2019 Economic Impact of the Foundry Industry

Methodology and Documentation

Prepared for

American Foundry Society
1695 N Penny Lane
Schaumburg, IL 60173

by

John Dunham & Associates
32 Court Street, Suite 207
Brooklyn, New York 11201

March 2020

The Economic Impact of the Foundry Industry: 2019

Executive Summary

The *2019 Economic Impact of the Foundry Industry* estimates the economic contributions made by the foundry and metalcasting industry to the U.S. economy in 2019. John Dunham & Associates (JDA) conducted this research, which was funded by American Foundry Society (AFS). This study uses standard econometric models first developed by the U.S. Forest Service, and now maintained by IMPLAN, Inc. Data came from industry sources, government publications, and Infogroup.

The foundry industry is defined to include foundries of all types of metals and processes, with the general definition that a foundry is a facility that pours metal into molds to create geometric shapes. In addition to conventional manufacturing foundries, this includes art foundries, college and university foundries, military/government foundries, artists and artisans who work in cast metal, die-casting facilities, continuous casting production, and captive foundries. Ancillary services that take place at foundries are also included; This comprises everything from machining, administrative, storage, 3D printing, foundry-managed wholesaling and foundry-managed retailing. The study measures the number of jobs in this industry, the wages paid to employees, total economic output, and federal and state business taxes generated. Excluded are facilities that operate primarily in extrusions, forging, stamping/fabrication, entities that contract out casting to other businesses, and producers of intermediate products like ingots and billets.

Industries are linked to each other when one industry buys from another to produce its own products. Each industry in turn makes purchases from a different mix of other industries, and so on. Employees in all industries extend the economic impact when they spend their earnings. Thus, economic activity started by the foundry industry generates output (and jobs) in hundreds of other industries, often in sectors and 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 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. Direct retail taxes include state and local sales taxes, license fees, and applicable gross receipt taxes. The foundry industry pays real estate and personal property taxes, business income taxes, and other business levies that vary in each state and municipality. All entities engaged in business activity generated by the industry pay similar taxes.

The foundry industry is a dynamic part of the U.S. economy, accounting for about **$110.52 billion in total economic output** or roughly 0.51 percent of GDP.[1] Foundries directly employed about 162,816 Americans in 2019. These workers earn over $11.61 billion in wages and benefits. When supplier and induced impacts are taken into account, the foundry industry is responsible for 492,565 jobs in the United States and $32.16 billion in wages; as well as $10.59 billion in direct federal, state and local taxes; not including state and local sales taxes imposed on foundry products.

[1] Based on 2019 GDP of $21.7 trillion. See: U.S. Bureau of Economic Analysis, Gross Domestic Product [GDP], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GDP, March 8, 2020.

Summary Results

The *2019 Economic Impact of the Foundry Industry* measures the combined impact of foundries and ancillary services in the United States. The industry is defined to foundries of all types of metals and processes, with the general definition that a foundry is a facility that pours metal into molds to create geometric shapes. In addition to conventional manufacturing foundries, this includes art foundries, college and university foundries, military/government foundries, artists and artisans who work in cast metal, die-casting facilities, continuous casting production, and captive foundries. Ancillary services that take place at foundries are also included; This comprises everything from machining, administrative, storage, 3D printing, foundry-managed wholesaling and foundry-managed retailing. The study measures the number of jobs in this industry, the wages paid to employees, total economic output, and federal and state business taxes generated. Excluded are facilities that operate primarily in extrusions, forging, stamping/fabrication, entities that contract out casting to other businesses, and producers of intermediate products like ingots and billets. The industry contributes about $110.52 billion in total to the U.S. Economy, or 0.51 percent of GDP and impacts firms in 523 sectors of the US economy through its production and distribution linkages.[2]

Other firms are related to the foundry industry as suppliers. These firms produce and sell a broad range of items including machinery, tools, parts, molds, forms, and other materials needed to produce foundry products. In addition, supplier firms provide a broad range of services, including personnel services, financial services, advertising services, consulting services or transportation services. Finally, a number of people are employed in government enterprises responsible for the regulation of the foundry industry. All told, we estimate that the foundry industry is responsible for 143,141 supplier jobs. These firms generate about $33.12 billion in economic activity.

An economic analysis of the foundry industry will also take additional linkages into account. While it is inappropriate to claim that suppliers to the supplier firms are part of the industry being analyzed,[3] the spending by employees of the industry, and those of supplier firms whose jobs are directly dependent on the foundry industry, should be included. This spending on everything from housing, to food, to educational services and medical care makes up what is traditionally called the “induced impact” or multiplier effect of the foundry industry. In other words, this spending, and the jobs it creates are induced by the manufacturing that takes place at foundries. We estimate that the induced impact of the industry generates 186,608 jobs and $33.11 billion in economic impact, for a multiplier of 0.75.

