



**American
Iron and Steel
Institute**

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The Economic Impact of the American Iron and Steel Industry

Methodology and Documentation

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Introduction

The Economic Impact of the American Iron and Steel Industry study estimates the economic contributions made by the iron and steel industry to the U.S. economy in 2017. John Dunham & Associates (JDA) conducted this research, which was funded by the American Iron and Steel Institute (AISI). This work used standard econometric models first developed by the U.S. Forest Service, and now maintained by the IMPLAN Group. Data came from industry sources, government publications and Infogroup.

The study defines the iron and steel industry as facilities¹ engaged in iron ore mining, coke production, ferrous scrap processing, mill services, iron and steelmaking and steel mill product manufacturing, ferrous metals foundries, steel product manufacturing from mill products, iron and steel product processing, and distribution through metals service centers and wholesalers. The study measures the number of jobs in these sectors, the wages paid to employees, the value added and the value of industry output. In addition, it measures the business and personal taxes paid by companies and employees involved in the iron and steel industry.

Industries are linked to each other when one firm buys from another to produce its own products. Each industry in turn makes purchases from a different mix of other

¹ This study is based on facilities. A single firm might operate dozens of facilities.

industries, and so on. Employees in all industries extend the economic impact when they spend their earnings. Thus, economic activity started by the iron and steel industry generates output and jobs in hundreds of other industries, often in states far removed from the original economic activity. The impact of supplier firms, and the “induced impact” of the re-spending by employees of industry and supplier firms, is calculated using an input/output model of the United States. The study calculates the impact on a national basis, by state, and by congressional district.

The study also estimates business and personal taxes paid by the industry and its employees. Federal taxes include industry-specific excise and sales taxes, business and personal income taxes, FICA, and unemployment insurance. State and local tax systems vary widely. Direct retail taxes include state and local sales taxes, license fees, and applicable gross receipt taxes. Manufacturers pay real estate and personal property taxes, business income taxes, and other business levies that vary in each state and municipality.

Summary Results

The iron and steel industry is a dynamic part of the U.S. economy, generating more than \$520 billion in total economic output and nearly two million American jobs in 2017. These jobs paid over \$131 billion in wages and benefits.

The manufacturing process as defined in this study begins with the production and processing of materials such as iron ore, ferrous scrap, or coke, and the provision of mill services. These activities directly account for 76,000 jobs. Iron and steelmaking and the manufacturing of steel mill products such as sheet, plate, pipes and bars, directly account for another 141,000 jobs. The iron and steel industry directly accounts for another 170,000 jobs related to ferrous metals foundries, steel product manufacturing from mill products, iron and steel product processing, and distribution through metals service centers and wholesalers. Thus, nearly 387,000 jobs paying \$34 billion dollars in wages and benefits are directly linked to the American iron and steel industry through steelmaking, steel mill and other steel products, processing, distribution, materials and mill services, which in total produces more than \$200 billion in output.

Numerous firms produce and sell a broad range of items to the iron and steel industry, including machinery for the production process, fuel, technology and packaging materials. In addition, supplier firms provide a broad range of services, including

personnel services, financial services, advertising services, legal services and transportation services. Additional people are employed by government entities responsible for the regulation of the iron and steel industry. The study estimates that the American iron and steel industry supports 716,000 supplier jobs, paying \$53 billion in wages and compensation. These suppliers generate \$173 billion in economic output.

Finally, this study accounts for the spending by employees of the iron and steel industry and its suppliers. This spending, items including, but not limited to housing, food, educational services and medical care, comprises the “induced impact” of the industry. In other words, this spending, and the jobs it creates, is induced by the production and distribution of iron and steel. The study estimates that the induced impact of the industry is \$143 billion, and generates 878,000 jobs paying \$45 billion in wages and benefits.

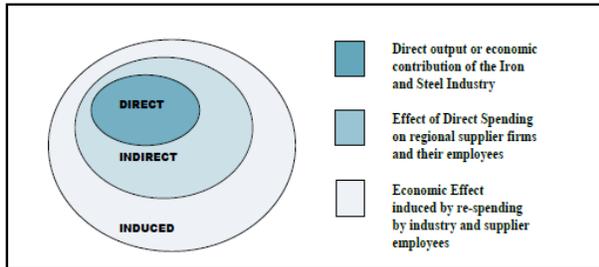
The American iron and steel industry also contributes to the public finances of the nation. This contribution consists of the direct taxes paid by firms and their employees, equaling a total of \$56 billion in revenues to the federal, state and local governments.

Economic Impact Modeling – Summary

The analysis consists of a number of parts, each of which will be described in the following sections of this document. These include data, models, calculations and outputs. These components are linked together into an interactive system that allows users to examine the links between the various parts of the industry and to produce detailed output documents on an as-needed basis. As such, there is no book – no thick report – outlining the impact of the industry, but rather a system of models and equations that can be continuously queried and updated. The economic impact study begins with an accounting of the direct employment in iron and steel industry sectors including iron ore mining, coke production, ferrous scrap processing, mill services, iron and steelmaking and steel mill product manufacturing, ferrous metals foundries, steel product manufacturing from mill products, iron and steel product processing, and distribution through metals service centers and wholesalers. The data come from a variety of government and private sources.

