

Stabilization of the U.S. Manufacturing Sector and Its Impact on Industrial Space



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Executive Summary

This research report examines expected growth in the U.S. manufacturing sector and its impact on industrial space. It identifies specific manufacturing industries and products that are anticipated to grow/re-shore in the U.S. during the next five to 10 years, and also quantifies the future space requirements for those industries. The outlook for the industrial sector is measured in four general ways: by examining percent contribution to Gross Domestic Product (GDP); employment numbers; production output in dollars; and trade in goods and services.

The manufacturing sector was once robust in both the number of people it employed and the amount of output it produced. The most growth occurred during World War II, much of which stemmed from the production of war supplies. Between 1979 and 2009, manufacturing declined as a result of both technological displacement and the rise in production in countries where wages were lower. Off-shoring of production facilities was also hastened by technological improvements that made transportation of the produced goods very affordable. As a result, the manufacturing industry experienced a mass exodus of production outside of the United States to more cost effective countries, and the U.S. manufacturing industry suffered significant job losses during those years.

Since 2009, U.S. manufacturing industries have recorded rises in both total production output and employment, and this trend has been called the “re-shoring” of manufacturing. Two of the main reasons for this return of manufacturing have been the continued rise in wages in countries like China, where manufacturing has been taking place more recently, as well as the steady rise in transportation costs. The top manufacturing export nations and the products they sell to other countries are listed in Figure A below.

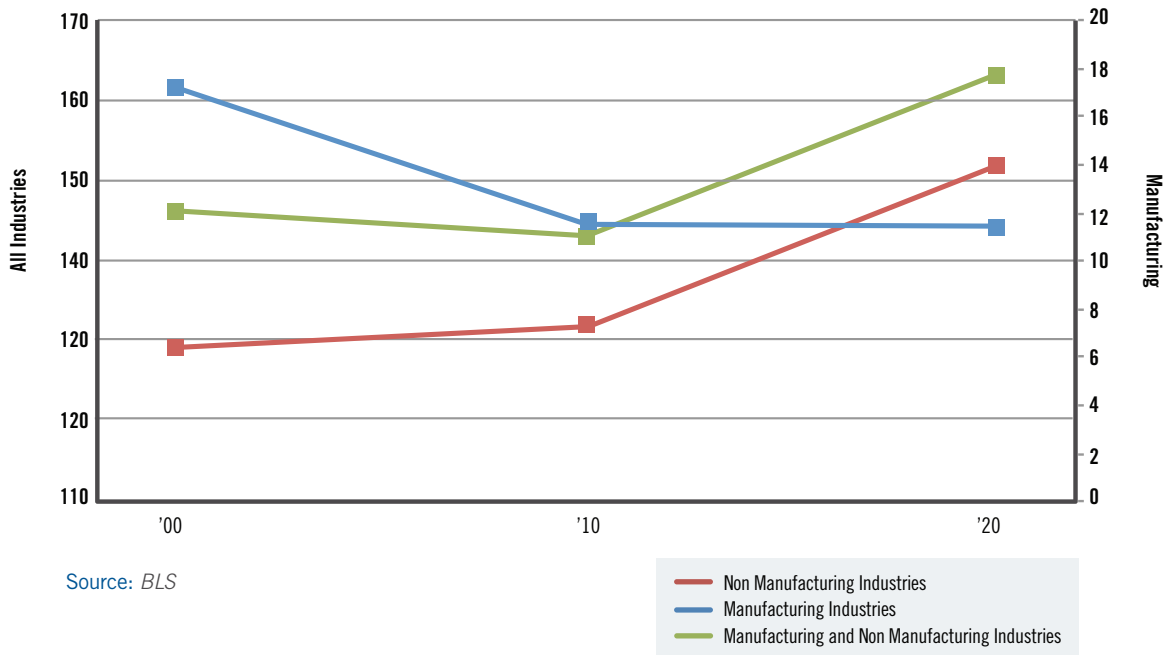
Manufacturing Ranks	Products
China	Toys, apparel, electrical and electronics
Germany	Machine, plant, electronics and automotive
U.S.	Automotive, chemical, ethanol, computer and transportation
India	Textile, engineering goods and chemicals
South Korea	Electronics, semiconductors, LCD panels and mobile phones

Source: Deloitte 2013 Global Manufacturing Competitiveness Index

Key Finding

The changes that have occurred since 2009 require government and the private sector to plan for modification within manufacturing in the coming decade. This report describes the major trends affecting manufacturing since the start of the re-shoring and discusses how these changes will affect industrial real estate demand. The key finding of this study is that manufacturing employment losses of the past decades will stabilize between 2010 and 2020, in the aggregate, for the manufacturing sector as seen in Figure B. Some manufacturing industries will contract while others expand, resulting in net stabilization of manufacturing jobs.

Figure B
Manufacturing Employment, 2000–2020
(Jobs in Millions)



Manufacturing and GDP, Employment, and Output

Manufacturing plays a pivotal role in the nation's Gross Domestic Product (GDP), as half of all U.S. exports are manufactured goods. Manufacturing employment serves as a key indicator for illustration of this re-shoring trend. While manufacturing employment in the aggregate will continue to stabilize, specific industries are poised for job gains. Indicators that describe this transition include the following:

- **GDP Trends:** Every manufacturing sector—except for computers and electronics and petroleum and coal products—declined as a **share of GDP** between 1977 and 2010. However, over that time period, **GDP value added** increased for computers and electronics; machinery; fabricated metal; chemicals; food manufacturing; beverage and tobacco products; and petroleum and coal products.

- **Employment Projections:** Manufacturing employment is forecast to stabilize between 2010 and 2020 with growth in fabricated metals, plastics and rubber, nonmetallic mineral, wood, and furniture product manufacturing industries. In the aggregate, manufacturing employment will stabilize, instead of continuing the contraction posted during the previous two decades.
- **Output Projections:** Growth will occur at the same pace as the overall economy in computer and electronics, transportation equipment, chemical, petroleum, and food product manufacturing between 2010 and 2020, after having grown at a slower pace than the overall economy for some time.

Products

In order to understand what manufacturing industries will grow, we must also understand which products are likely to re-shore in the coming decade. In the past, the products requiring less labor to produce, such as chemicals and technology, have remained in the U.S., while more labor intensive products, such as apparel, were produced elsewhere. These trends are expected to continue during the next decade. Labor intensive industries tend to be those requiring more labor than capital costs. Less labor intensive products include chemicals, transportation equipment, computers and electronic products, and machinery manufacturing.

Demand for Space

The level of employment in manufacturing industries has a direct impact on demand for space. Examining average square feet per employee and the forecasted number of employees in each manufacturing industry, enables one to calculate the implication of this re-shoring trend for real estate products. Key aspects of this forecast include:

- **Square Feet by Industry:** Of the 20 manufacturing industries surveyed, only three—food products, beverages and tobacco products, and transportation equipment products—saw growth in their use of space between 1998 and 2006. The remaining 17 industries used less space in 2006 than they did in 1998, and quite a few of these industries experienced significant declines. Based on Energy Information Administration (EIA) data, average square feet per employee figures range from 250 to 1,400. At the low end of the range are industries such as computer, food, and petroleum manufacturing, carrying out tasks that require nominal amounts of space. At the high end of the range are industries such as furniture, textile, or primary metal manufacturing that use more equipment, resulting in the need for more space per employee.
- **Inventory Forecast:** Two distinct projection metrics show a need for similar levels of space for the manufacturing sector. The calculation based on historical averages predicts that manufacturing will require 11.2 billion square feet of space by 2020. The calculation based on the most recent inventory figures predicts that more than 10.2 billion square feet of space will be required. The difference between the two calculations is less than 10 percent.
- **Industry Demand:** The industries projected to require additional manufacturing space include fabricated metals, plastics, wood, nonmetallic mineral, and furniture products. The industries projected to decrease their use of manufacturing space are computer and electronic products, chemical products, apparel, electrical products, and textiles.

Geographic Implications

Historically, there have been major manufacturing centers, as well as smaller manufacturing communities, away from the major hubs. During the next decade, a large shift is expected to metropolitan areas where the re-shored manufacturing will be carried out. Companies are expected to choose more strategic locations for their facilities so that they can decrease transportation costs that have risen steadily during the years. Manufacturers want to be close to population centers so their finished products are closer to consumers and they have access to both skilled and cheap labor. Additionally, proximity to ports decreases transportation costs for items entering and exiting the U.S. With most of the growth industries in the durable goods manufacturing subsector, the current employment base suggests the following U.S. regional concentration patterns:

- Wood product: Southeast and Far West;
- Nonmetallic mineral product: Southeast and Great Lakes;
- Primary metal: Great Lakes and Southeast;
- Fabricated metal product: Great Lakes and Southeast,
- Transportation equipment: Southeast and Far West;
- Furniture and related product: Southeast and Great Lakes;
- Food manufacturing: Southeast and Great Lakes;
- Plastics and rubber products: Great Lakes and Southeast.

When all the data is combined, it is clear to see that wood product, nonmetallic mineral product, furniture and related product, and plastic and rubber products exhibit the most growth potential across a variety of measures. Figure C summarizes expectations for key indicators.

Figure C Industry Outlook Summary, 2013–2020			
Sector/Subsector/Industry	Contribution to GDP	Employment	Output
Manufacturing			
Durable goods manufacturing			
Wood product manufacturing	Level	Up	Up
Nonmetallic mineral product manufacturing	Level	Up	Up
Primary metal manufacturing	Down	Level	Up
Fabricated metal product manufacturing	Down	Up	Up
Transportation equipment manufacturing	Down	Level	Up
Furniture and related product manufacturing	Level	Up	Up
Nondurable goods manufacturing			
Food manufacturing	Down	Up	Up
Plastics and rubber products manufacturing	Level	Up	Up

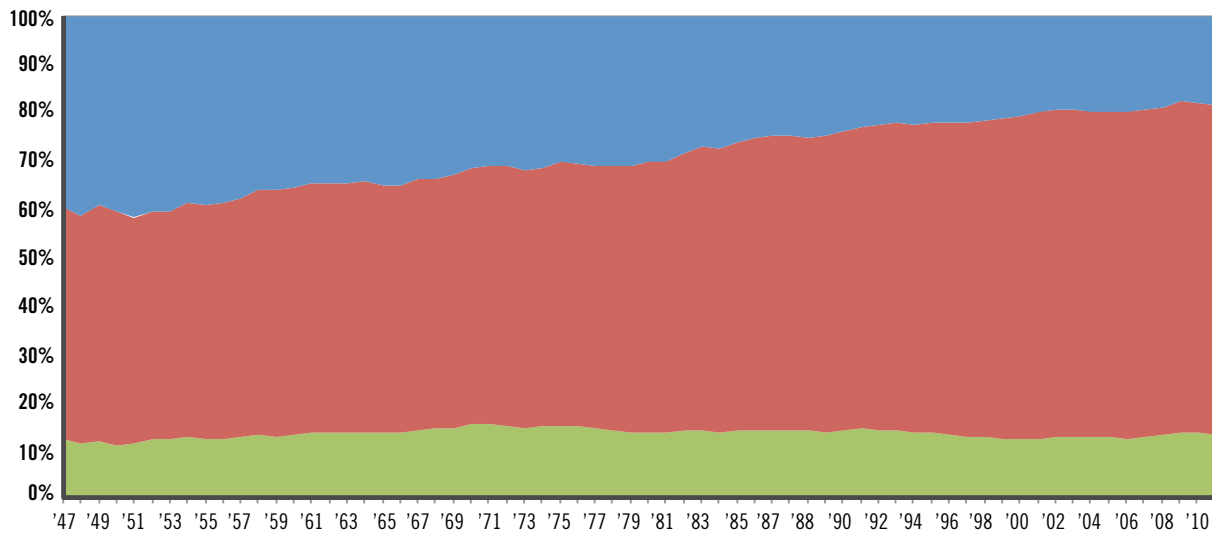
1. Manufacturing Growth in the U.S.

Between June 1979 and December 2009, the manufacturing industry lost nearly 41 percent of its jobs to increased production in countries with cheaper manufacturing costs, such as China, and to the Great Recession, which caused a large decline in national production. Since 2009, as the economy began to rebound, there have been improvements in the manufacturing industry. For multiple reasons, including rising wages, political instability in countries where products were previously manufactured, and rising costs surrounding transportation of products, some companies have found that it is now more economical to manufacture within the U.S. This shift has led to a so called “re-shoring.”

The Super Sectors and GDP

In order to understand the future of the manufacturing sector and its effects on industrial real estate, one must first understand the industry’s past broad trends and its role in the U.S. economy. Goods-producing industries, including manufacturing, have decreased as a share of GDP during the last half century; however, this focus on GDP’s declining share misses an important point. Although the share has declined, and employment has dropped in absolute terms, manufacturing output has increased.

