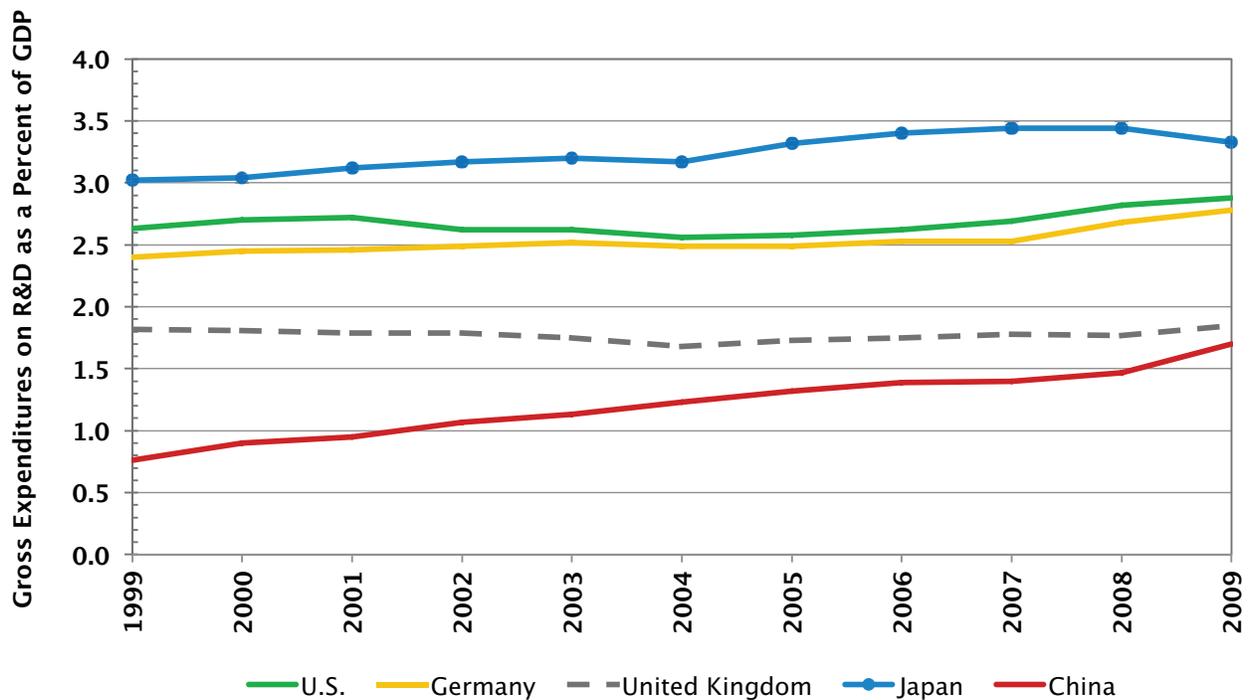
Source(s): National Science Foundation, Business R&D and Innovation Survey

## The U.S. Is Competitive but Not Dominant in Total R&D Investment

It is encouraging that even through the recent recession the U.S. continued to focus on innovation. Total U.S. R&D spending rose from 2.6 percent of GDP in 2006 to 2.9 percent in 2009; however, while competitive, the nation is clearly not dominant in this arena. U.S. investment is only modestly above that of Germany, and both have been rising since 2004. Further, Japanese R&D spending as a share of GDP remains notably above those of these countries, although it fell between 2008 and 2009. While China's level of investment remains far behind those of the U.S. and other rich nations, it has been rising steadily and significantly. At 1.7 percent, China's R&D investment as a share of the economy during 2009 was more than twice that seen in 1999.

While R&D spending is one important investment metric, economists increasingly recognize that innovation results from a complex ecosystem. Research from MAPI and other sources reveals the contribution of cutting-edge scientific output from academic institutions, capital investment and the growth of the science and engineering workforce. Such research demonstrates that even a modest increase in these innovation inputs can generate a sizable increase in product and process innovation output.

**Figure 16 – The U.S. Is Competitive but Not Dominant in Total R&D Investment**



Source(s): OECD Main Science and Technology Indicators

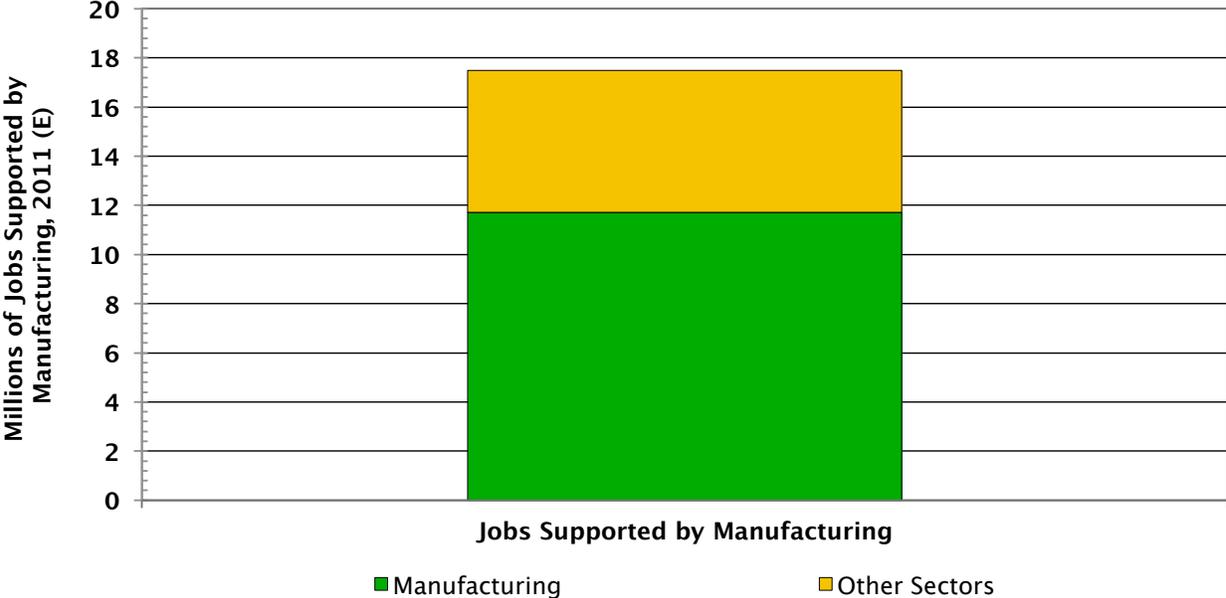
# Employment and Compensation

## Manufacturing Supports Millions of U.S. Jobs in Other Sectors

More than one in seven U.S. private sector jobs depends on the U.S. manufacturing base. The sector supports millions of people who make things in America and a large number of employees in other sectors of the economy.

Specifically, manufacturing supported an estimated 17.5 million jobs in the United States in 2011; this includes 11.7 million jobs directly within manufacturing and 5.8 million jobs in sectors such as professional services (accounting, legal, consulting, etc.), wholesaling, transportation, agriculture and F.I.R.E. (finance, insurance and real estate).

Figure 17 – Manufacturing Supports Millions of U.S. Jobs in Other Sectors



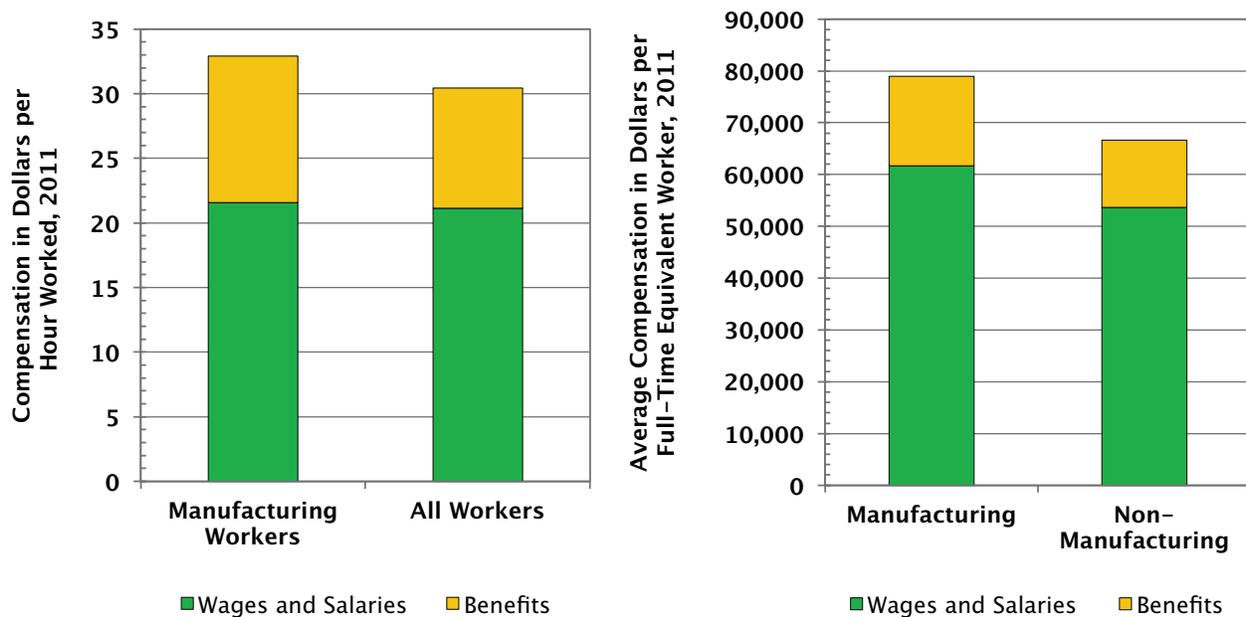
Source(s): Estimated (E) from the U.S. Bureau of Economic Analysis, Annual Input-Output Tables

## Manufacturing Pays Higher Average Compensation

Today's manufacturing employees earn higher wages and receive more generous benefits than other working Americans. In December 2011, manufacturing employers paid \$32.93 per hour in wages and benefits, while all employers in the economy paid about \$30.44 per hour, meaning that there is an 8 percent premium for working in manufacturing.

Most of the difference in compensation is due to the fact that manufacturers provide a higher level of benefits for workers than do other industries, including for paid leave, supplemental pay and insurance. Although manufacturers are making workers more responsible for their own health care costs (as seen in other industries), employer-provided health care payments continue to grow faster than wages and salaries. Health care contributions by manufacturing employers increased 4.1 percent a year over the past seven years compared with a 2.5 percent annual gain in wage and salary costs per hour. Employer-provided health care imposes a significant disadvantage to manufacturing industries that have to compete internationally with countries where health care is paid for by general tax revenues.

**Figure 18 – Manufacturing Pays Higher Average Compensation**



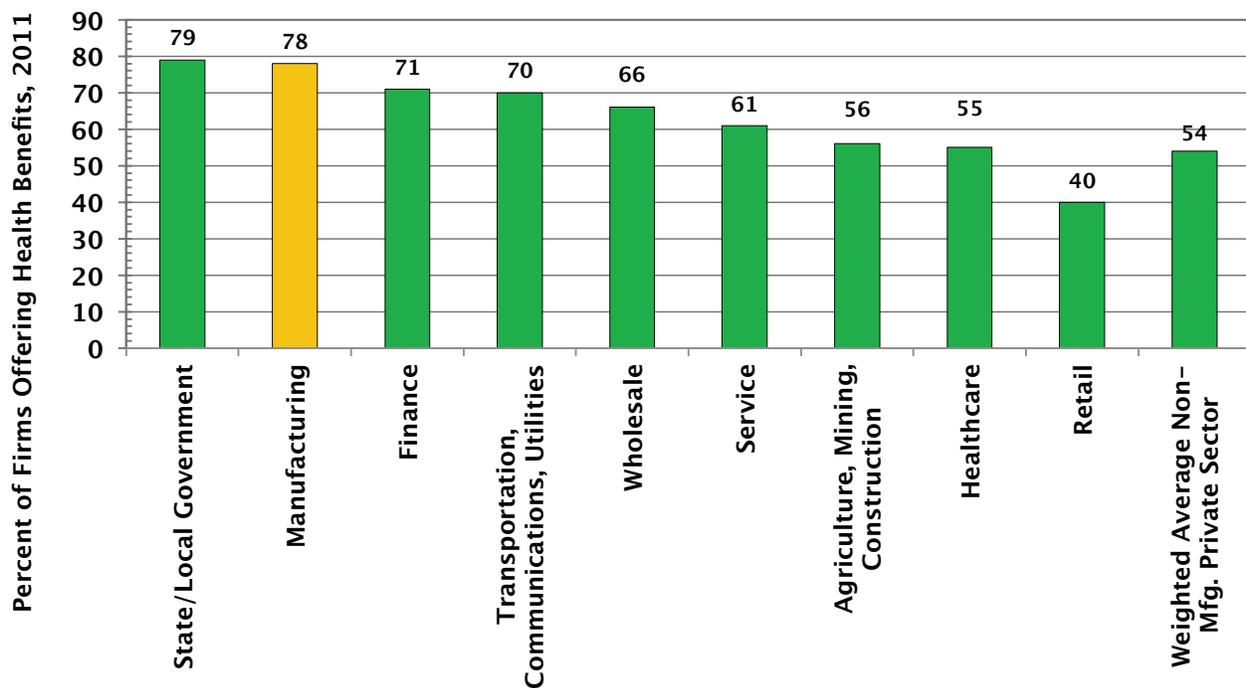
Source(s): Left – U.S. Bureau of Labor Statistics  
Right – U.S. Bureau of Economic Analysis

## Manufacturing Is a Leader in Offering Health Care Benefits

The rising cost of health care is a major concern and a significant cost for manufacturers. Yet, the sector is the leader among private sector employers with regard to the share of companies offering health benefits to workers. The weighted average “offer rate” for other industry groups is 54 percent, well below the 78 percent of all manufacturers. In 2011, 85 percent of manufacturing employees participated in these employer-financed plans.

All large manufacturing companies with 5,000 or more employees provide coverage; data from the Kaiser Family Foundation suggest that the share is nearly as high for companies with as few as 200 employees. In addition, more than 65 percent of manufacturers offer wellness programs such as smoking cessation plans and on-site exercise facilities or gym memberships—rates twice those of other private sector employers.

**Figure 19 – Manufacturing Is a Leader in Offering Health Care Benefits**



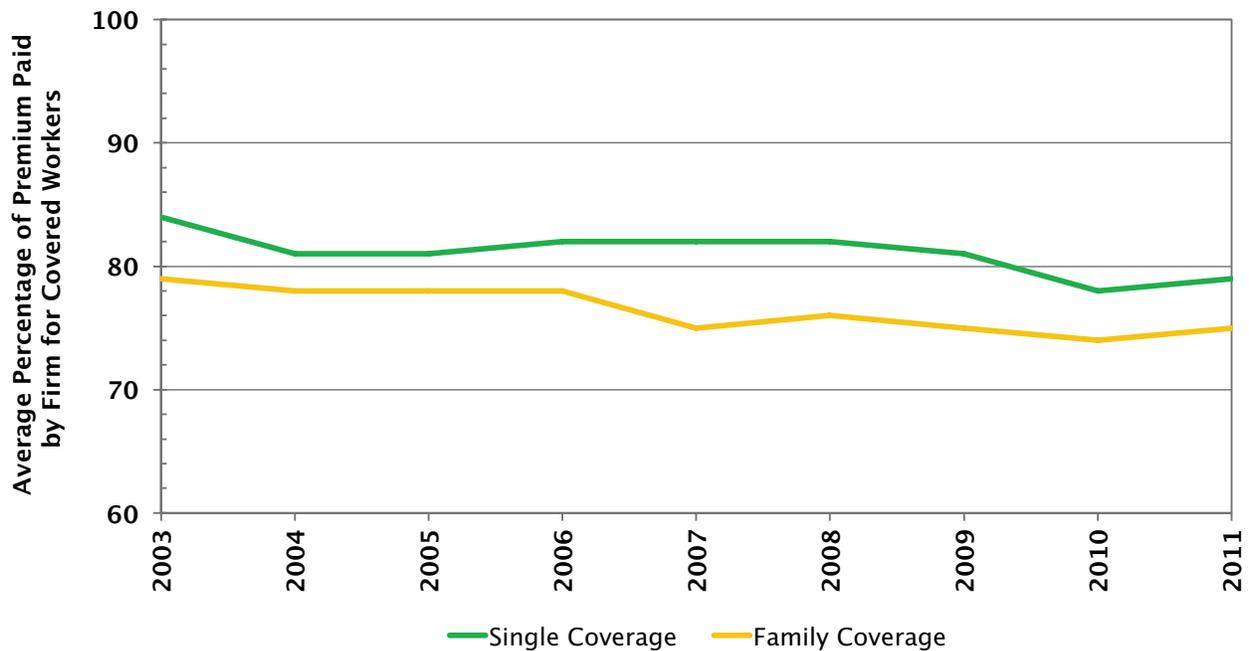
Source(s): Kaiser Family Foundation, Employer Health Benefits Annual Survey

## Manufacturers Support Health Insurance for Workers and Families

In 1999, the average premium for family coverage in the manufacturing sector was \$5,788. By 2011, this figure rose to \$13,768. The 7.5 percent annual rate of increase over 12 years was more than double the rate posted by the Producer Price Index, which reflects the changes in prices that manufacturers charge for their output.

In the face of rising health insurance premiums, manufacturers roughly maintained their percent contribution for family coverage from 2006 to 2011 and have made only slight reductions for single coverage. The average contribution for premiums made by manufacturers in 2011 was \$3,885 for single coverage and \$10,326 for family coverage. Thus, an average company providing coverage for the families of 1,000 employees would pay premiums in excess of \$10 million annually.

**Figure 20** – Manufacturers Support Health Insurance for Workers and Families



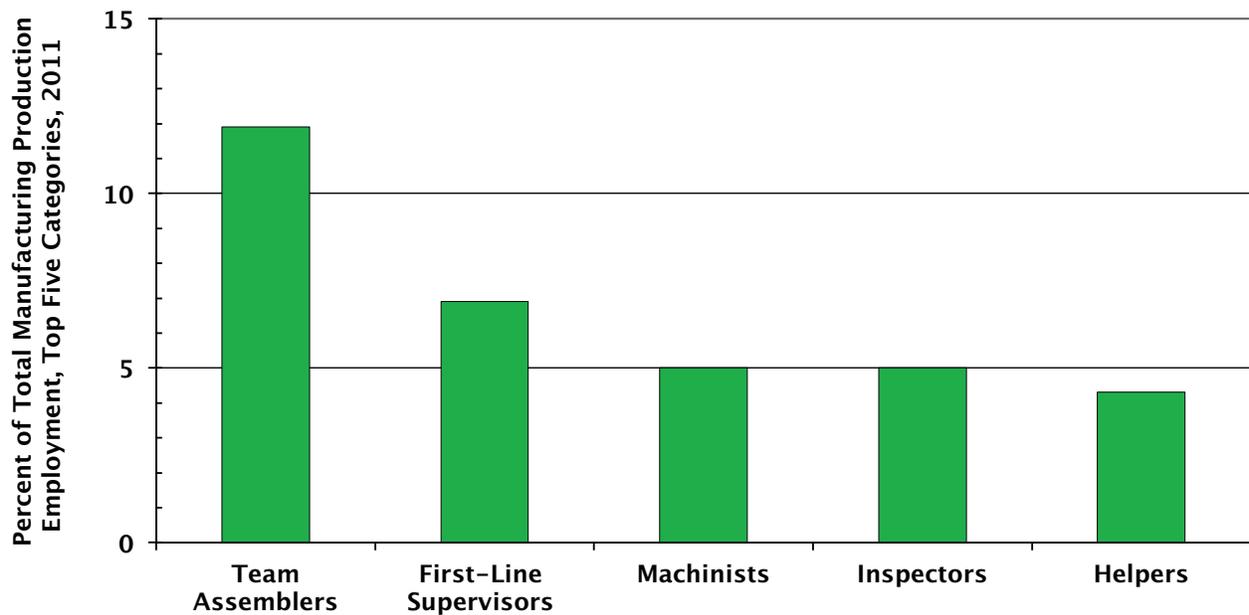
Source(s): Kaiser Family Foundation, Employer Health Benefits Annual Survey

## A Wide Range of Occupations Contribute to U.S. Manufacturing Production

Employees involved in production activities account for 51 percent of the U.S. manufacturing workforce. The U.S. Bureau of Labor Statistics recognizes more than 100 occupational classifications in manufacturing production; these constitute a wide range of education and skill levels, such as computer-controlled machine tool operators, electronic equipment assemblers, butchers and bakers.

The top five categories by employment share make up about one-third of total U.S. manufacturing production employment. The largest category is team assemblers (at nearly 12 percent), who are responsible for assembling an entire product or component of a product. The top five also includes team leaders, an occupation of increasing importance as team structures become more prevalent in U.S. manufacturing, concomitant with the widening implementation of lean production systems and cultures. The next three categories are machinists, inspectors and production helpers. The latter supply or hold materials and clean the work area and equipment.

