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# Economic Profile of Fabricated Metals Manufacturing in Iowa

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# Economic Profile of Fabricated Metals Manufacturing in Iowa

## **Abstract**

The fabricated metals industry in Iowa is a major durable goods industry which produced \$1.68 billion in GDP in 2013 and accounted for 5 percent of manufacturing GDP. The sector employed 20,611 persons, or around 9.5 percent of the state's manufacturing workforce. This technical study profiles the industry's structural and economic characteristics. This study was done for the Center for Industrial Research and Service (CIRAS) at Iowa State University.

## **Keywords**

manufacturing, Iowa, fabricated metals, economic evaluation

## **Disciplines**

Industrial Organization | Labor Economics | Public Economics | Regional Economics

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# ECONOMIC PROFILE OF FABRICATED METALS MANUFACTURING IN IOWA

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## INDUSTRY DEFINITION

The fabricated metals subsector of durable goods manufacturing transforms metal into intermediate inputs for other manufacturers or produces end products for final use. Major fabricated metals processes include forging, stamping, bending, forming, and machining, all of which are used to shape single pieces of metal. Other processes include welding and assembly. Establishments may use individual processes or a combination of processes in producing goods. This sector does not make computers and electronics, machinery, or metal furniture.


### **33211 FORGING AND STAMPING**

- Forged or stamped products from purchased metals used primarily as manufactured goods inputs
- Products: Rolled metals, stamped or spun metal objects, and powder metallurgy products

 21 establishments with 599 payroll employees in 2014


### **33221 CUTLERY AND HANDTOOL MANUFACTURING**

- Used for cooking, dining, sawing, and other hand-powered activities
- Products: Cutlery, kitchenware, flatware, saw blades, and non-powered handtools

 20 establishments with 691 payroll employees in 2014


### **33231 PLATE WORK AND FABRICATED STRUCTURAL PRODUCT MANUFACTURING**

- Used to make buildings and other structures or products
- Products: Prefabricated metal buildings, panels, and sections; structural metal and platework products

 93 establishments with 3,194 payroll employees in 2014


### **33232 ORNAMENTAL AND ARCHITECTURAL METAL PRODUCTS MANUFACTURING**

- Used mainly in commercial, industrial, and residential buildings.
- Products: Metal framed windows and doors, worked sheet metal, ornamental and architectural products, buildings, carports, dwellings, garages, greenhouses, sheds, silos, utility buildings, cowls, awnings, chutes, culverts, downspouts and ducts, eaves, flues, guardrails, troughs, stovepipes

 91 establishments with 2,937 payroll employees in 2014


### **33241 POWER BOILER AND HEAT EXCHANGER MANUFACTURING**

- Used for industrial, commercial, and home heating
- Products: Power boilers, heat exchangers, condensers, nuclear control rod drives and steam supply systems, nuclear reactors, and intercooler shells

 3 establishments with 104 payroll employees (2013 data)


### **33242 HEAVY GAUGE METAL TANK MANUFACTURING**

- Used primarily in factories, farms, and commercial establishments
- Products: Tanks, vessels, containers, vats, stills, smelting pots, retorts, kettles

 14 establishments with 370 payroll employees (2013 data)


**33243 LIGHT GAUGE METAL CAN, BOX, AND OTHER METAL CONTAINER MANUFACTURING**

- Used as containers for commercial products and for storage
- Products: Cans, boxes, lids, metal and aluminum containers for food and beverage products, metal bottles, bins, kegs, collapsible tubes, drums, jugs, chests, hoppers, barrels

 9 establishments and 825 payroll employees in 2014


**33251 HARDWARE MANUFACTURING**

- Metal devices used in products, buildings, and other manufactured goods
- Products: Hinges, handles, keys, locks, brackets, casters, cabinet and casket hardware

 9 establishments and 430 payroll employees in 2014


**33261 SPRING AND WIRE PRODUCT MANUFACTURING**

- Uses forming, cutting, bending and heath winding to make components for other manufactured goods
- Products: Coiled, helical, or flat springs; torsion bars; clock, furniture and mattress springs; baling wire, brads, cable, traps, grills, screening

 11 establishments and 384 payroll employees in 2014


**33271 MACHINE SHOPS**

- Use lathes, screw machines, and other boring, grinding, or milling machines to produce metal or plastic goods
- Products: Metal and plastic components, repair or replacement parts, custom designed metal goods

 196 establishments and 4,187 payroll employees in 2014


**33272 TURNED PRODUCE AND SCREW, NUT, AND BOLT MANUFACTURING**

- Using large volume machinery, produce items used primarily in manufactured goods to fasten, affix, or otherwise secure components
- Products: Precision machined products on a job or order basis, bolts, cotter pins, hooks washers, rivets, screws, nuts, pins, turnbuckles

 21 establishments and 1,075 payroll employees in 2014


**33281 COATING, ENGRAVING, HEAT TREATING, AND ALLIED ACTIVITIES**

- Using coatings, engraving, or other heat treating processes on metal formed products
- Products: Annealed, brazed, burned, hardened or tempered metals; anodized, buffed, plated, descaled, electroplated, laminated, pickled, polished, sandblasted, or tumbled metal products

 62 establishments and 1,125 payroll employees in 2014


**33292 METAL VALVE MANUFACTURING**

- Produces metal valves that are components of other manufactured products
- Products: Industrial and fluid power valves and fittings, plumbing fixtures, fire hydrants, valves for nuclear applications, pneumatic valves, control valves, lawn and firefighting nozzles, pipe flanges and unions

 22 establishments and 2,573 payroll employees in 2014

**33299 ALL OTHER GENERAL PURPOSE MACHINERY**

- Miscellaneous general metal based products for consumers and commerce
- Products: Ammunition, ball and roller bearings, foil containers, industrial patterns, steel wool, small arms and other ordinance, metal safes, portable metal ladders

 22 establishments and 2,163 payroll employees in 2014

## INDUSTRY SIZE AND COMPOSITION

### *GROSS DOMESTIC PRODUCT (GDP)*

Fabricated metals manufacturing is a major durable goods sector in the Iowa economy and produced \$1.68 billion in GDP and accounted for 5 percent of Iowa's manufacturing GDP and 1 percent of its total GDP for all industries in 2013. Nationally, fabricated metals contributed 6.9 percent of manufacturing GDP and 0.08 percent of national GDP in 2013.

### *JOBS*

Fabricated metals manufacturing's 20,611 jobs represented 9.5 percent of Iowa's manufacturing payroll employment and 1.6 percent of its total employment in 2014. In the U.S., fabricated metals manufacturing accounts for 2.3 percent of manufacturing sector jobs and 0.2 percent of all jobs.

Iowa's fabricated metals activities are mostly distributed across architectural and structural metals (29.6 percent of jobs), machine shops and turned products manufacturing (25.5 percent), and the all other fabricated metal products sector (23.0 percent). These subsectors combined account for more than 78 percent of total employment in this sector. U.S. jobs in those subsectors are very similar in distribution to that found in Iowa, and they collectively account for 69.5 percent fabricated machinery jobs. The smallest contributions to this subsector in terms of jobs are in spring and wire products, hardware, and forging and stamping. Collectively they explain fewer than 7 percent of fabricated metal jobs. Figure 1 contrasts the distribution of employment in Iowa and the U.S. by industry.

### *BUSINESS ESTABLISHMENTS*

Iowa had 624 fabricated metals manufacturing establishments in 2014. Machine shops and related had the most firms, followed by architectural and structural metals. The smallest number of establishments is in hardware and in spring and wire product manufacturing.

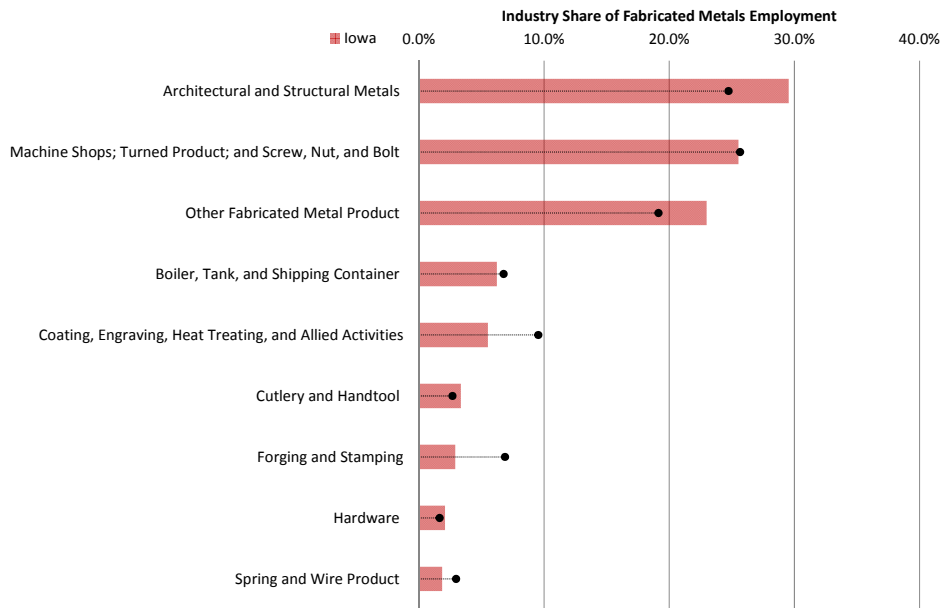
Data from 2013 show establishments with 500 or more workers accounting for just half of one percent of total fabricated metals establishments. About eight percent have 100 to 499 workers. Nearly 70 percent of Iowa's fabricated metals manufacturing establishments have fewer than 20 employees.

With an average of 64 employees per establishment, firms in the category of other fabricated metal products are significantly larger than the other categories. The smallest number of employees per firm is found in the coating, engraving, heat treating, and allied products industry at 18 payroll employees. Iowa's overall manufacturing sector averages 54 workers per establishment.

Figure 2 shows the distribution of Iowa's fabricated metals establishments by size and detailed industry. Figure 3 maps the approximate distribution of establishments by employment size across the state.