Figure 1
Percent GDP Contribution by Super Sector, 1947–2011



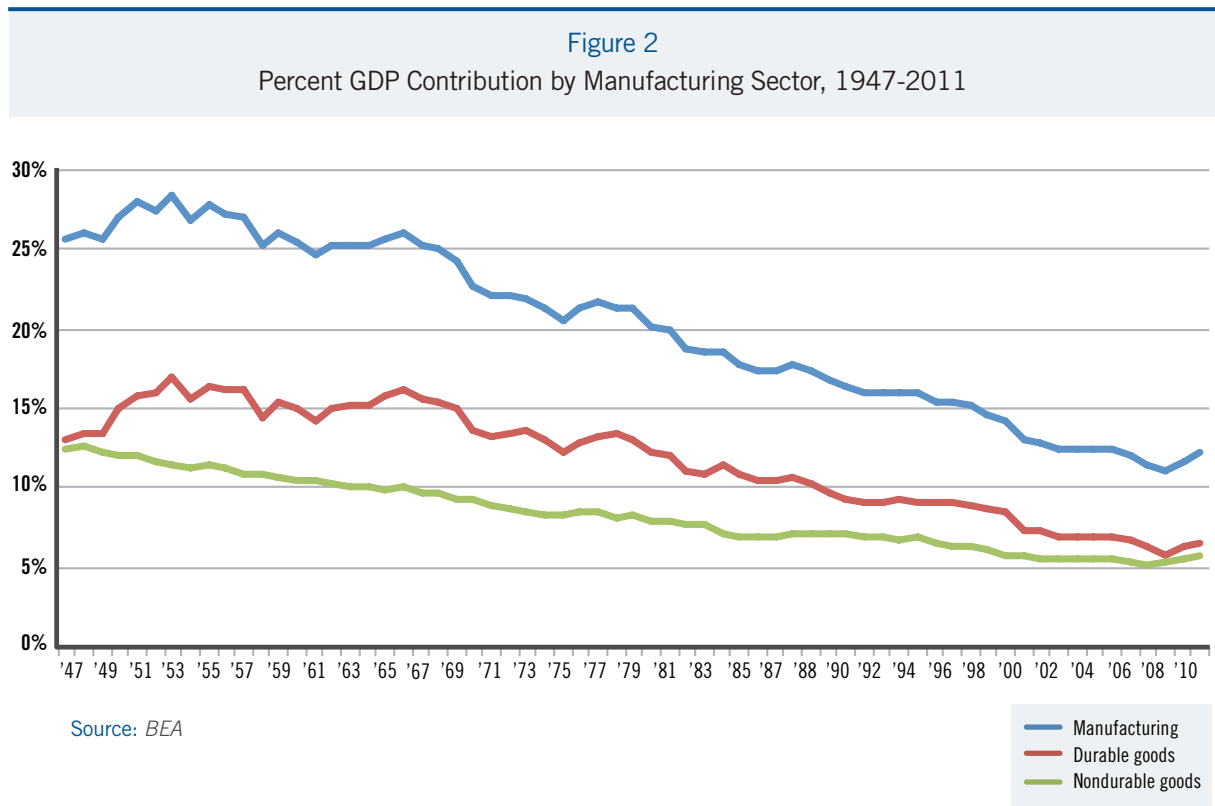
Source: Bureau of Economic Analysis (BEA)



The shift that the U.S. experienced since World War II, as the country moved toward a service-based economy, can be seen more clearly when one looks at the percent contribution to U.S. GDP of the three Super Sectors: goods-producing industries, service-producing industries, and government. As shown in Figure 1, the government sector has contributed about the same amount every year since 1947, between 12 and 15 percent. The other two sectors have posted dramatic changes. In 1947, goods-producing industries contributed about 40 percent of GDP, while service-producing industries contributed about 50 percent. Since 1947, the service-producing industries have grown steadily to about 80 percent of GDP in 2009, while the goods-producing industries shrank to about 20 percent of GDP. Much of the decline in goods-producing industries has resulted from moving production to countries with lower wages. The current inversion of this wage gap, along with rises in shipping costs, has paved the way for our current re-shoring trend.

GDP for the Manufacturing Sector

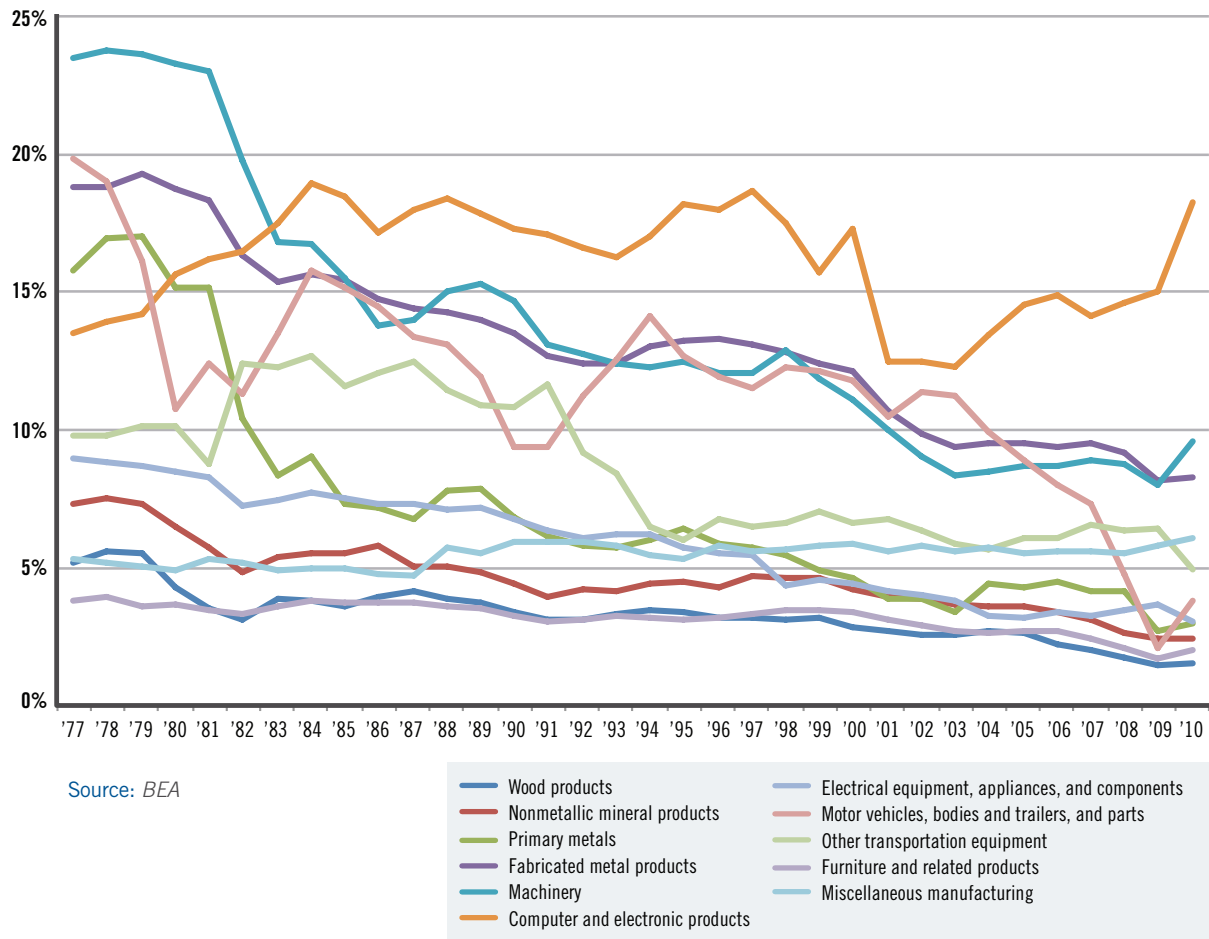
Looking at manufacturing sector trends within the goods-producing industries shows that since World War II, manufacturing has also declined as a share of GDP. This decline has not been the same across the durable and nondurable goods industries. The contribution to GDP from nondurable goods has declined rather steadily, falling by more than 50 percent since 1947. Durable goods, on the other hand, have not posted a steady decline. Durable goods rose from the 1947 percentage share of GDP until 1970, and then began to decline, eventually decreasing to 50 percent of the 1947 percentage in 2009.



Durable Goods and GDP

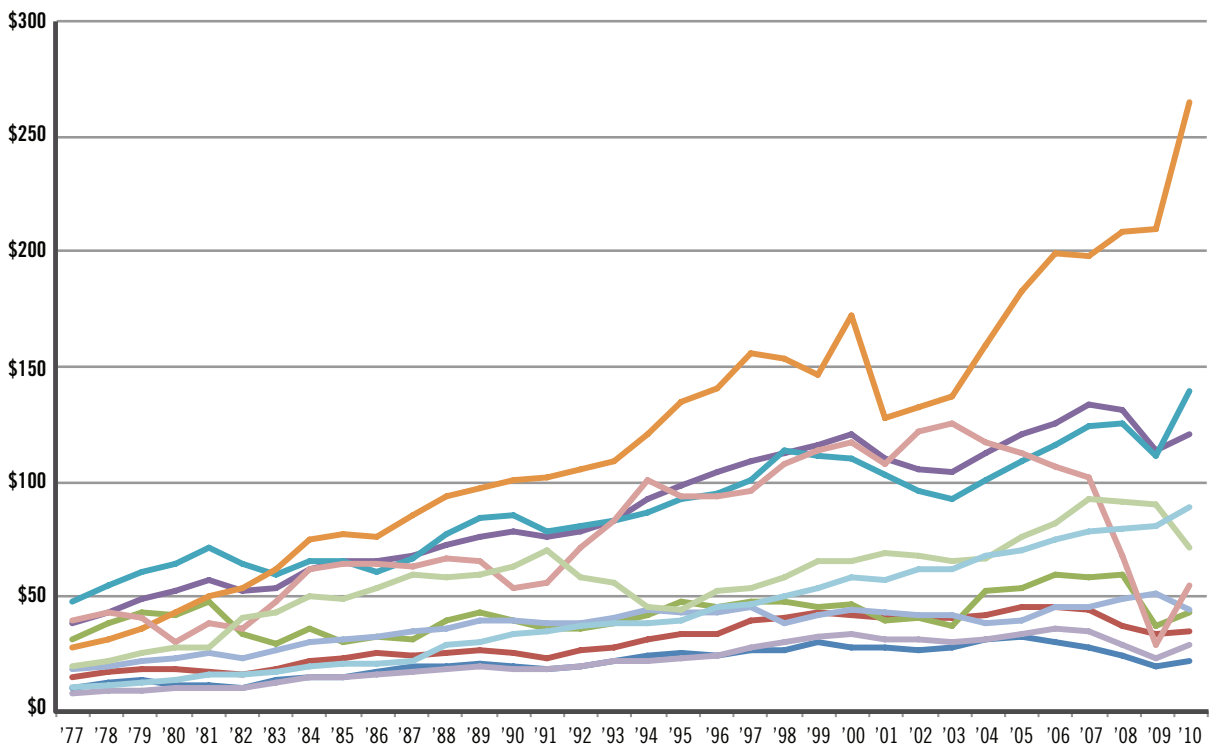
Durable goods share of GDP has decreased since 1977 for most industries except computer and electronic products. The graph below shows how the percentage of GDP of each category of detailed durable goods has changed between 1977 and 2010. Of the 10 industries portrayed, eight declined. The industries that declined were wood products, nonmetallic mineral products, primary metals, fabricated metal products, machinery, motor vehicles and parts, other transportation equipment, and furniture. The only industries that grew between 1977 and 2010 were computer and electronic products, and electrical equipment, appliances, and components.

Figure 3
Percent GDP Contribution by Durable Goods Industries, 1977-2010



The value added to GDP for detailed durable goods industries shows computer and electronic products, machinery and fabricated metal products growing. Although many products have posted decreases in terms of the percentage contributed to GDP, almost all of the products have recorded increases relative to the amount of value added to GDP since 1977. The reason for this is that although the products have increased the amount they add to GDP, they have not increased at the same rate of GDP, and thus their percentage decreased. The goods increased the most in value added to GDP were computer and electronic products, as well as electronic equipment and appliances and fabricated metal and machinery.