It is sometimes mistakenly thought that initial spending accounts for all of the impact of an economic activity or a product. For example, at first glance it may appear that consumer expenditures for a product are the sum total of the impact on the local economy. However, one economic activity always leads to a ripple effect whereby other

sectors and industries benefit from this initial spending. This inter-industry effect of an economic activity can be assessed using multipliers from regional input-output modeling.



The economic activities of the iron and steel industry are linked to other industries in the state and national economies. The activities required to produce a structural steel shape, from iron ore mining to scrap processing to iron and steelmaking to steel mill product manufacturing to fabrication

of the shape from a steel mill product to shipping to a customer generate the direct effects on the economy. Regional impacts occur when these activities require purchases of goods and services such as machinery or electricity from local or regional suppliers. Additionally, induced impacts occur when workers involved in direct and indirect (supplier) activities spend their wages. The framework in the chart above illustrates these linkages.

This method of analysis allows the impact of local production activities to be quantified in terms of final demand, earnings, and employment in states and the nation as a whole.

Once the direct impact of the industry has been calculated, the input-output methodology discussed in the following sections is used to calculate the contribution of the supplier sector and of the re-spending in the economy by employees in the industry and its suppliers.

Model Description and Data

This analysis is based on data provided by Infogroup,² data provided by AISI, and the federal government. The analysis utilizes the IMPLAN Group model in order to quantify the economic impact of the iron and steel industry on the economy of the United States. The model adopts an accounting framework through which the relationships between different inputs and outputs across industries and sectors are

² Infogroup is the leading provider of business and consumer data for the top search engines and leading in-car navigation systems in North America. Infogroup gathers data from a variety of sources by sourcing, refining, matching, appending, filtering, and delivering source data. The company verifies its data at the rate of almost 100,000 phone calls per day to ensure absolute accuracy.

computed. This model can show the impact of a given economic decision – such as a factory opening or operating a sports facility – on a predefined, geographic region. It is based on the national income accounts generated by the US Department of Commerce, Bureau of Economic Analysis (BEA).³

Every economic impact analysis begins with a description of the industry being examined. In the case of the AISI model, the iron and steel industry is defined as iron ore mining, coke production, ferrous scrap processing, mill services, iron and steelmaking and steel mill product manufacturing, ferrous metals foundries, steel product manufacturing from mill products, iron and steel product processing, and distribution through metals service centers and wholesalers.

Data for the distribution of steel through metal service centers specifically comes from Economic Impact of the Metals Industry⁴. A break is applied to direct jobs in order to capture jobs created by the movement of steel through these firms. The break is based on a report from *Modern Casting*, published by the American Foundry Society in December 2016.⁵ The report measures the tonnage of iron and steel produced across the globe. U.S. production of gray iron, ductile iron, malleable iron, and steel as a percent of total metals production is used as a proxy to estimate a production percent within the U.S.

Data on scrap operations that supply materials to mills is based on the Economic Impact of the Scrap Recycling Industry.⁶ Specifically, ferrous scrap recycling operations are included in this study. For scrap operations that handled nonferrous as well as ferrous materials, a break is applied to isolate the ferrous related jobs in these facilities. This break is calculated using the estimated volumes of scrap materials processed for domestic consumption and export in 2016 provided to JDA in March of 2017 by the Institute of Scrap Recycling Industries.

³ RIMS II is a product developed by the U.S. Department of Commerce, Bureau of Economic Analysis as a policy and economic decision analysis tool. IMPLAN was originally developed by the U.S. Forest Service, the Federal Emergency Management Agency and the Bureau of Land Management. It was converted to a user-friendly model by the IMPLAN Group in 1993. The AISI Model uses the Input-Output tables for 2016.

⁴ John Dunham & Associates, New York. 2017.

⁵ *Modern Casting*, American Foundry Society. December, 2016. Available on-line at: <https://www.moderncasting.com/issues/december-2016>

⁶ John Dunham & Associates, New York. 2017.

The IMPLAN group model is designed to run based on the input of specific direct economic factors. It uses a detailed methodology (see IMPLAN Methodology section) to generate estimates of the other direct impacts, tax impacts, and supplier and induced impacts based on these entries. In the case of the Economic Impact of the American Iron and Steel Industry model, direct employment in the industry is the base starting point for the analysis. Direct employment is based directly on data provided to John Dunham & Associates by Infogroup. Multiple stages of cleaning were then performed on these data, including removing duplicate records, removing defunct facilities and companies, and correcting inaccurate data. The data from Infogroup was then merged with member data provided by AISI. In addition, for cases where data were available from the AISI, the Infogroup data were replaced with these. Missing employment figures were replaced using state medians based on the facility's primary mode of operation (steel mill, metal service center, etc.). Missing firm addresses were found by JDA staff using on-line searches.