**FIGURE 1**

**Distribution of Fabricated Metals Employment in Iowa and the U.S. by Detailed Industry, 2014**



**FIGURE 2**

**Number of Establishments by Employment Size**

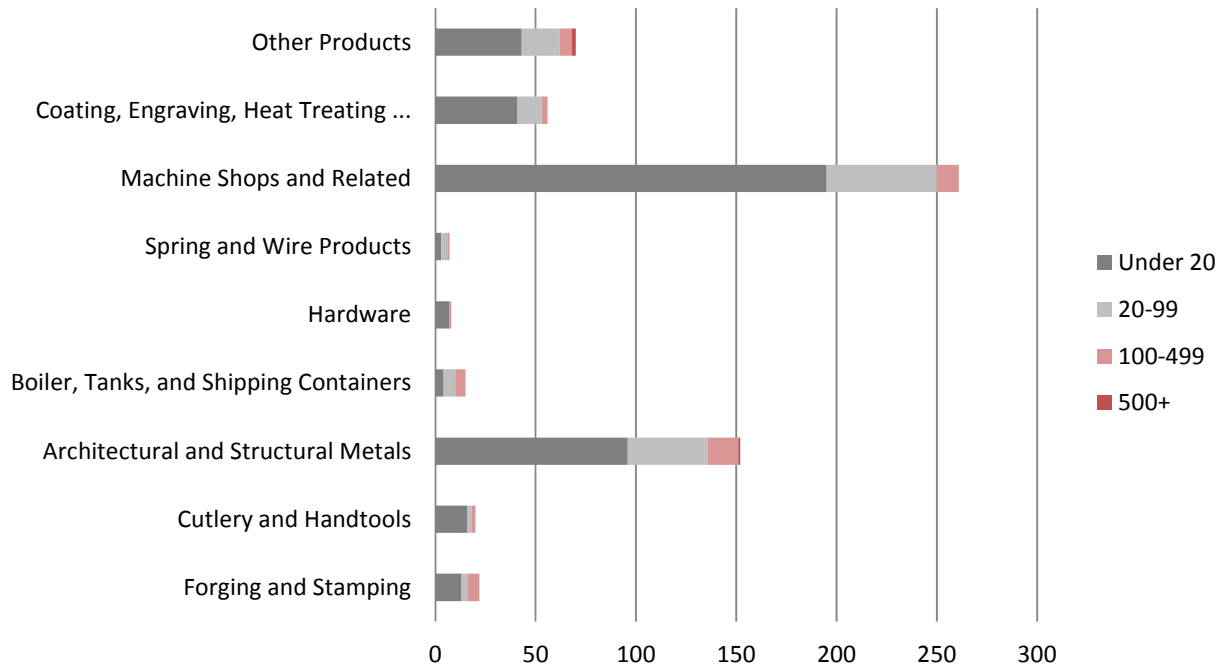
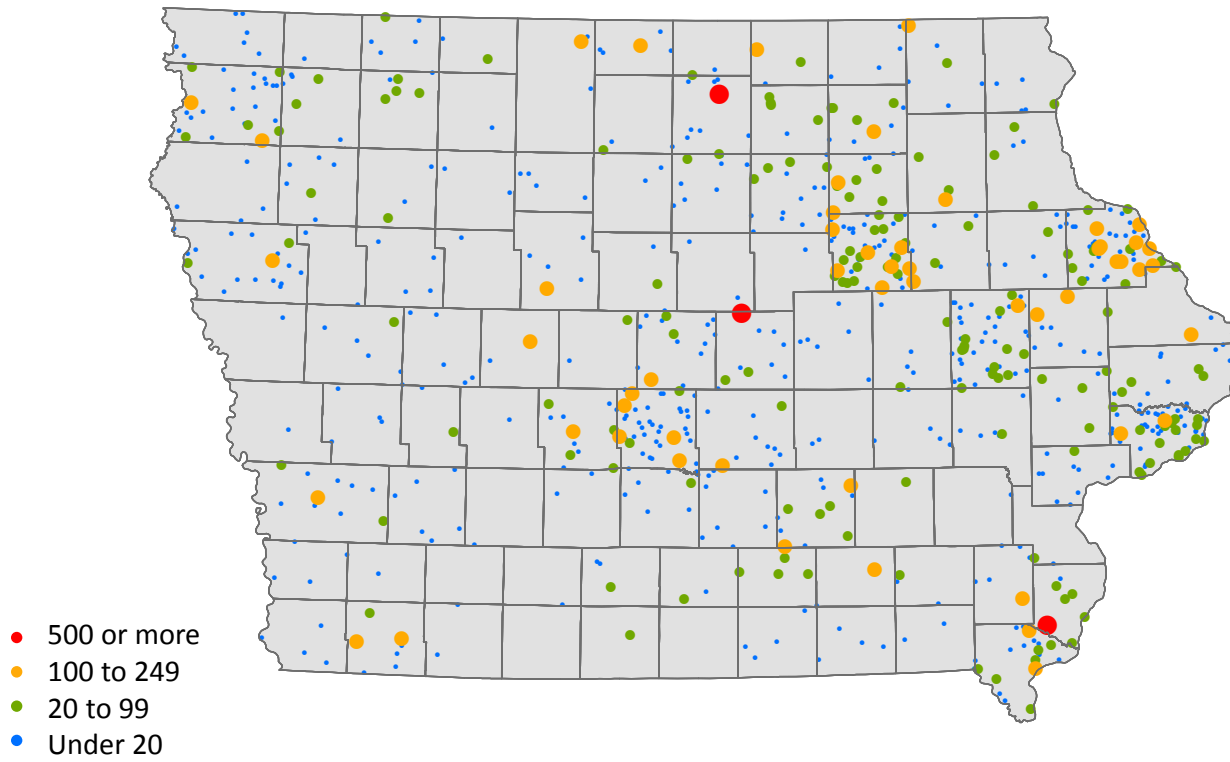




FIGURE 3. FABRICATED METALS ESTABLISHMENTS BY EMPLOYMENT SIZE



## IOWA’S COMPETITIVE POSITION

### EMPLOYMENT CONCENTRATION

Iowa demonstrates only a slight competitive advantage in fabricated metals manufacturing: 1.4 percent of the nation’s fabricated metals jobs are located in Iowa, while Iowa has just 1.1 percent of U.S. jobs across all industries. Figure 4 shows Iowa’s percentage of fabricated metals employment by detailed industry.

Location quotients, which measure the state’s share of national employment in a particular industry in relation to the state’s share of all U.S. jobs, show that Iowa has about 28 percent more jobs in fabricated metals than the U.S. average (LQ = 1.28). Iowa’s strongest advantages lie within hardware, cutlery and handtool establishments, other fabricated metal products, and architectural and structural metals. In all four of these, the state’s employment is 50 percent or more than would be expected. Three industries are below the national norm, with forging and stamping employment levels at nearly half of the national expected value. Figure 5 illustrates Iowa’s machinery manufacturing location quotients by industry.

**FIGURE 4**

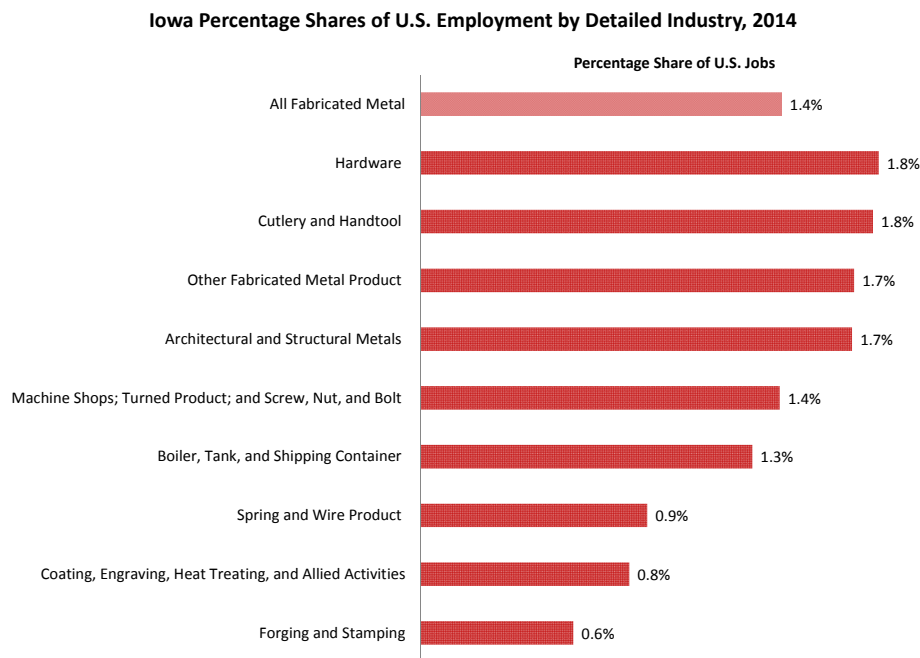
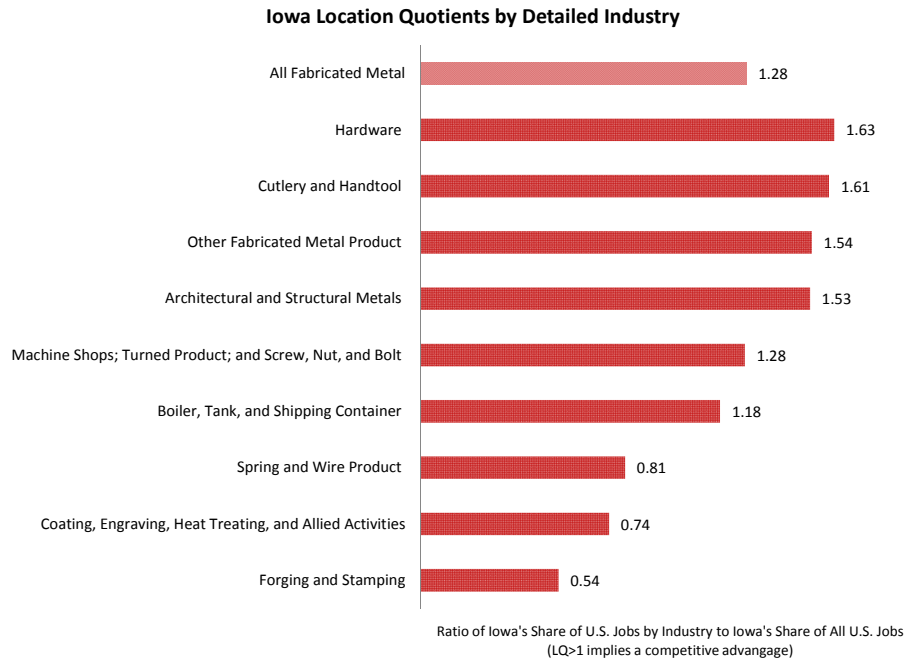