An important part of an impact analysis is the calculation of the contribution of the industry to the public finances of the country. In the case of the foundry industry, the traditional direct taxes paid by the firms and their employees provide $10.59 billion in revenues to the federal, state and local governments. These figures do not include state and local sales taxes paid on cast products.

Table 1 on the following page presents a summary of the total economic impact of the industry in the United States. Summary tables for each state are included in the Output Model, which is discussed in the following section.

---

2 Economic sectors based on IMPLAN sectors.

3 These firms would more appropriately be considered as part of the supplier firm’s industries.

Table 1 – Economic Contribution of the Foundry Industry

	Direct	Supplier	Induced	Total
Jobs (FTE)	162,816	143,141	186,608	492,565
Wages	$11,609,719,000	$10,113,767,400	$10,440,717,300	$32,164,203,700
Economic Impact	$44,290,276,900	$33,120,046,900	$33,111,369,100	$110,521,692,900
Taxes				$10,591,600,000

Output Model

John Dunham & Associates produced the Economic Impact study for the American Foundry Society (AFS). 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 were joined together into an interactive system that allows AFS 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.

Economic Impact Modeling – Summary

The Economic Impact Study begins with an accounting of the direct employment in the domestic manufacture foundry products, as well as ancillary services on which the industry relies. 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 events are linked to other industries in the state and national economies. The activities required to manufacture foundry products generate the direct effects on the economy. Supplier (or indirect) impacts occur when these activities require purchases of goods and services such as machinery or electricity from local or regional suppliers. Additional induced impacts occur when workers involved in direct and supplier activities spend their wages in the general economy. The ratio between induced output and direct output is termed the multiplier.

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

Once the direct impact of the industry has been calculated, the input-output methodology discussed below 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. This induced impact is the most controversial part of economic impact studies and is often quite inflated. In the case of the AFS model, only the most conservative estimate of the induced impact has been used.

Model Description and Data

This analysis is based on data provided by Infogroup, the American Foundry Society, and the federal government. The analysis utilizes the IMPLAN Inc. model in order to quantify the economic impact of

the foundry industry on the economy of the United States.[4] The model adopts an accounting framework through which the relationships between different inputs and outputs across industries and sectors are computed. This model can show the impact of a given economic decision – such as a factory opening or operating a sports facility – on a pre-defined, geographic region. It is based on the national income accounts generated by the US Department of Commerce, Bureau of Economic Analysis (BEA).[5]

Every economic impact analysis begins with a description of the industry being examined. In the case of the AFS model, the foundry industry is defined generally as the pouring of metal into molds to create geometric shapes, as well as the services that directly support this process.

The IMPLAN 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 AFS Economic Impact Model, direct employment in the foundry and metalcasting industry is the starting point for the analysis. Direct employment is based on data provided to John Dunham & Associates by Infogroup as of December 2019 and from industry data provided by AFS. Infogroup data is recognized nationally as a premier source of micro industry data. This data is gathered at the facility level; therefore, a company with a manufacturing plant, warehouse and sales office would have three facilities, each with separate employment counts. Since the Infogroup data are adjusted on a continual basis, staff from John Dunham & Associates scanned the data for discrepancies. Client-provided data is given first priority in assigning jobs to a facility, followed by Infogroup data; for facilities where neither source has employment information, median job counts are used (based on industry and state data) to fill in gaps.

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.

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 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.

---

4 The model uses 2018 input/output accounts.

5 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 US Forest Service, the Federal Emergency Management Agency and the Bureau of Land Management. It was converted to a user-friendly model by the Minnesota IMPLAN Group in 1993.

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 county and 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 zips entirely contained in a single congressional district, jobs are allocated based on the percentage of total sector jobs in each zip. For zips that are broken by congressional districts, allocations are based on the percentage of total jobs physically located in each segment of the zip. Physical locations are based on either actual address of the facility, or the zip code of the facility, with facilities placed randomly throughout the zip code area. All supplier and indirect 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 Methodology[6]

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 as estimates. The Minnesota 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 are available at the county level, but there are many issues with disclosure – especially in the case of smaller industries. 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 US Make Table forms the bases 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-

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

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, the Regional Purchase Coefficients (RPCs) – essential to the IMPLAN model – 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.