Once the initial direct employment figures have been established, they are entered into a model linked to the IMPLAN database. The IMPLAN data are used to generate estimates of direct wages and output. Wages are derived from data from the U.S. Department of Labor's ES-202 reports that are used by IMPLAN to provide annual average wage and salary establishment counts, employment counts and payrolls at the county level. Since this data only covers payroll employees, it is modified to add information on independent workers, agricultural employees, construction workers, and certain government employees. Data are then adjusted to account for counties where non-disclosure rules apply. Wage data include not only cash wages, but health and life insurance payments, retirement payments and other non-cash compensation. It includes all income paid to workers by employers. Distribution income partners of LLCs are also included in wage figures.

Total output is the value of production by industry in a given state. It is estimated by IMPLAN from sources similar to those used by the BEA in its RIMS II series. Where no Census or government surveys are available, IMPLAN uses models such as the Bureau of Labor Statistics growth model to estimate the missing output.

The model also includes information on income received by the federal, state and local governments, and produces estimates for the following taxes at the federal level: corporate income, payroll, personal income, estate and gift, and excise taxes; customs duties; and fines, fees, etc. State and local tax revenues include estimates of: corporate

profits, property, sales, severance, estate and gift and personal income taxes; licenses and fees and certain payroll taxes.

While IMPLAN is used to calculate the state level impacts, Infogroup data provide the basis for congressional district level estimates. Publicly available data at the congressional district level is limited by disclosure restrictions, especially for smaller sectors of the economy. Our model therefore uses actual physical location data provided by Infogroup in order to allocate jobs – and the resulting economic activity – by physical address or when that is not available, zip code. For zip codes entirely contained in a single congressional district, jobs are allocated based on the percentage of total sector jobs in each zip code. For zip codes that are broken by congressional districts, allocations are based on the percentage of total jobs physically located in each segment of the zip code. Physical locations are based wherever possible on the actual address of the facility. When an address cannot be determined, JDA staff use either Google Earth or Google Maps to physically locate the facility. All supplier jobs are allocated based on the percentage of a state’s employment in that sector in each of the districts. Again, these percentages are based on Infogroup data.

IMPLAN Methodology⁷

Francoise Quesnay one of the fathers of modern economics, first developed the analytical concept of inter-industry relationships in 1758. The concept was actualized into input-output analysis by Wassily Leontief during the Second World War, an accomplishment for which he received the 1973 Nobel Prize in Economics.

Input-output analysis is an econometric technique used to examine the relationships within an economy. It captures all monetary market transactions for consumption in a given period and for a specific geography. The IMPLAN model uses data from many different sources – as-published government data series, unpublished data, sets of relationships, ratios, or other estimates. The IMPLAN group gathers this data, converts it into a consistent format, and estimates the missing components.

There are three different levels of data generally available in the United States: federal, state and county. Most of the detailed data is available at the county level, and as such there are many issues with disclosure, especially in the case of smaller industries.

⁷ This section is paraphrased from IMPLAN Professional: Users Guide, Analysis Guide, Data Guide, Version 2.0, MIG, Inc., June 2000.

IMPLAN overcomes these disclosure problems by combining a large number of datasets and by estimating those variables that are not found from any of them. The data is then converted into national input-output matrices (Use, Make, By-products, Absorption and Market Shares) as well as national tables for deflators, regional purchase coefficients and margins.

The IMPLAN Make matrix represents the production of commodities by industry. The Bureau of Economic Analysis (BEA) Benchmark I/O Study of the U.S. Make Table forms the basis of the IMPLAN model. The Benchmark Make Table is updated to current year prices, and rearranged into the IMPLAN sector format. The IMPLAN Use matrix is based on estimates of final demand, value-added by sector and total industry and commodity output data as provided by government statistics or estimated by IMPLAN. The BEA Benchmark Use Table is then bridged to the IMPLAN sectors. Once the re-sectoring is complete, the Use Tables can be updated based on the other data and model calculations of interstate and international trade.

In the IMPLAN model, as with any input-output framework, all expenditures are in terms of producer prices. This allocates all expenditures to the industries that produce goods and services. As a result, all data not received in producer prices is converted using margins which are derived from the BEA Input-Output model. Margins represent the difference between producer and consumer prices. As such, the margins for any good add to one. Deflators, which account for relative price changes during different time periods, are derived from the Bureau of Labor Statistics (BLS) Growth Model. The 224 sector BLS model is mapped to the 536 sectors of the IMPLAN model. Where data are missing, deflators from BEA's Survey of Current Businesses are used.

Finally, one of the most important parts of the IMPLAN model, the Regional Purchase Coefficients (RPCs) must be derived. IMPLAN is derived from a national model, which represents the "average" condition for a particular industry. Since national production functions do not necessarily represent particular regional differences, adjustments need to be made. Regional trade flows are estimated based on the Multi-Regional Input-Output Accounts, a cross-sectional database with consistent cross interstate trade flows developed in 1977. These data are updated and bridged to the 536 sector IMPLAN model.

Once the databases and matrices are created, they go through an extensive validation process. IMPLAN builds separate state and county models and evaluates them,

checking to ensure that no ratios are outside of recognized bounds. The final datasets and matrices are not released before extensive testing takes place.



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