FIGURE 5

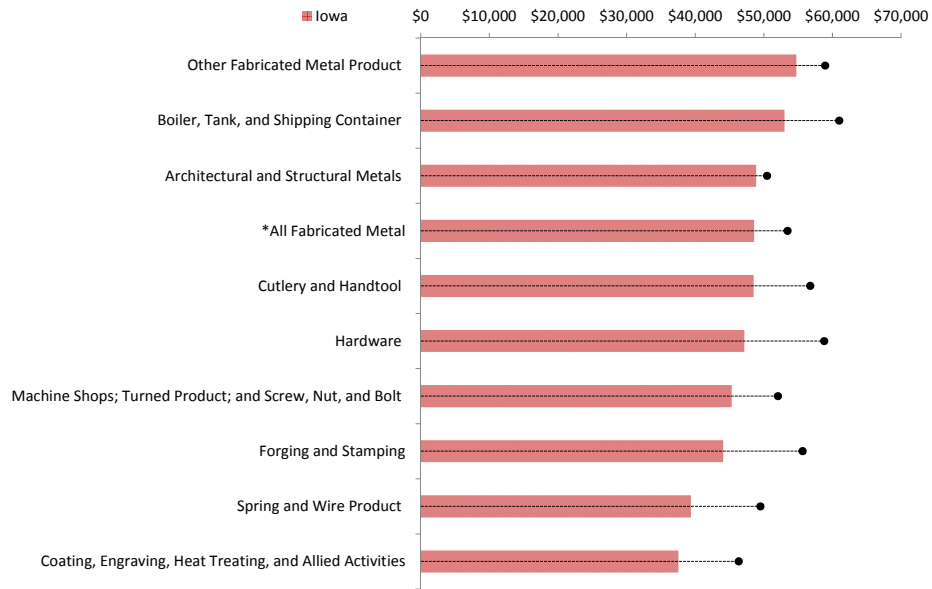


**AVERAGE EARNINGS**

Iowa’s fabricated metals manufacturing workers earned \$48,591 in wages and salaries per job in 2014, which was 91 percent of the national average for the subsector. The highest average was found in the other fabricated metal product industry at \$54,740. U.S. average pay in that industry was slightly higher at \$58,933. Architectural and structural metals is the most competitive with the U.S. average at 97 percent, while the greatest gap between the U.S. and Iowa is found in both forging and stamping and in spring and wire product manufacturing at 79 percent of the U.S. value. Average earnings per job by detailed industry are shown in Figure 6.

**FIGURE 6**

**Average Wage and Salary Per Job by Detailed Industry, 2014, Iowa and the U.S.**

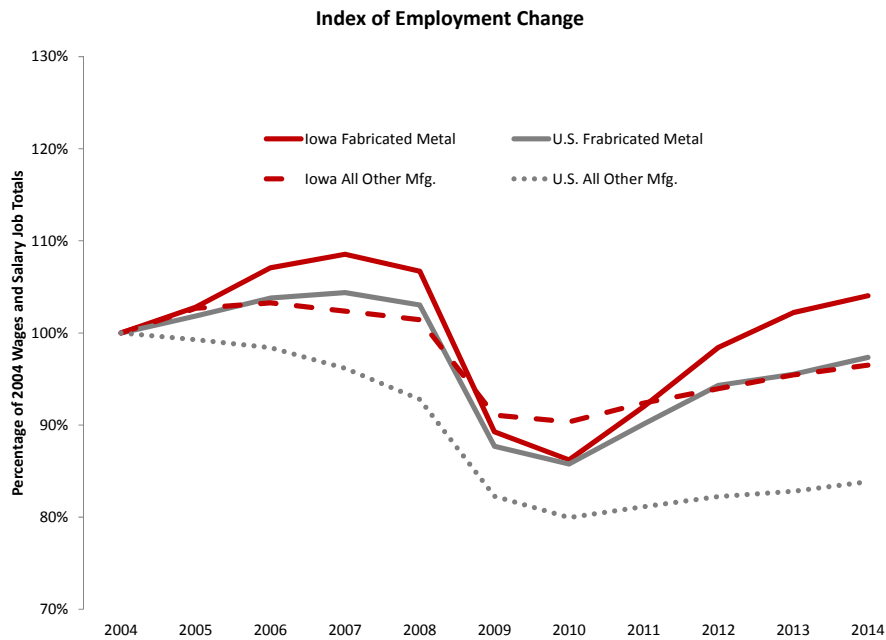


## EMPLOYMENT TRENDS

### OVERALL TREND

The U.S. fabricated metals subsector had 1,449,289 jobs in 2014. Nationally, the subsector has lost 2.7 percent of its jobs since 2004. Iowa's fabricated metals subsector, in contrast, had 4 percent more jobs in 2014 than in 2004, although 2014's 20,611 jobs were less than peak employment of 21,503 recorded in 2007. Both in Iowa and nationally, the fabricated metals subsector has experienced comparatively fewer job losses than other manufacturing industries. Figure 7 shows recent state and national employment trends in machinery manufacturing and all other manufacturing industries. Employment values are indexed to base year levels in 2004.

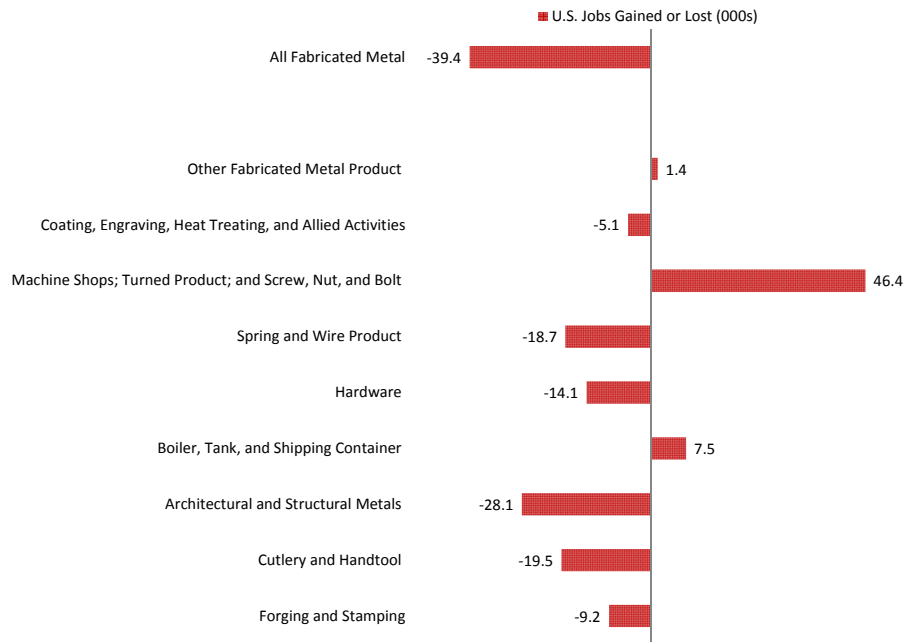
FIGURE 7



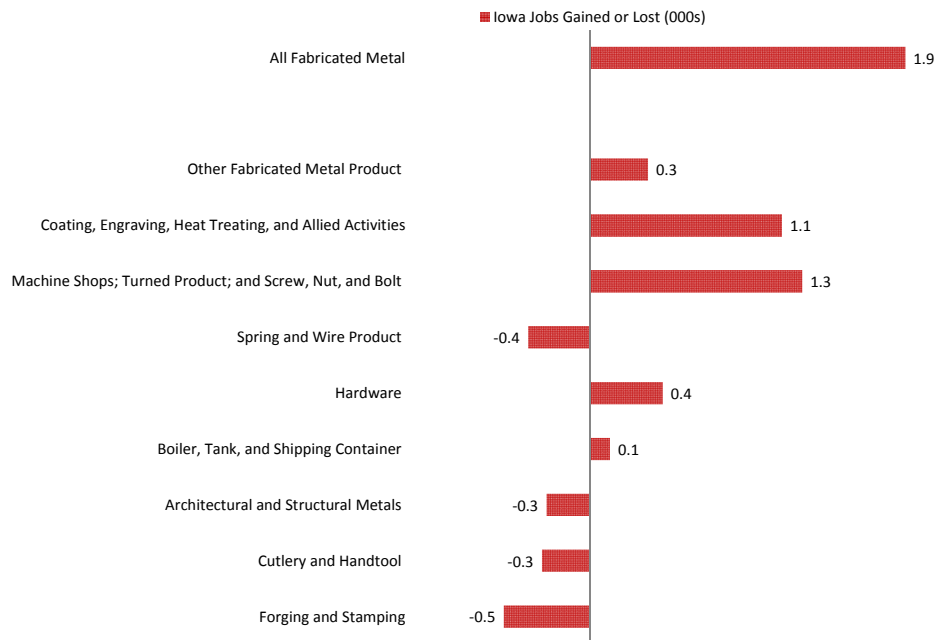
### COMPOSITION OF CHANGE

The composition of recent fabricated metal manufacturing employment change in Iowa differs from the national pattern comparing 2014 with 2004. The U.S. posted declines of 39,400 jobs. While strong gains of 46,400 jobs were realized in the machine shops and related industries, the only other area posting gains was in the manufacture of boiler tanks and shipping containers. Minor to sharp losses were realized in all other areas of this subsector. In contrast, five of the nine categories in Iowa had job gains, the most of which were found in machine shops and related and in coating, engraving, heat treating, and allied activities. In all, Iowa had 1,900 more jobs in this subsector than it had in 2004. Figure 8 and Figure 9 illustrate the distribution of job gains and losses nationally and in Iowa from 2004-2014.