Figure 4
GDP Contribution, Durable Goods, 1977-2010
 (Value Added in Billions of Dollars)



Source: BEA

- Wood products
- Nonmetallic mineral products
- Primary metals
- Fabricated metal products
- Machinery
- Computer and electronic products
- Electrical equipment, appliances, and components
- Motor vehicles, bodies and trailers, and parts
- Other transportation equipment
- Furniture and related products
- Miscellaneous manufacturing

Nondurable Goods and GDP

As shown below, the detailed nondurable goods share of GDP has decreased since 1977 for most industries, except petroleum and coal products. Unlike durable goods, nondurable goods have registered decreased percentages of GDP at a much steadier pace. Besides petroleum, every other nondurable goods category has decreased since 1977. The products that held larger shares in 1977—food and beverage products and chemical products—fluctuated regularly, and even increased between certain years. The products that contributed lower shares to GDP, on the other hand, decreased at a relatively stable rate, and increased much less frequently, illustrating stable demand for cheaper goods and fluctuations for more expensive ones that are more volatile.

Figure 5
Percent GDP Contribution by Nondurable Goods Industries, 1977-2010

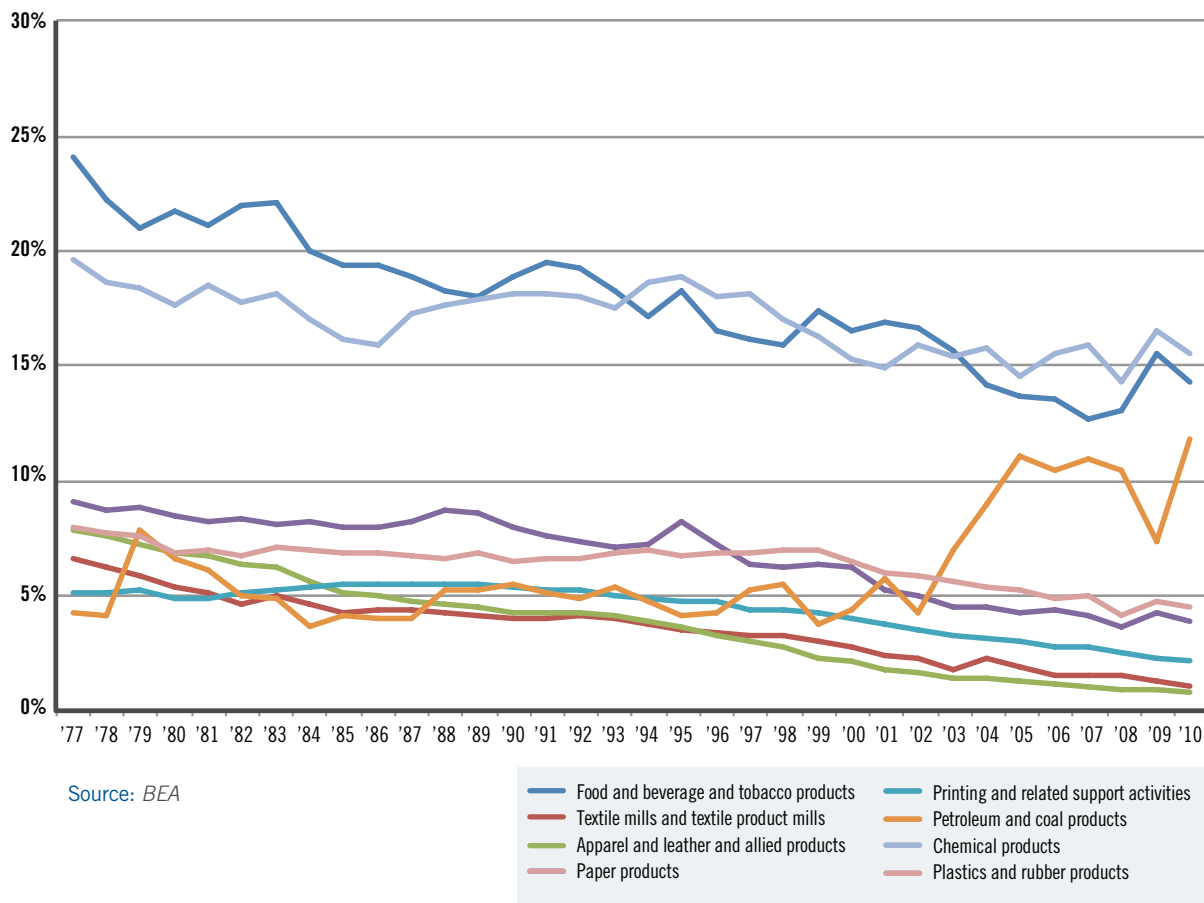
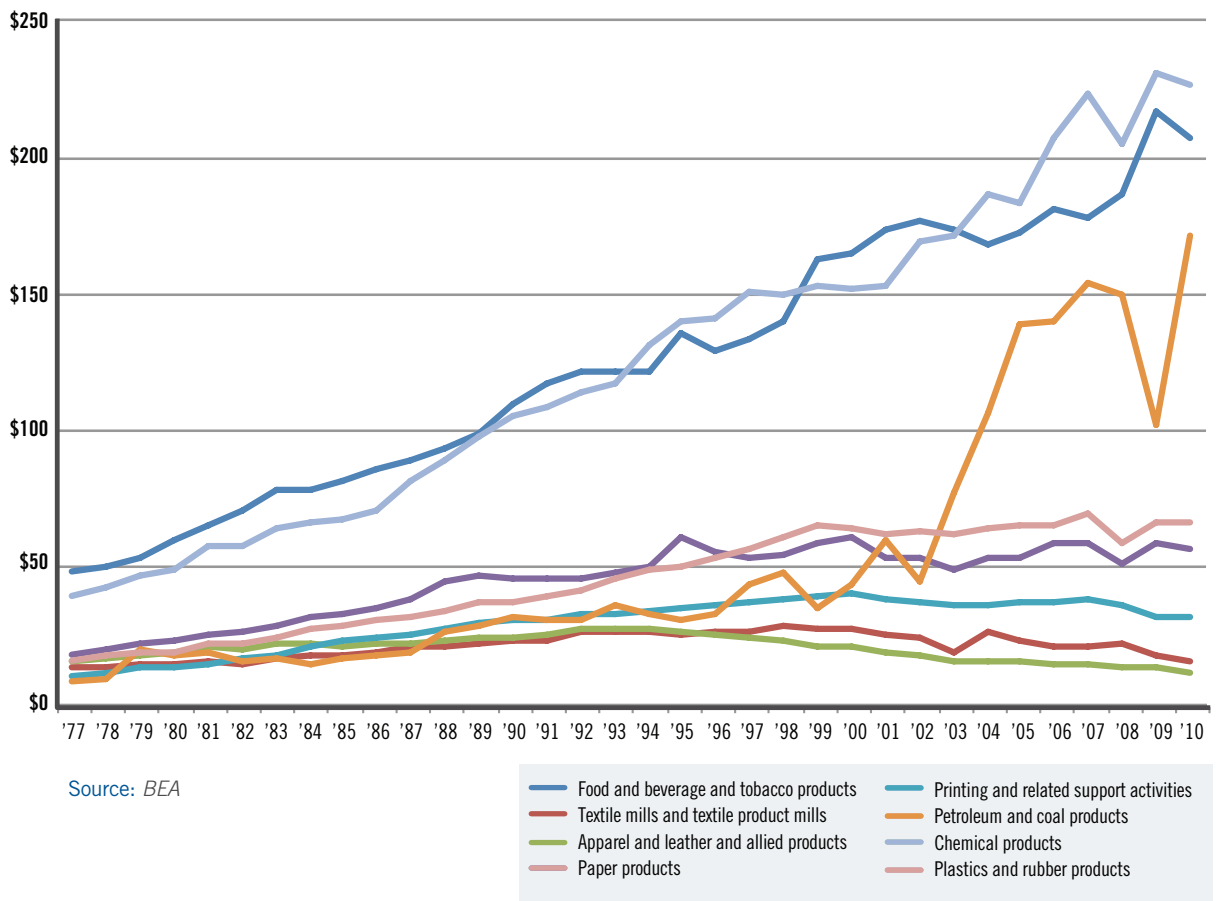


Figure 6 illustrates the value added to GDP for detailed nondurable goods industries, indicating that chemical products, food and beverage and tobacco products, and petroleum and coal products industries are growing. In contrast to durable goods, all but apparel has increased its value added to GDP since 1977. This decrease in value added to GDP for apparel can be seen as either a reason for or by-product of the mass exodus of apparel production to lower wage countries, which began around 1970. Food, beverage, tobacco products, chemical products, and petroleum products, have all increased their value added to GDP by great amounts, while the other products increased less substantially.

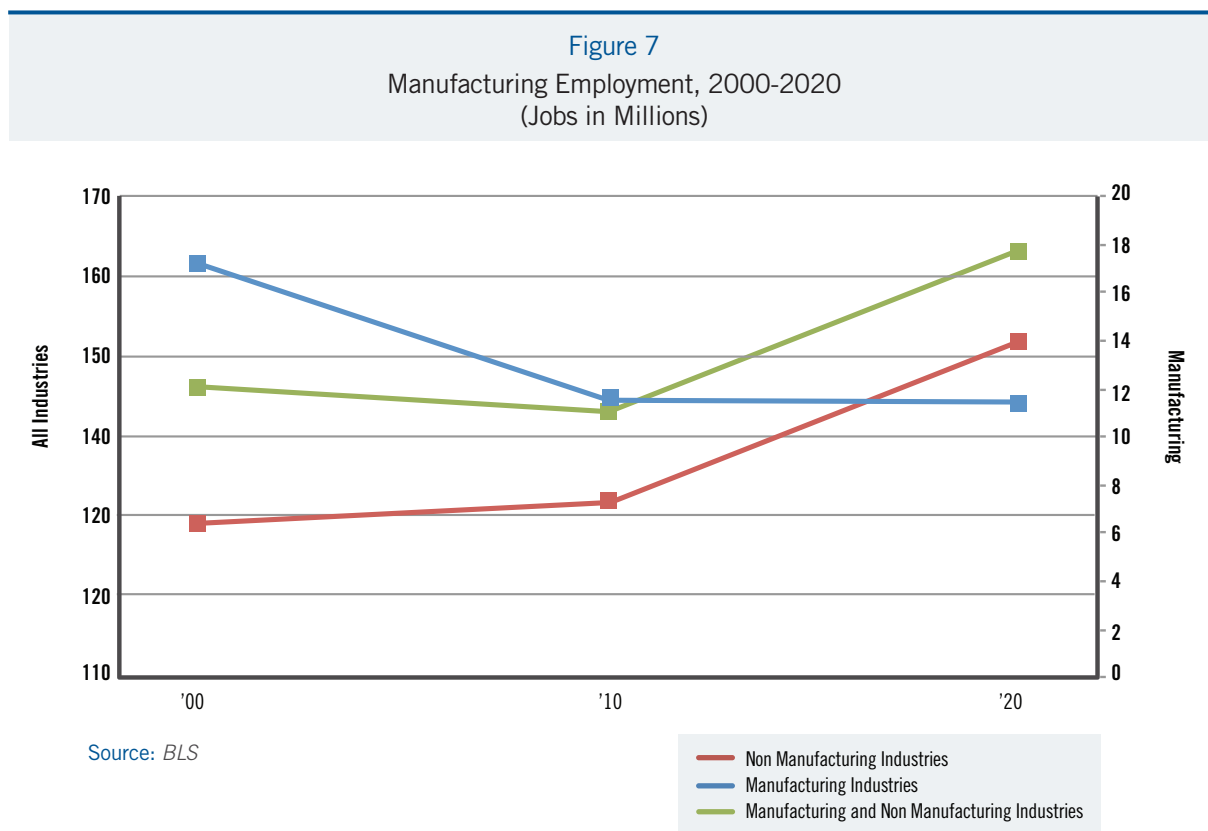
Figure 6
GDP Contribution, Nondurable Goods, 1977-2010
 (Value Added in Billions of Dollars)



Manufacturing Sector Employment

Figure 7 indicates that employment for all industries will grow to 163 million jobs from a current 2010 level of 143 million by 2020. The manufacturing sector will decelerate its historic decline, stabilizing at a level of roughly 11 million between 2010 and 2020. The graph shows the decrease in manufacturing jobs between 2000 and 2010, during which the manufacturing industries lost about 6 million jobs. This decrease is part of a trend that began in 1970, as jobs in textiles, apparel, and other industries were lost to overseas locations, increased productivity, and lower labor cost markets.

The graph also shows the loss of 3 million jobs in the economy as a whole between 2000 and 2010, due to the Great Recession, and forecasts an increase of 20 million jobs between 2010 and 2020.