**Figure 21 – A Wide Range of Occupations Contribute to U.S. Manufacturing Production**



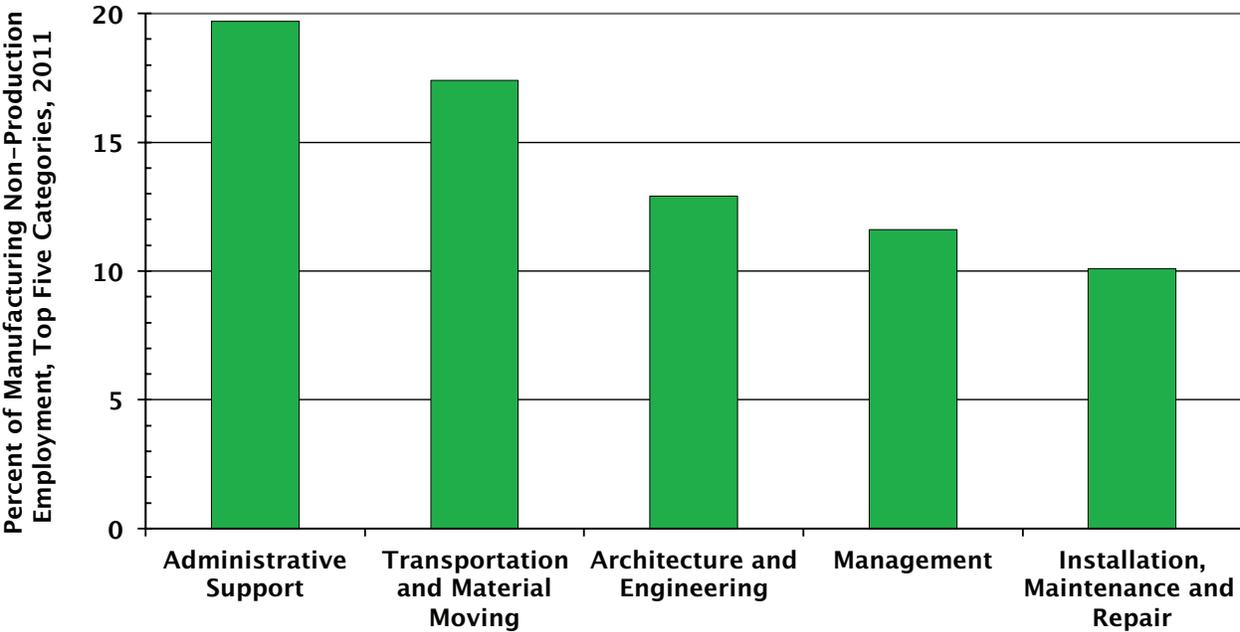
Source(s): U.S. Bureau of Labor Statistics

# Both Professional and Semi-Skilled Employees Staff the Non-Production Side of U.S. Manufacturing

Non-production manufacturing occupations are generally weighted more toward higher-skilled and professional employment than occupations on the production side. But even within the non-production workforce there is great human capital diversity, such as computer and mathematical occupations and sales and food preparation.

Non-production occupational shares are more concentrated than on the production side. The top five occupations make up about 72 percent of the non-production workforce. The broad category of office and administrative support, which includes file clerks and data entry employees, has the largest share at 19.7 percent. Also in the top five are positions related to transportation and material moving; architecture and engineering; management; and installation, maintenance and repair.

**Figure 22 – Both Professional and Semi-Skilled Employees Staff the Non-Production Side of U.S. Manufacturing**



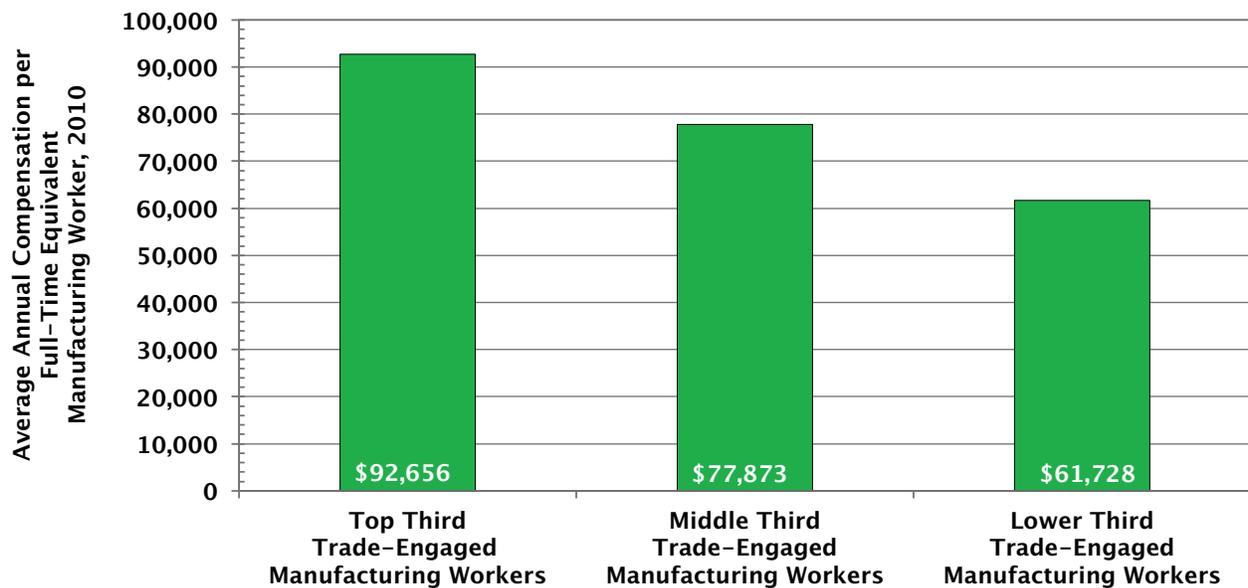
Source(s): U.S. Bureau of Labor Statistics

## Trade Engagement Pays Through Higher Wages

Higher employee compensation and trade intensity go hand in hand. Employees in the most trade-intensive industries—where combined exports and imports amount to at least 75 percent of their domestic industrial output—earn an annual compensation package that averages about \$92,660. This is 50 percent higher than average compensation in the least trade-engaged sectors of manufacturing. Industries in this most trade-engaged category also account for about half of U.S. manufacturing trade. In comparison, the middle group of trade-engaged industries pays about \$77,780 a year in wages and benefits. Industries in this category account for slightly more than one-third of U.S. manufacturing trade. The industries with the least trade engagement pay approximately \$61,730 a year and account for only 16 percent of U.S. manufacturing trade.

The premium pay of trade-engaged industries also extends to other manufacturing and service companies in the supply chain. Employers at these companies—where jobs are directly supported by exporting—enjoy higher pay than their peers at companies that are solely domestic.

**Figure 23** – Trade Engagement Pays Through Higher Wages



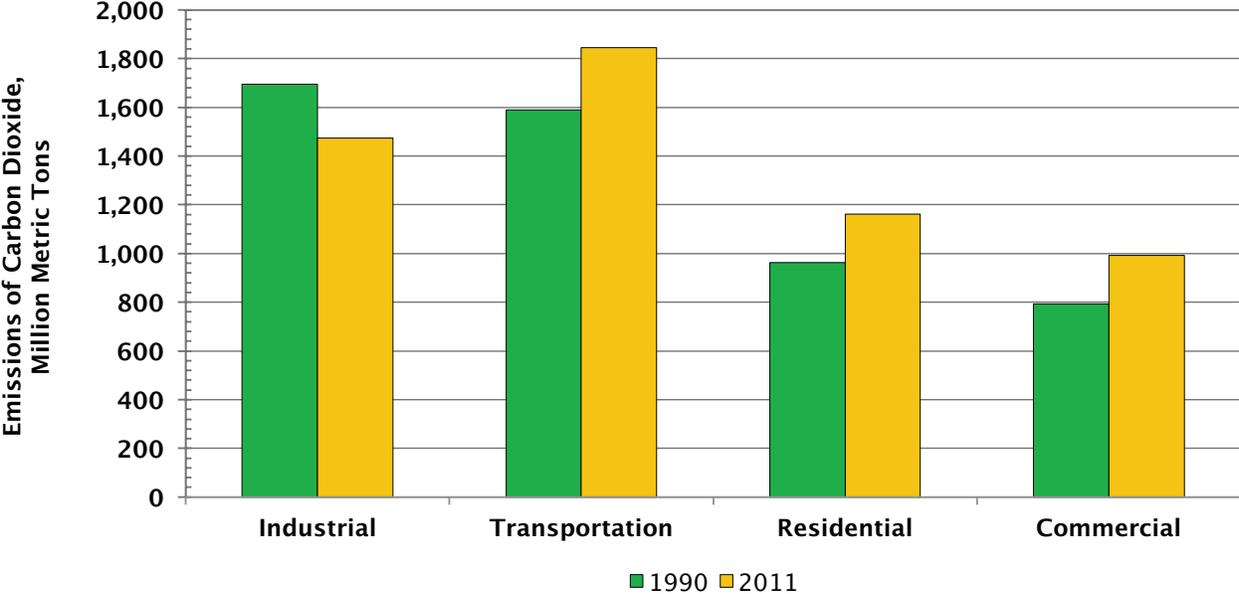
Source(s): U.S. Bureau of Economic Analysis, estimated from the Annual Input-Output Tables

# Environment and Quality of Life

## Technology Leads to a Cleaner and Greener Environment

The U.S. industrial sector remains the leader in greenhouse gas emission reductions relative to other sectors, with an overall 13 percent decline since 1990. By using cleaner technologies, implementing energy-efficiency initiatives and incorporating sustainable business strategies, the sector is poised to continue reducing CO2 emissions even as industrial production rises. By contrast, CO2 emissions from the transportation, residential and commercial sectors have all increased since 1990; collectively, CO2 emissions from those sectors rose by 20 percent through 2011.

Figure 24 – Technology Leads to a Cleaner and Greener Environment

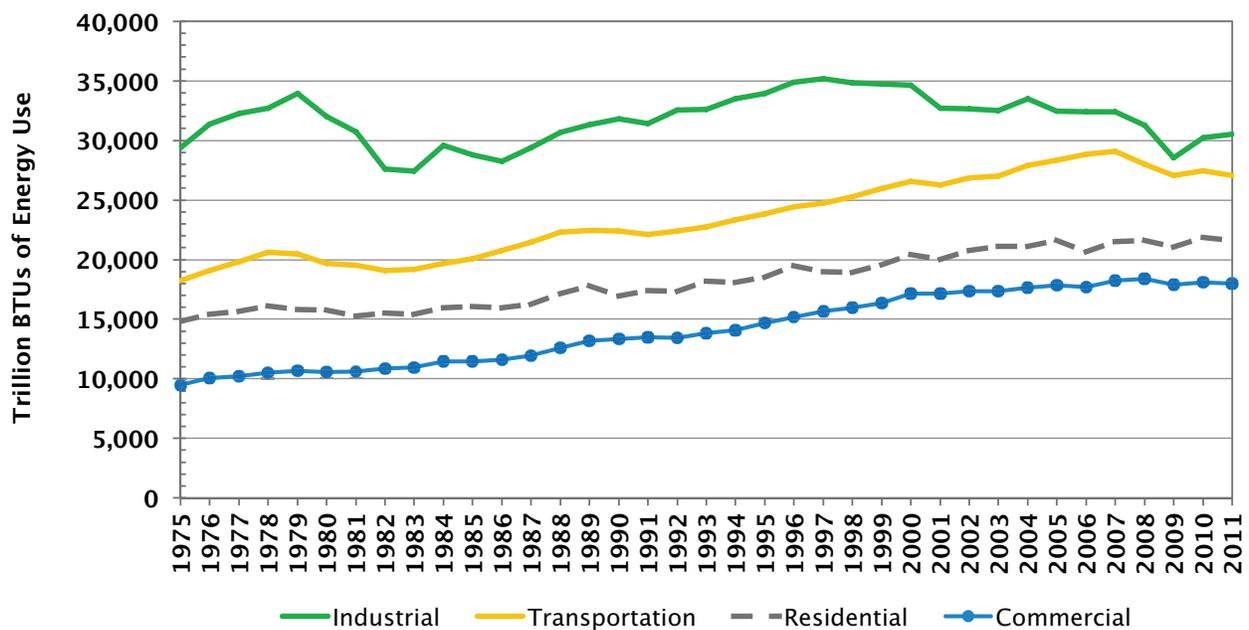


Source(s): U.S. Energy Information Administration

## The Industrial Sector's Energy Use Plateaus While Others' Increase

While the industrial sector is the largest consumer of energy, its energy usage has plateaued at 1975 levels, while all other sectors' consumption has greatly increased. Thanks in large part to more efficient technologies and corporate energy-reduction strategies, the industrial sector's overall energy use remains near 1975 levels. This plateau is in sharp contrast to transportation, residential and commercial energy consumption, which in the same period rose 48, 46 and 90 percent, respectively.

**Figure 25** – The Industrial Sector's Energy Use Plateaus While Others' Increase



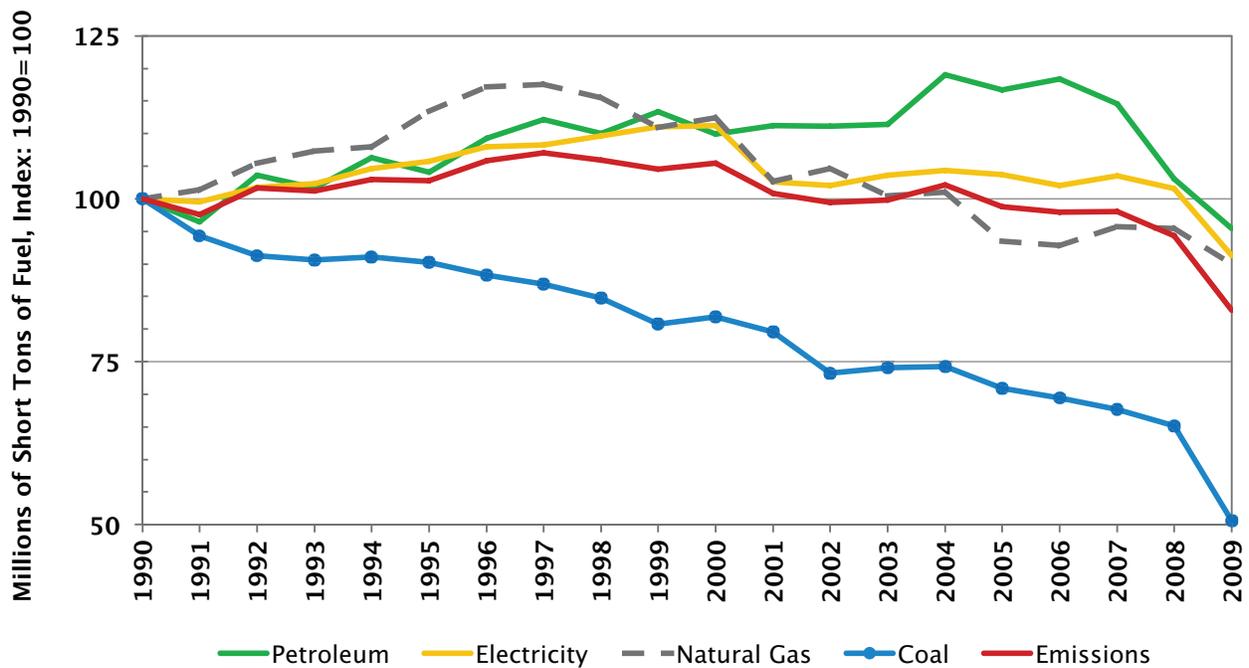
Source(s): U.S. Energy Information Administration

## Industrial Fuel Use and Emissions Have Declined Below 1990 Levels

U.S. manufacturing has also accomplished total declines in the use of every industrial fuel source; by 2009, consumption levels of petroleum, electricity, natural gas and coal were all significantly below those from 1990. The use of coal in particular saw a 50 percent decrease.

The reduction in industrial fuel use below 1990 levels is significant. It demonstrates manufacturers' commitment to reducing energy consumption, as well as forging a path for alternate energy sources. The sector leads on the use of renewable energies. Increasing use of renewables and a decrease in fossil fuel consumption are good indicators of manufacturers' commitment to sustainability.

**Figure 26** – Industrial Fuel Use and Emissions Have Declined Below 1990 Levels

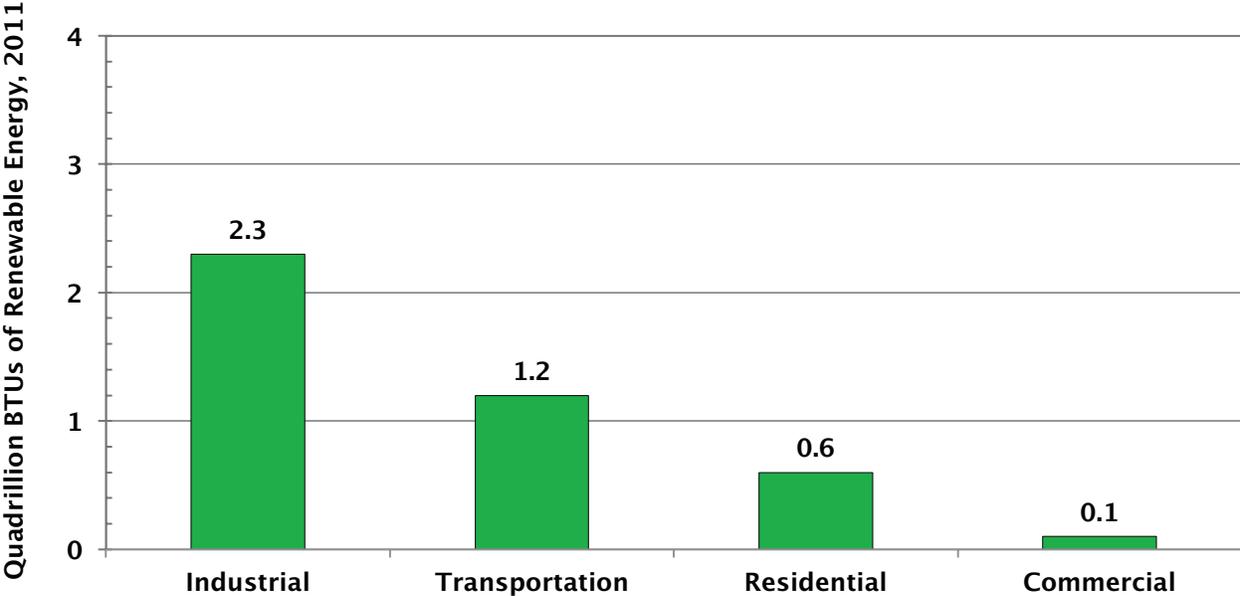


Source(s): U.S. Energy Information Administration

# Manufacturing Leads on Renewable Energy Usage

Manufacturing is a strong leader in the use of renewable energy. In 2011, the industrial sector used 2.3 quadrillion BTUs of renewable energy, compared with 1.9 quadrillion BTUs from the transportation, residential and commercial sectors combined. Renewable energies provide an efficient and environmentally friendly means to power various manufacturing activities. As more manufacturers incorporate sustainability efforts into their long-term business structures, and as more forms of renewable energy become available to a wider audience, this trend will likely continue to grow.

Figure 27 – Manufacturing Leads on Renewable Energy Usage



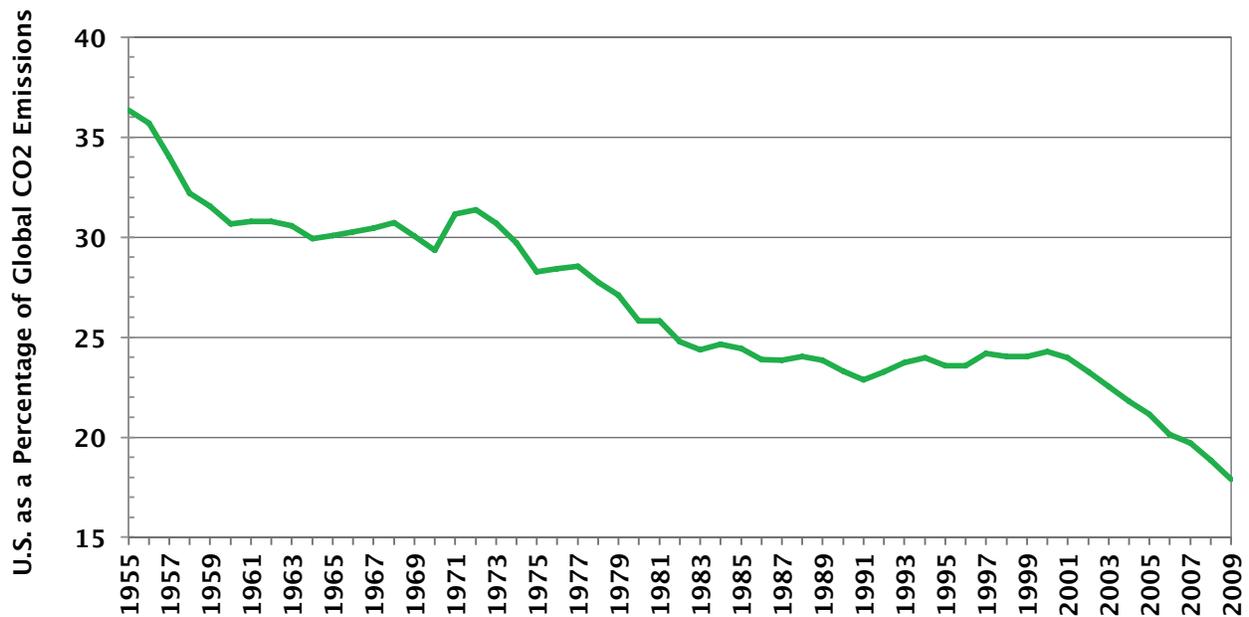
Source(s): U.S. Energy Information Administration

## Technological Innovation Addresses Global Climate Change

The U.S. share of global CO<sub>2</sub> emissions has declined dramatically since 1955, from 36.3 percent to 17.9 percent in 2009. During that time, the world has seen developed countries implement greener technologies and more efficient business systems, thereby reducing CO<sub>2</sub> emissions. However, developing countries, such as China and India, are ramping up industrial production and contributing to ever-greater shares of emissions. There is obviously no unilateral solution to global climate change, and any reduction in carbon emissions will require a commitment by all nations.

U.S. companies are among the world leaders driving the technological innovations necessary for energy efficiency and related economic growth and prosperity. Continued innovation by U.S. manufacturers is essential for a successful global response to the problem of climate change.