**FIGURE 8. DISTRIBUTION OF RECENT U.S. JOB GAINS AND LOSSES BY DETAILED INDUSTRY, 2004-2014**



**FIGURE 9. DISTRIBUTION OF RECENT IOWA JOB GAINS AND LOSSES BY DETAILED INDUSTRY, 2004-2014**



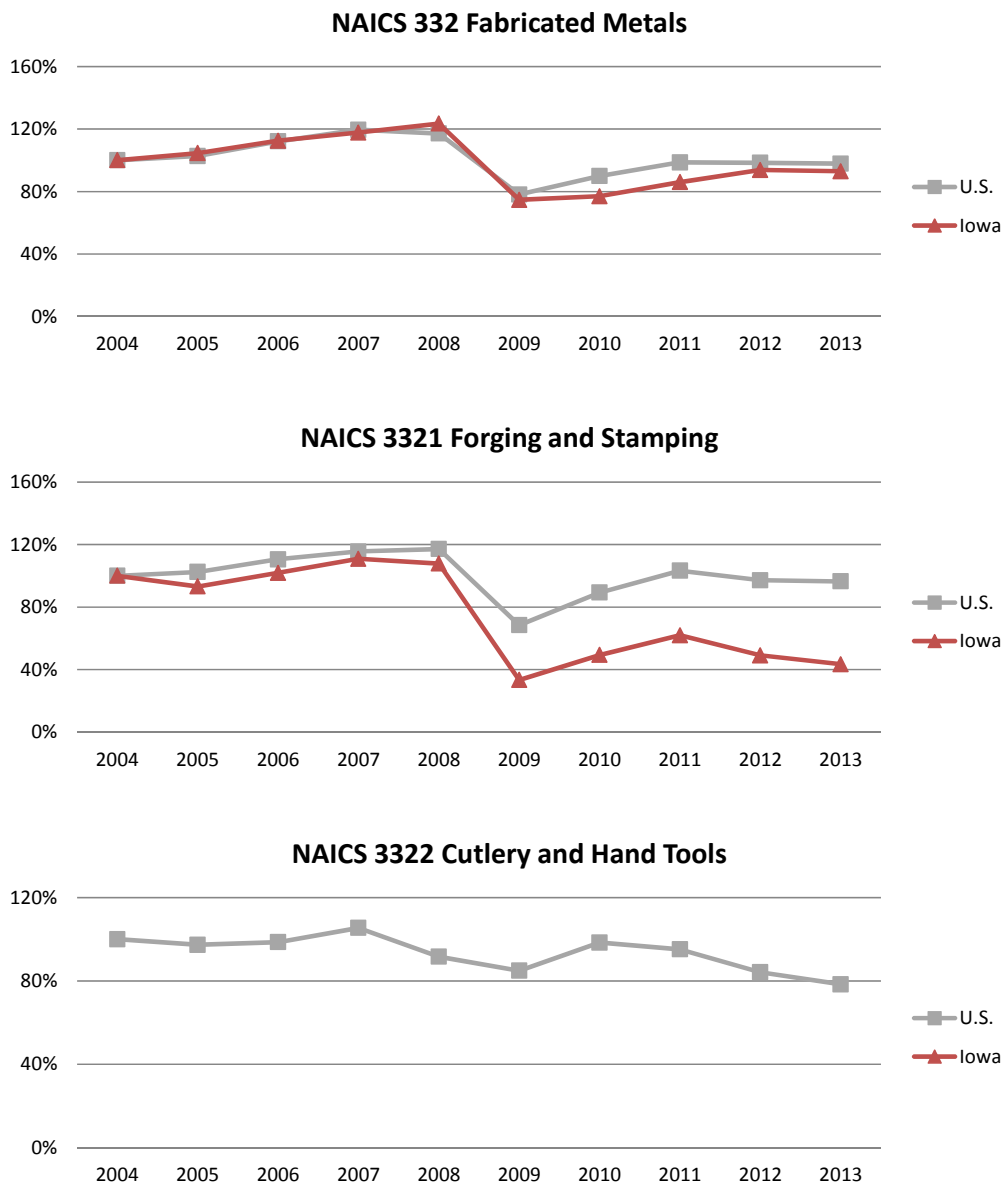
## PRODUCTIVITY TRENDS

Gross domestic product (GDP) measures the market value of all goods and services produced in a region. GDP includes all payments made to labor, returns to ownership, and indirect tax payments. Real change in GDP over time is used to monitor the economic performance of a region or industry.

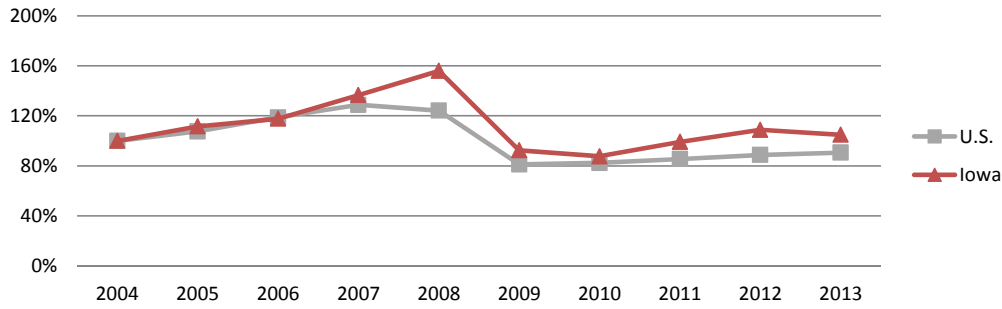
### REAL GDP BY INDUSTRY

At the industry level, GDP measures the contribution of labor and capital toward the industry's gross output. Also referred to as value added, GDP is roughly equivalent to an industry's sales and other operating income less the value of intermediate inputs of goods and services purchased from other industries. Figure 10 shows trends in real GDP in fabricated metals manufacturing and its component industries. Values are indexed to a base year of 2004.

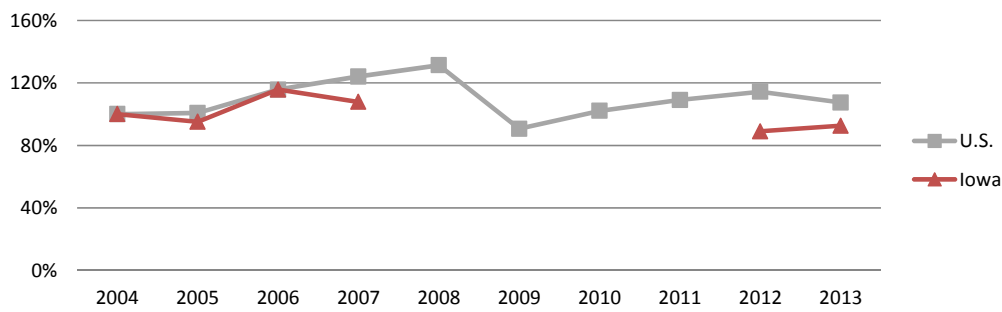
**FIGURE 10. INDEX OF REAL GDP**



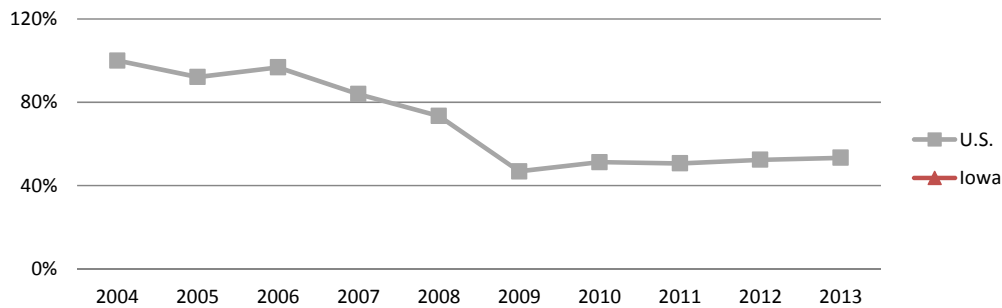
**NAICS 3323 Architectural and Structural Metals**



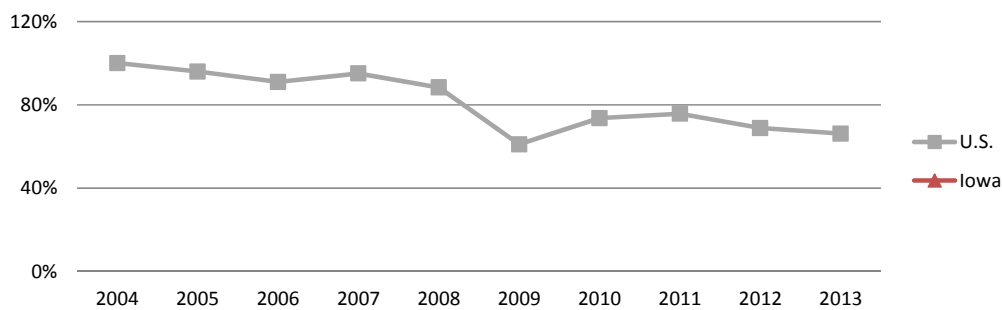
**NAICS 3324 Boilers, Tanks, and Shipping Containers**