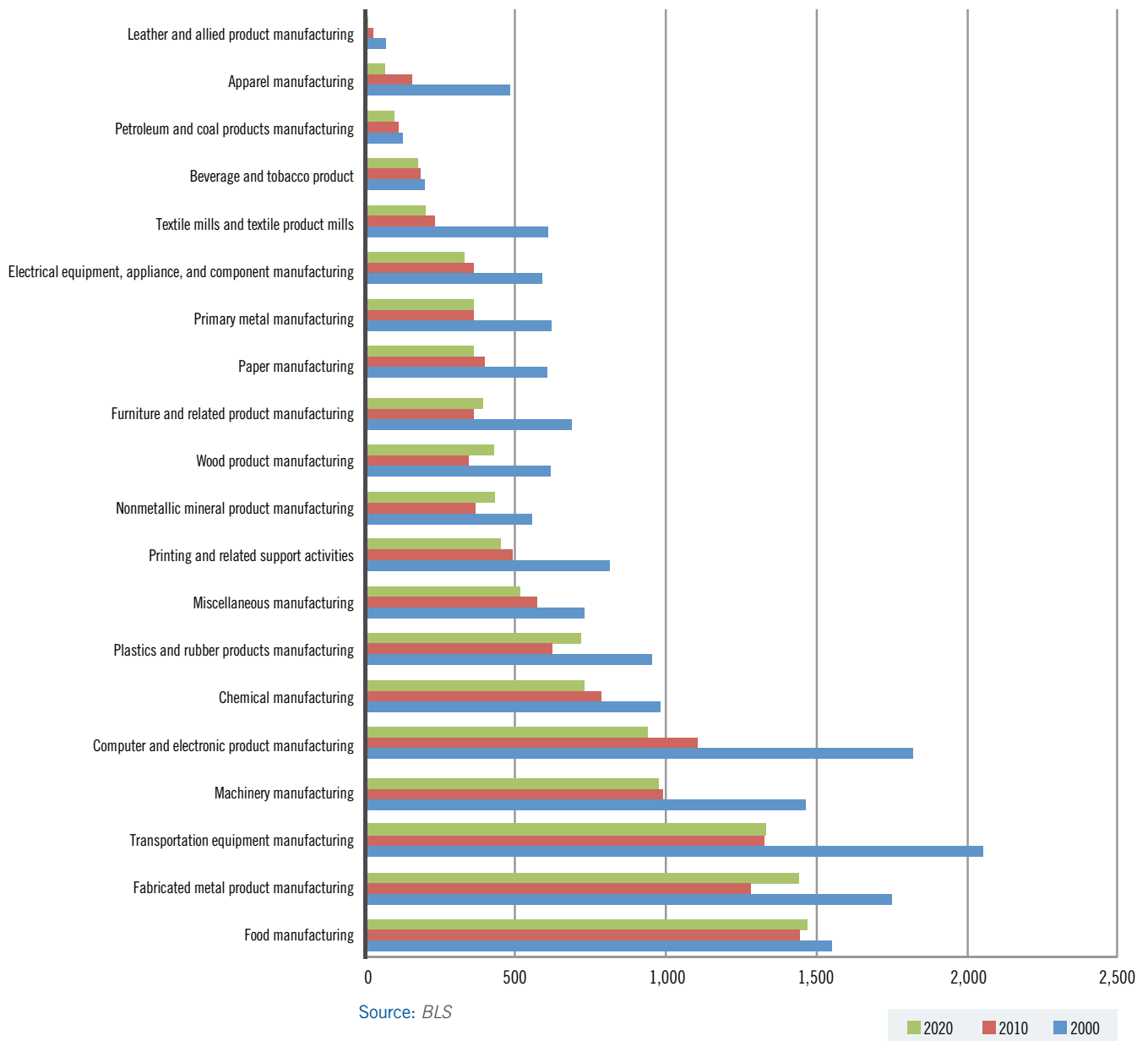


Non-manufacturing industries are expected to grow while manufacturing industries are expected to stabilize, resulting in net job growth between now and 2020. This is a reversal of previous trends in which nonmanufacturing industries added jobs, while manufacturing shed them. In this context, the net effect of the growth and re-shoring of jobs in select manufacturing industries is stabilization in the U.S. manufacturing sector.

Manufacturing Industry Employment

As shown in Figure 8, multiple industries will increase employment between 2010 and 2020, while others will either remain at the same level or decrease slightly. The manufacturing industries expected to increase employment are fabricated metal, plastics and rubber, nonmetallic mineral, wood, and furniture products.

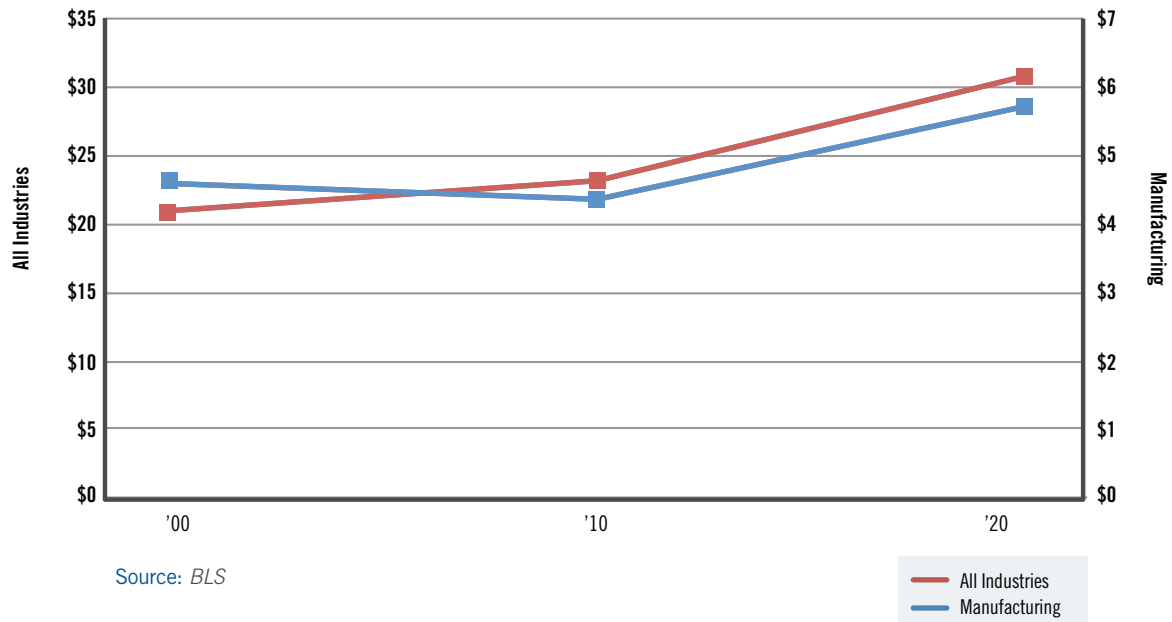
Figure 8
Employment by Manufacturing Industry, 2000-2020
(Jobs in Thousands)



Manufacturing Sector Output

Manufacturing output decreased by about \$200 million between 2000 and 2010. This decrease is not expected to continue through 2020, as manufacturing output is expected to rise by more than \$1 billion between 2010 and 2020. This growth will end the decade-long trend in which output of the economy grew while manufacturing output shrank. The output of the economy increased between 2000 and 2010, and is expected to do so between 2010 and 2020. Additionally, the output of manufacturing and the output of the economy are expected to increase at the same pace through 2020, which has not happened in more than a decade. One implication of this tandem movement is that the manufacturing sector is expected to synchronize with other industries.

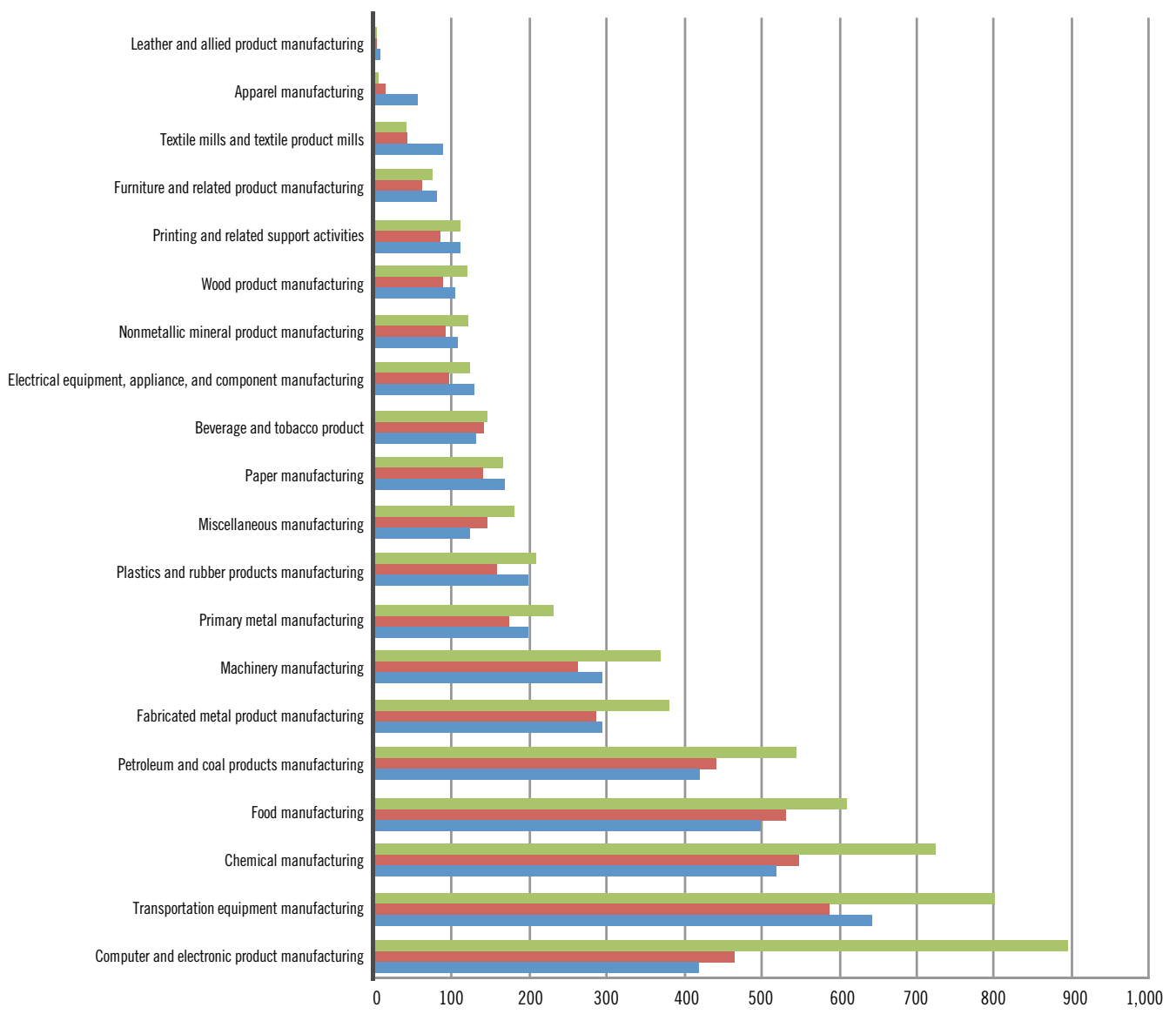
Figure 9
Manufacturing Output, 2000-2020
(In Trillions of 2005 Dollars)



Manufacturing Industry Output

Although the output of the manufacturing sector as a whole decreased between 2000 and 2010, the decrease was not uniform throughout the different manufacturing industries, as some saw decreases while others posted increases. Looking at the forecast period in Figure 10, all of the manufacturing industries—except leather, apparel, and textiles—are expect to increase output through 2020. Many of these industries are predicted to surpass their pre-recession output of 2000 by 2020.

Figure 10
Output by Manufacturing Industry, 2000-2020
(In Billions of 2005 Dollars)



Source: BLS

2020 2010 2000

Conclusions

As previously stated, the manufacturing sector reached its most recent low point during the Great Recession; however, since then, manufacturing industries have grown. While the economy as a whole has begun to rebuild, “between 2009 and 2010, manufacturing output grew at a rate more than double [that of] GDP.”¹ The Bureau of Labor Statistics (BLS) reports that the U.S. is, “expected to experience an increase in real output from \$4.4 trillion to \$5.7 trillion, a 2.8 percent annual increase, higher than the prerecession level of real output,” and this, “14.5 percent projected growth rate over the 2010-2020 period makes this industry the fastest in output growth.”²

Other reports have also projected similar growth within the industry, which could play a major role in U.S. GDP. A Brookings report from 2012 entitled “The Outsized Benefits of U.S. Manufacturing” states that, “manufacturing accounts for 11 percent of U.S. GDP”³ and that this amount could increase if certain steps are taken. These steps revolve around technological innovation, which is seen “as key to the future of manufacturing in this country.”⁴ As a result of technology advances, and the difference between wages in the U.S. and China beginning to shrink, companies are expected to bring their manufacturing of high technology products back to the U.S.