**Figure 28** – Technological Innovation Addresses Global Climate Change



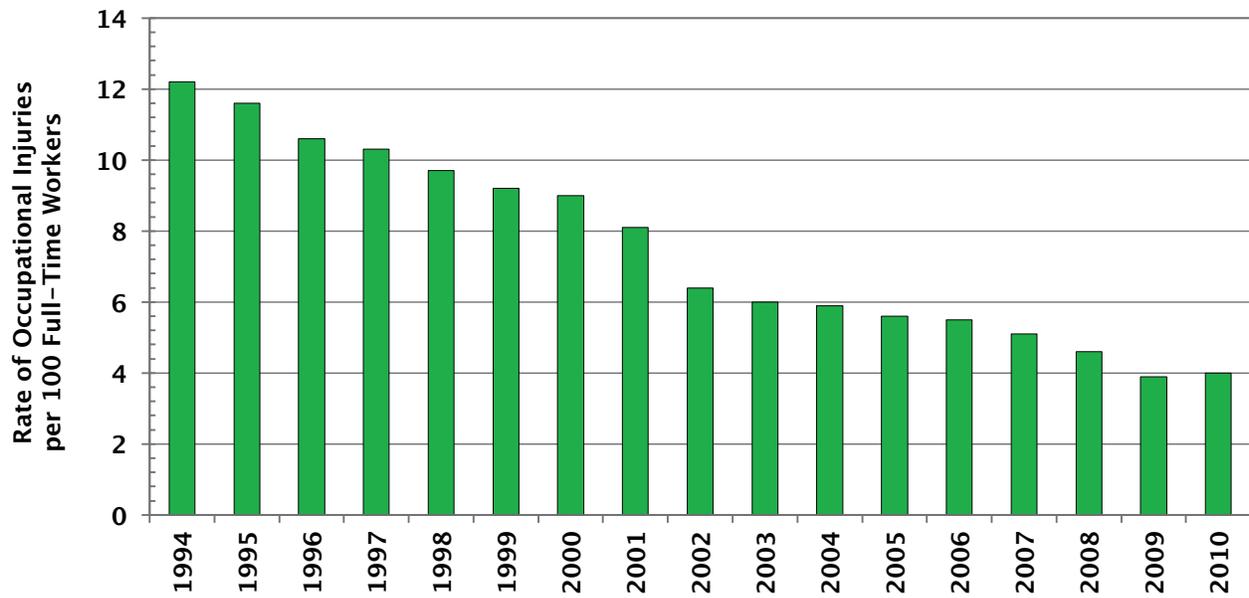
Source(s): U.S. Energy Information Administration and World Resources Institute

## Technology Transforms Safety in the Workplace

Manufacturers see workplace safety as an important business tool. Rather than simply a cost of doing business, safety programs reduce costs and contribute to the bottom line. As a consequence, many companies have incorporated safety into their lean manufacturing culture. Safe practices reduce absenteeism, increase productivity and improve efficiency, quality and morale.

Between 1994 and 2010, the rate of occupational injuries in manufacturing facilities decreased by two-thirds, from just more than 12 injuries per 100 workers to only 4. This is a substantially faster rate of improvement than that of the overall private sector.

**Figure 29** – Technology Transforms Safety in the Workplace



Source(s): U.S. Bureau of Labor Statistics

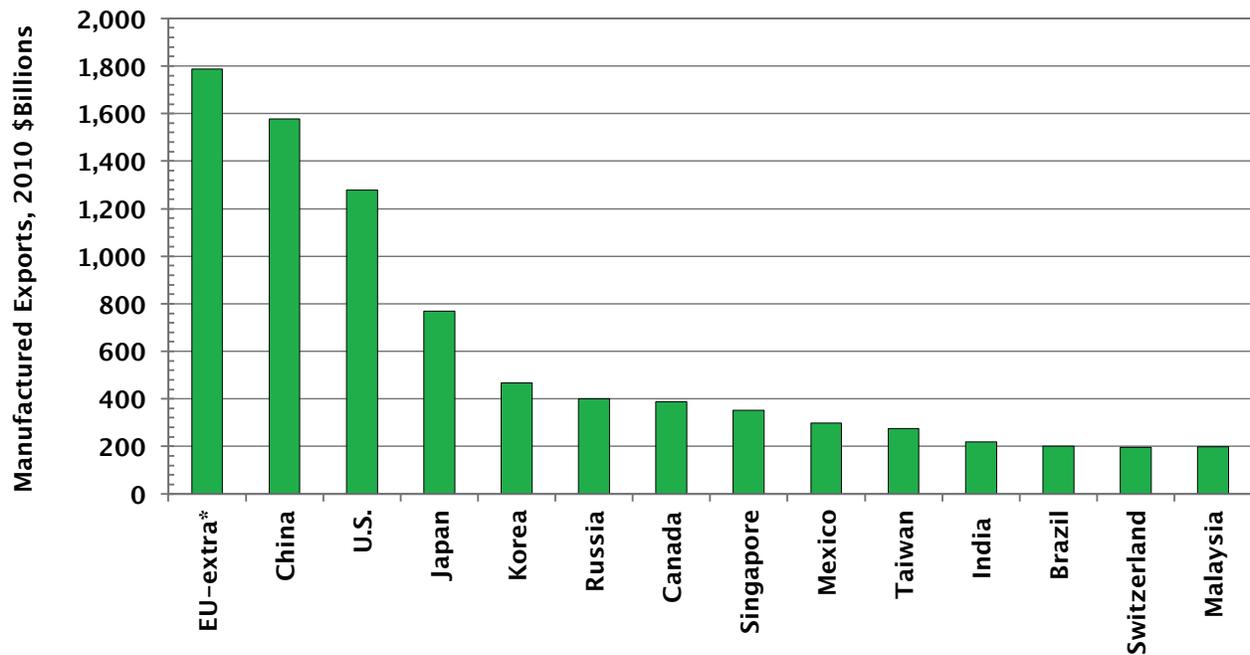
Note: Industry classification changed from SIC to NAICS in 2002, and changes in some OSHA definitions occurred in 2003

# Trade and Investment

## The U.S. Is the Third Largest Manufacturing Exporter

The United States is the third largest exporter of manufactured goods, ranking below the European Union and China but well ahead of fourth-place Japan. The export market had its most dramatic shift in recent years via the rapid rise of China to pass the United States. In 2000, U.S. manufacturing exports were more than three times larger than China's, while in 2011, Chinese exports were 21 percent higher than those of the United States.

**Figure 30** – The U.S. Is the Third Largest Manufacturing Exporter



\* "Extra" refers to exports to non-members. Total EU exports, including to other members, was \$4,249 billion  
Source(s): WTO, International Trade Statistics

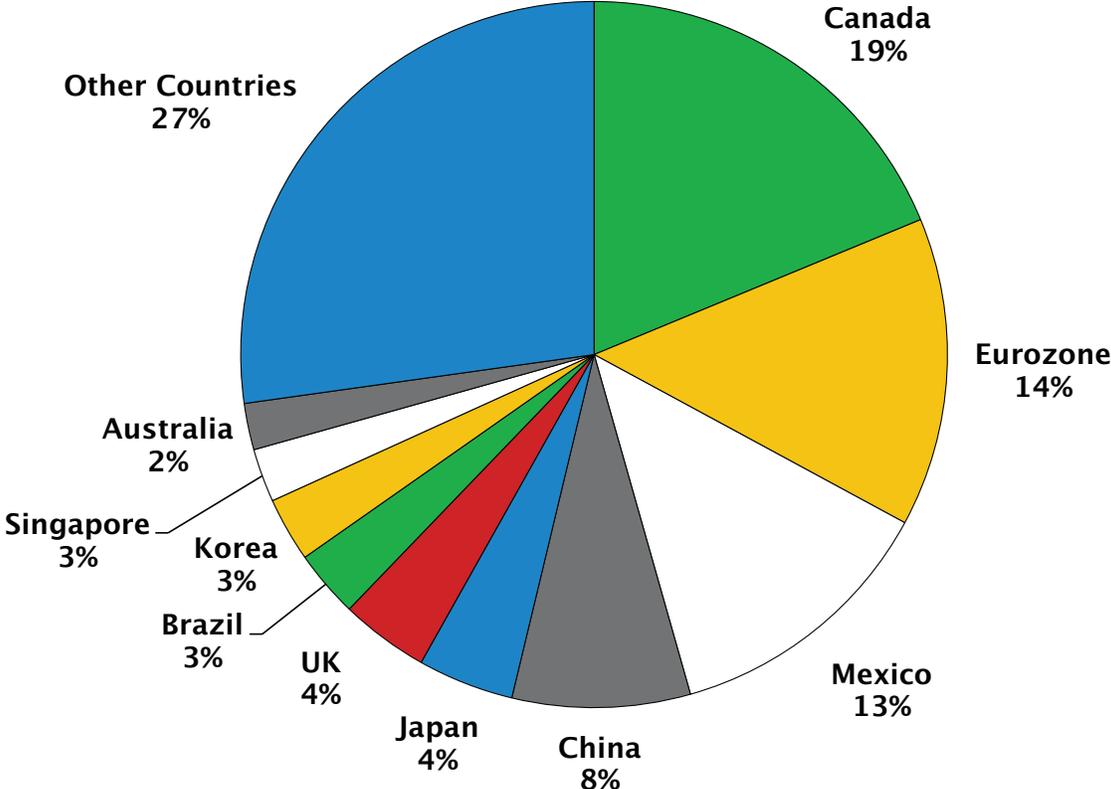
# U.S. Manufacturing Exports to 238 Countries

The United States exports manufactured products to 238 countries, with most going to just a few locations. Exports to the Eurozone and nine countries made up 73 percent of all U.S. exports in 2011.

Canada and Mexico, our North American Free Trade Agreement partners, are the top two destination countries for U.S. manufacturers. The proximity to the United States and the free trade agreement make Canadian and Mexican consumers, businesses and governments a natural market for our products. In addition, the combination of the geographic proximity and the nations' different cost structures allows U.S. manufacturers to optimize their supply chains by exporting components and semifinished products to affiliate manufacturing companies across the border.

The 17 countries in the common Euro currency zone (Eurozone) receive 14 percent of U.S. manufacturing's exports; as a region, it is the second-largest destination. The long-term viability of the currency union in its 17-member form, however, is in doubt. The sovereign debt crisis in Greece will not subside, and financial stress continues to build in Portugal, Cyprus, Spain and Italy. A double-dip economic recession in Europe is likely already under way and will limit U.S. exports to the region.

**Figure 31 – U.S. Manufacturing Exports to 238 Countries (Exports by Country/Region, 2011)**



Source(s): U.S. International Trade Commission and MAPI

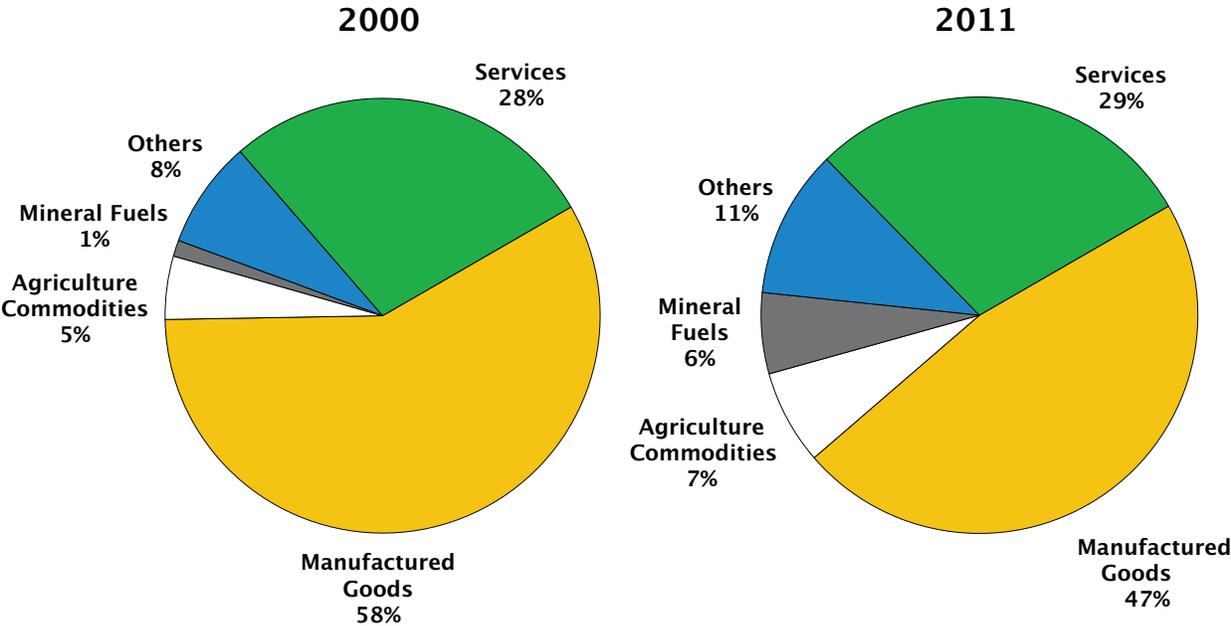
# Manufacturing Still Dominates U.S. Exports, but Its Share Is Declining

U.S. manufacturers exported \$123 billion of goods per month in 2011, and exports increased from \$649 billion in 2000 to \$1,481 billion in 2011, or by 128 percent. Manufactured goods still dominate total U.S. exports, but the share declined from 58 percent in 2000 to 47 percent in 2011; the share of mineral fuels increased from 1 percent to 6 percent during this period.

Breaking down the composition of manufactured goods exports in 2011 reveals that capital goods represented 33 percent of exports, while consumer goods made up only 12 percent. Advanced technology products, such as aerospace equipment (\$89 billion in exports), life sciences (\$29 billion) and information and communications equipment (\$89 billion), accounted for 19 percent of total goods exports.

U.S. exports of manufactured goods were down sharply in 2008 as a result of the global recession, but made a significant recovery since 2009. In 2011, these exports reached record annual levels, and net exports made a positive contribution to economic growth. The pace of export growth is expected to slow in 2012 as the Eurozone slides into recession and emerging markets—including China—decelerate.

**Figure 32 – Manufacturing Still Dominates U.S. Exports, but Its Share Is Declining**



Source(s): U.S. Census Bureau and MAPI calculations

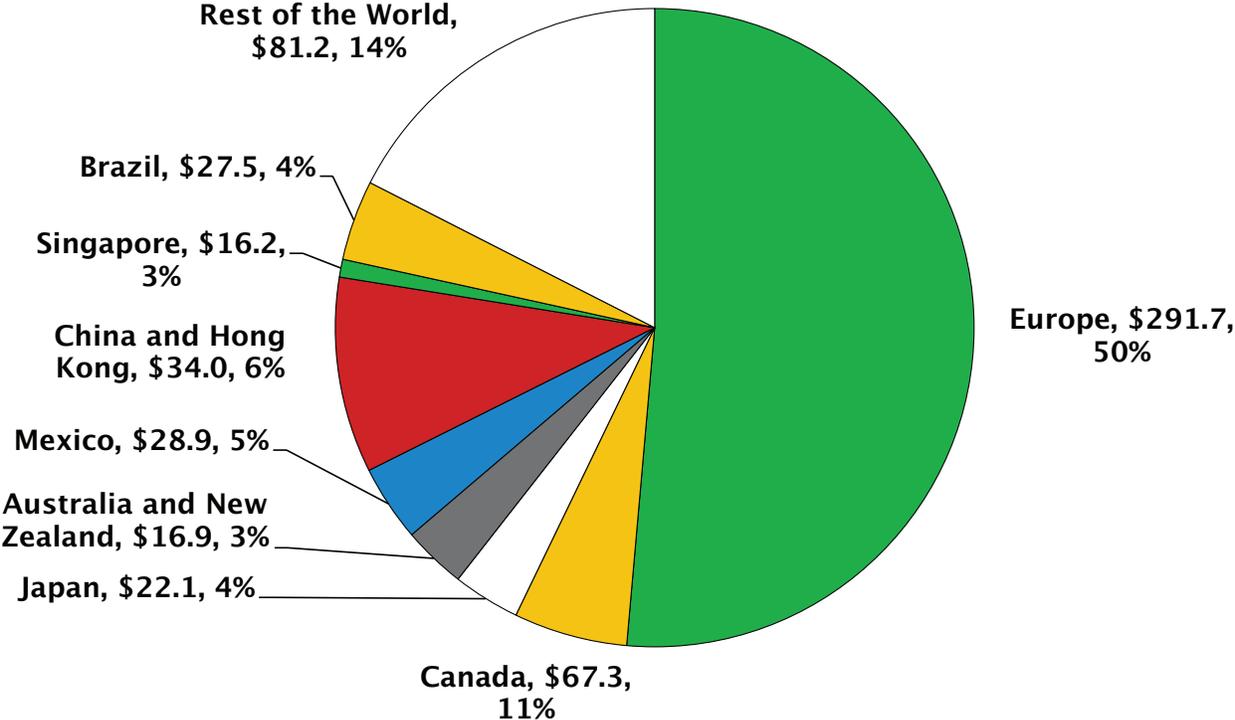
# U.S. Manufacturers Invest Primarily in High-Wage Countries

A very large share of U.S. FDI in manufacturing goes to developed, high-wage countries. In the past decade, 68 percent of the new investment dollars in manufacturing affiliates abroad were spent in Europe, Canada, Japan, Australia and New Zealand, and this percentage share is down only slightly from 71 percent a decade ago. Cheap labor is clearly not the driving force behind FDI; the main factor is access to large and growing markets, and this link attracts long-term investment. Especially since 95 percent of the world’s consumers live outside the United States, the primary motivation for taking an ownership position in a foreign firm is to establish a regional presence and commit to participating in the global market.

China is the world’s fastest-growing marketplace for industrial products, and so it is not surprising that U.S. firms are eager to engage in that market. U.S. FDI in manufacturing within China has grown at a 13 percent annual rate in the past decade versus 6 percent growth in total manufacturing FDI. Nevertheless, U.S. FDI in China remains a small proportion of overall investment, totaling only 5.8 percent of total stock of U.S. manufacturing FDI in 2010. Further, U.S. FDI in Chinese manufacturing was 10 percent of the growth in FDI over the past decade.

**Figure 33 – U.S. Manufacturers Invest Primarily in High-Wage Countries**

## Growth in U.S. Manufacturing FDI Position, 2000–2010



Source(s): U.S. Bureau of Economic Analysis, U.S. Direct Investment Position Abroad on a Historical Cost Basis

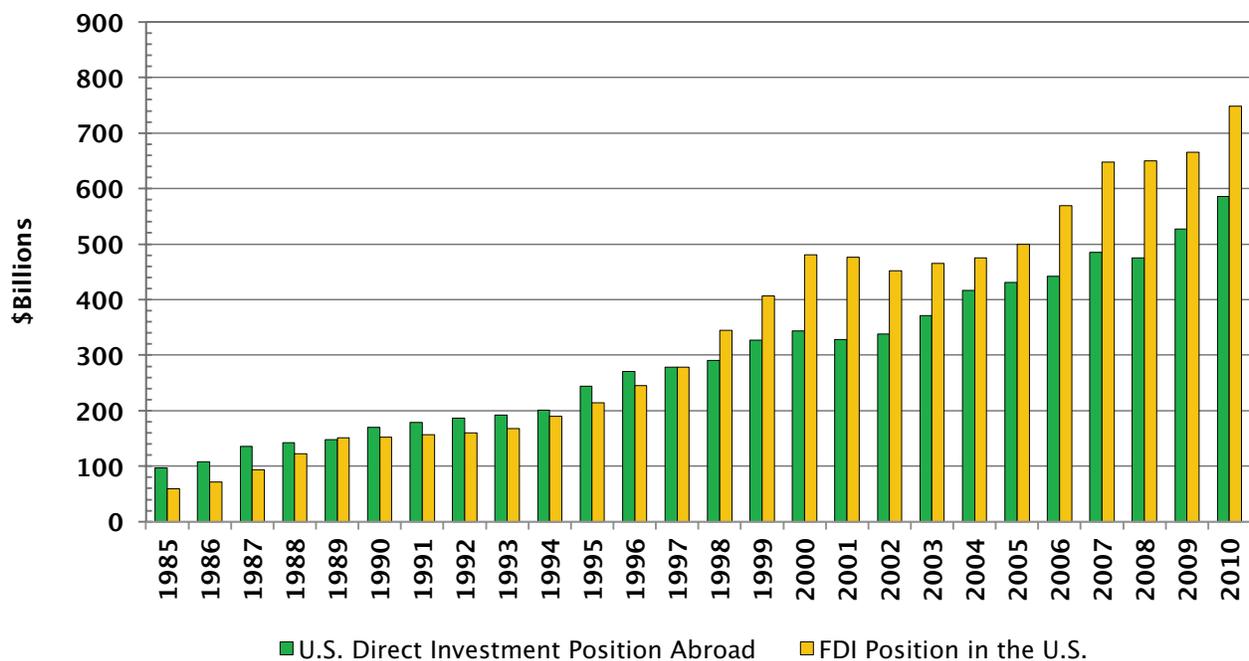
## Foreign Investment in U.S. Manufacturing Grows

America is an attractive place to do business, and foreign business leaders vote with their feet when they set up shop here. U.S. affiliates of foreign industrial companies hold \$750 billion worth of investments, with a clear upward trend over several decades.

FDI in America’s manufacturing pays well for investors, employees and government alike. Rates of return are high because supplier networks, logistics and the legal environment all contribute to ease of conducting business. About 1.68 million Americans are directly employed by foreign-owned manufacturing firms.

Foreign capital enlarges exports, employment and the tax base. Foreign companies bring along their know-how, technology and innovation, all of which enrich the domestic economy both directly and indirectly. Direct investments—both in and out of the country—are win-win propositions.