**NAICS 3325 Hardware**

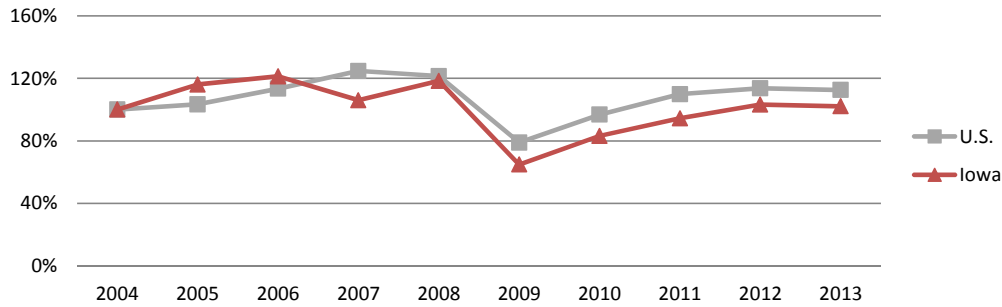


**NAICS 3326 Spring and Wire Products**

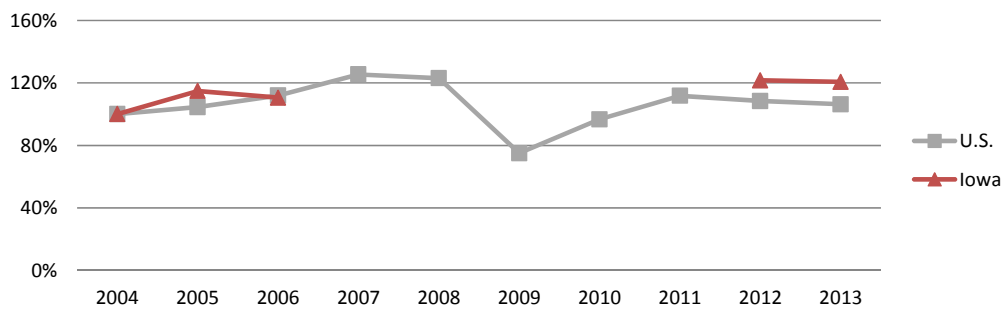




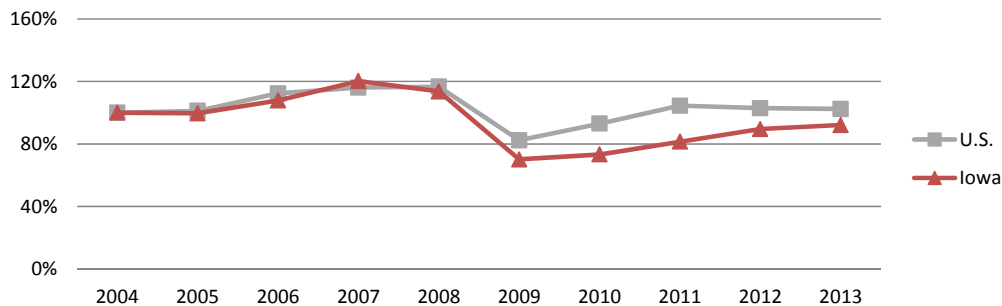
**NAICS 3327 Machine Shops and Related**



**NAICS 3328 Coating, Engraving, and Heat Treating**



**NAICS 3329 Other Fabricated Metals**

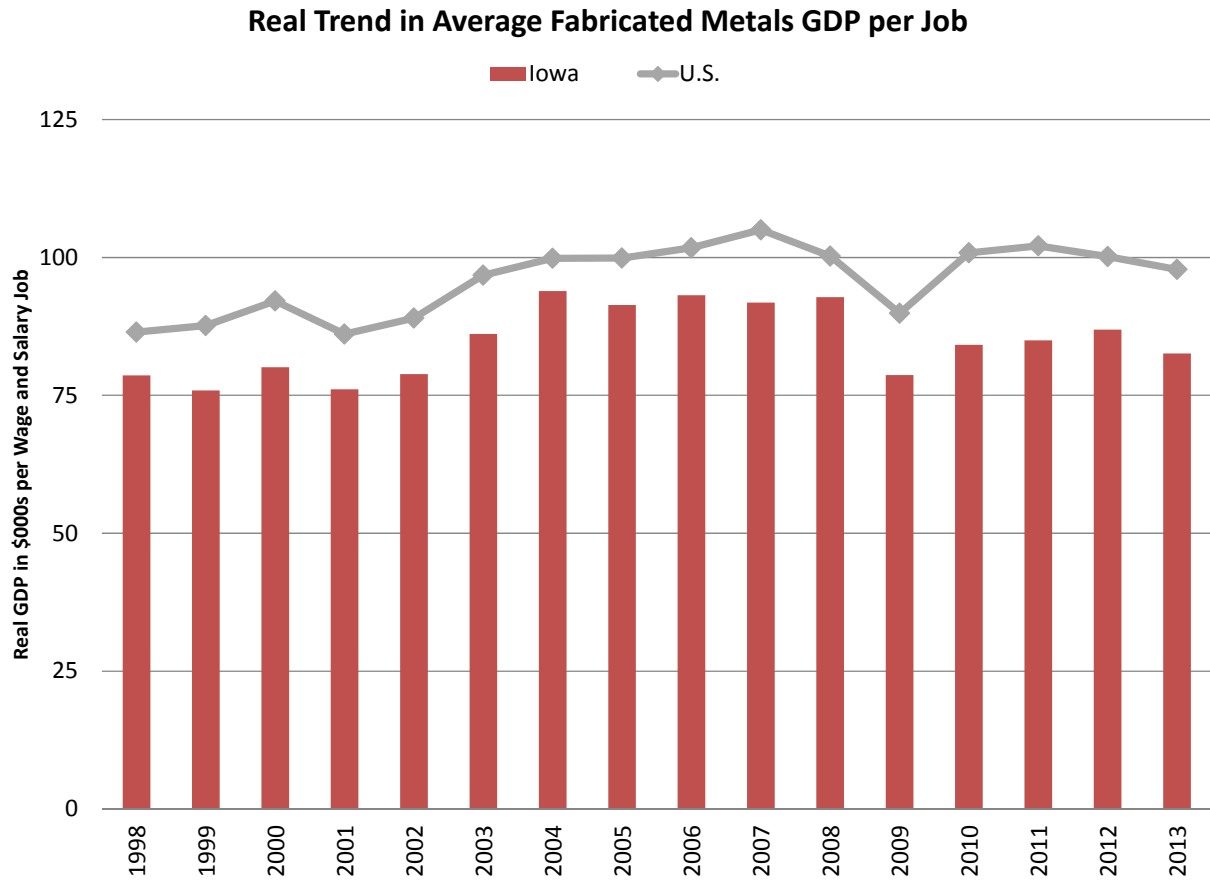


**AVERAGE GDP PER JOB**

Standardizing real GDP on a per job basis provides an indirect measure of an industry’s productivity over time. Growth in real GDP per job may result from numerous sources including production efficiency gains, increased firm or industry profitability, or adoption of more capital-intensive production processes. Declining GDP per job ratios may indicate falling worker productivity levels or market conditions that contribute to lower firm or industry profitability. Rapid declines in an industry’s GDP per job ratio may signal impending workforce reductions.

Figure 11 shows recent Iowa and U.S. trends in real average GDP per job in the fabricated metals manufacturing subsector. The U.S. GDP per job ratio has remained relatively flat since 1998, with slightly higher values from 2004-8, compared to 2009-13. Iowa’s real GDP per job ratio has consistently trailed the national average with values usually ranging between 85-95 percent of U.S. levels.

FIGURE 11



## EXPORT SALES

### U.S. MACHINERY EXPORTS

Export sales account for 17 percent of the total sales of U.S. machinery manufacturing industries. In all other manufacturing subsectors, foreign exports account for an average of 16 percent of sales.

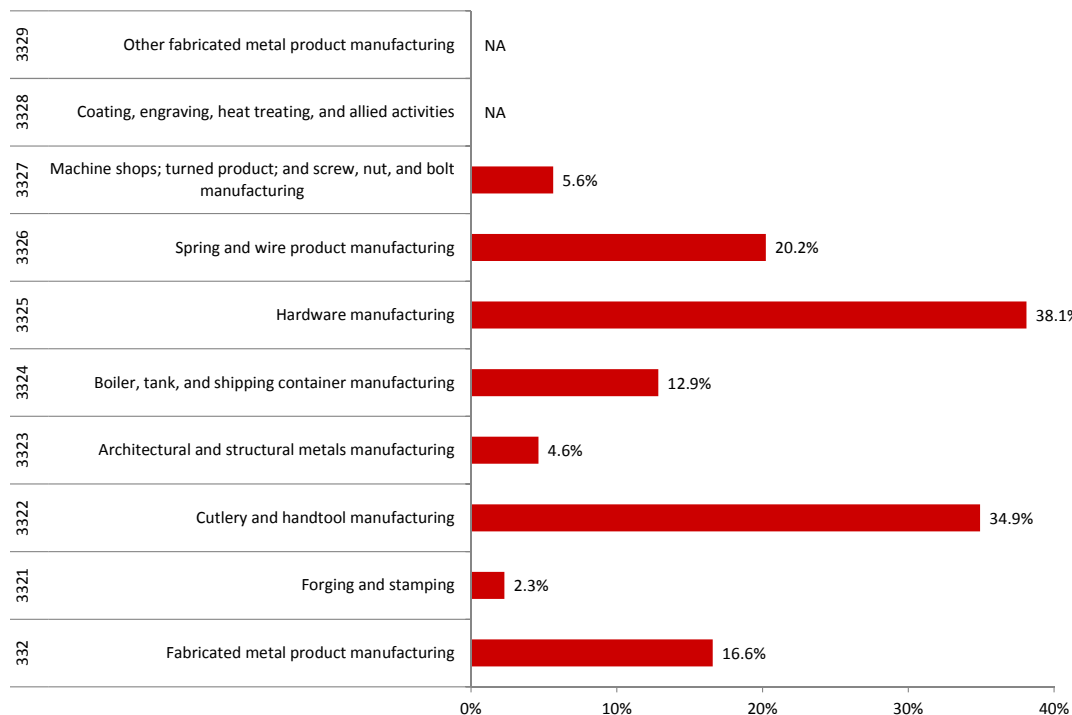
Figure 12 shows export shares of total output by detailed fabricated metals manufacturing industry in 2012. Hardware and cutlery and handtool manufacturing had the highest percentage of their sales to foreign markets at 38 percent and 35 percent, respectively. Forging and stamping and architectural and structural metals industries had the lowest fraction of sales to foreign exports.