A 2011 article by The New American magazine states that this “resultant sea-change by repatriating jobs in these industries would be massive, potentially adding \$100 billion to America’s GDP, while reducing oil consumption due to lower transportation costs.”⁵ At the same time, the Boston Consulting Group suggests that this growth would create jobs due to a “shortage of highly skilled manufacturing workers” possibly reaching “approximately 875,000 machinists, welders, industrial-machinery mechanics, and industry engineers by 2020.”⁶ As measured by GDP, employment, and output, the manufacturing industry is projected to grow in the next decade, and this growth will cause a demand for more space, having major implications for industrial real estate products.

2. Manufactured Goods and U.S. International Trade

Another aspect of the re-shoring trend is manufacturing's relationship with the trade that the U.S. conducts internationally. International trade plays a major role in the manufacturing industry, as the products consumed in the U.S. either have to be produced here or imported from other countries. The balance in trade has shown a consistent decrease only reduced between 2008 and 2009 during the Great Recession and mostly due to a negative trade in goods.

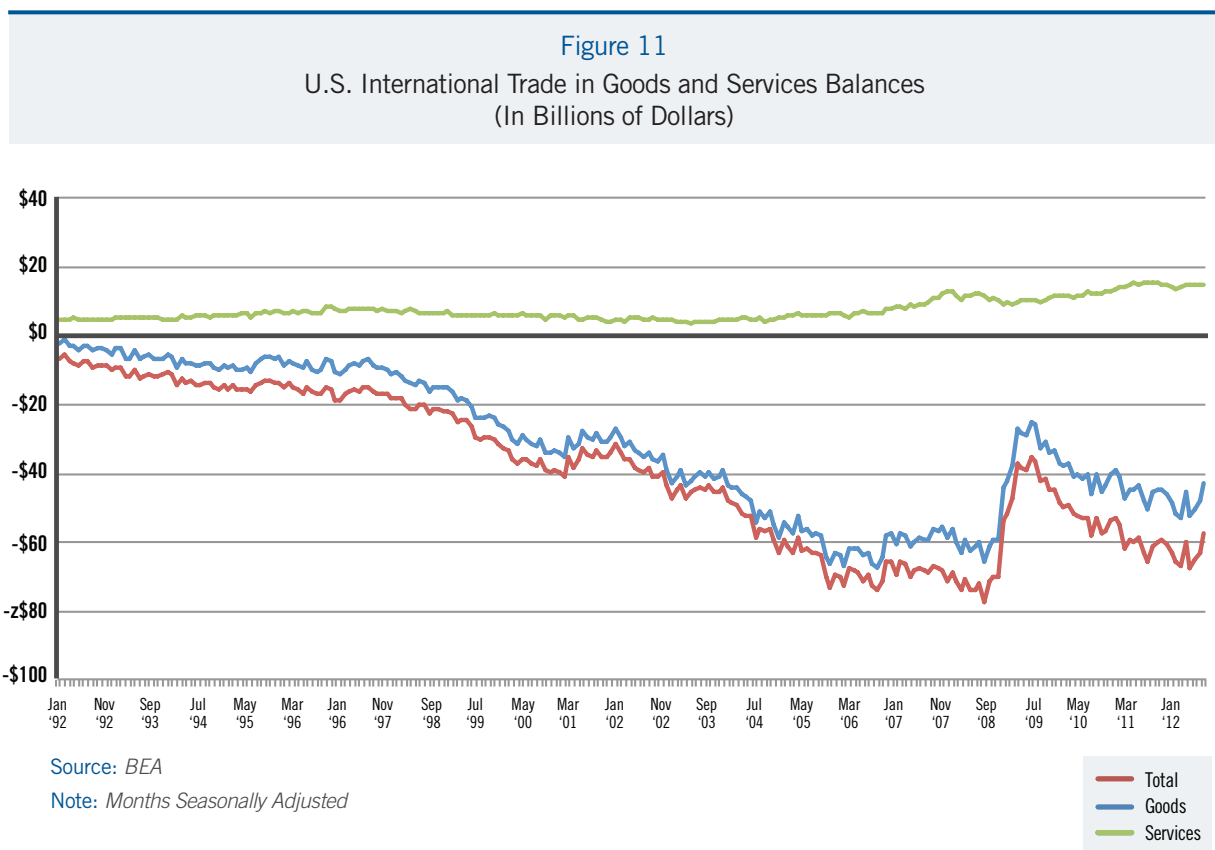
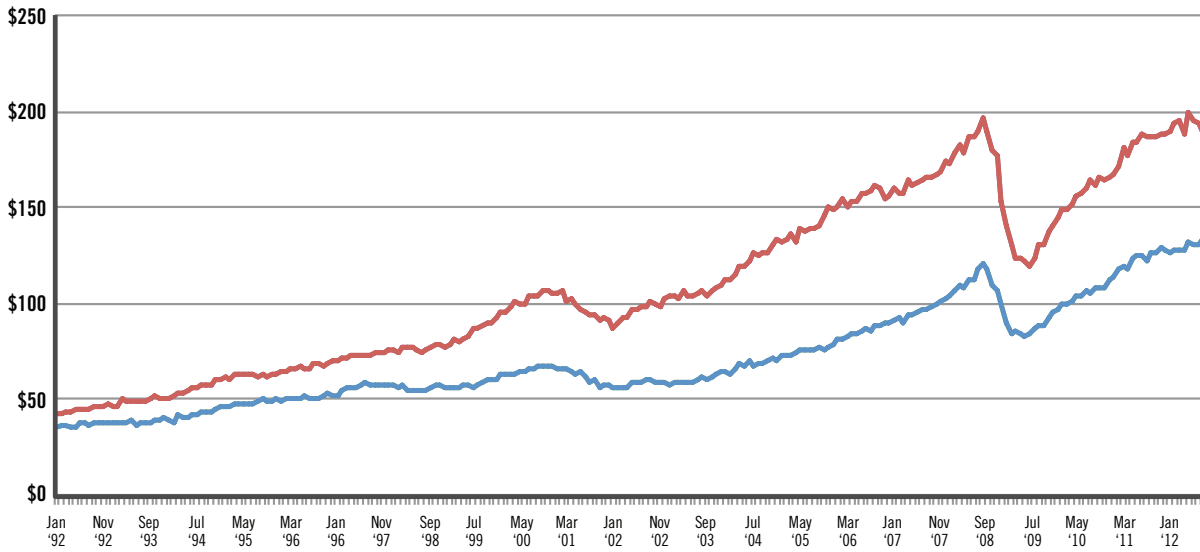


Figure 12 provides a more in-depth look at the differences between goods imported and goods exported, showing that these have increased in tandem since the 1990s, illustrating a sustained economic growth trend. The information presented in Figure 12 describes the relationship between the goods imported and the goods exported between 1992 and 2012. Although the gap between the exports and imports fluctuates, portraying larger and smaller trade deficits, the graph shows that there is a general connection between imports and exports, as they rise and fall at the same times. The trade deficit increased steadily between 1992 and 2009. But after the Great Recession, in 2009 imports declined by more than exports; however the trade deficit began increasing rather steadily, shortly thereafter.

Figure 12
U.S. International Trade in Goods, Exports and Imports
(In Billions of Dollars)



Source: BEA

Note: Months Seasonally Adjusted

— Goods Imports
— Goods Exports

Durability versus Labor Inputs

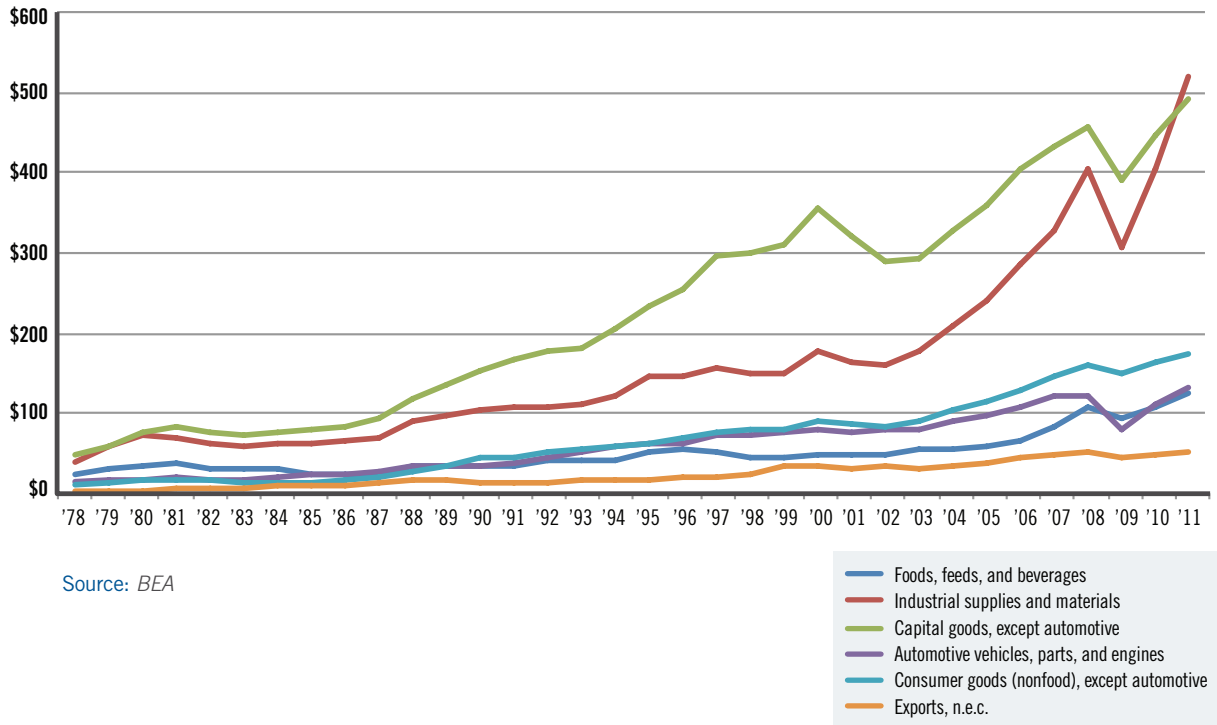
Goods are classified based on their durability or labor inputs. Based on durability, a durable good is a good that has a life span lasting more than three years, while a non-durable good is usually consumed, either in one use or within three years. The second way to classify products that are produced is by the amount of labor input that is needed for production. For example, high-labor goods are goods such as apparel and televisions, while low-labor goods are construction equipment, household items, and appliances.

Industries most likely to grow or re-shore in the U.S.

While discussing the recent growth in manufacturing, The Brookings Institution (Brookings) states that the “main increase [in manufacturing] between 2009 and 2011 was in durable goods.”⁷ Of these durable goods, Boston Consulting Group projects that the “sectors most likely to return are transportation goods, electrical equipment/appliances, furniture, plastics and rubber products, machinery, fabricated metal products, and computers/electronics.”⁸ The New American magazine reports that the same products will grow and or re-shore as it states that the “seven industry groups that could enjoy the most significant benefits are transportation goods, electrical equipment and appliances, furniture, plastics, rubber products, machinery, and computers.”⁹

The goods mentioned by these other reports are the same as those identified by the Bureau of Economic Analysis, which indicates that U.S. exports in these categories have generally increased since the 1970s, especially for industrial supplies and materials and non-automotive capital goods.