**Figure 34 – Foreign Investment in U.S. Manufacturing Grows**



Source(s): U.S. Bureau of Economic Analysis, International Investment Position and MAPI

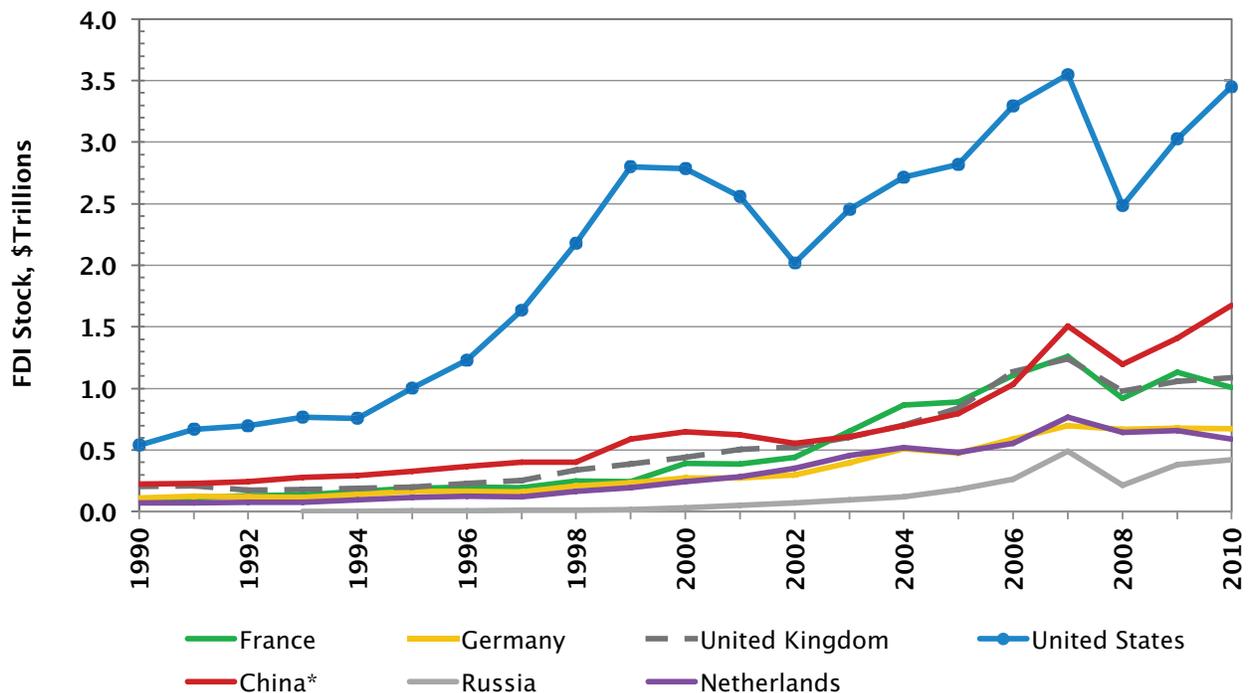
## The U.S. Is the Number-One Destination for FDI

The United States is the world's largest recipient of FDI. Foreign investors are attracted by this country's sizable and open market, the quality of its infrastructure, high income levels, access to cutting-edge technology and research, rule of law and treatment of foreign-owned businesses. The U.S. draws investment from the most internationally competitive foreign-owned companies; these investors bring global experience, new products and different processes as well as capital, making our economy one of the most flexible and dynamic in the world.

Some other major recipients of FDI are the United Kingdom, France, the Netherlands and Germany among the advanced countries and China (including Hong Kong) and Russia among the transition economies.

The developed countries' share of global FDI inflows fell below 50 percent for the first time in 2011 because of the gloomier economic outlook prompted by government austerity measures, sovereign debt crises and regulatory concerns. Compared with the European countries and Japan, the recovery of U.S. FDI inflows was strong, a result of the relatively robust economic growth and fast increase in reinvested earnings. To continue to attract FDI, the United States must be able to compete with other countries in factors critical to foreign investors, such as an educated workforce, a high-quality business environment and a transparent regulatory process. Structural costs such as energy and taxes, however, are raising the costs of domestic production and make this country less appealing for investment.

**Figure 35 – The U.S. Is the Number-One Destination for FDI**



\* Includes Hong Kong

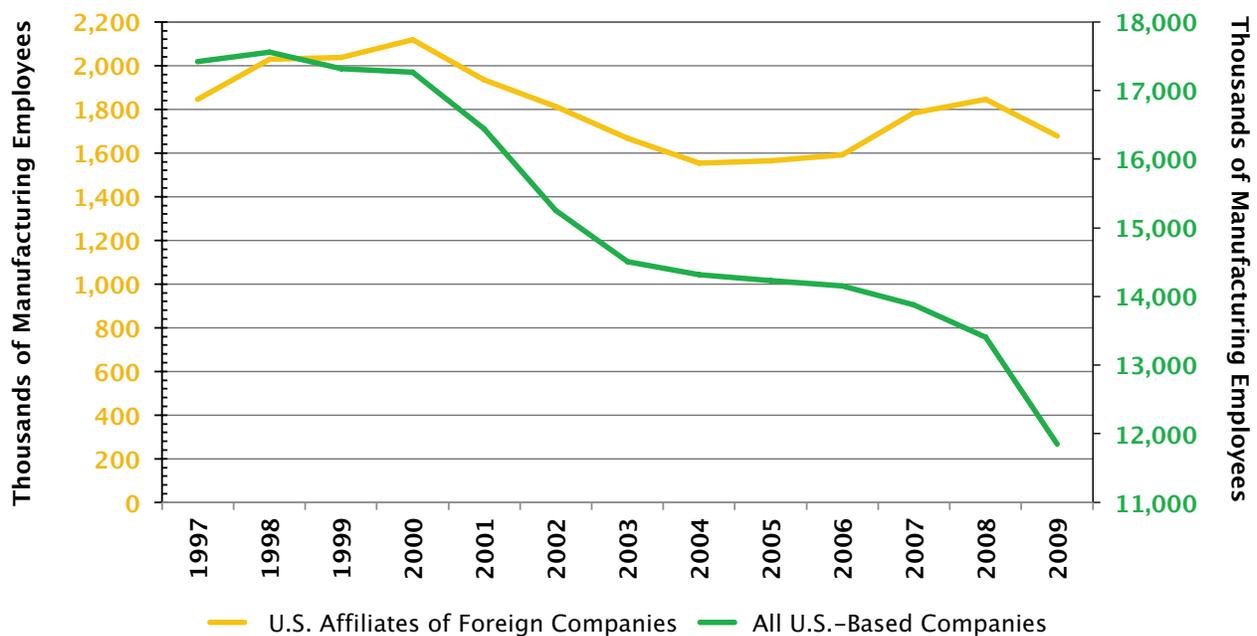
Source(s): UNCTAD World Investment Report

## Foreign Companies Are Important to U.S. Manufacturing

Foreign firms operating their U.S. subsidiaries are important players in the domestic market. Sometimes they mitigate the vagaries of a business cycle. In the past decade and a half, employment in all manufacturing companies plunged 47 percent. During the same time, payrolls in foreign subsidiaries dipped barely 10 percent, and they actually rose in the two years preceding the Great Recession, easing the overall pain. Work in U.S. affiliates also pays well: wages averaged \$73,000 a year in 2009, quite a bit more than compensation paid at all U.S. companies.

Foreign entities that operate in the United States remunerate generously because they are efficient. Our markets are rich and large, but they are also highly competitive. It is fair to say that only the very fit would dare take the plunge and put down roots in America. Deploying sophisticated engineering in turn requires technical and managerial talent that is productive and hence ought to be well paid.

**Figure 36 – Foreign Companies Are Important to U.S. Manufacturing**



Source(s): U.S. Bureau of Economic Analysis, Bureau of Labor Statistics and MAPI

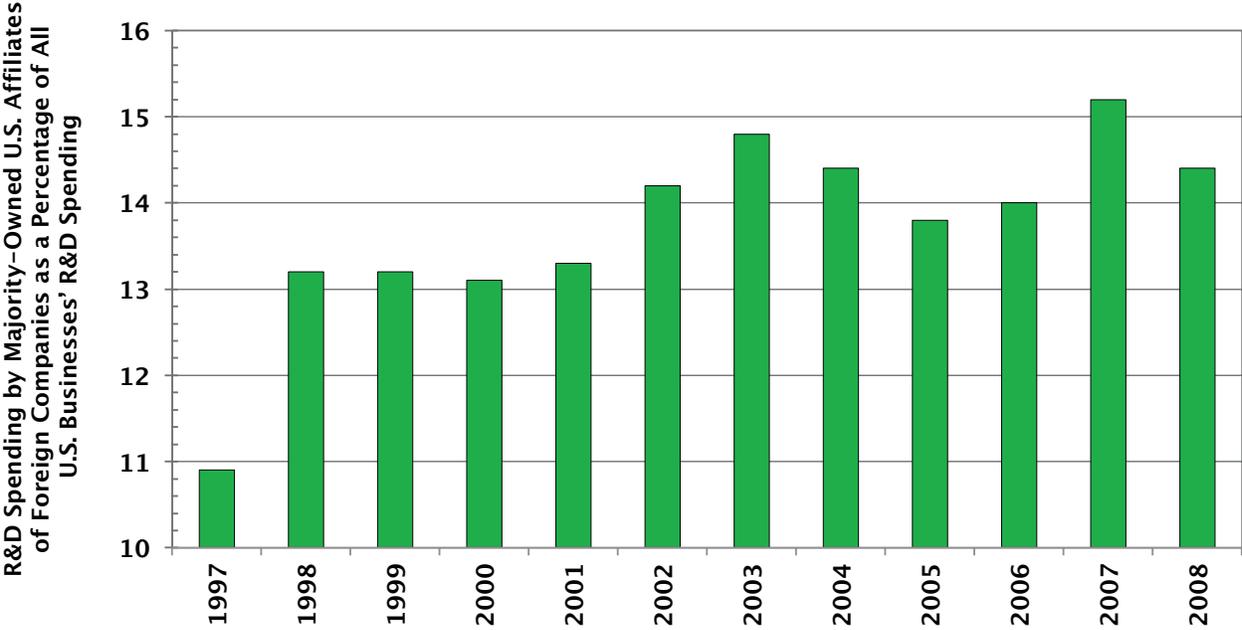
# U.S. Affiliates of Foreign Companies Are Highly Innovative

Foreign companies operating in the United States tend to be more resilient than domestic entities against vagaries of business cycles. They also pay better than average and export more than their domestic counterparts. Higher payrolls probably reflect a concentration of foreign investments in fast-growing sectors.

Domestic affiliates of foreign companies also distinguish themselves with their innovation. Spending on R&D by these affiliates as a percent of R&D spending by all U.S.-based businesses has been inching up over time. In the past decade, that share rose from just under 11 percent to more than 14 percent—a significant climb given the large base.

This is a highly beneficial trend. Foreign companies beef up domestic savings via outside finance, their exports and employment of Americans, and also bring in ideas, know-how and technology. All of these invisible forces spill over to the rest of the economy. Such knowledge diffusion transpires through supplier relationships, joint ventures and learning by doing. America gets stronger by opening up to the world and sharing its own ideas with others.

Figure 37 – U.S. Affiliates of Foreign Companies Are Highly Innovative



Source(s): U.S. Bureau of Economic Analysis, Direct Investment and Multinational Companies and MAPI

## Section II

# Current and Future Challenges for U.S. Manufacturing

While the importance of manufacturing to the U.S. economy is clear, there are both immediate and future challenges that threaten our ability to maintain a vibrant and growing manufacturing base. First among them is the structural cost of manufacturing imposed by the government. These costs for corporate taxes, health care and pensions, environmental regulations, energy and tort litigation add a full 20 percent to manufacturers' cost of doing business relative to our major trading partners. This is an increase of several percentage points from 2008, and it represents a fundamental challenge in a global, interconnected and competitive marketplace.

Of equal concern is the shrinking supply of qualified workers. The manufacturing workforce is growing older at a greater rate than the economy as a whole, and the U.S. education system is not equipping American students with the right skills and in the right disciplines to contribute to the manufacturing economy. This lack of qualified workers is beginning to impact manufacturers' ability to compete in the global market.

In this section, the Current and Future Challenges for U.S. Manufacturing are examined in four different areas: Competitiveness, Innovation, Skilled Workforce and Employment, and Trade. Some of the key findings include the following:

- U.S. manufacturers face a 20 percent structural cost burden compared to companies from our nine largest trading partners.
- The U.S. has the highest statutory and effective corporate tax rate in the world.
- U.S. health care costs have increased more than 80 percent in the past decade, creating greater personnel costs for manufacturers.
- Regulations continue to impart a heavy burden on U.S. manufacturers.
- U.S. dominance in product innovation is now in question.
- Manufacturing job losses have impacted every region of the country.
- The U.S. manufacturing workforce is older and less educated in comparison to other sectors.
- The U.S. is losing export market share as our trade gap widens.

These challenges must be addressed for the U.S. to maintain and grow its industrial base.

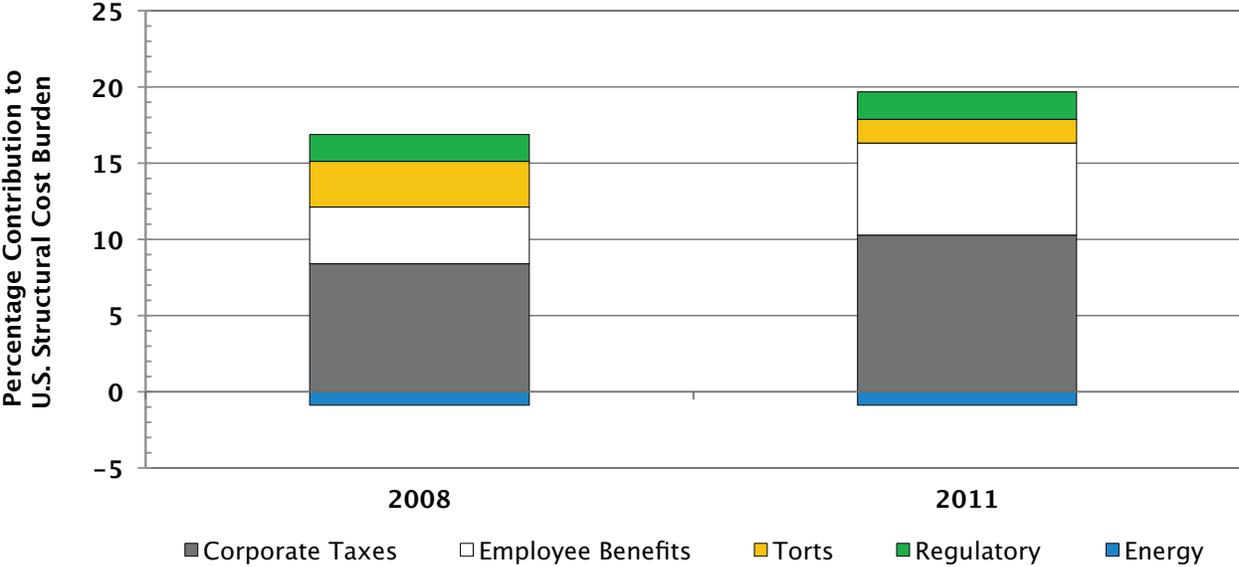
# Competitiveness

## The U.S. Has a Structural Cost Disadvantage

Since 2003, MAPI and The Manufacturing Institute have tracked the excess burden of structural costs—corporate tax liability, employee benefits, tort litigation, regulatory compliance and energy—of U.S. manufacturers relative to their counterparts in our nine largest trading partners. This competitive disadvantage persisted throughout the first decade of the century and started to increase again in 2011.

Taken together, structural costs were 20 percent higher than for our major competitors, up from 17.6 percent in 2008. Without this cost disadvantage, the United States would be a lower-cost platform for manufacturing than all of our major trading partners except China, Mexico and Taiwan thanks to a 50 percent increase in productivity since 2000.

Figure 38 – The U.S. Has a Structural Cost Disadvantage



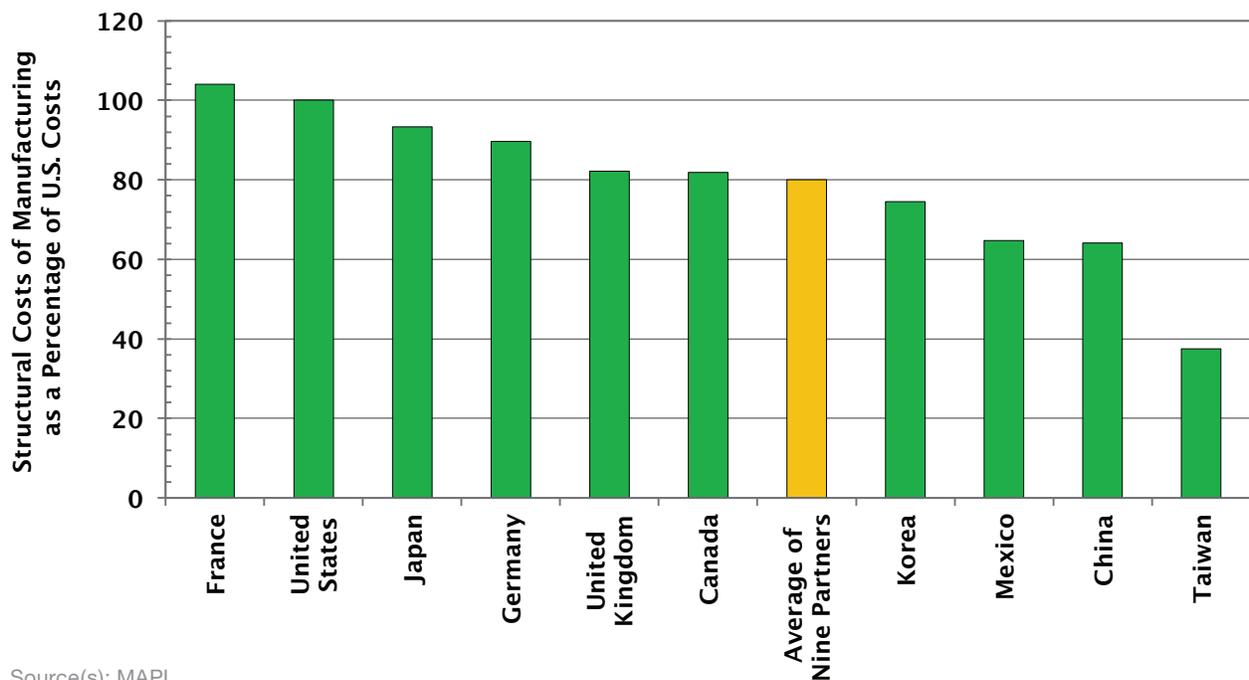
Source(s): MAPI

## Among Nine Largest Trading Partners, Only France Has Higher Structural Costs Than the U.S.

The excess structural cost burden facing the U.S. manufacturing sector more than offsets the competitive advantage it holds with regard to labor and capital costs. This “raw cost index” was just under \$30 per hour in the United States, \$3 less than the trade-weighted average of our nine largest trading partners. When the effects of higher structural costs are factored in, however, this cost advantage turns into a burden of \$3 per hour. The excess corporate tax burden alone erases the U.S. manufacturing advantage, and the effects of employee benefits, torts and regulatory compliance simply add insult to injury.

China, Mexico and Taiwan enjoy significantly lower raw production costs, although they have risen rapidly since the initial study in 2003. In China and Mexico, these costs more than doubled, and in Taiwan rose by almost 50 percent, compared with a 23 percent increase in the United States.

**Figure 39** – Among Nine Largest Trading Partners, Only France Has Higher Structural Costs Than the U.S.



Source(s): MAPI

## The U.S. Does Not Keep Pace with Falling Corporate Tax Rates

Subsequent to a corporate tax reduction in Japan on April 1, 2012, the United States now holds the unenviable position as the country with the highest combined federal-state statutory corporate tax rate among our major trading partners (and indeed the entire OECD). Rate cuts in 1986 brought the United States below the OECD average at the time, but since then we have fallen behind by standing still. While many believe that generous depreciation allowances, deductions and exclusions make the U.S. burden less severe than statutory rates would suggest, careful analysis of the marginal effective tax rate on capital follows roughly the same pattern as statutory rates, with the U.S. at the top.

There is wide agreement among economists and policymakers that corporate income taxes distort business decision making, discourage capital investment, reduce hiring and cause firms to invest billions of dollars in tax planning, compliance and dispute resolution that could otherwise be put to more productive uses. Evidence also indicates that cutting rates has no meaningful negative effects on revenues. Economic simulations by MAPI indicate that reducing the U.S. statutory corporate tax rate from 35 percent to 24 percent would add an extra \$500 billion to GDP within five years, create 2 million new jobs and improve the longer-run fiscal outlook.

