

The 2018 Plumbing Manufacturing Industry Economic Impact Study
Methodology and Documentation

Prepared for



By



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Executive Summary:

The Plumbing Manufacturers International Economic Impact Study estimates the economic contributions made by the plumbing manufacturing industry to the U.S. economy in 2018. John Dunham & Associates conducted this research, which was funded by Plumbing Manufacturers International (PMI). This work used standard econometric models first developed by the U.S. Forest Service, and now maintained by the IMPLAN Group LLC. Data came from PMI, industry sources, and Infogroup LLC.

The study defines the plumbing manufacturing industry as those firms involved in the production, importation/wholesaling, and retailing of plumbing and plumbing related products. The study measures the number of jobs in these sectors, the wages paid to employees, the value added, and total output.

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 plumbing manufacturing 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, by congressional district and by state legislative districts.

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. 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. All entities engaged in business activity generated by the industry pay similar taxes.

The plumbing manufacturing industry is a dynamic part of the U.S. economy, accounting for about \$85.50 billion in output or roughly 0.44 percent of GDP. Plumbing product manufacturers, wholesalers and retailers directly and indirectly employed approximately 464,370 Americans in 2018. These workers earned about \$25.98 billion in wages and benefits. Members of the industry and their employees paid \$11.18 billion in direct federal, state and local taxes. This does not include state and local sales taxes imposed on plumbing products.

Summary Results:

The Economic Impact of the Plumbing Manufacturing Industry study measures the impact of the plumbing manufacturing industry, as defined by the production, importation/wholesaling, and retailing of plumbing and plumbing related products, on the entire economy of the United States. The industry contributes about \$85.50 billion in economic output or 0.44 percent of GDP and, through its production and distribution linkages, impacts firms in close to 514 sectors of the US economy.¹ Plumbing products are defined by this study to include a wide range of products including potable water supply system components, fixture fittings, waste fixture fittings, fixtures, flushing devices, sanitary drainage system components, and plumbing appliances.

¹ Based on GDP of \$19.226 trillion. See: *National Income and Product Accounts Gross Domestic Product, 2nd quarter 2017 (Advance estimate), and Annual Update*, News Release, US Department of Commerce, Bureau of Economic Analysis, July 28, 2017. Economic sectors based on IMPLAN sectors.

Plumbing product production includes not only companies that directly manufacture plumbing products in the United States, but the US operations of companies that manufacture plumbing products in other regions that directly import them into the US market. All told, these firms employ 29,888 people in manufacturing or importing operations, sales, packaging, and direct distribution.

Once plumbing products have been produced or imported, they must be distributed to stores throughout the country. This analysis includes a multitude of wholesalers that distribute plumbing and plumbing related products, ranging from general durable goods wholesalers to plumbing and heating equipment merchant wholesalers to hardware merchant wholesalers.² In addition to domestic wholesalers, many companies are involved in the importation of plumbing products produced abroad by other countries. Only employees responsible for the distribution of plumbing and plumbing related products at each wholesaler type is included in this analysis. The wholesaling segment of the industry directly employs around 36,430 individuals in every state in the country.

Finally, the plumbing products industry includes thousands of retailers that directly sell plumbing and plumbing related products to the consumer. These include a wide range of retailers, which includes home centers, hardware stores, other building material dealers, and department stores. Only the percentage of employees involved in plumbing sales are included. We estimate that there are 126,739 people employed selling plumbing and plumbing related products in the United States.

Other firms are related to the plumbing products industry as suppliers. These firms produce and sell a broad range of items including alloys, plastics, electronics, fuel, packaging materials, sales displays or machinery used by businesses manufacturing, distributing or retailing plumbing and plumbing related products. In addition, supplier firms provide a broad range of services, including personnel services, financial services, advertising services, consulting services or even transportation services. Finally, a number of people are employed in government enterprises which are responsible for the regulation of the industry. All told, we estimate that the plumbing products industry is responsible for 109,263 supplier jobs with these firms generating almost \$24.06 billion in economic activity.

An economic analysis of the plumbing products 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 plumbing product sales and production, should surely be included. This spending includes everything from housing, to food, to educational services, to medical care and makes up what is called the “induced impact” or multiplier effect of the plumbing products industry. In other words, this spending, and the jobs it creates is induced by the production, distribution and sale of plumbing and plumbing related products. We estimate that the induced impact of the industry is nearly \$26.58 billion, and generates about 162,050 jobs, for a multiplier of about 0.76.⁴

An important part of an impact analysis is the calculation of the contribution of the industry to the public finances of the community. In the case of the plumbing products industry, the traditional direct taxes paid by the firms and their employees provide nearly \$11.18 billion in revenues to the federal, state and local governments. These figures do not include state and local sales taxes paid on plumbing product purchases themselves.

² Based directly on data provided to John Dunham & Associates by Infogroup LLC as of January 2018 and U.S. Census Bureau, 2012 Economic Census: Wholesale Trade: Subject Series.