Figure 13
 U.S. Exports in Goods by Commodity, 1978-2011
 (In Billions of Dollars)

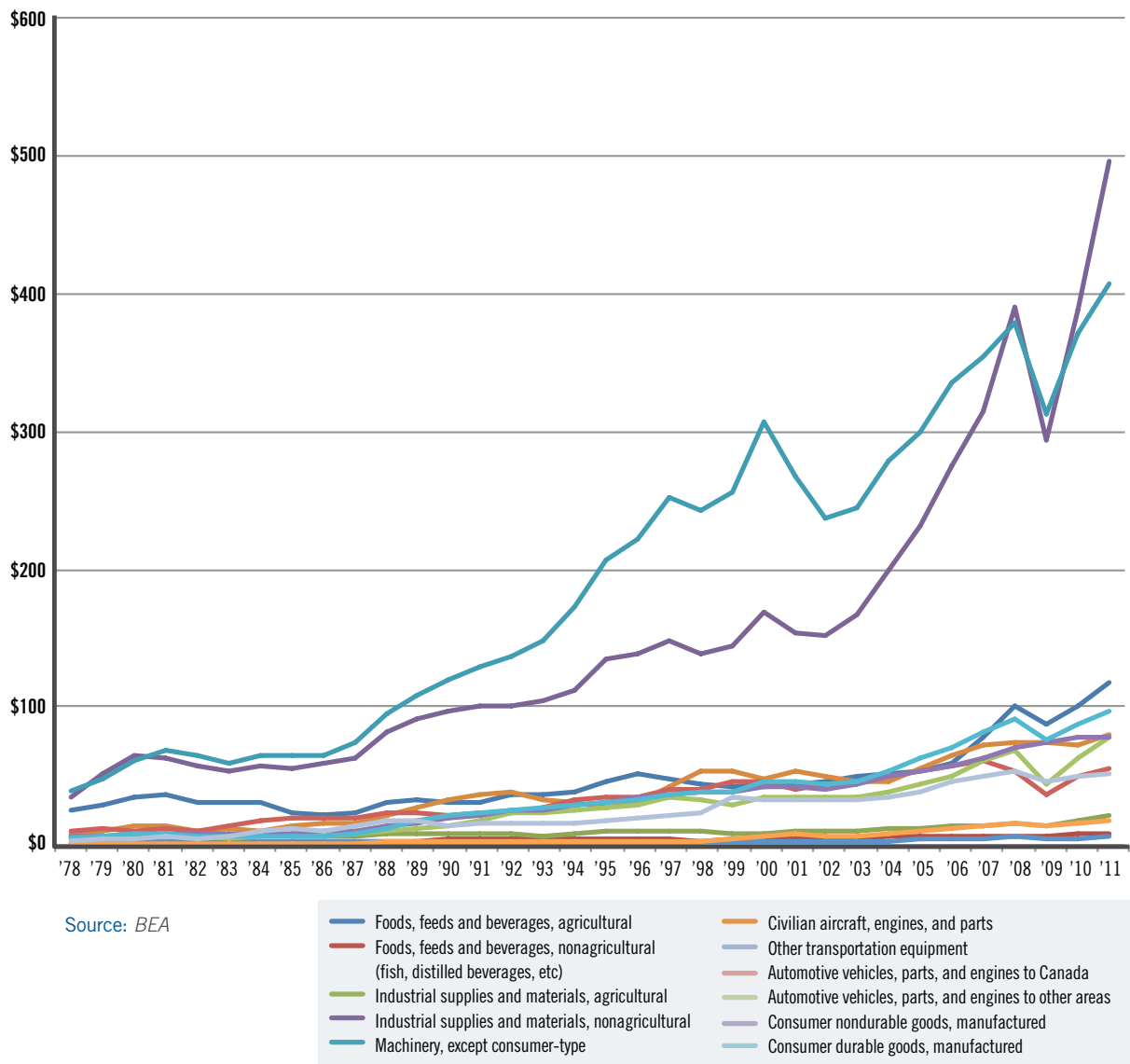


Since 1978, U.S. exports of goods has grown. The two main export groups—industrial supplies and capital goods—have grown tremendously, while export of other goods has grown more modestly. Although all goods recorded declines in exports during the Great Recession between 2008 and 2009, most have since posted growth, even surpassing their 2008 levels. According to the International Trade Administration, the largest exports from the U.S. are: transportation equipment (Canada, Mexico, China, Germany and Japan); computer and electronic products (Mexico, Canada, China, Japan and Hong Kong); chemicals (Canada, Mexico, China, Belgium and Japan); machinery except electrical (Canada, Mexico, China, Australia and South Korea); and petroleum and coal products (Mexico, Canada, Netherlands, Chile and Brazil).

U.S. Exports: Detailed Commodities

Examining commodities at a more detailed level, one sees in Figure 14 that non-agricultural industrial and materials and non-consumer type machinery are the largest exports.

Figure 14
 U.S. Exports in Goods by Detailed Commodity, 1978-2011
 (In Billions of Dollars)



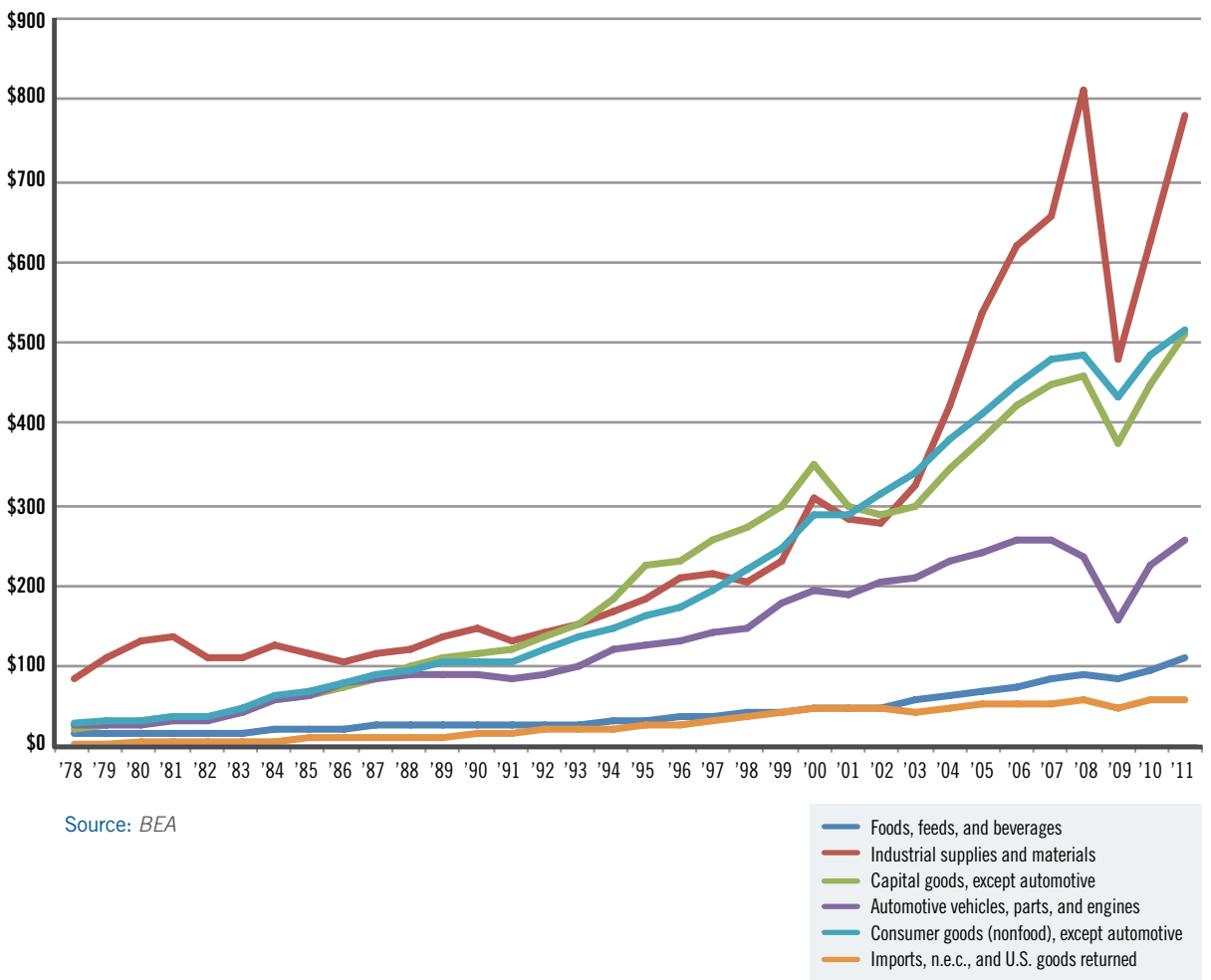
These two commodities have also seen the greatest growth since 1978. The other commodities—broken down into more specific categories in Figure 14—have also posted growth, but on a much smaller scale. Just as in the previous graph, all of the goods recorded a decrease in exports between 2008 and 2009, but have since rebounded.

This data shows that the focus of U.S. manufacturing during the next decade will be on durable goods, which has seen “job growth in a variety of middle-wage durable goods manufacturing industries”¹⁰ since 2009, and production of these products will most likely generate the most demand for real estate.

According to the International Trade Administration, the largest import categories to the U.S. are: computer and electronic products (China, Mexico, Japan, Malaysia and Taiwan); oil and gas (Canada, Saudi Arabia, Mexico, Venezuela and Iraq); transportation equipment (Mexico, Canada, Japan, Germany and South Korea); chemicals (Canada, Ireland, Germany, China and Japan) and machinery, except electrical (Japan, China, Germany, Mexico and Canada).

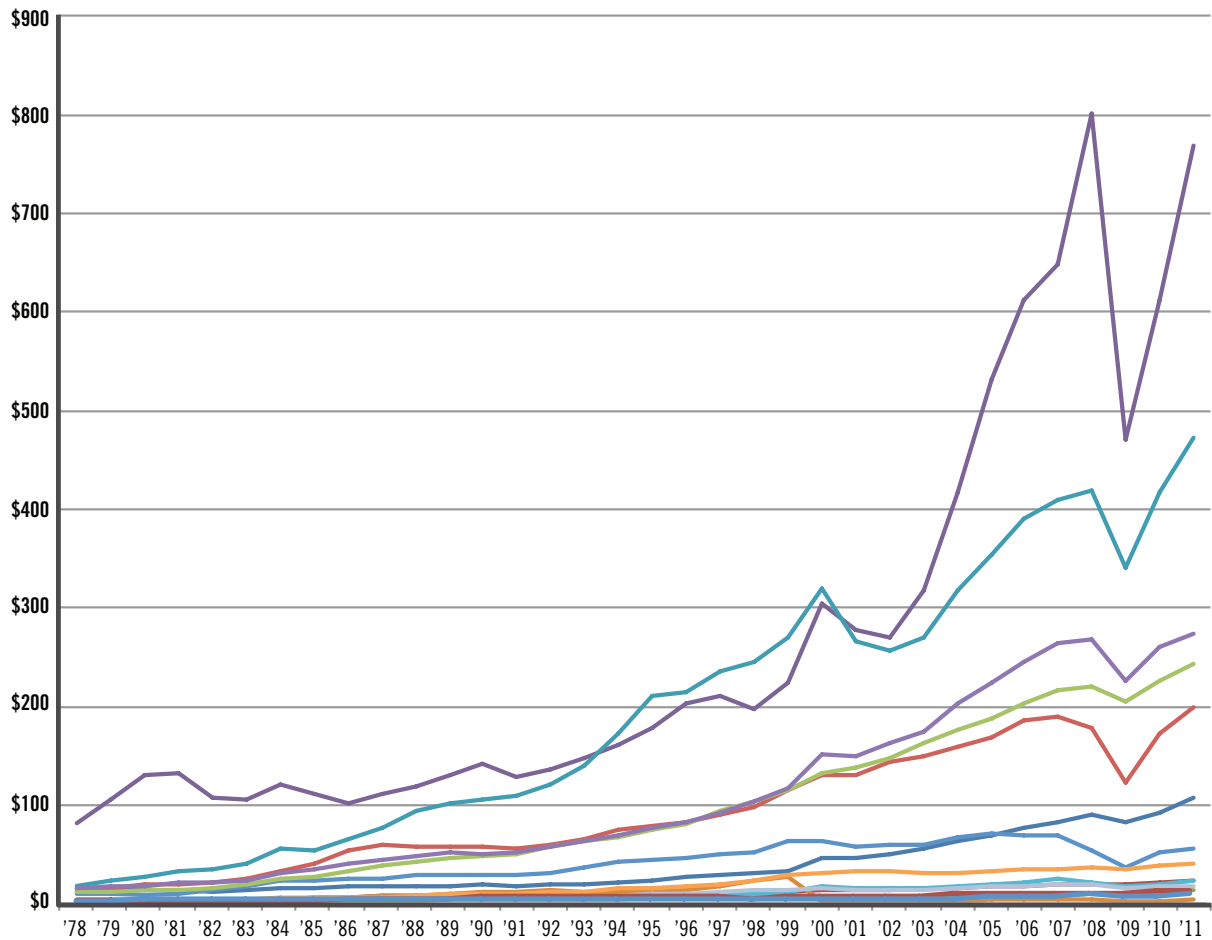
U.S. Imports have generally increased for industrial supply and materials and non-automotive consumer and capital goods. Looking at the aggregate commodity categories depicts the state of U.S. imports since 1978, as these imports have grown. It is interesting that the same categories—industrial supplies and capital goods—are the largest imports and have grown the most since 1978, and that imports in general have followed a very similar trend as exports, rising and falling in relation to the 2008 recession.

Figure 15
U.S. Imports in Goods by Commodity, 1978-2011
(In Billions of Dollars)



Examining detailed commodities shows large import figures for non-agricultural industrial supplies and materials and non-consumer type machinery. Just as in Figure 15, we now see the import graph (Figure 16) in greater detail. This graph shows the same trends as the import graph and indicates that the same products are likely to expand.