**Figure 40 – The U.S. Does Not Keep Pace with Falling Corporate Tax Rates**

	Statutory (1997)	Statutory (2012)	Effective (2011)
United States	40.0	40.0	34.6
Japan	57.1	38.0	29.5
France	36.6	33.3	34.1
Mexico	34.0	30.0	17.5
Germany	57.4	29.4	23.8
Canada	44.6	28.0	20.5
China	33.0	25.0	16.6
Korea	30.8	24.2	29.5
United Kingdom	31.0	24.0	27.9
Taiwan	25.0	17.0	10.9

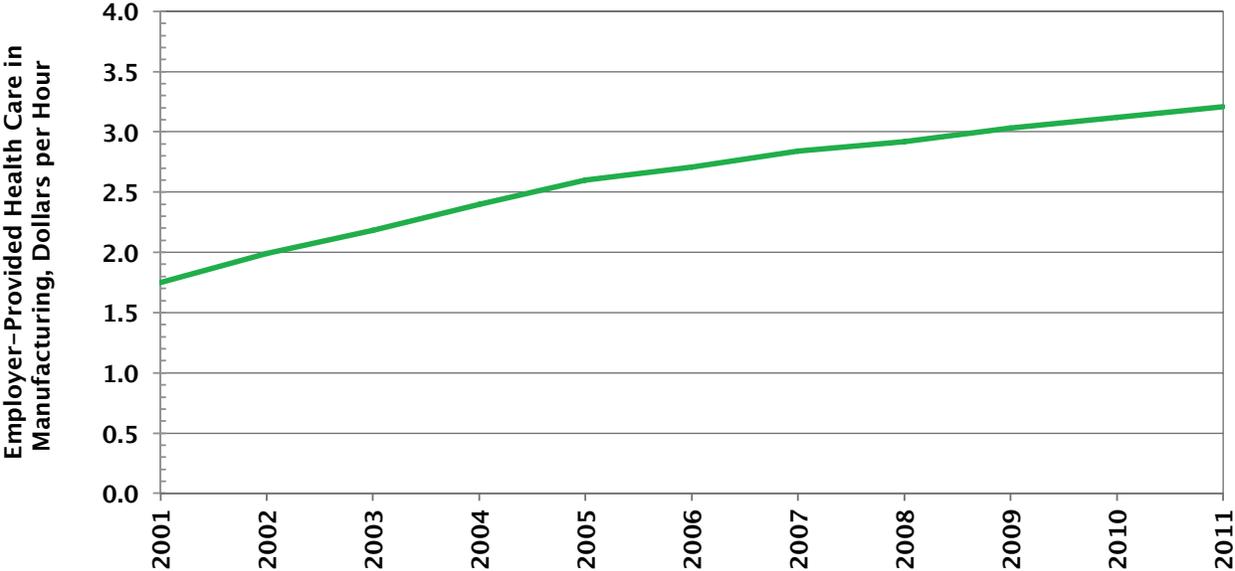
Source(s): MAPI Costs Study and Organisation for Economic Co-operation and Development and country budget documents  
 Note: Rates include both national and subnational corporate taxes where they exist

# U.S. Health Care Costs Are Skyrocketing

Health care costs are one of the most difficult challenges facing manufacturers. In the 10 years ending in 2011, employer costs for employee health care increased 83 percent—an increase in the U.S. structural cost disadvantage of 6.3 percentage points. To put the cost burden in perspective, overall producer prices for finished goods excluding energy only rose 2.1 percent a year. Employer-provided health care costs are growing several times faster than sales prices.

Manufacturers want to maintain their proud commitment to providing health benefits through affordable coverage by using electronic records to improve cost-effectiveness and quality of health care, preventing and managing chronic care of workers through education and encouraging consumer-directed health care options.

Figure 41 – U.S. Health Care Costs Are Skyrocketing



Source(s): U.S. Bureau of Labor Statistics

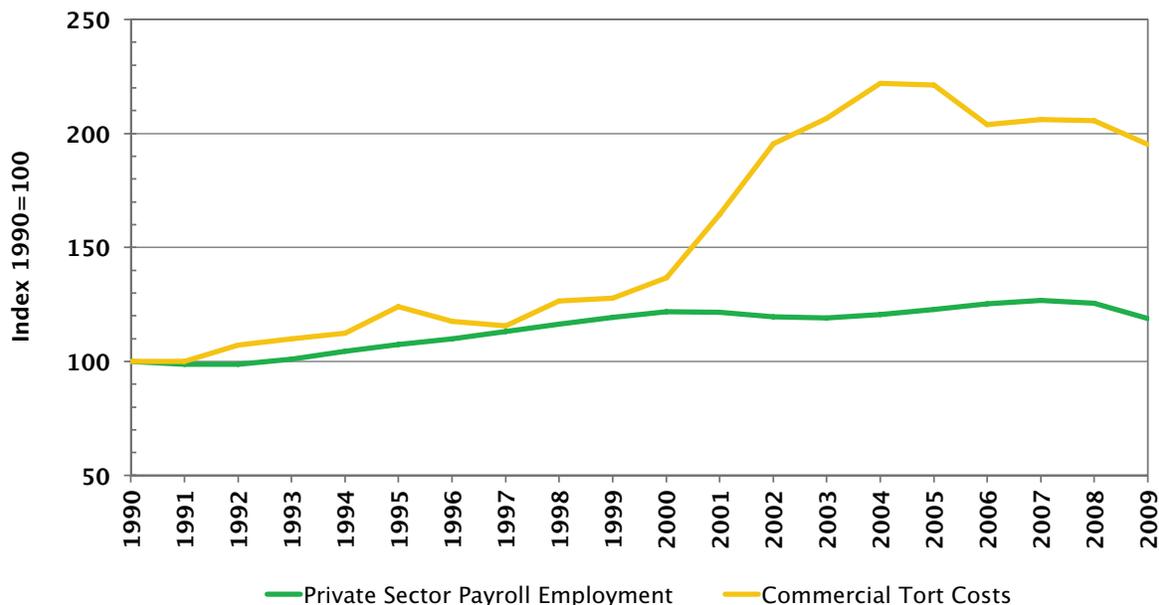
## Commercial Tort Costs on Decline but Still Too High

Another impediment to U.S. manufacturing competitiveness is the expense of defending against tort claims. Overall, tort claims and the attendant litigation cost more than \$250 billion a year, or more than 2 percent of GDP. Almost two-thirds of this amount is for commercial tort claims (such as product liability and business-related property losses) and medical malpractice claims. Even though the explosive growth of tort claims in the past 10 years has subsided, the fact remains that—scaled to GDP—the U.S. tort system is more than twice as expensive as its major competitors, such as Japan, France, Canada and the UK. Everyone pays as a result of these costs: health care costs rise, investment and new product development is deferred and—in some extreme cases—plants are closed when insurance fees jump.

Legislation in the mid-2000s limited some of the more problematic areas of the U.S. tort system (such as linking attorney compensation to amounts claimed rather than amounts awarded in class action suits and preventing “jurisdiction shopping” to plaintiff-friendly courts), and this has changed behavior. Commercial tort costs in the United States have decreased by 12 percent from their 2004 peak of \$173.5 billion. In the context of growing manufacturing output, the share of manufacturing value-add devoted to litigating tort claims fell to 2.9 percent in the 2011 costs study compared with a peak estimated at nearly 5 percent in 2006.

Nevertheless, the U.S. tort system is fundamentally different from most systems elsewhere in the industrialized world in that each party pays its own legal costs. In almost all other countries, the plaintiff must pay all or part of the defendant’s legal costs in case of judgment in the defendant’s favor. Because of the strong disincentives for groundless lawsuits in such systems, it is unlikely that the foreign advantage will disappear entirely without more fundamental changes to the incentive structure in the U.S. system.

**Figure 42 – Commercial Tort Costs on Decline but Still Too High**



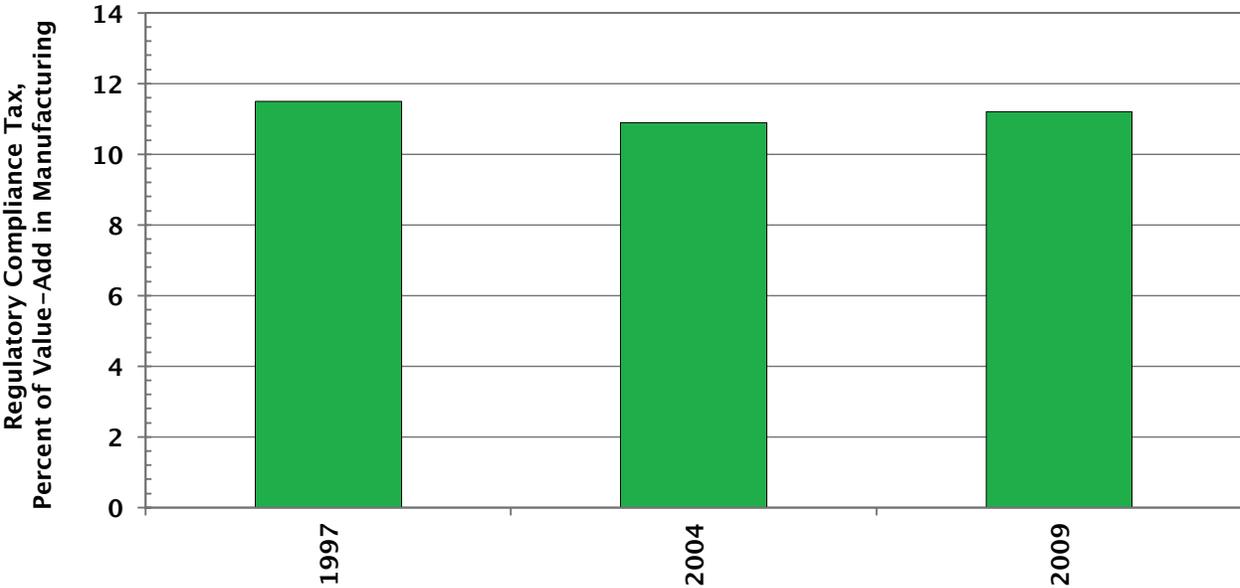
Source(s): Towers Watson and U.S. Bureau of Labor Statistics

# Despite Rhetoric, Regulations Are as Burdensome as Ever

More than any other sector, manufacturers bear the highest share of the cost of regulatory compliance. Many regulations have positive benefits for the economy and society; for example, workplace safety and air quality have improved steadily for the past three decades. Yet, few understand the cost of these regulations and their impact on companies facing intense global competition with overseas firms that often do not have similar costs.

The expense of complying with federal regulations is steep. Manufacturers spend an estimated \$192 billion annually to abide by economic, environmental and workplace safety regulations and ensure tax compliance—equivalent to an 11 percent “regulatory compliance tax.” As an example, the U.S. industry is faced with the highest pollution abatement costs compared with its major trading partners—even higher than the so-called “green economies” of Western Europe. In 2007, U.S. manufacturers spent an estimated 6.2 percent of value-added complying with air and water emissions standards (which are among the strictest in the world) compared with 6 percent in France and Germany, 5.5 percent in Canada and 3.5 percent in the UK. Regulatory costs impact the global competitiveness of manufacturers, constrain the demand for employees in U.S. facilities and further encourage firms to locate production abroad.

Figure 43 – Despite Rhetoric, Regulations Are as Burdensome as Ever



Source(s): MAPI Costs Study

## Developed Countries' Share of Global Manufacturing Falls

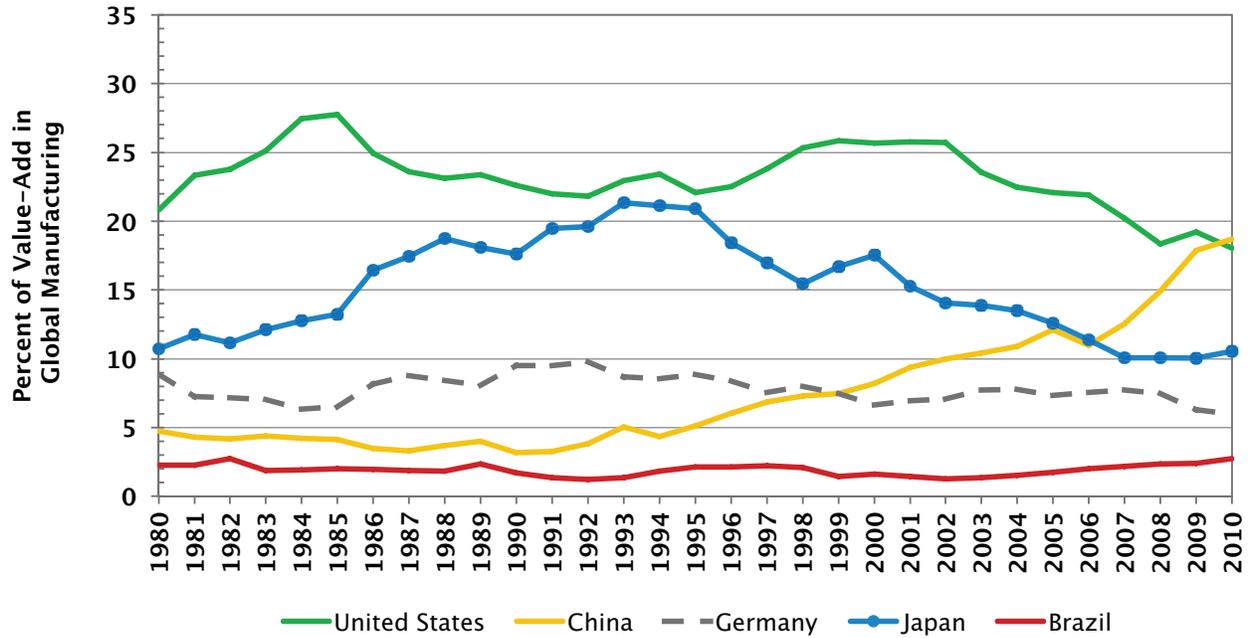
The world does not stand still regardless of how fast American manufacturing grows. Japan's share of global output rose from approximately 11 percent in 1980 to just more than 20 percent within about a decade and a half. Yet, Japan's share subsequently shrank to the 10–10.5 percent range by 2010 (depending on who does the number crunching—the United Nations or the World Bank). When Japan's proportion was at its highest, China began to expand manufacturing production relentlessly. From a low of about 4 percent two decades ago, it rose continuously to reach about 18 percent in 2010.

Is the United States still the largest manufacturing nation? It depends on who's measuring. If you trust the World Bank's data, shown in the second figure, the U.S. holds the number-one spot with a 17.7 percent share. Using the United Nations data shown in the first figure, however, China comes out on top with a share of 18.7 percent.

Rapid growth of emerging market economies offers challenges and opportunities for the U.S. industry. Our manufacturing value-added has fallen as a share of the total U.S. economy from 20 percent in 1980 to 13 percent in 2010. During the same time, U.S. manufacturing's share of global manufacturing value-added dipped only marginally. This means that virtually all of the industrialized world lost ground—and not only to emerging markets, but also to services.

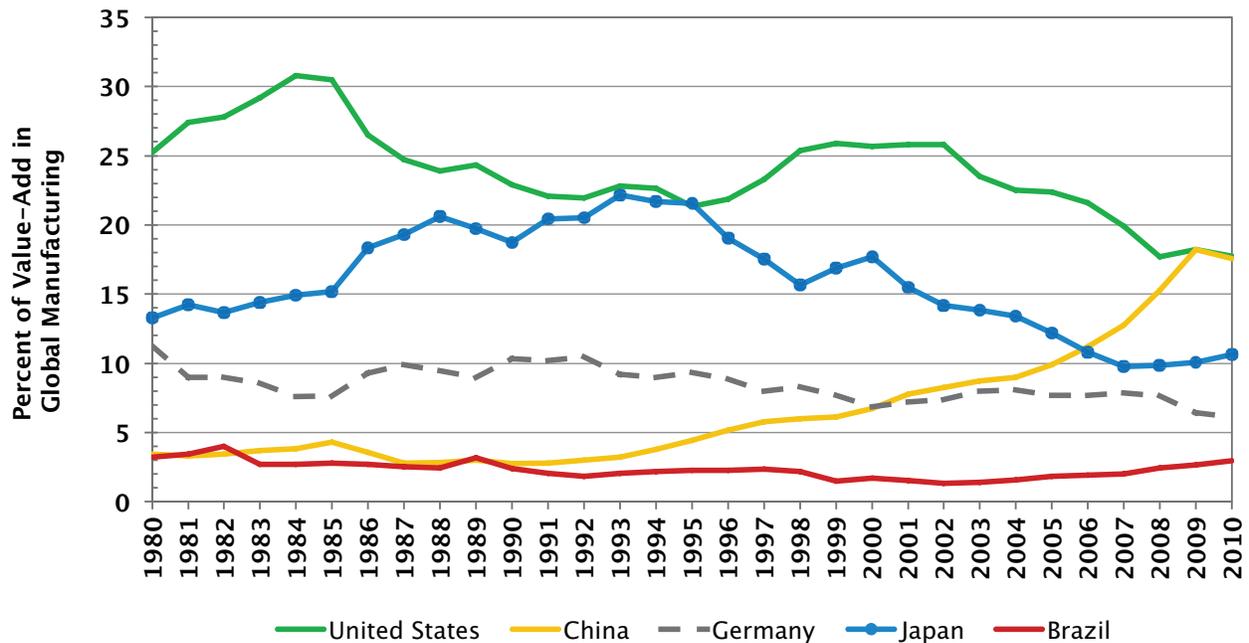
Maintaining America's share of world industrial output will require—among other strategies—unobstructed access to foreign markets, a favorable domestic tax and regulatory environment and a highly skilled workforce. Innovation that drives “creative destruction” lies at the core of fast-growing sectors, such as computing and telecommunications. This dominant position cannot be taken for granted, but neither should the view of inevitable decline of U.S. manufacturing.

**Figure 44a** – According to the UN, U.S. Manufacturing Slipped to Number Two



Source(s): United Nations and MAPI

**Figure 44b** – According to the World Bank, U.S. Still Leads in Global Manufacturing



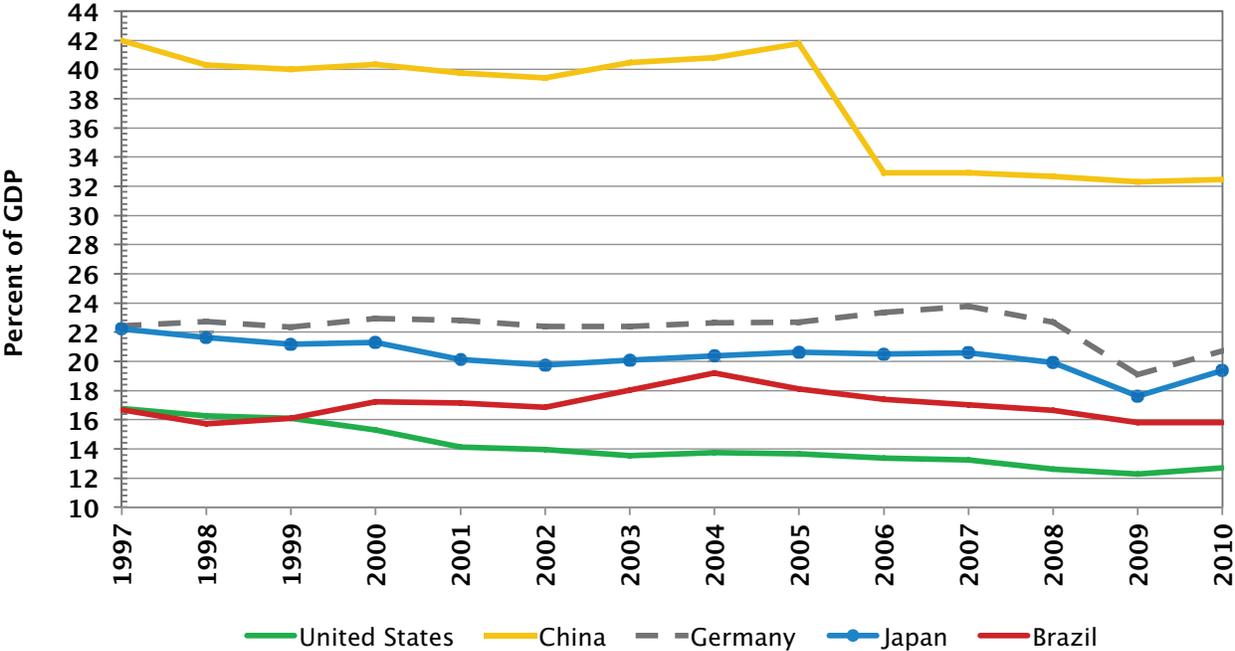
Source(s): World Bank, WDI and GDF databases and MAPI

# Manufacturing's Share Within Countries Declines

The share of an economy's value-added that is generated by manufacturing has been on the decline in the developed world for decades. In a nutshell, consumers increasingly demand services—often new ones—and producers make the necessary accommodations. But manufacturing in the United States plays a significantly reduced role in the economy relative to most of its industrial trading partners. Today, Germany's and Japan's manufacturing output relative to GDP stands some 7–8 percentage points higher than the American equivalent.

Such gaps call for political action. America can and should learn from its advanced peers. Whether it is via vocational training, labor relations or export promotion, government involvement has proven supportive of the vibrant manufacturing tradition that all these countries share.

Figure 45 – Manufacturing's Share Within Countries Declines



Source(s): United Nations

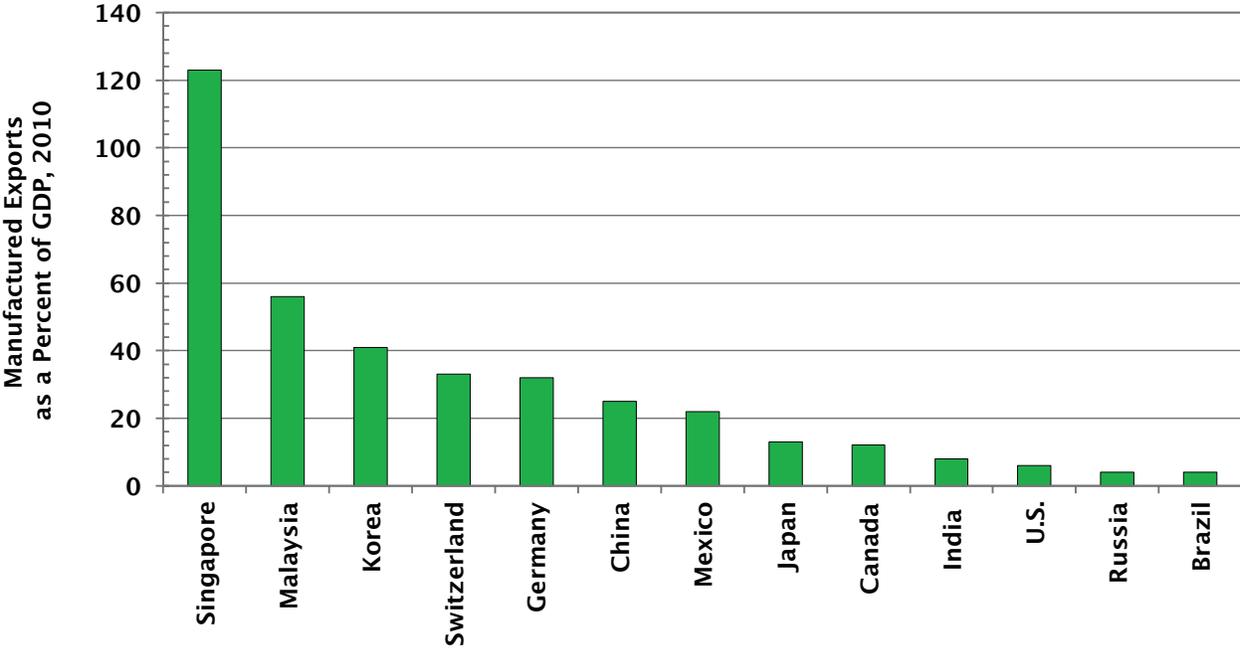
# Manufacturing Exports Alone Are Not Enough to Sustain U.S. Economic Growth

The U.S. is a leading global trader, and exports in goods and services accounted for more than 10 percent of GDP over the past two decades; in 2011, they accounted for about 14 percent, the largest share since at least 1929.