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

⁴ Often economic impact studies present results with very large multipliers – as high as 4 or 5. These studies invariably include the firms supplying the supplier industries as part of the induced impact. John Dunham & Associates believes that this is not an appropriate definition of the induced impact and as such limits this calculation to only the effect of spending by direct and supplier employees.

Table 1 below 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.

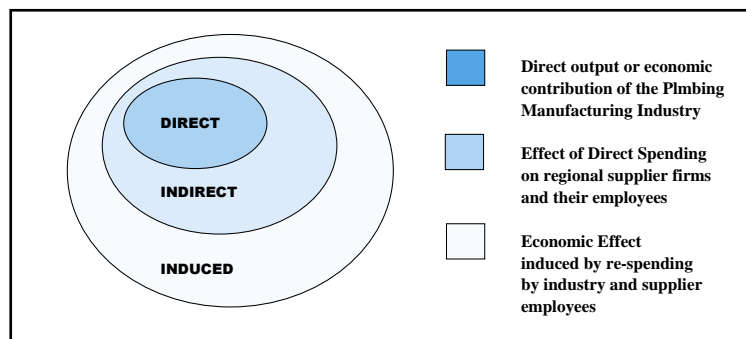
Table 1 – Economic Contribution of the Plumbing Manufacturing Industry

	Direct	Supplier	Induced	Total
Jobs	193,057	109,263	162,050	464,370
Wages	\$10,376,648,900	\$7,236,296,200	\$8,364,188,300	\$25,977,133,400
Economic Impact	\$34,856,831,200	\$24,059,555,000	\$26,583,575,800	\$85,499,962,000
Taxes				\$11,182,611,200

Economic Impact Modeling – Summary:

John Dunham & Associates, Inc. produced this study for Plumbing Manufacturers International (PMI). 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 linked together into an interactive system that allows PMI 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 the domestic manufacture of plumbing and plumbing related products, foreign manufacturers operations located in the United States, wholesaling/importing and retailing sectors. 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 produce a faucet for example, from cutting and shaping metal alloys, to installing components, to quality control, to shipping generate the direct effects on the economy. Regional (or indirect) impacts occur when these activities require purchases of goods and services such as metal alloys or electricity from local or regional suppliers. Additionally, induced impacts occur when workers involved in direct and indirect activities spend their wages. The ratio between induced economic and direct impact is termed the multiplier. The framework in the chart on the prior page 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 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 PMI 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 LLC, Plumbing Manufacturers International (PMI), and other industry sources. The analysis utilizes the IMPLAN Model in order to quantify the economic impact of the plumbing products industry on the economy of the United States.⁵ 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).⁶

Every economic impact analysis begins with a description of the industry being examined. In the case of the PMI model, the plumbing products industry is defined as the production, importation/wholesaling, and retailing of plumbing and plumbing related products.

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 PMI Economic Impact Model, direct employment in the plumbing products industry is the starting point for analysis. Direct employment is based directly on data provided to John Dunham & Associates by Infogroup LLC, and data from PMI as of January 2018. 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 is adjusted on a continual basis, JDA staff verified a large sample of the data. Multiple stages of cleaning were then performed on these data, including removing duplicate records, removing defunct facilities and companies, and correcting inaccurate data where possible. The data from Infogroup was then merged with member data provided by PMI. The database was then checked against company websites, or addresses looked up on Google maps to ensure that companies actually existed or were still in business. Employment estimates were generally taken directly from the Infogroup data; however, employment figures for facilities were replaced where necessary with figures directly obtained from the companies themselves. Where no data was available, employment at each location was estimated to be equal to the median value for similar sites in the same state.

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

⁵ The model uses 2016 input/output accounts.

⁶ 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.

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 and exercised stock options received by proprietors including sole proprietors, and distributions to 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, 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 and state legislative district level estimates. The model uses actual physical location data 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.

Data on the wholesale and retail sectors are all based on employment in each store type obtained from Infogroup. In order to estimate total employment in each sector, the totals are multiplied by the share of plumbing and plumbing related product sales in each of the wholesale and retail store categories where plumbing products are sold. The percentage of sales is derived from data maintained by the US Department of Commerce, Bureau of the Census.⁷

IMPLAN Methodology:⁸

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.

⁷ See: 2012 Economic Census, *Retail Trade: Industry Series: Preliminary Product Lines Statistics by Industry for the United States: 2012* and : 2012 Economic Census, *Wholesale Trade: Industry Series: Preliminary Product Lines Statistics by Industry for the United States: 2012* US Department of Commerce, Bureau of the Census, at: <http://www.census.gov/econ/census/>

⁸ This section is paraphrased from IMPLAN Professional: Users Guide, Analysis Guide, Data Guide, Version 2.0, MIG, Inc., June 2000.

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 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. 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-Output model. Margins represent the difference between producer and consumer prices. As such, the margins for any good add to one. If, for example, 10 percent of the consumer price of plumbing products is from the purchase of steel, then the steel margin would be 0.1.

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.