By dollar value of export sales, architectural and structural metals account for the largest fraction of U.S. fabricated metals exports. Machine shops and related products are the second largest category of exports by dollar value. Figure 13 shows the dollar value of U.S. fabricated metals exports by industry group in 2012.

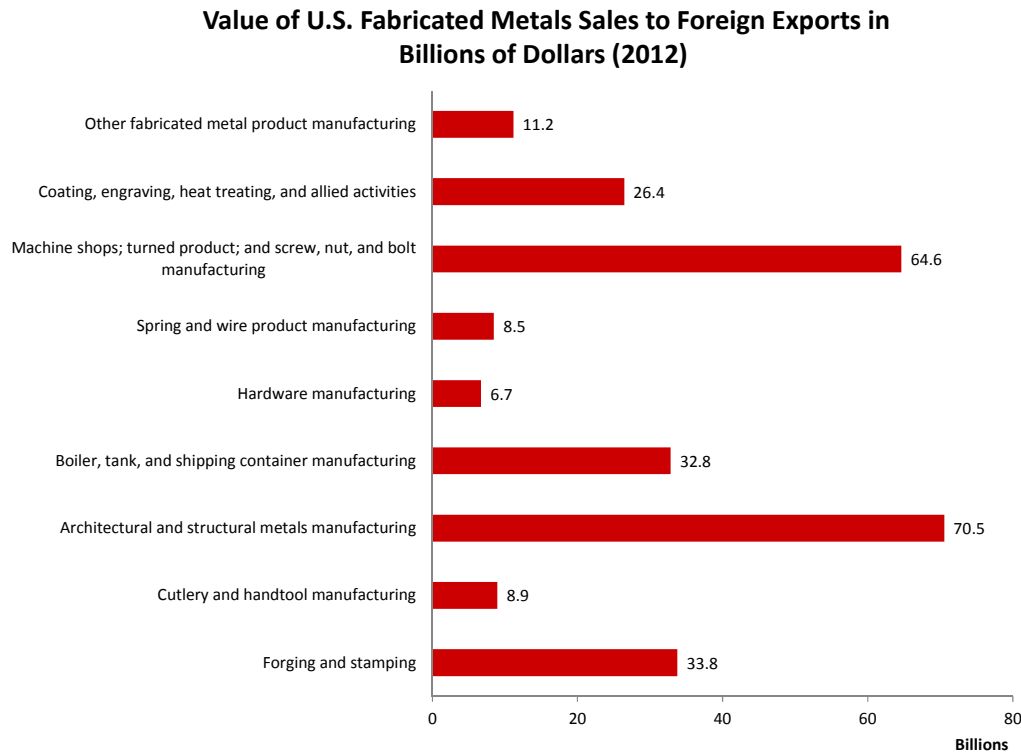
The real value of U.S. machinery exports has grown by 64 percent since 2004. Exports of products within the other fabricated metals industry group drove much of the recent growth, accounting for 59 percent of fabricated metals export growth from 2004-2014. Boilers, tanks, and shipping containers explain 13 percent of the growth.

**FIGURE 12**

**Percentage of U.S. Fabricated Metals Sales to Foreign Exports (2012)**



**FIGURE 13. U.S. MACHINERY MANUFACTURING EXPORTS BY TYPE, IN BILLIONS OF DOLLARS**



**IOWA EXPORTS**

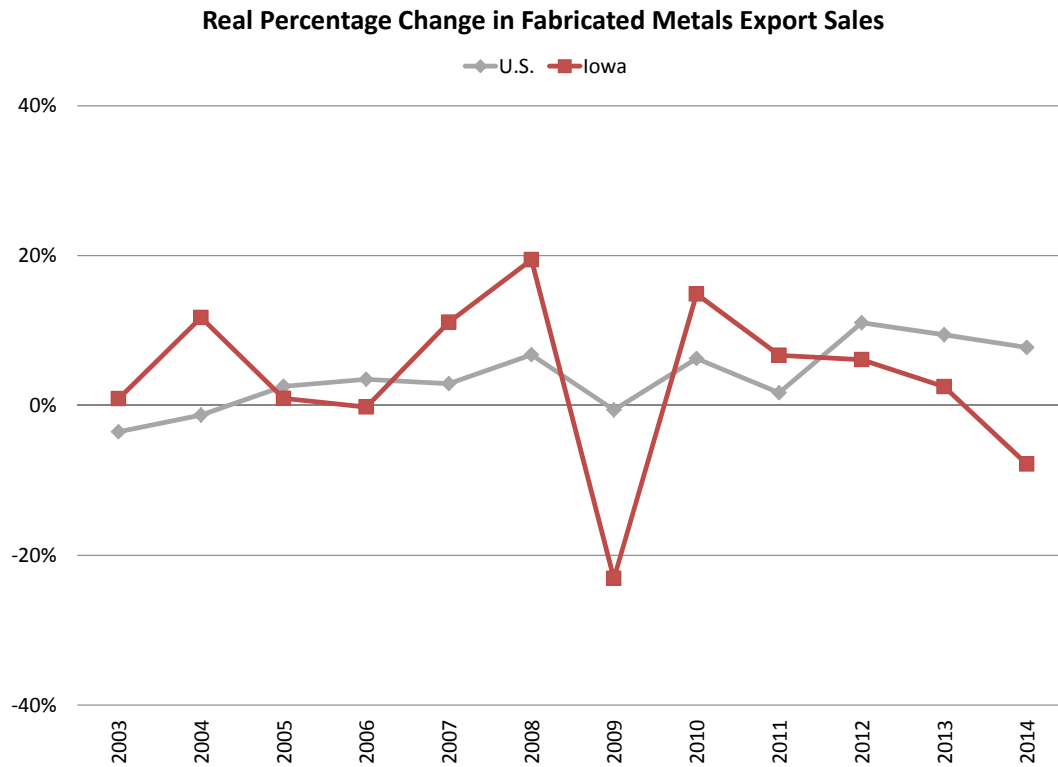
Iowa produced 0.7 percent of the fabricated metals products exported from the United States in 2014. The state’s share of U.S. export sales has generally hovered near the one percent mark since 2002. Architectural and structural metals manufacturing is Iowa’s strongest export industry within the subsector, accounting for 1.9 percent of U.S. exports.

Figure 14 compares real annual percentage growth in the value of Iowa and U.S. fabricated metals exports. Real export sales from the U.S. have grown steadily since 2004, other than a slight decline of less than one percent in 2009. Iowa experienced a much sharper decline in 2009, and has seen slower growth than the U.S. since 2012. In 2014, Iowa’s \$357 million in machinery exports were down 8 percent from their most recent inflation-adjusted peak in 2013.

**IOWA’S TRADING PARTNERS**

The top trading partners for Iowa’s fabricated metals exports in 2014 included Canada, Mexico, and Brazil. China, Germany, the United Kingdom, Saudi Arabia, South Korea, Japan, and Denmark rounded out the top ten.

FIGURE 14



## OCCUPATIONAL PROFILE

Nearly two-thirds of Iowa's fabricated metal workers are in production occupations. Though not shown, the larger occupations in declining order within the production grouping are machinists; team assemblers; welders, cutters, solderers, and brazers; and machine tool setters, operators, and tenders. A combined 14 percent of jobs are associated with office and administrative support and management, and a scant 4 percent of the jobs are engineering or related positions. Figure 15 shows the distribution of fabricated metal employment by major occupational group in 2014.