Growing exports of goods and services have been a central driver of the economic recovery and contributed about half of the nation’s economic growth in the two years after the recession. Much of the rise in exports is a result of the global rebound from the depths of the recession, the depreciation of the dollar and the soaring prices for commodities, including for wheat, cotton and petroleum products.

The United States is a consumer-driven economy, and consumer spending makes up about two-thirds of GDP. Excluding exports of services, agriculture and minerals, exports in manufacturing make up only 5 percent of the U.S. economy. Without real improvement in the labor market and a sustained recovery in housing, the rebound in exports alone is not enough to bring the U.S. economy back to its pre-recession growth path.

**Figure 46 – Manufacturing Exports Alone Are Not Enough to Sustain U.S. Economic Growth**



Source(s): World Bank and MAPI calculations

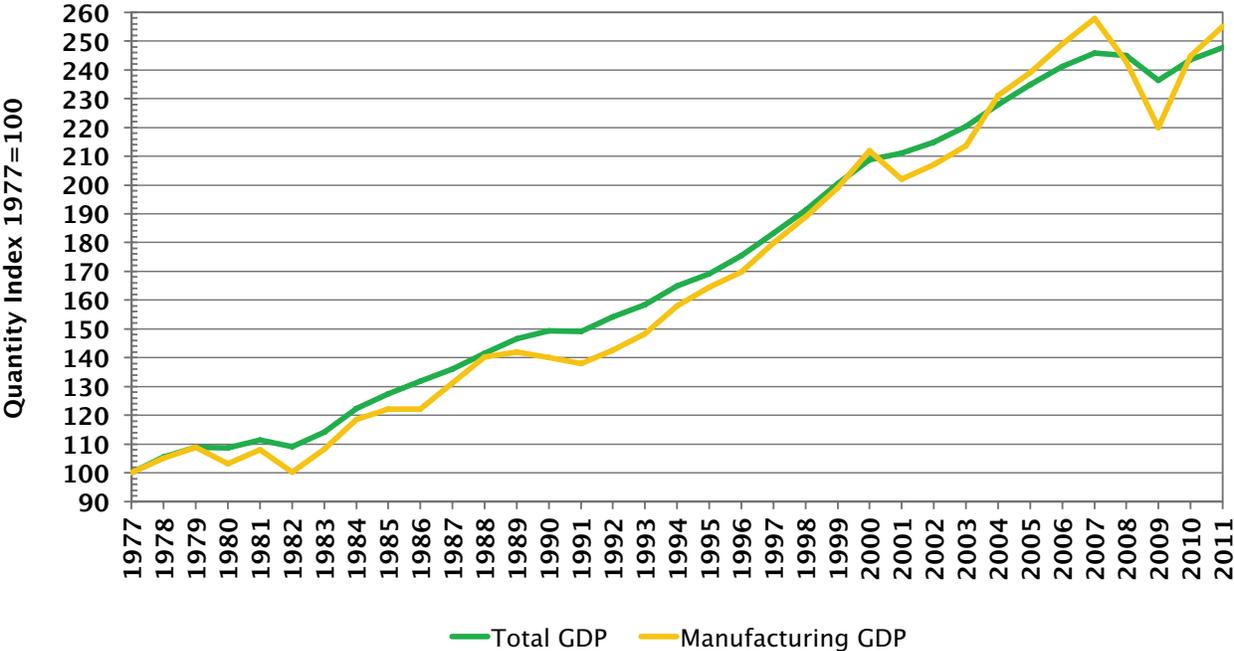
# Inflation-Adjusted Manufacturing Has Kept Up with Overall Economy

Manufacturing is often compared to agriculture in terms of a slow decline in share of employment and national output; however, after adjusting for price changes, the quantity of manufacturing value-added (GDP) generally kept pace with the overall economy between 1977 and 2011, taking into account both recessions and expansions. Manufacturing inflation-adjusted GDP does fall faster during recessions (as in the 2008–2009 recession), but also grows faster in expansions (as is currently the case). Measured in physical volume, manufacturing’s share of the economy is relatively unchanged since 1977.

Inflation-adjusted manufacturing growth is not, however, widespread within the sector’s industries. One industry—computer and electronic products—accounts for a disproportionately large share of the growth in manufacturing. The geometric rise in processing speeds translates into extremely strong growth in the physical volume of the industry’s value-added because of a unique quality adjustment applied in the industry.

There is no denying that computer and electronic products have provided great value for customers in the economy. The rapid decline in computer and electronic product prices, however, creates a measurement conundrum. When manufacturing value-added is measured in current dollars, the sector has shrunk as a share of the economy. Manufacturing value-added made up 12.2 percent of total GDP in 2011, down substantially from 21.6 percent in 1977.

**Figure 47 – Inflation-Adjusted Manufacturing Has Kept Up with Overall Economy**

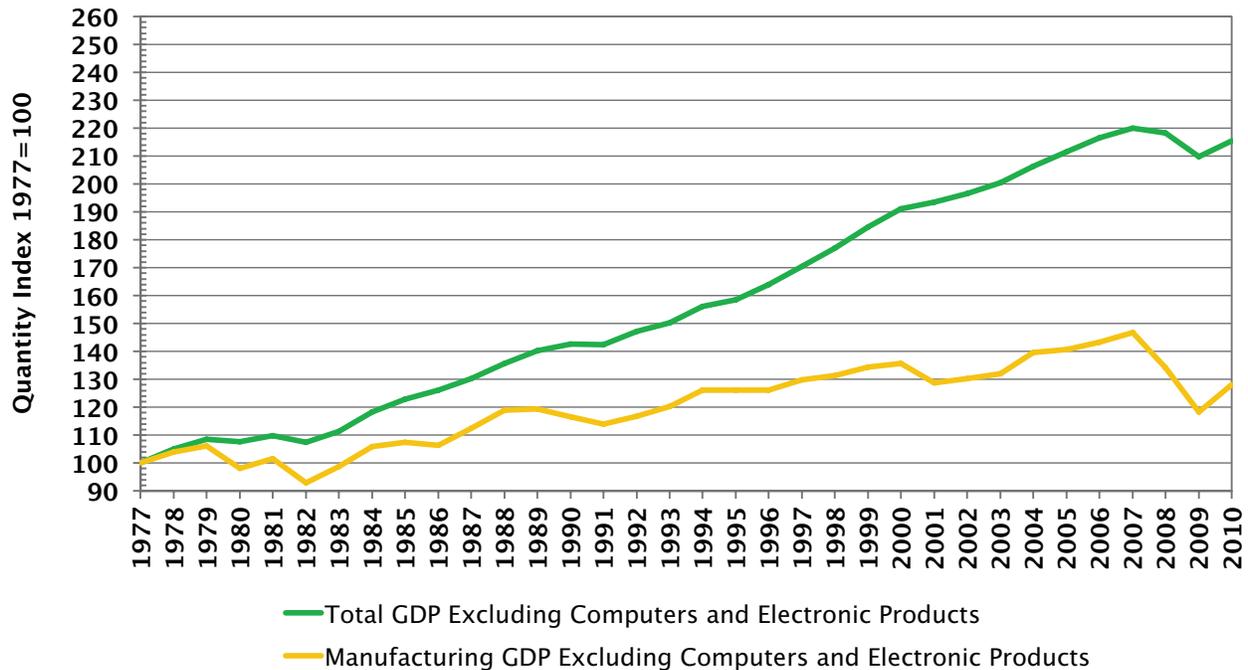


Source(s): U.S. Bureau of Economic Analysis, GDP by Industry

## Traditional Manufacturing Has Not Kept Up with Overall Economic Growth

Traditional (non-high-tech) manufacturing has not kept pace with the growth in the rest of the economy. In 2007, the quantity of total GDP excluding computers and electronic products had increased 120 percent over the preceding 30 years, while the quantity in traditional manufacturing increased only 47 percent. Manufacturing volume declined a great deal more in the 2008–2009 recession, and the industry’s recovery is not complete. Non-high-tech manufacturing industrial production declined 21 percent in the recession and will not recover its pre-recession level until the first quarter of 2015. In contrast, production in the total economy fell 5 percent in physical volume during the 2008–2009 recession and was fully recovered by the third quarter of 2011.

**Figure 48** – Traditional Manufacturing Has Not Kept Up with Overall Economic Growth



Source(s): U.S. Bureau of Economic Analysis, GDP by Industry

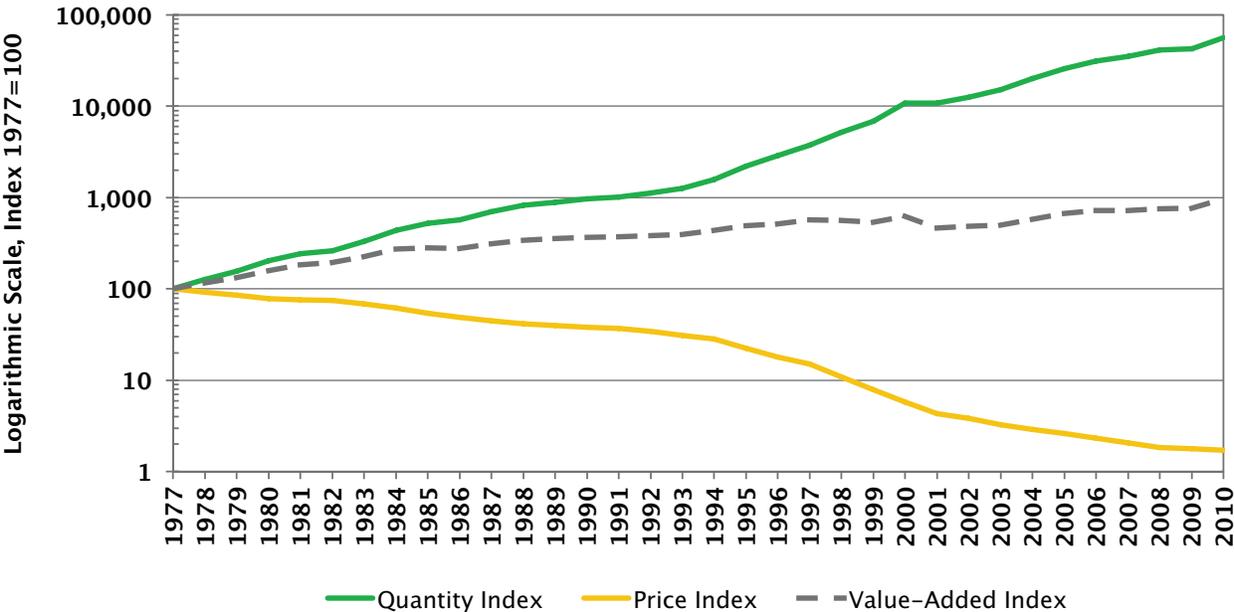
# Measuring the Quantity of Manufacturing GDP Is Distorted by High-Tech

Manufacturing’s share of GDP since 1977 has either remained unchanged or declined by nearly one-half depending on whether the value-added is inflation-adjusted or in current dollars. The major issue in measuring activity is quantifying the contribution of computers and electronic products. Government statisticians account for the increased quality of computers and electronic products over time through lowering the price indicator for the industry. For example, when the processing speed of semiconductors doubles, that is expressed as a 50 percent decline in industry prices.

Using a logarithmic scale, the value-added of computers and electronic products (in dollars) increased tenfold from 1977 to 2010. The industry’s value is broken into a 98 percent decline in price and a 564-fold increase in quantity. Clearly, having a component of a total that increases 564 times will accelerate the growth in the total at the expense of the pace of the less rapidly growing components.

Manufacturing is in the enviable position of spawning a new super-fast-growing industry (when quality-adjusted), but computers and electronic products’ value-added in dollars is only 1.8 percent of total GDP and 15 percent of overall manufacturing value-added. When this segment is removed from the quantity change in total GDP and overall manufacturing, the pace of manufacturing physical volume growth compared to that of the overall economy is substantially different.

**Figure 49 – Measuring the Quantity of Manufacturing GDP Is Distorted by High-Tech**



Source(s): U.S. Bureau of Economic Analysis, GDP by Industry

## The U.S. Ranks High but Is Not the Easiest Country To Do Business In

The World Bank performs a comprehensive analysis of structural costs to start and conduct business in virtually every country in the world. Not surprisingly, advanced economies receive high rankings; these economies are rich for a reason, and they have rules and institutions that make starting a new business relatively fast and cheap, in turn promoting innovation and job creation. In addition, they have comparatively flexible labor and capital markets that constantly reallocate resources based on consumer preferences and overall spending patterns.

The United States is high on the list of several hundred countries, but it is not at the top. Currently, the U.S. ranks fourth in terms of the ease of doing business, and Singapore, Hong Kong and New Zealand are ahead of us. A sign of the growing prowess of the Asian economies is that Hong Kong was ranked seventh back in 2005.

**Figure 50** – The U.S. Ranks High but Is Not the Easiest Country To Do Business In

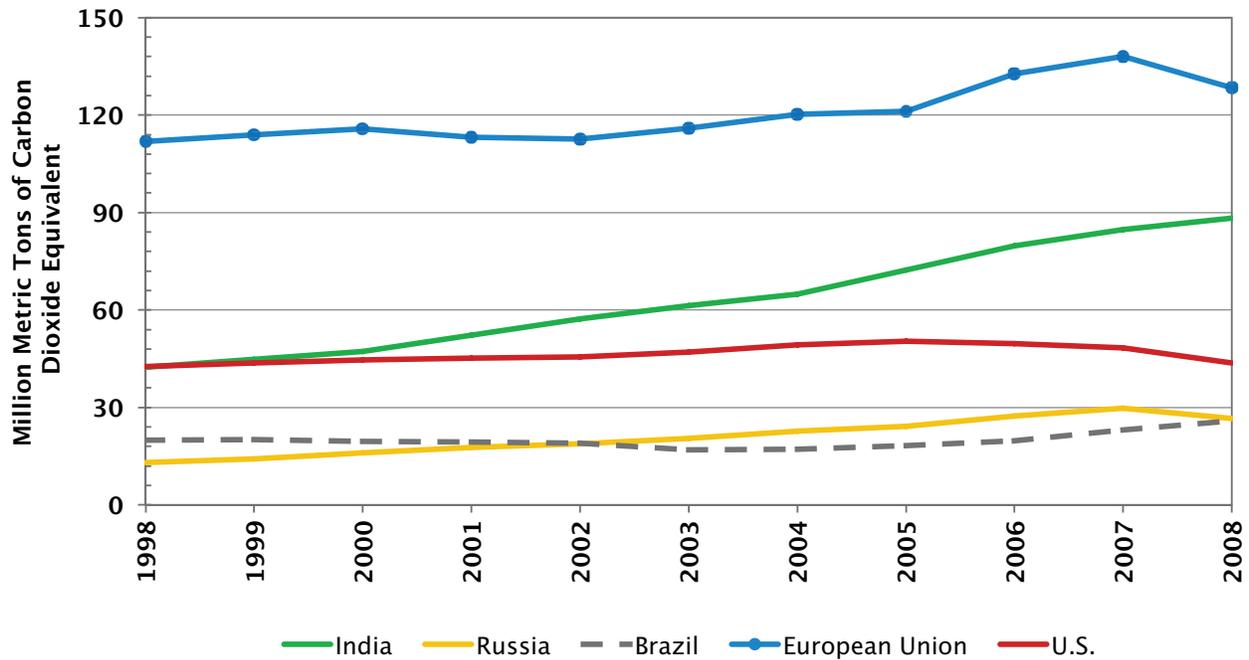
Rank	2005	2011
1	New Zealand	Singapore
2	Singapore	Hong Kong
3	United States	New Zealand
4	Canada	United States
5	Norway	Denmark
6	Australia	Norway
7	Hong Kong	United Kingdom
8	Denmark	Korea
9	United Kingdom	Iceland
10	Japan	Ireland
11	Ireland	Finland
12	Iceland	Saudi Arabia
13	Finland	Canada
14	Sweden	Sweden
15	Lithuania	Australia

Source(s): World Bank, Ease of Doing Business Index

## U.S. Industrial Emissions Have Plateaued, While Others' Rise

Staying competitive in the global marketplace requires continual progress in both using energy more efficiently and protecting the environment. U.S. manufacturers have responded by introducing a variety of pioneering technologies, new business processes and enlightened management techniques.

Figure 51 – U.S. Industrial Emissions Have Plateaued, While Others' Rise



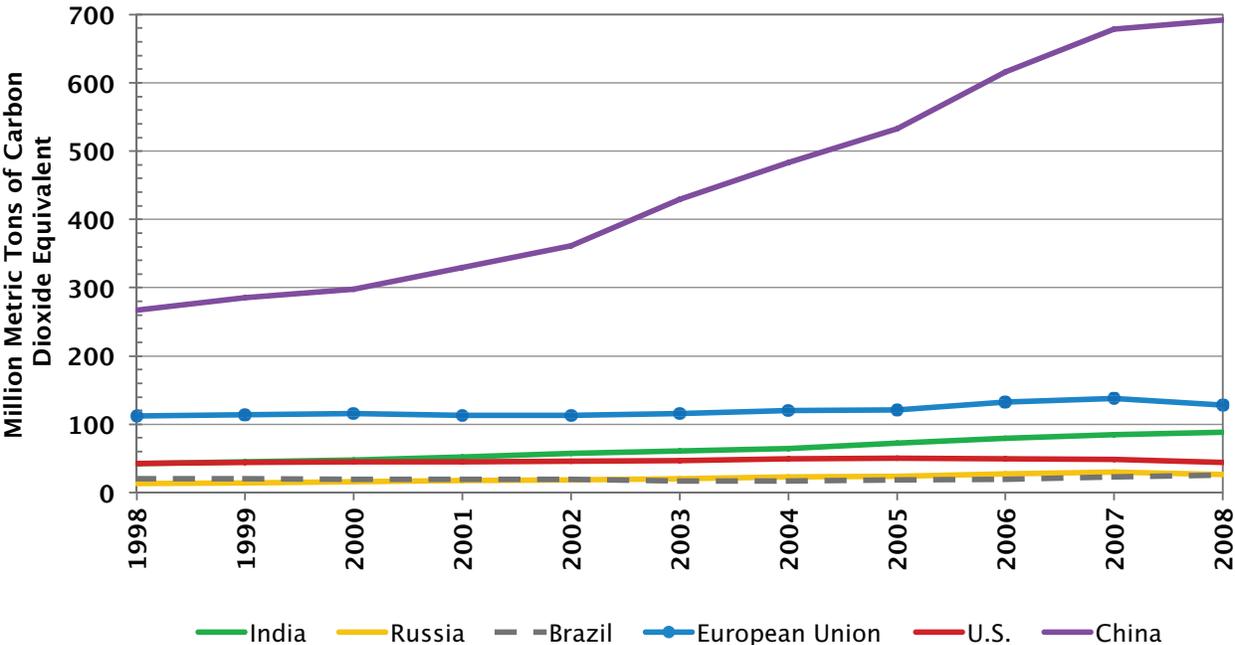
Source(s): World Resources Institute

# China's Industrial Emissions Are Greater Than Other Top Countries Combined

Since 1998, China's industrial emissions have grown more than 159 percent. Over the same period, emissions have grown by 30 percent in Brazil, 105 percent in Russia and 108 percent in India. Meanwhile, the U.S. industrial sector experienced a rise of only 2.6 percent.

This disparity presents both a threat and an opportunity for U.S. companies. These countries' emissions could perhaps continue unchecked, inflicting global damage to our collective air, water and other natural resources. There is an opportunity, however, for U.S. companies to use technological innovations to help all countries reduce their individual emission levels.

**Figure 52** – China's Industrial Emissions Are Greater Than Other Top Countries Combined



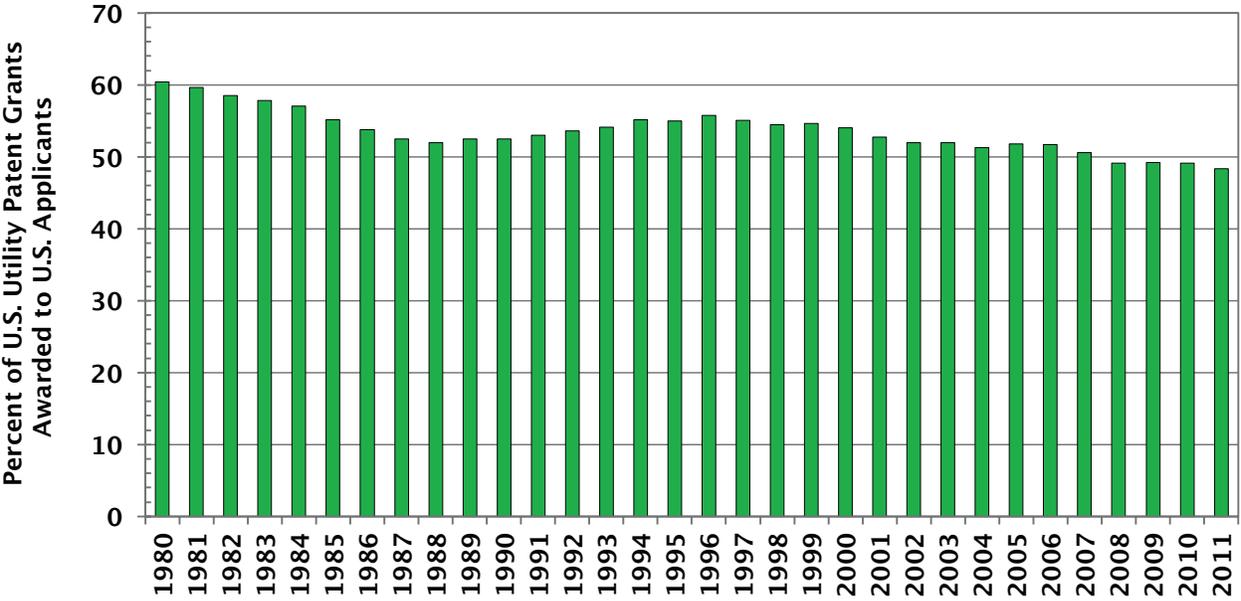
Source(s): World Resources Institute

## U.S. Dominance in Product Innovation Begins to Slip

The manufacturing sector has long been a catalyst for U.S. strength in disruptive, breakthrough innovations. The resulting new and improved products and technologies have shaped existing industries and been instrumental in the formation of new markets. But as developing countries with export-oriented growth strategies have begun to embrace innovation as a means to competitiveness in high-technology product markets, U.S. dominance in disruptive product innovation has been challenged. During 2011, U.S. inventors were awarded 48 percent of all U.S. utility patent grants, well below the 60 percent seen in 1980.