Figure 16
 U.S. Imports in Goods by Detailed Commodity, 1978-2011
 (In Billions of Dollars)



Source: BEA

- Foods, feeds, and beverages, agricultural
- Foods, feeds, and beverages, nonagricultural (fish, distilled beverages, etc)
- Industrial supplies and materials, agricultural
- Industrial supplies and materials, nonagricultural products
- Machinery, except consumer-type
- Transportation equipment, except automotive
- Automotive vehicles, parts, and engines, from Canada
- Automotive vehicles, parts, and engines from other areas
- Consumer nondurable goods, manufactured
- Consumer durable goods, manufactured
- Unmanufactured consumer goods (gemstones, nursery stock)
- U.S. goods returned
- Other products, including balance of payments adjustments not included above (minimum value shipments and miscellaneous imports)

Conclusions

Regarding the trends of products based on labor, Boston Consulting Group projects that, “products that require less labor [or are highly automated] and are churned out in modest volumes, such as household appliances and construction equipment, are most likely to shift to U.S. production.”¹¹ In contrast, “goods that are labor-intensive and produced in high volumes, such as textiles, apparel, and televisions, will likely continue to be made overseas,”¹² and “higher labor intensive products will remain in China.”¹³

These projections echo Brookings, which stated in 2012 that, “the majority of exports will be in chemicals, transportation equipment, computers and electronic products, and machinery.”¹⁴ These low-labor products, which the U.S. has not only produced for its own consumption but have been an integral part of U.S. exports, seem to have the potential to not only remain constant, but to grow in the next decade. Some products do not garner the same optimism—these are mainly textile-manufacturing industries that “are declining rapidly due to increased imports.”¹⁵

These industries, representative of high-labor and high-volume products, face the brunt of the difficulties that China poses for U.S. manufacturing, as China’s large volume of low-wage workers allows for mass quantities to drive prices down. These low prices then make it impossible for U.S. manufacturers to compete. This contraction in the textile industries has not been a recent event. A CBRE Econometric Advisors report entitled “The Health of the U.S Manufacturing Sector” shows how “textile production in our country is in decline—in fact, the ‘apparel and leather goods’ category of industrial production peaked in 1978 and has since seen production fall by more than 80 percent.”¹⁶ These struggles can be seen across high labor and high volume products and is indicative of the challenges that these products will face in the coming decade.

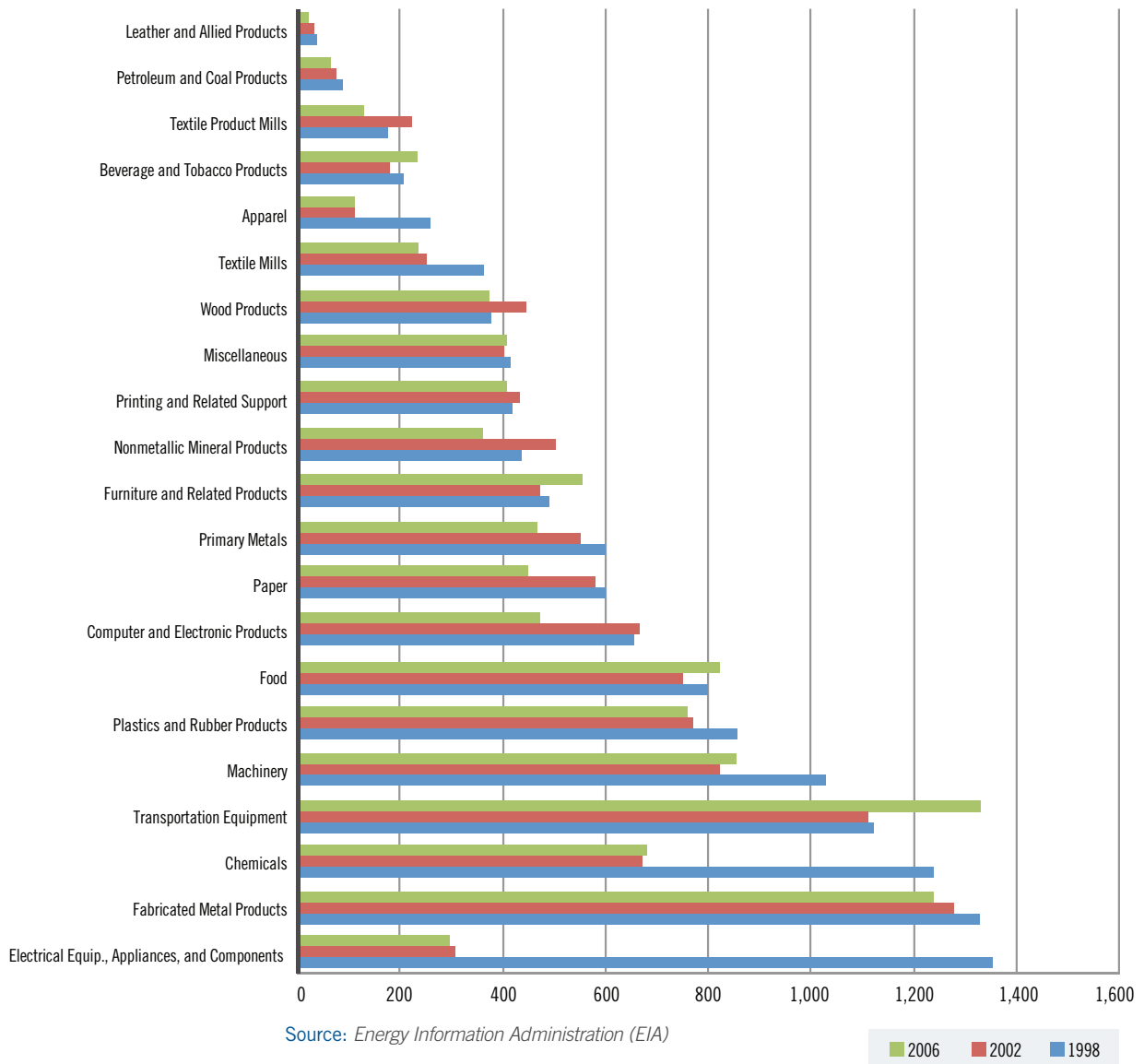
3. Real Estate Impacts of Growth in U.S. Manufacturing Industries

The loss of jobs in the manufacturing sector between 2000 and 2010 occurred in every manufacturing industry. Not a single manufacturing industry saw an increase or leveling off in employment and some industries, such as transportation equipment, computer and electronics, textile mills and products, and apparel manufacturing, even experienced drastic losses. As shown previously, multiple industries will increase employment between 2010 and 2020, while others will either remain at the same level or decrease slightly. The manufacturing industries expected to increase employment are fabricated metal, plastics and rubber, nonmetallic mineral, wood, and furniture products.

This projected growth can be applied to the amount of space used by manufacturing businesses to forecast the amount of manufacturing space needed by 2020. In Figure 17, Energy Information Administration (EIA) data shows total manufacturing space used by various industries. Of the 21 manufacturing industries surveyed, only three—food products, beverages and tobacco products, and transportation equipment products—saw growth in their use of square feet between 1998 and 2006. The remaining 18 industries used less space in 2006 than they did in 1998, and quite a few of these industries experienced significant declines, especially electrical equipment, appliances and components, machinery, primary metals, and textile mills. This decrease in space usage between 1998 and 2006 amounted to 20 percent of the total manufacturing space used in 1998.

Figure 17

Approximate Enclosed Floorspace Onsite: 1998, 2002, 2006
(In Millions of Square Feet)



Using these estimates for square feet used by manufacturing industry, along with the data on manufacturing employment, the square feet per employee in each manufacturing industry can be calculated. Figure 18 displays space used by employees by manufacturing industry for 1998, 2002 and 2006. Significant change in square feet per employee between 1998 and 2006 include large decreases for electrical equipment, appliance and component manufacturing, chemical manufacturing, and petroleum and coal products manufacturing. Significant increases took place in the following industries: furniture and related product manufacturing, textile mills and textile product mills, wood product manufacturing, transportation equipment manufacturing, primary metal manufacturing, printing and related support activities, and plastics and rubber products manufacturing.

Figure 18
Manufacturing Industries
(Square Feet per Employee)

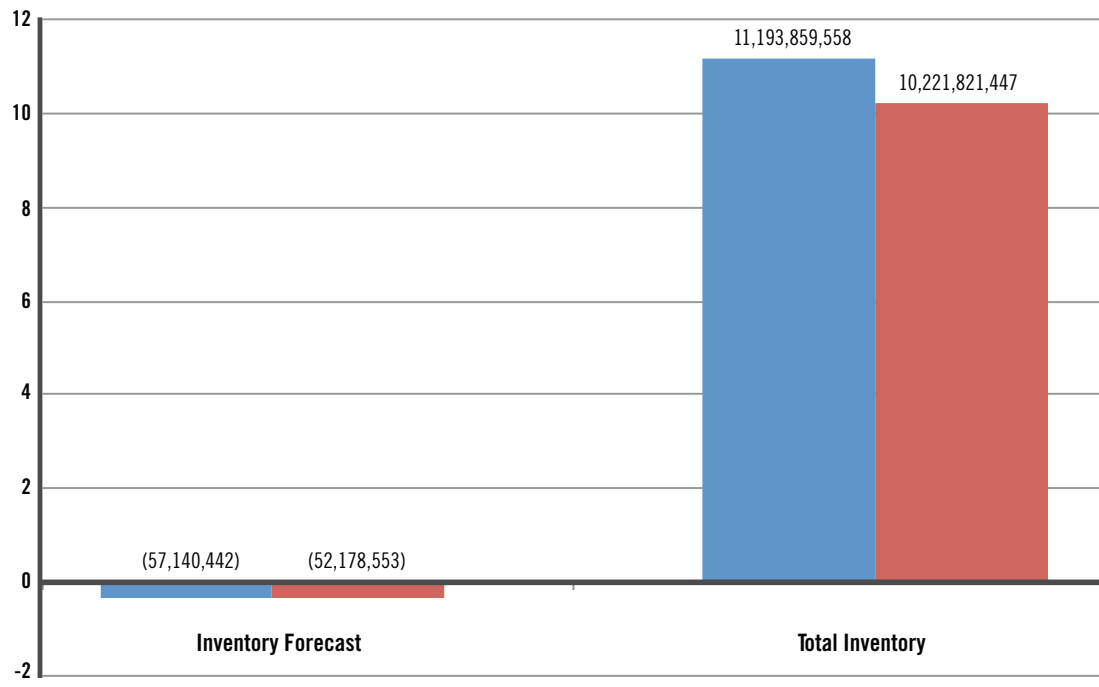
	Square Feet per Employee		
	1998	2002	2006
Food manufacturing	515	483	567
Beverage and tobacco product	990	874	1273
Textile mills and textile product mills	887	787	1552
Apparel manufacturing	534	230	704
Leather and allied product manufacturing	568	495	755
Wood product manufacturing	617	726	1091
Paper manufacturing	994	959	1132
Printing and related support activities	517	537	836
Petroleum and coal products manufacturing	714	633	570
Chemical manufacturing	1262	685	870
Plastics and rubber products manufacturing	899	807	1218
Nonmetallic mineral product manufacturing	785	904	973
Primary metal manufacturing	965	885	1306
Fabricated metal product manufacturing	757	729	964
Machinery manufacturing	708	566	860
Computer and electronic product manufacturing	360	365	429
Electrical equipment, appliance, and component manufacturing	2285	523	821
Transportation equipment manufacturing	544	540	999
Furniture and related product manufacturing	715	693	1558
Miscellaneous manufacturing	569	550	719
Manufacturing	744	617	892

*Source: Energy Information Agency (EIA), Manufacturing Energy Consumption Survey (MECS),
Regional Plan Association (RPA) Calculations*

Using these figures, two forecasts were created for the total inventory of manufacturing space to be used in 2020. One was based on historical averages between 1998 and 2006. The other was calculated using the most current data available from 2006. These forecasts were produced by multiplying the calculated average space per employee by the projected 2020 employment rates for each manufacturing industry. By combining these two forecasts, the range of projected space that will be used in 2020 emerged.

The two forecasts show a similar level of inventory for the manufacturing sector. The calculation, based on the averaged data, predicts that manufacturing will use more than 11.1 billion square feet of space, while the calculation based on 2006 data predicts use of 10.2 billion square feet, a difference of under 10 percent. In either case, these forecasts in Figure 19 show that based on pre-recession data, manufacturing as a whole is expected to stabilize its use of space between now and 2020.