FIGURE 15. KEY OCCUPATIONS IN IOWA FABRICATED METAL MANUFACTURING INDUSTRIES

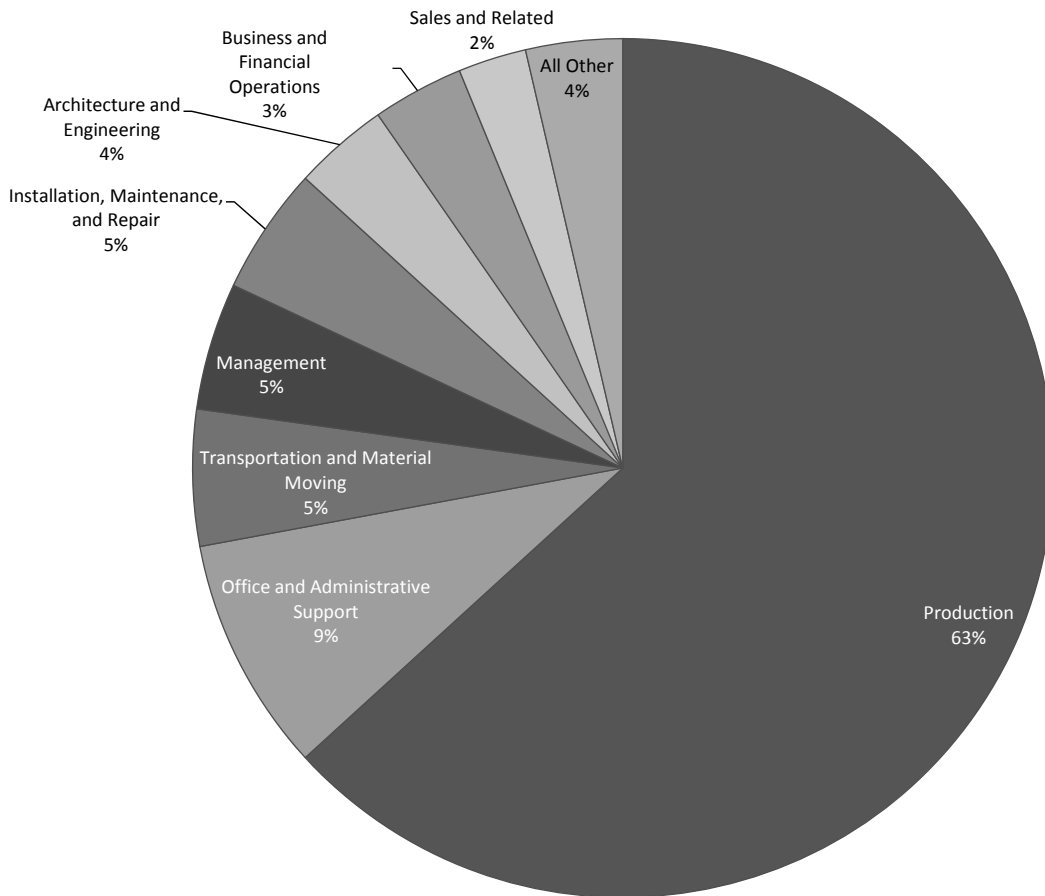
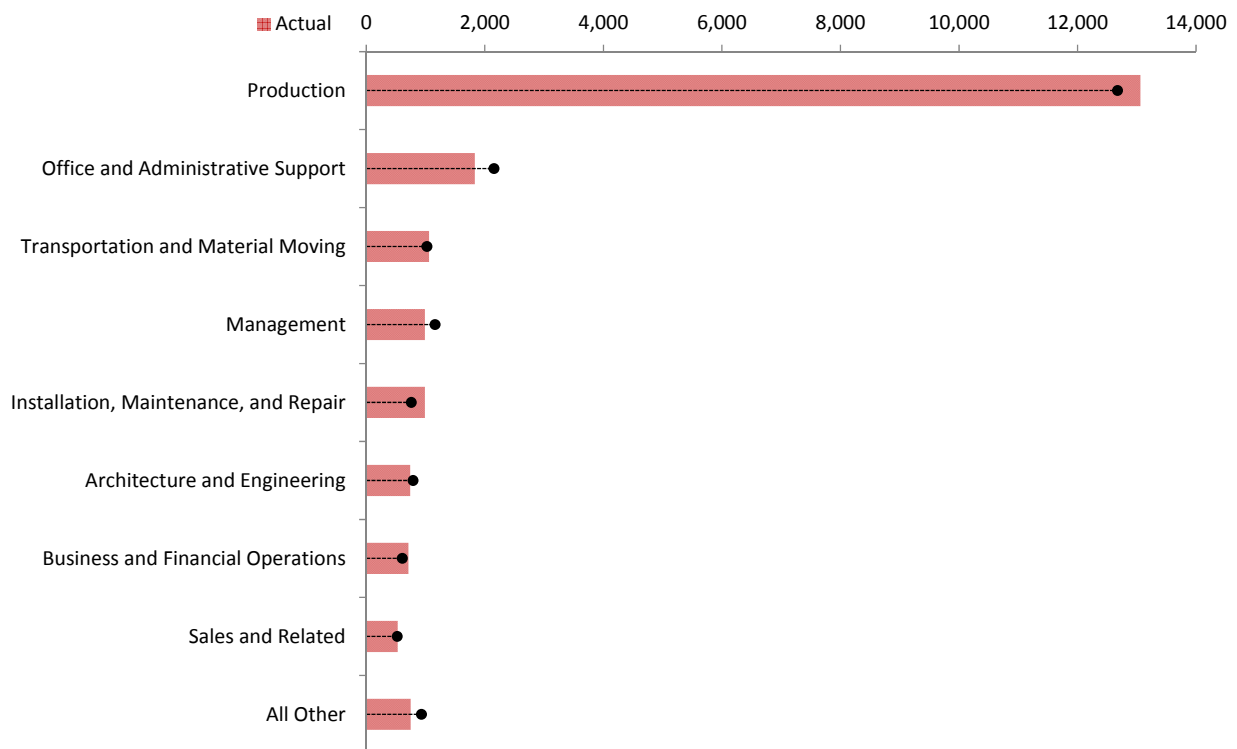


Figure 16 displays the broad occupational distribution for the state of Iowa. It also, using national staffing patterns to predict expected occupations, displays how Iowa deviates from the U.S. fabricated metals distribution. Overall, Iowa has significantly more workers than would be expected in production jobs; installation, maintenance, and repair; and in business and financial operations. The state has many fewer than would be expected in office and administrative support, management, architecture and engineering, and in the all-encompassing all other category.

**FIGURE 16**

**Actual and Expected Occupational Staffing (Based on National Averages)  
 for Iowa Fabricated Metals Manufacturing, 2014**



## RESEARCH AND DEVELOPMENT

### *R&D SPENDING*

Only 12 percent of U.S. fabricated metals manufacturing firms pursued R&D activities in 2010. The R&D engagement rate for the manufacturing sector as a whole was 23 percent. Spending by R&D performers within the U.S. fabricated metals subsector averaged \$0.6 million per firm for worldwide R&D efforts. In 2011, R&D spending by active performers was equivalent to 1.3 percent of worldwide sales.

Iowa's fabricated metals firms account for about one penny of every dollar spent on R&D in the manufacturing sector. Nationally, the fabricated metals subsector's share of manufacturing R&D is also one percent.

### *PATENTING ACTIVITY*

Patenting activity provides one of the few available measures for monitoring R&D level by industry within states. According to data from the U.S. Patent and Trademark Office, 223 fabricated metals manufacturing-related utility patents originated from Iowa during 2008-2012. These patents accounted for 1.1 percent of the national total. When standardized by number of firms in the industry, Iowa's fabricated metals-related patenting efforts rank 26th among all states. Iowa originates an average of one patent per every 14 fabricated metals firms per year. Leading states on this measure include Maryland, Delaware, and Arizona.

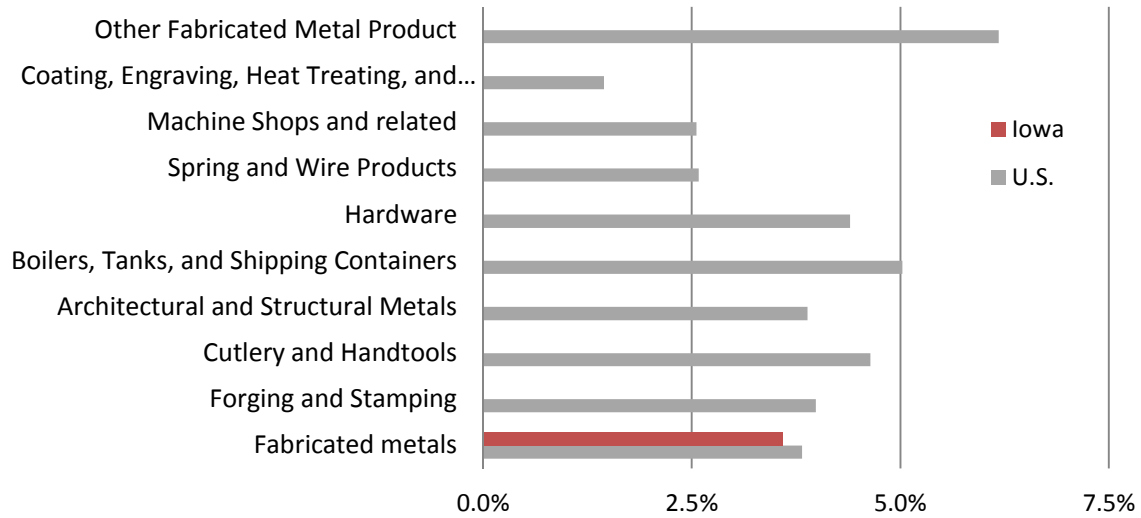
### *RESEARCH STAFF*

Staffing levels of engineering-related workers provide another indirect measure of R&D intensity within a state's industries. Among U.S. fabricated metals companies with R&D efforts, an average of five percent of their domestic workforce is involved in the R&D activities. That five percent includes scientists and engineers and their managers, technicians and technologists, and clerical and other support staff for R&D programs. Research estimates produced by the U.S. Bureau of Labor Statistics suggest that Iowa slightly lags the national average in its percentage of engineering-related workers in fabricated metals manufacturing. In Iowa, engineers and engineering technicians account for an estimated 3.6 percent of all fabricated metals subsector workers. The U.S. average for the industry is 3.8 percent. Figure 171 shows the estimated U.S. and Iowa percentages for the subsector as a whole and U.S. estimates for individual fabricated metals industries.