Amid a modest recovery from a deep downturn and an increasingly competitive global business environment, the U.S. must continue to focus on innovation investment and output. We need to develop science and engineering strength within the workforce and put into place the necessary level of public support for inventive activity.

Figure 53 – U.S. Dominance in Product Innovation Begins to Slip

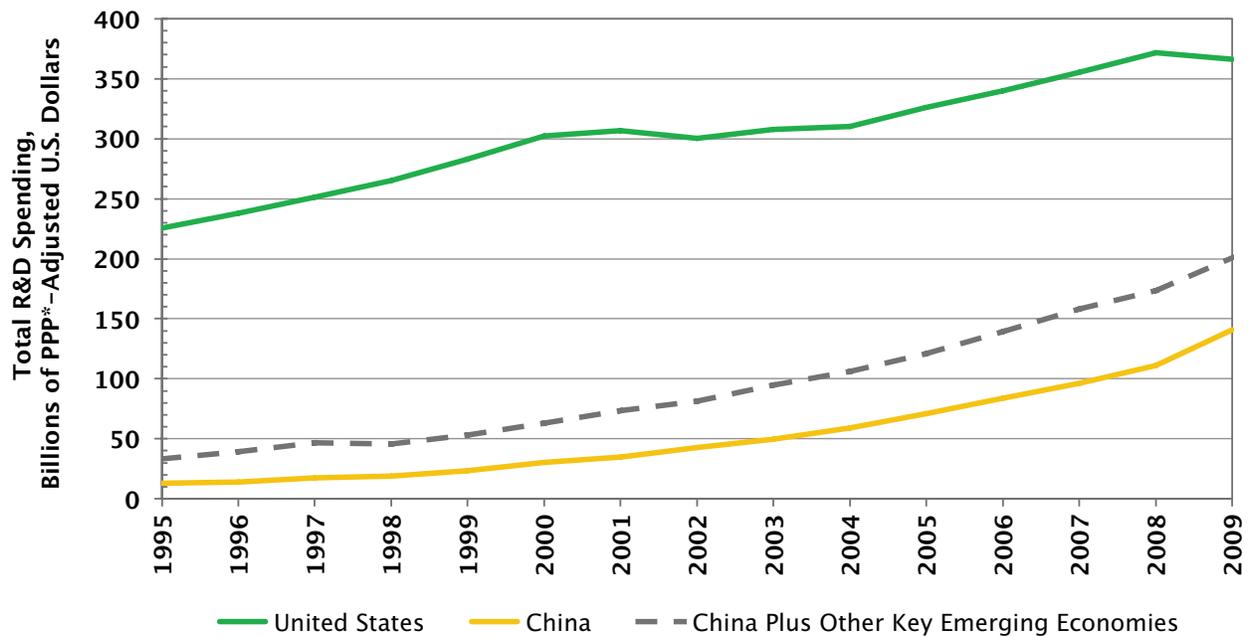


Source(s): U.S. Patent and Trademark Office

## U.S. R&D Spending Lead Over Emerging Markets Narrows

For more than a half-century, the United States has led the world in science and innovation. In today's competitive world, our country can no longer take its supremacy for granted. Aggregate R&D spending by 10 large and fast-growing economies for which reliable data exist reached 55 percent of the U.S. level in 2009, up from 19 percent just 10 years prior. If current trends continue, R&D spending in these key emerging markets may exceed U.S. levels by the end of this decade.

**Figure 54** – U.S. R&D Spending Lead Over Emerging Markets Narrows



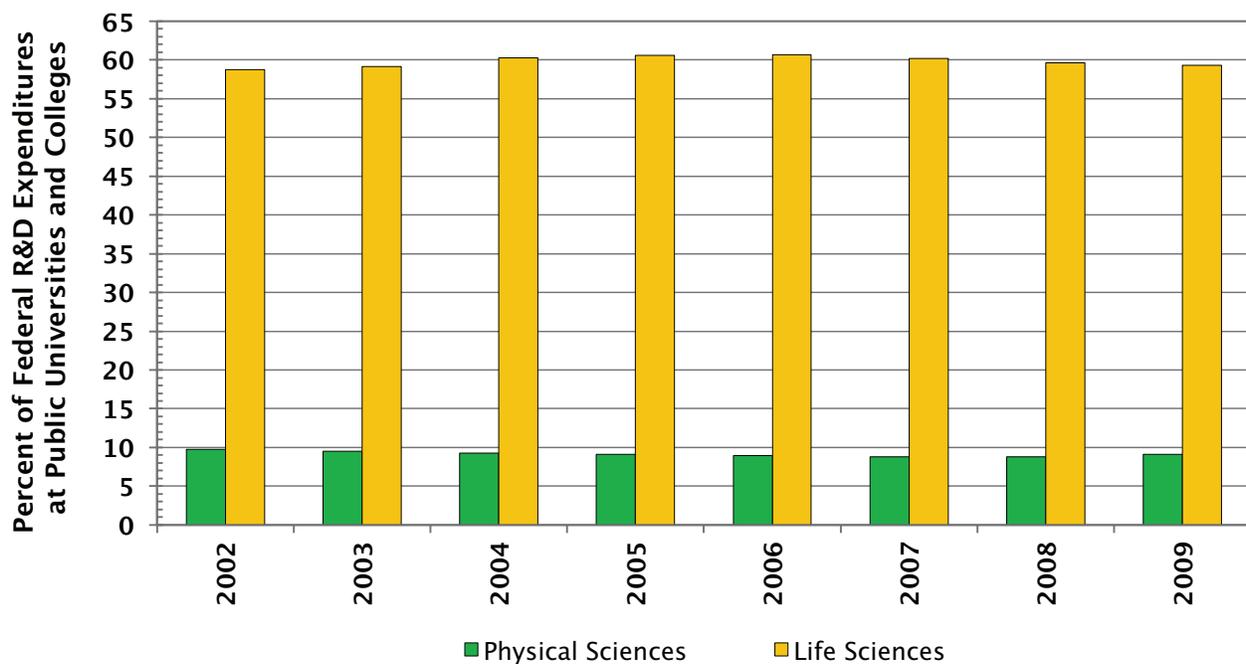
Source(s): Organisation for Economic Co-operation and Development and International Monetary Fund  
 \* PPP = Purchasing Power Parity

## Minimal Change in Federal Funding for Physical and Life Sciences

The share of federal R&D monies awarded for basic research in physical sciences, which declined steadily from 9.7 percent in 2002 to 8.8 percent by 2008, rose modestly to 9.1 percent in 2009. The lion's share of federal funds for basic research is still allocated to the life sciences; however, at 59.3 percent of federal academic R&D monies during 2009, federal investment in this area is down from a recent peak of 60.7 percent during 2006.

Aging populations in the U.S. and other rich nations as well as persistent advancements in medicine will certainly continue to incentivize high levels of federal investment in life science research. But a modestly stronger federal investment in physical science will likely benefit capital goods industries, a segment of manufacturing in which the U.S. is relatively competitive. Public expenditures on basic physical science research may be further motivated by global supply challenges for energy and non-energy raw material inputs.

**Figure 55 – Minimal Change in Federal Funding for Physical and Life Sciences**



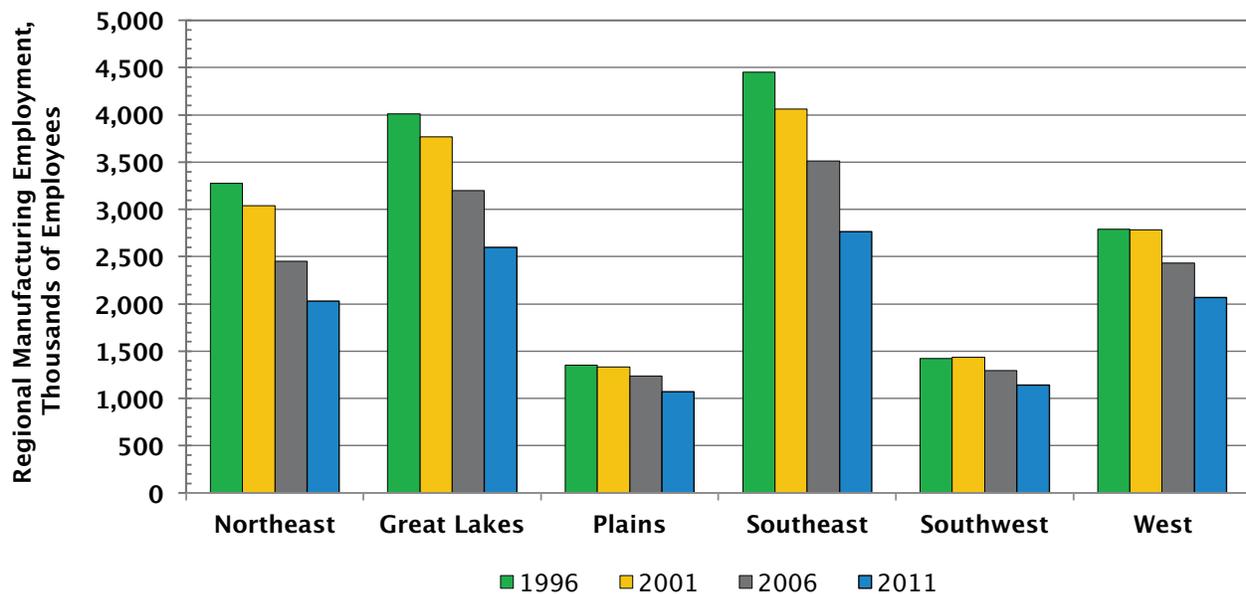
Source(s): National Science Foundation, Survey of Research and Development Expenditures at Universities and Colleges and MAPI

# Skilled Workforce and Employment

## No Region Has Been Immune to the Decline in Manufacturing Employment

Job losses have been a fact of life in the manufacturing sector for well over a decade. No region has escaped the seemingly inexorable decline. Since the mid-1990s, the Southeast alone has lost nearly 1.7 million manufacturing jobs. The Southeast and Great Lakes regions have borne the brunt of the job losses that characterized the Great Recession. The Northeast, which experienced an employment decline at least as severe as that of the Southeast in percentage terms, was more significantly affected by the 2000–2002 manufacturing recession.

**Figure 56** – No Region Has Been Immune to the Decline in Manufacturing Employment



Source(s): U.S. Bureau of Labor Statistics

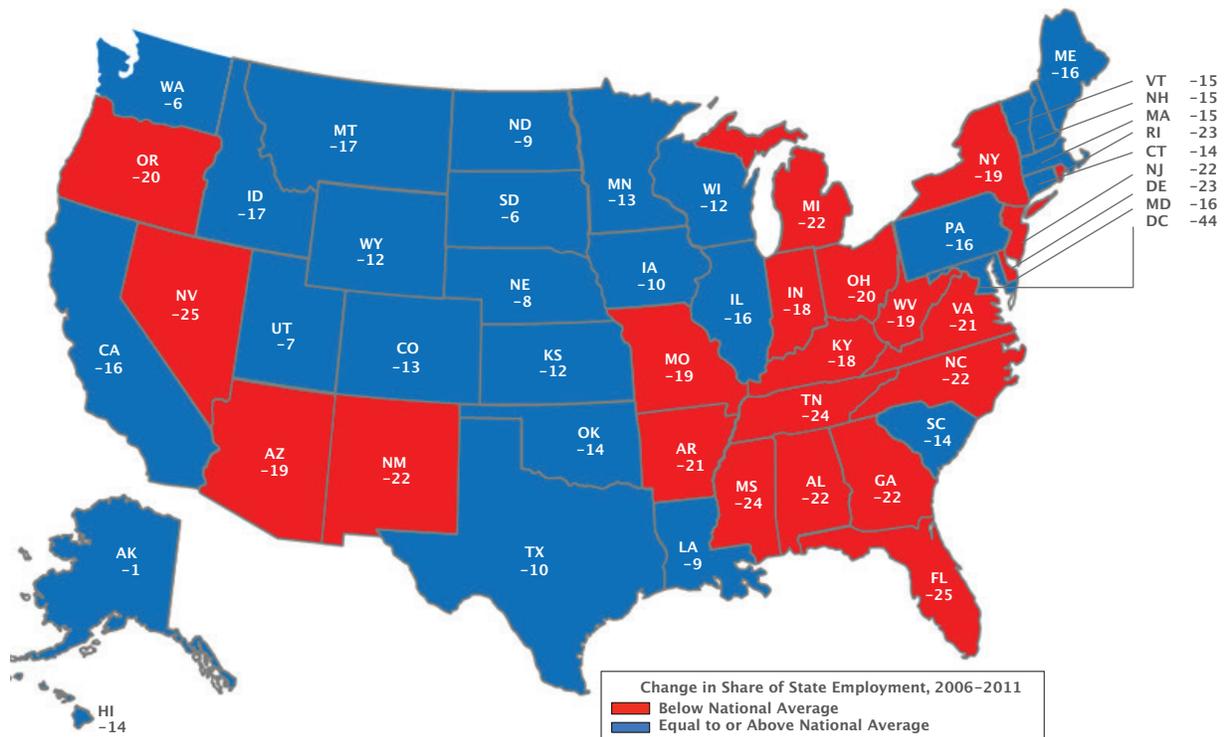
## Manufacturing Job Losses Have Been Most Severe in the Midwest and Southeast

The strong job growth observed in most sectors of the U.S. economy following the 2001 recession was not mirrored in manufacturing. The U.S. trade deficit played a part, as it cut into the manufacturing base in the United States, but so did increasing productivity. Rising capital investment and widespread adoption of new manufacturing techniques demonstrated industry's willingness to adapt to changing circumstances. Lean manufacturing and Six Sigma quality programs created demand for a smaller but more highly skilled workforce.

Data on state employment show that, on average, the number of manufacturing jobs fell by 17 percent over the past five years. Although states in the Midwest and Southeast were hit the hardest, between 2006 and 2011 all states' manufacturing sectors experienced significant job losses.

**Figure 57 – Manufacturing Job Losses Have Been Most Severe in the Midwest and Southeast**

Percentage Change in Manufacturing Employment by State, 2006–2011



Source(s): U.S. Bureau of Labor Statistics

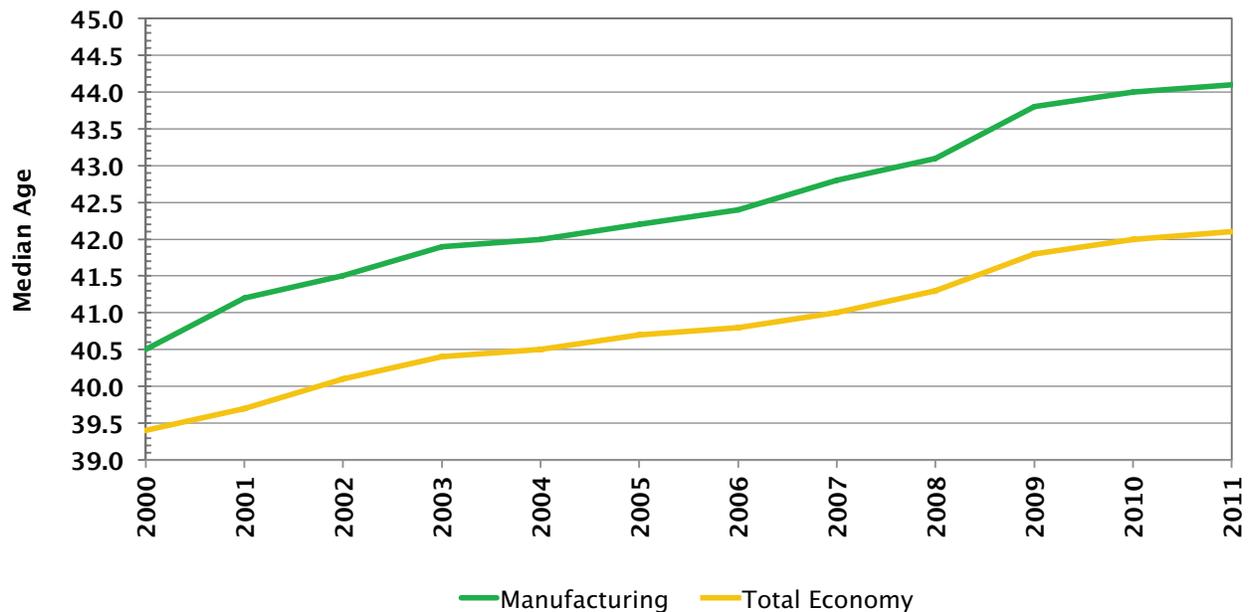
## The Age Gap Between the Manufacturing and the Non-Farm Workforces Widens

The U.S. like other rich nations is in the early stages of a period of dramatic population aging. The share of the population 60 and older increased from 16.8 percent in 1990 to 18.4 percent in 2010; by 2025, United Nations demographers predict that nearly one-quarter of the United States will be in this cohort.

The manufacturing sector appears to be disproportionately experiencing the ramifications of an aging workforce. In 2000, the median age of the manufacturing workforce—at 40.5—was 1.1 years above the median age of the total non-farm workforce. By 2011, this gap nearly doubled, with the median age in manufacturing being 44.1 years versus 42.1 years for the total non-farm workforce.

The U.S. factory sector clearly needs an influx of young talent. In addition to focusing on educational needs, the nation must convince its university graduates and younger workers that there are rewards in a manufacturing career.

**Figure 58** – The Age Gap Between the Manufacturing and the Non-Farm Workforces Widens



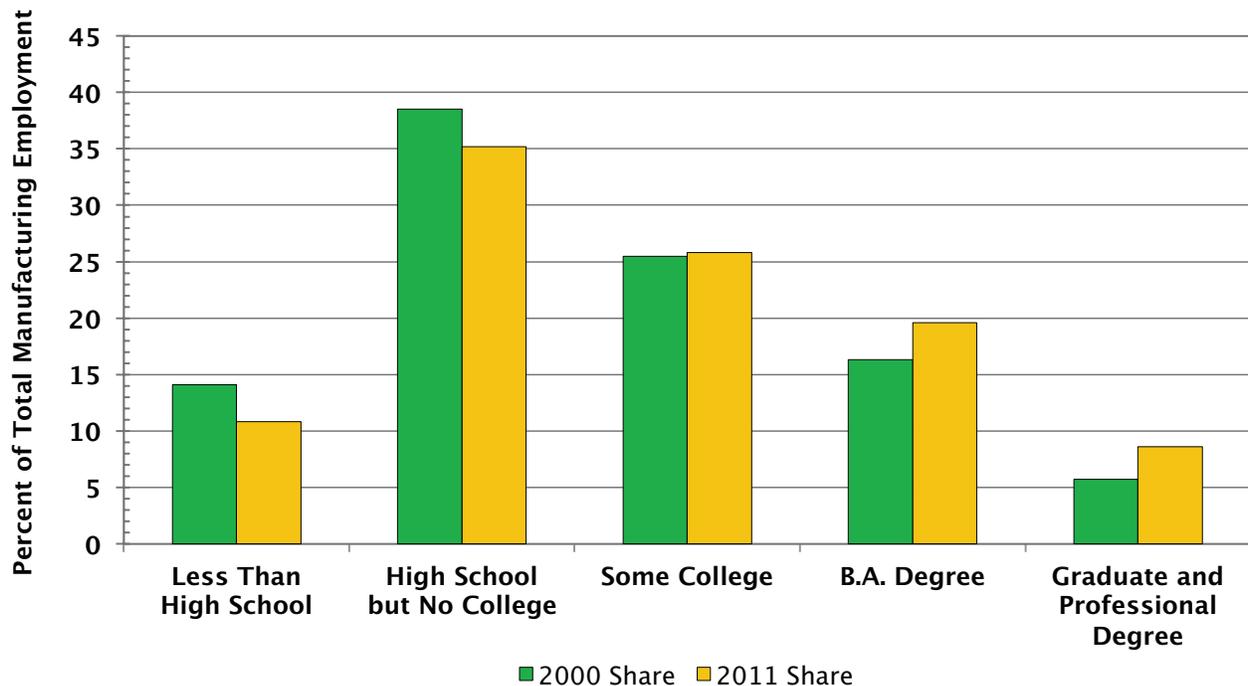
Source(s): U.S. Bureau of Labor Statistics, Current Population Survey

## The Manufacturing Workforce Has Become More Educated

Both the factory sector's increasing technological sophistication and new production paradigms requiring more process- and team-oriented workers have partially catalyzed a change whereby the share of the manufacturing workforce with a B.A. degree has increased from 16.3 percent in 2000 to 19.6 percent in 2011. The share with a graduate and/or professional degree rose from 5.7 percent to 8.6 percent over the same time period.