Figure 19
2020 Inventory Scenarios
(In Billions of Square Feet)

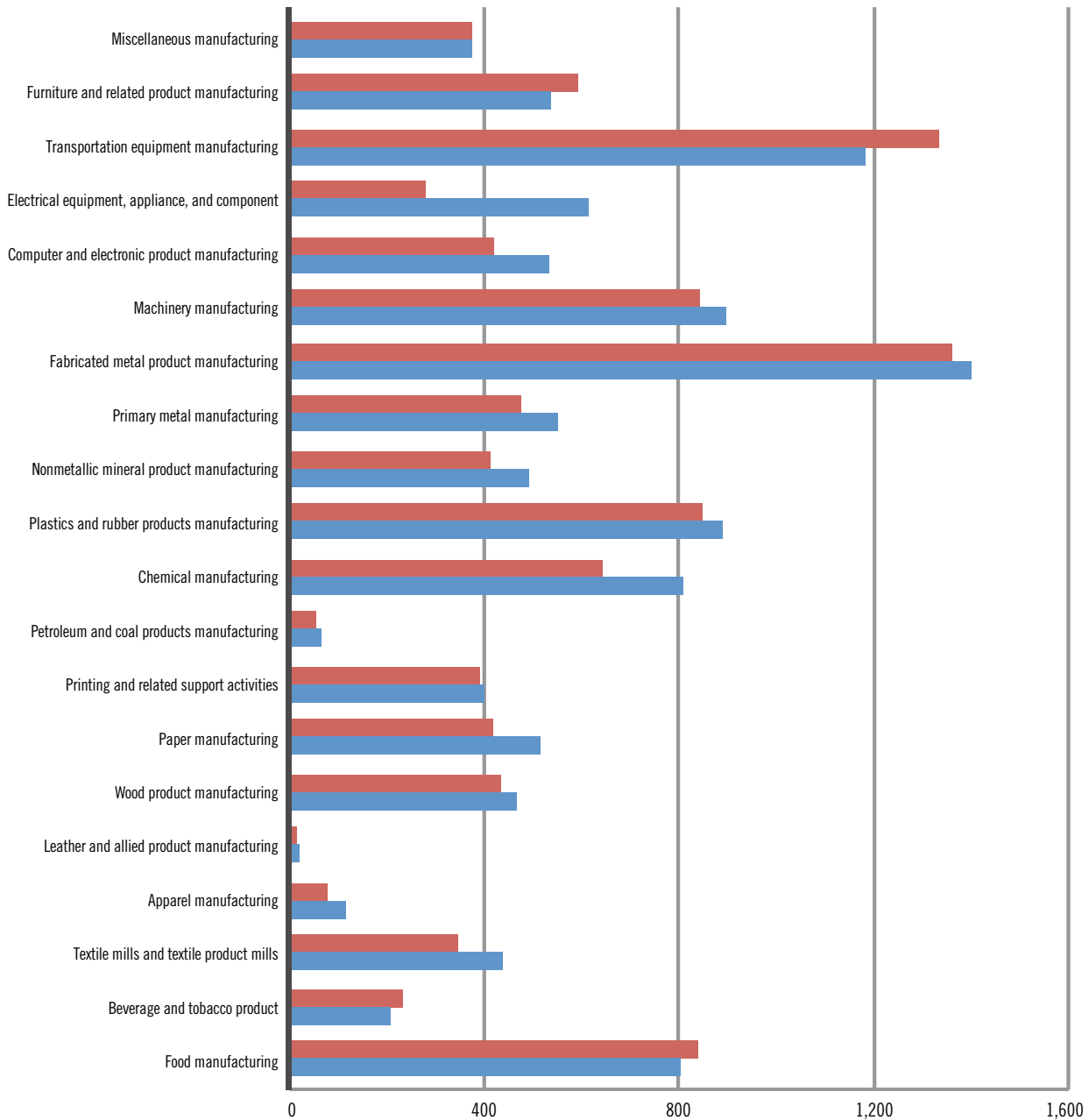


Source: EIA MECS

■ 98-06 Scenario (Historical Average)
■ 2006 Scenario (Most Recent Data)

A different picture emerges when looking at individual industries. Figure 20 shows each scenario by detailed industry, showing the inventory requirements by 2020, based on the previously mentioned forecast.

Figure 20
 Total Manufacturing Inventory, 2020
 (In Millions of Square Feet)



Source: EIA MECS

■ 98-06 Total Inventory (Historical Average)
 ■ 2006 Total Inventory (Most Recent Data)

Figure 21 displays the change in space, either positive or negative, that each manufacturing industry is predicted to experience between 2006 and 2020, based on the 2006 forecast, illustrating the effects of changes occurring in U.S. manufacturing industries on industrial space.

The industries projected to increase their manufacturing space the most, based on the 2006 data are fabricated metal products, plastics products, wood products, nonmetallic mineral products, and furniture products. Industries projected to decrease their manufacturing space needs the most are computer and electronic products, chemical products, apparel, electrical products, and textiles.

Figure 21		
Change in Total Square Feet by Manufacturing Industry		
	Inventory Forecast	
	2006 – 2020	2013 – 2020
Food manufacturing	12,807,173	8,965,021
Beverage and tobacco product	(2,145,389)	(1,501,772)
Textile mills and textile product mills	(27,669,545)	(19,368,681)
Apparel manufacturing	(31,714,286)	(22,200,000)
Leather and allied product manufacturing	(6,572,021)	(4,600,415)
Wood product manufacturing	64,566,817	45,196,772
Paper manufacturing	(27,350,709)	(19,145,496)
Printing and related support activities	(20,260,339)	(14,182,237)
Petroleum and coal products manufacturing	(7,672,850)	(5,370,995)
Chemical manufacturing	(43,296,678)	(30,307,675)
Plastics and rubber products manufacturing	87,853,249	61,497,275
Nonmetallic mineral product manufacturing	46,823,148	32,776,204
Primary metal manufacturing	5,369,160	3,758,412
Fabricated metal product manufacturing	123,502,453	86,451,717
Machinery manufacturing	(10,388,277)	(7,271,794)
Computer and electronic product manufacturing	(50,657,443)	(35,460,210)
Electrical equipment, appliance, and component manufacturing	(18,356,107)	(12,849,275)
Transportation equipment manufacturing	2,352,524	1,646,767
Furniture and related product manufacturing	36,851,236	25,795,865
Miscellaneous manufacturing	(32,000,000)	(22,400,000)
Net Change All Manufacturing Industries	(52,178,553)	(36,524,987)

Source: EIA MECS, RPA Calculations

Note: Square-footage outlooks based on 2006 forecast.

Geographic Implications

In what parts of the country will demand for industrial space be highest? All the research points to metropolitan areas, with some regions doing better than others. Brookings suggests that, “in 2010, metropolitan areas contained 79.5 percent of all manufacturing jobs.”¹⁷ Although manufacturing prospects are in metropolitan areas, some areas are expected to grow more than others. A current “majority of all manufacturing is in the South and Midwest,” the “Midwest had the fastest manufacturing job gains during the last two years,”¹⁸ and “older manufacturing cities in the Northeast and Midwest are coming out of the recession faster.”¹⁹ These reports seem to expect the Midwest and Northeast to produce more than the South in the coming years.

The real estate impact of manufacturing growth can be summarized by the following indicators:

- **Square Feet by Industry:** Of the 20 manufacturing industries surveyed, only three—food products, beverages and tobacco products, and transportation equipment products—saw growth in their use of space between 1998 and 2006. The remaining 17 industries used less space in 2006 than they did in 1998, and quite a few of these industries experienced significant declines. Based on Energy Information Administration (EIA) data, average square feet per employee figures range from 250 to 1,400. At the low end of the range are industries such as computer, food, and petroleum manufacturing, carrying out tasks that require nominal amounts of space. At the high end of the range are industries such as furniture, textile, or primary metal manufacturing that use more equipment, resulting in the need for more space per employee.
- **Inventory Forecast:** Two distinct projection metrics show a need for similar levels of space for the manufacturing sector. The calculation based on historical averages predicts that manufacturing will require 11.2 billion square feet of space by 2020. The calculation based on the most recent inventory figures predicts that more than 10.2 billion square feet of space will be required. The difference between the two calculations is less than 10 percent.
- **Industry Demand:** The industries projected to require additional manufacturing space include fabricated metals, plastics, wood, nonmetallic mineral, and furniture products. The industries projected to decrease their use of manufacturing space are computer and electronic products, chemical products, apparel, electrical products, and textiles.

The most likely or favored locations for the eight industries expected to expand by 2020 are listed below. Most of the growth industries are in the durable goods manufacturing subsector, and the current employment base suggests the following concentration patterns for each industry:

- Wood product: Southeast and Far West;
- Nonmetallic mineral product: Southeast and Great Lakes;
- Primary metal: Great Lakes and Southeast;
- Fabricated metal product: Great Lakes and Southeast,
- Transportation equipment: Southeast and Far West;
- Furniture and related product: Southeast and Great Lakes;
- Food manufacturing: Southeast and Great Lakes;
- Plastics and rubber products: Great Lakes and Southeast.

Figure 22
Geographic Distribution of Manufacturing Employment, 2010
(In Number of Jobs)

Sector/Subsector/Industry	U.S.	New England	Midwest	Great Lakes	Plains	Southeast	Southwest	Rocky Mountain	Far West
Manufacturing	12,107,900	639,976	1,491,015	2,628,101	1,090,040	2,873,303	1,191,862	345,292	1,848,311
Durable goods manufacturing	7,423,800	439,008	830,608	1,724,793	644,495	1,614,329	783,705	216,890	1,169,972
Wood product manufacturing	390,500	(D)	(D)	62,261	37,350	132,037	29,989	(D)	62,477
Nonmetallic mineral product manufacturing	391,500	14,068	53,115	70,625	32,208	104,202	51,111	15,584	50,587
Primary metal manufacturing	372,100	(D)	(D)	129,244	(D)	82,089	29,549	6,984	(D)
Fabricated metal product manufacturing	1,330,100	84,557	164,359	366,098	111,197	251,535	157,798	33,716	160,840
Machinery manufacturing	1,037,700	48,104	112,980	301,123	127,563	205,424	123,952	20,945	97,609
Computer and electronic product manufacturing	1,118,900	104,411	147,750	111,873	81,237	142,056	147,656	48,041	335,876
Electrical equipment and appliance manufacturing	368,600	26,770	(D)	89,641	30,527	107,278	24,920	4,577	(D)
Transportation equipment manufacturing	1,346,900	71,554	74,126	(D)	(D)	345,359	130,205	23,782	209,917
Furniture and related product manufacturing	392,500	13,175	(D)	86,931	33,094	119,978	33,437	14,063	(D)
Miscellaneous manufacturing	675,000	50,475	(D)	125,635	57,236	124,371	55,088	(D)	131,140
Nondurable goods manufacturing	4,684,100	200,968	660,407	903,308	445,545	1,258,974	408,157	128,402	678,339
Food manufacturing	1,492,300	48,257	176,070	263,617	212,234	378,036	127,568	54,182	232,336
Beverage and tobacco product manufacturing	195,800	6,555	(D)	24,771	10,352	(D)	18,834	7,995	56,983
Textile mills	125,600	(D)	(D)	5,938	1,368	(D)	3,823	(D)	10,704
Textile product mills	129,500	5,169	12,767	13,662	8,096	62,894	8,531	3,362	15,019
Apparel manufacturing	198,000	(D)	39,249	11,311	(D)	45,874	10,479	3,790	73,813
Leather and allied product manufacturing	34,300	4,536	(D)	5,209	3,075	5,255	5,809	(D)	5,503
Paper manufacturing	396,500	24,468	(D)	94,386	(D)	125,568	23,478	6,179	(D)
Printing and related support activities	558,000	28,169	89,091	124,817	64,175	111,444	46,691	16,344	77,269
Petroleum and coal products manufacturing	112,900	1,773	(D)	15,054	(D)	25,690	28,267	4,301	(D)
Chemical manufacturing	807,100	38,268	159,714	160,978	51,121	208,071	81,648	19,317	87,983
Plastics and rubber products manufacturing	634,100	28,797	(D)	183,565	53,921	163,633	53,029	10,957	(D)

Source: Bureau of Economic Analysis

Notes: (D) means not disclosed; blue lettering indicates industry expected to grow between 2013 and 2020.

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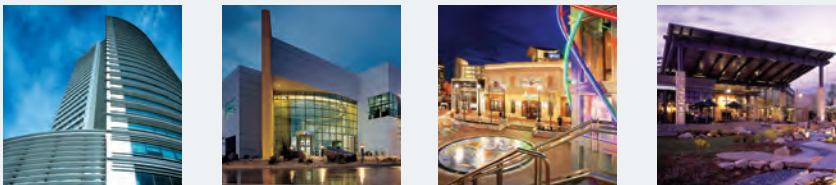
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