FIGURE 17

### Estimated Percentage of Workers in Engineering-Related Occupations, 2014



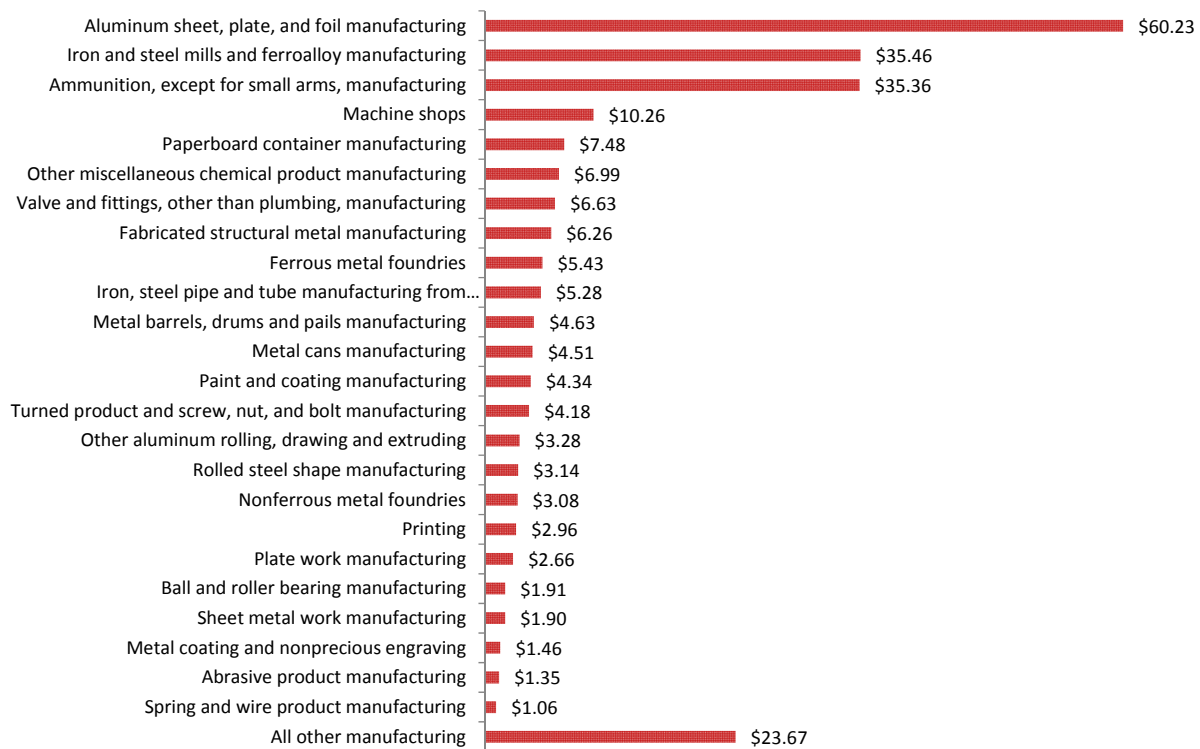
## BACKWARD AND FORWARD INDUSTRIAL LINKAGES

### BACKWARD LINKAGES: AMOUNTS

Iowa's fabricated metals manufacturers require Iowa-supplied manufactured inputs, and they make sales to Iowa manufacturers. These relationships are estimated using an input-output model of the entire state economy, which accounts for all production related transactions among all industries and other economic institutions in the state. Figure 18 provides an estimate of the backward or supply chain linkages the fabricated metals industry relies on in Iowa. In total, \$267.2 million of inputs were purchased from Iowa manufacturers. The higher amounts of input purchases were for aluminum, iron, and steel products as well as ammunition components. It is also evident that the fabricated metals industry purchases manufactured inputs primarily from other fabricated metals producers.

FIGURE 18

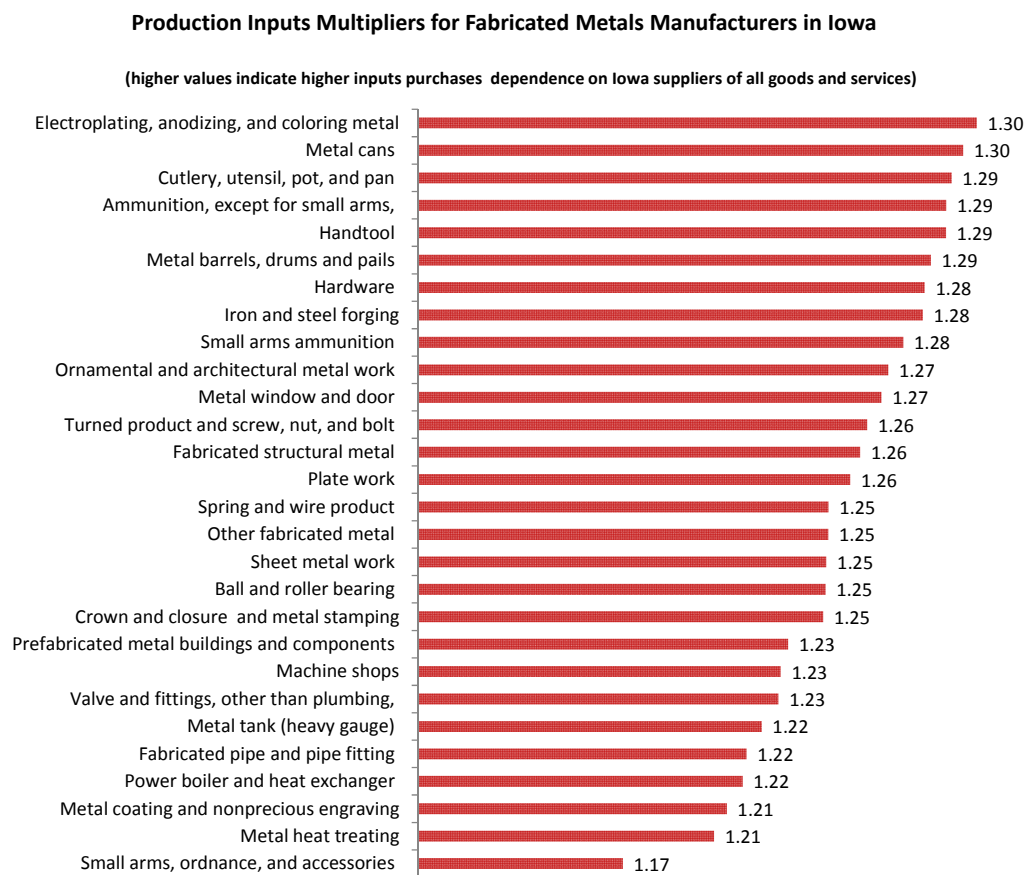
**Fabricated Metal Manufacturers Estimated Purchases from Iowa Manufacturing Firms in 2013**  
(amounts in millions)



**BACKWARD LINKAGES: MULTIPLIERS**

Inter-industrial modeling systems allow us to compile an indexed value of industrial reliance on in-state suppliers for manufactured goods and other services. This index is called an inputs multiplier, and it describes the relationship an industry has with the rest of the state’s producers. The median inputs multiplier in Iowa for manufacturing firms was 1.26 in 2013. That value means this: for every \$1 of total production input expenditures, the median Iowa manufacturing firm required \$.26 worth of input supplies from some other Iowa firm. Figure 19 displays the multipliers for the fabricated metal industrial categories in the input-output modeling system for Iowa. Eleven firms had multipliers higher than the median manufacturing value of 1.26. The range was 1.17 for small arms, ordinance, and accessories, and the highest was 1.30 for electroplating, anodizing, and coloring metal manufacturing

**FIGURE 19**

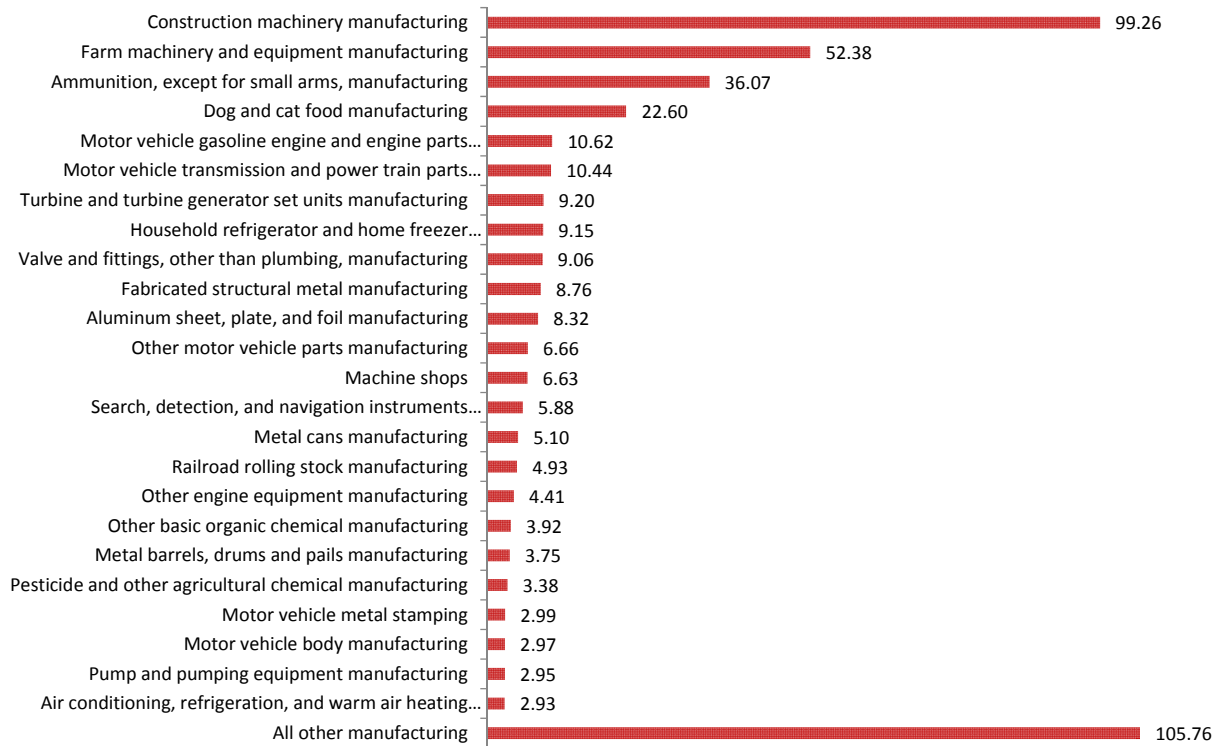


**FORWARD LINKAGES**

Iowa’s fabricated metal industry is a major supplier to other Iowa manufacturers. These sales are called forward linkages as they, too, help us understand inter-industrial dependencies in the state. In 2013, an estimated \$543.8 million in fabricated metal sales were made to other Iowa manufacturers. Figure 20 displays those values ranked by purchasing manufacturing industry. Farm and construction machinery combined to account for 28 percent of total sales by this subsector to Iowa manufacturers

**FIGURE 20**

**Fabricated Metal Manufacturers Estimated Sales To Iowa Manufacturing Firms in 2013**  
(amounts in millions)



## KEY DATA SOURCES

International Trade Administration, U.S. Department of Commerce

Science and Engineering Indicators, National Science Foundation

U.S. Bureau of Economic Analysis

U.S. Bureau of Labor Statistics

U.S. Census Bureau

U.S. Patent and Trademark Office

Input-output model of the Iowa economy