There has been a marked decline in the share of the U.S. factory workforce with less than a high school education, from 14.1 percent in 2000 to 10.8 percent in 2011. In a difficult post-recession labor market, where employers appear unwilling to take chances on hiring lower-educated and lower-skilled workers, this percentage will almost certainly continue to decline.

**Figure 59** – The Manufacturing Workforce Has Become More Educated



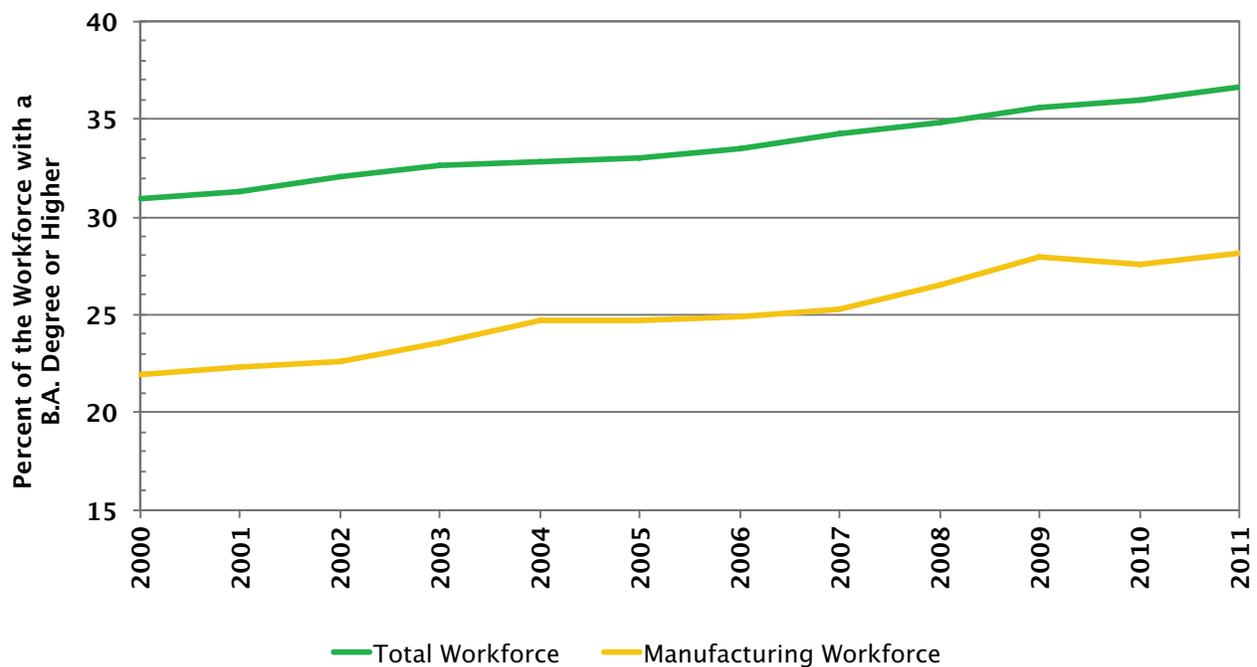
Source(s): U.S. Bureau of Labor Statistics, Current Population Survey and MAPI

## The Manufacturing Workforce Is Behind in Higher Education

While the manufacturing workforce has become more educated, it is still behind the overall economy by some measures of educational attainment. The share of workers with a B.A. degree and higher has risen steadily for both the economy and the manufacturing sector; however, the latest data for 2011 show that the share of the manufacturing workforce with a B.A. degree or higher—28 percent—is nine percentage points below the economy-wide average.

The U.S. needs to educate and train workers with the necessary skills for a technologically and globally oriented factory sector. This will likely require coordination between industry, public schools and post-secondary institutions to better align education with rapidly evolving industry needs. Doing so will create the manufacturing workforce that can generate the product and process innovations universally deemed necessary for thriving in a globally challenging business climate.

**Figure 60** – The Manufacturing Workforce Is Behind in Higher Education



Source(s): U.S. Bureau of Labor Statistics and MAPI

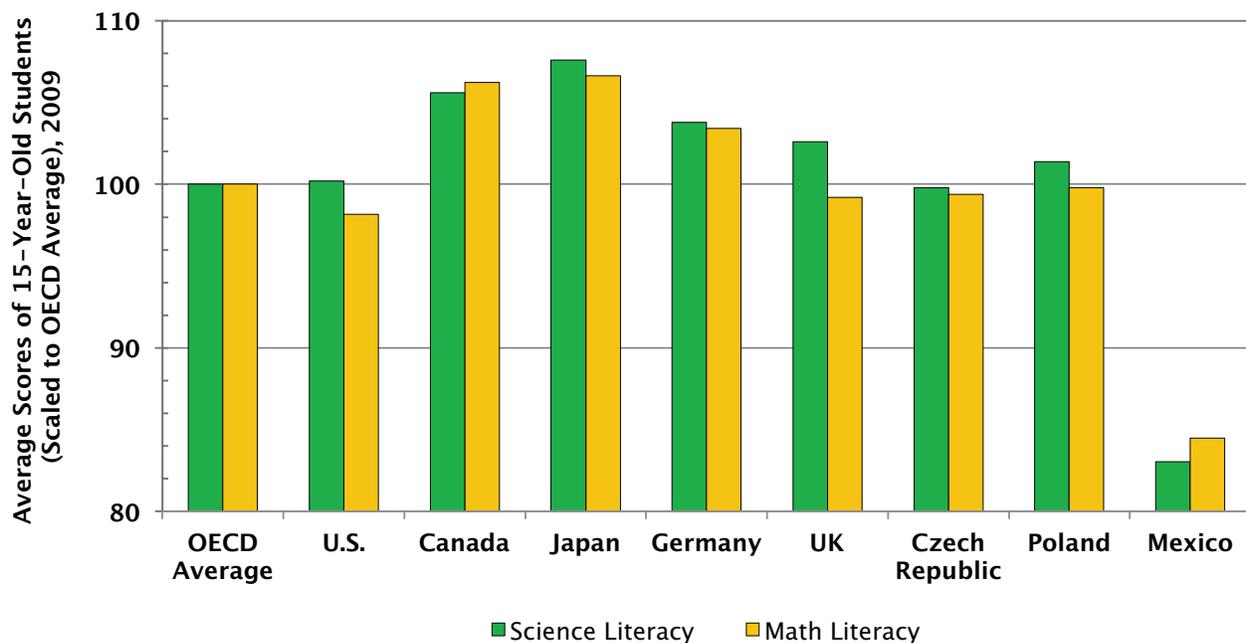
## U.S. Students Are Not Competitive in Math and Science Skills

There is a disturbing gap between the math and science performance of students in the U.S. as compared with our key trade partners and competitors. The figure below depicts the scores of American students against those in a number of industrialized and developing economies that participate in the OECD's Programme for International Student Assessment (PISA). This system of international tests is designed to measure the proficiency of 15-year-olds in such areas as reading and literacy, math and science.

The data in the figure are scaled to an OECD average. As shown, the U.S. is below the OECD average in math literacy and just slightly above in science literacy. In these two areas—which are crucial for manufacturing—our students significantly lag behind their counterparts in Canada, Japan, Germany and the United Kingdom.

The relatively weak math and science aptitude in the U.S. contributes to the dearth of engineering graduates and partially frames the broader challenges for the manufacturing workforce. This problem casts a cloud on the outlook for future U.S. innovation strength. We need to consider making changes in math and science education, from credentialing to teaching methods. There is no intrinsic reason that our students could not perform more competitively in these critical areas if appropriate reforms are put into place.

**Figure 61** – U.S. Students Are Not Competitive in Math and Science Skills



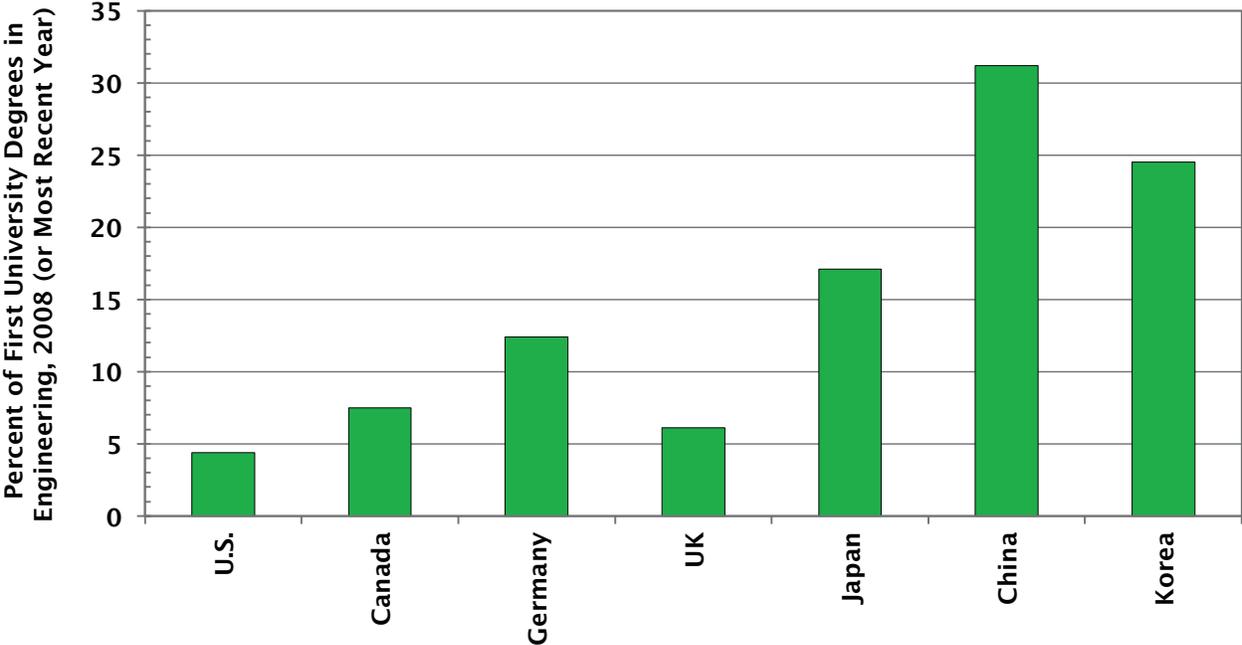
Source(s): U.S. National Center for Education Statistics and MAPI

# The United States Lags Significantly in Graduating Engineers

By any interpretation of recent numbers, the U.S. has a considerable challenge with its engineering workforce. The latest data show that engineering degrees as a share of total first university degrees was a meager 4.4 percent. While the industry-led growth of developing economies such as China and Korea would naturally give rise to a higher share of engineering graduates than in the U.S. and other rich nations, the U.S. engineering graduate share is markedly behind Japan at 17.1 percent and Germany at 12.4 percent.

Even Canada and the UK, whose manufacturing sectors have significant competitive challenges, have higher shares of first university degrees in engineering than the United States. We must bridge this gap or risk declining competitiveness in both disruptive and incremental product innovation.

Figure 62 – The United States Lags Significantly in Graduating Engineers



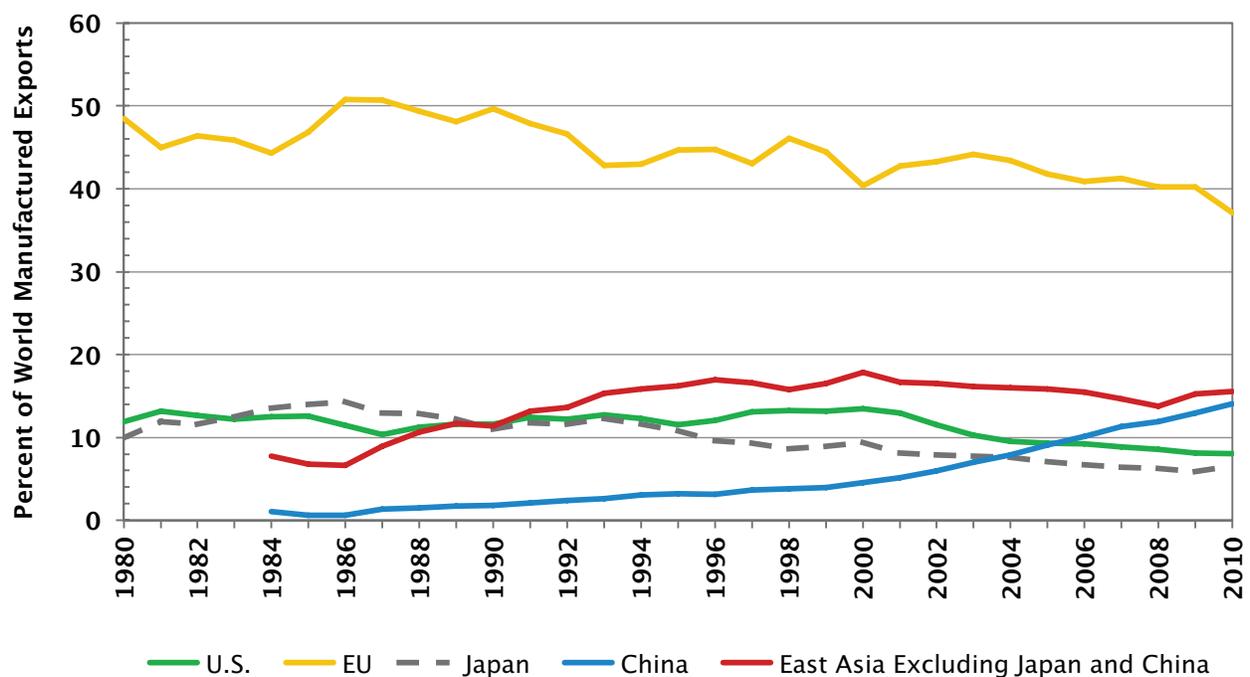
Source(s): National Science Foundation, Science and Engineering Indicators and MAPI

## The U.S. Is Losing Export Market Share

U.S. exports of manufactured goods face strong competition in many markets, particularly from China, which has become a leading exporter in chemicals, textiles, office and telecommunications equipment, and electronic products.

In terms of global market share of manufactured exports, the U.S. share declined from 13 percent in 2000 to 8 percent in 2010, while China's rose from 5 percent to 14 percent; the EU share decreased from 40 percent to 37 percent. Thus, although U.S. exports in manufactured goods have grown steadily in recent years, we have lost market share to even more rapidly growing exports in China and other emerging markets.

**Figure 63** – The U.S. Is Losing Export Market Share



Source(s): World Bank and MAPI calculations

## The Trade Gap Widens for Manufacturers

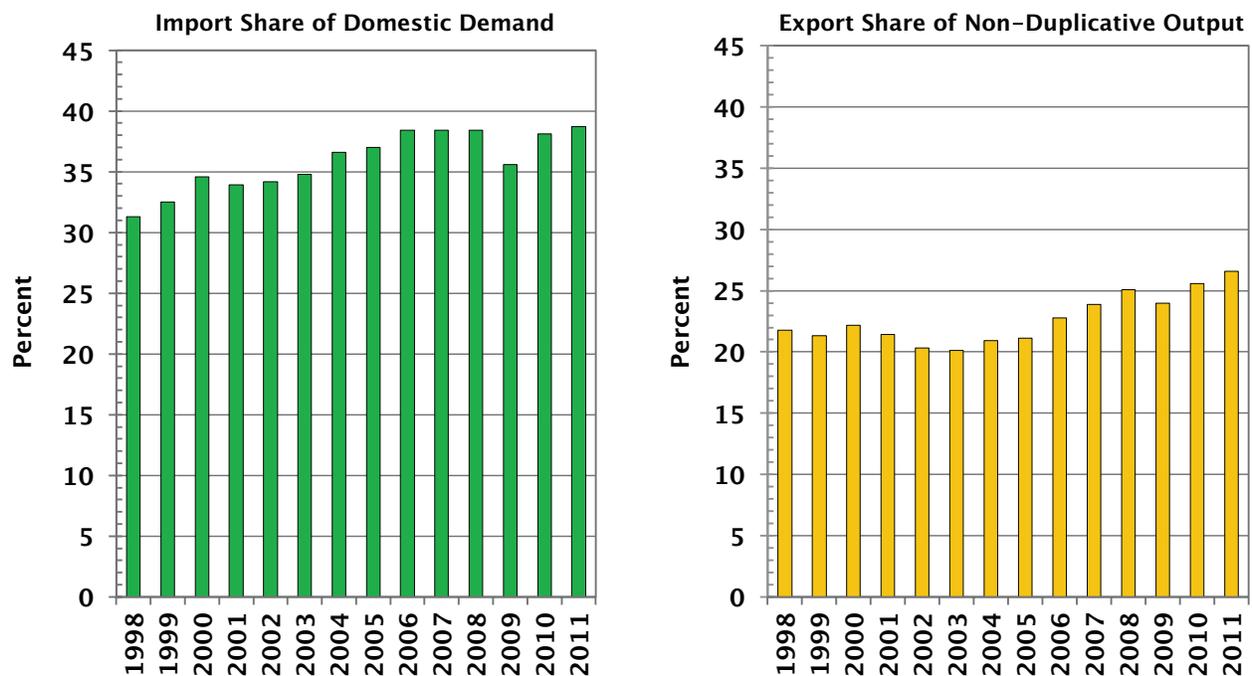
Trade has been rising faster than the overall economy for decades. Just a dozen years ago, imports made up about 32 percent of domestic consumption; they are now 37 percent. Exports' share of non-duplicative output has also edged up.

The reasons for this rising trade intensity remain unchanged from those of centuries past.

Manufacturing stays highly productive while merchandise commerce becomes more cost-effective over time. For example, with transportation costs, advances in intermodal shipping allow goods to move quickly and inexpensively virtually across the globe. Cross-border manufacturing and sourcing bring the production process closer to the ultimate consumer. As a result, the variety of products offered increases while their prices tend to decline relative to those products that are not traded across borders.

Movements in exchange rates shape trade direction in the short term. For example, the past decade's steady rise in the percentage of domestic production that was sold abroad can be traced to trends in exchange rates. From 2003 until 2011, the dollar depreciated 15 percent; the share of manufacturing production exported, however, rose from just more than 20 percent to about 27 percent between 1998 and 2011.

**Figure 64 – The Trade Gap Widens for Manufacturers**

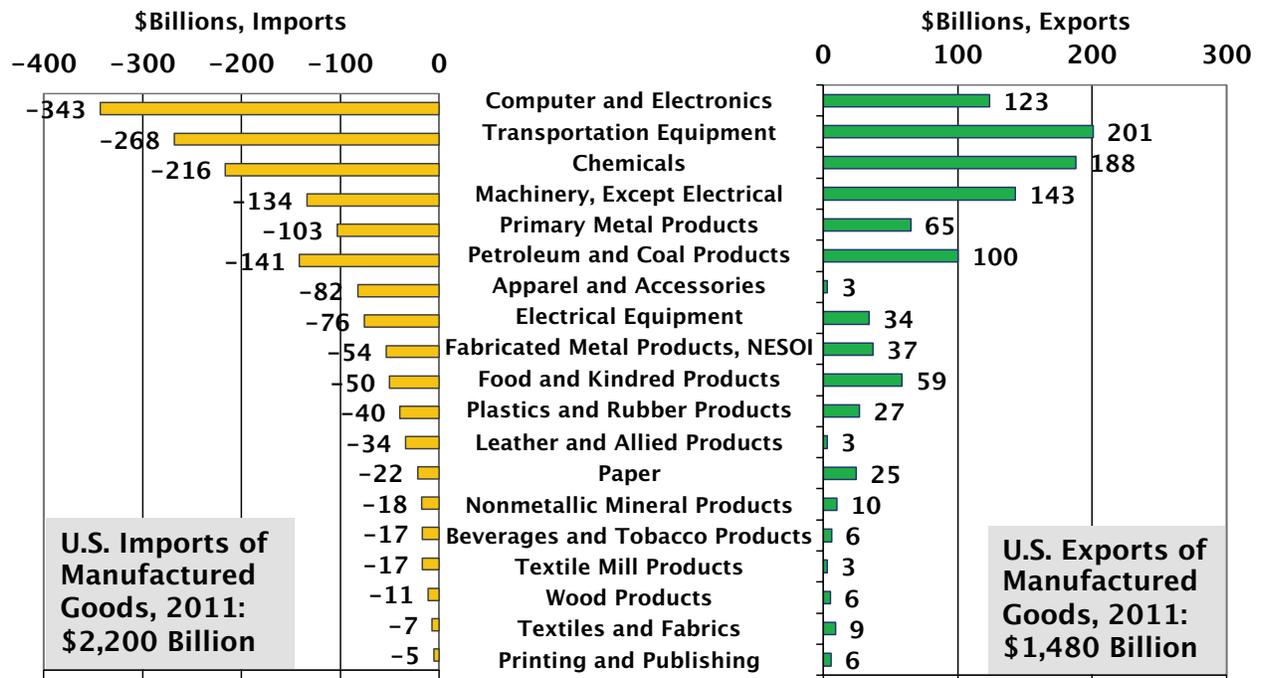


Source(s): U.S. Bureau of Economic Analysis, Input-Output Tables and MAPI

## A Few Core Industries Dominate Foreign Trade in Manufactures

The United States runs a trade deficit that is primarily explained by oil imports and a persistent imbalance with China; further, we export roughly the same types of goods that we import. When measured by value, the top-six categories closely overlap. Most are highly processed durable goods, such as computers and electronics, transportation equipment (airplanes, aerospace and automobiles) and machinery. These goods embody relatively elevated value-added per employee. Highly processed nondurables also figure prominently in trade, including chemicals. On the other side of the spectrum lie products like printed texts, textiles and nonmetallics, which are not heavily traded.

**Figure 65 – A Few Core Industries Dominate Foreign Trade in Manufactures**



Source(s): U.S. International Trade Commission and MAPI