

2013 Economic Impact of the Aluminum Industry

Methodology and Documentation

Prepared for



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September 2013

The Economic Impact of the Aluminum Industry: 2013

Executive Summary

The *2013 Economic Impact of the Aluminum Industry* estimates the economic contributions made by the aluminum industry to the U.S. economy in 2013. John Dunham and Associates (JDA) conducted this research, which was funded by the Aluminum Association (AA). This work used standard econometric models first developed by the U.S. Forest Service, and now maintained by the Minnesota IMPLAN Group. Data came from industry sources, government publications and Dun and Bradstreet, Inc.

The aluminum industry is defined to include alumina refining; primary aluminum processing; secondary aluminum smelting and alloying; manufacturing of aluminum sheet, plate, foil, extrusions, forgings, coatings, and powder; aluminum foundries; metals service centers, and wholesalers. 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. Not included in the study are aluminum fabricators and production processes including welding and CNC machining.

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 aluminum 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 aluminum 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 aluminum industry is a dynamic part of the U.S. economy, accounting for about **\$152.4 billion in total economic output** or roughly 0.9 percent of GDP.¹ Aluminum manufacturers and wholesalers directly employed 155,800 Americans in 2013. These workers earned over \$12.0 billion in wages and benefits. When supplier and induced impacts are taken into account, the aluminum industry is responsible for 672,700 jobs in the United States and \$40.9 billion in wages; as well as \$15.9 billion in direct federal, state and local taxes; not including state and local sales taxes imposed on aluminum products.

¹ Based on 2013 GDP of \$16.7 trillion. Economic sectors based on IMPLAN sectors. See: “Gross Domestic Product: Second Quarter 2013 (Second Estimate)” *Bureau of Economic Analysis*. August 29, 2013. Available at: http://www.bea.gov/newsreleases/national/gdp/2013/pdf/gdp2q13_2nd.pdf

Summary Results

The Aluminum Industry Economic Impact Study measures the combined impact of the aluminum refining, processing, manufacturing, and wholesaling industry (hereafter the aluminum industry) in the United States. The industry is defined to include alumina refining; primary aluminum processing; secondary aluminum smelting and alloying; manufacturing of aluminum sheet, plate, foil, extrusions, forgings, coatings, and powder; aluminum foundries; metals service centers, and wholesalers. The industry contributes about \$152 billion in total to the U.S. Economy, or 0.9 percent of GDP and, through its production and distribution linkages, impacts firms in 425 sectors of the US economy.²

The manufacturing process, as defined in this study, begins with refining mined alumina and the activity of processing it into aluminum, or recovering secondary aluminum and smelting it. The aluminum can also be alloyed in primary or secondary processing plants. Then, through a variety of processes, aluminum is transformed into sheet, plate foil, extrusions, forgings, coatings, powder, and castings produced in foundries. Some facilities produce primary or secondary aluminum, while others manufacture aluminum products with aluminum purchased elsewhere. Together, 1,645 firms consist of the manufacturing sector of the aluminum industry, and these firms employ over 132,000 people.³

Aluminum products are further distributed by wholesalers and metals service centers. Metals service centers are *businesses that inventory and distribute metals for industrial customers and perform first-stage processing*.⁴ The aluminum industry is responsible for over 23,000 jobs at metals service centers and wholesalers.

Other firms are related to the aluminum 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 aluminum 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 aluminum industry. All told, we estimate that the aluminum industry is responsible for 198,700 supplier jobs. These firms generate about \$40.7 billion in economic activity.

An economic analysis of the aluminum 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,⁵ the spending by employees of the industry, and those of supplier firms whose jobs are directly dependent on the aluminum industry, should surely 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 aluminum industry. In other words, this spending, and the jobs it creates are induced by the manufacturing and distribution of aluminum products. We estimate that the induced impact of the industry generates 318,200 jobs and \$46.7 billion in economic impact, for a multiplier of 2.0.⁶

² Ibid.

³ Throughout this study, the term “firms” actually refers to physical locations. One aluminum company, for example, may have facilities in dozens of locations throughout the country. Each of these facilities is included in the 1,645 count.

⁴ “About Us,” *Metals Service Center Institute*. Available at: <https://www.mscci.org/ABOUTUS.aspx>

⁵ These firms would more appropriately be considered as part of the supplier firm’s industries.

⁶ 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 and 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.

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 aluminum industry, the traditional direct taxes paid by the firms and their employees provide \$15.9 billion in revenues to the federal, state and local governments. These figures do not include state and local sales taxes paid on aluminum products.

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 Aluminum Industry

	Direct	Supplier	Induced	Total
Jobs (FTE)	155,759	198,719	318,238	672,716
Wages	\$12,028,773,600	\$13,617,451,200	\$15,279,425,600	\$40,925,650,400
Economic Impact	\$64,970,302,000	\$40,686,283,400	\$46,720,167,300	\$152,376,752,700
Taxes				\$15,857,682,900

Output Model

John Dunham and Associates produced the Economic Impact study for the Aluminum Association (AA). 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 AA 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 and wholesaling of aluminum products. 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 aluminum products generate the direct effects on the economy. Regional (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 indirect activities spend their wages. The ratio between induced jobs and direct jobs 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 AA 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 Dun & Bradstreet, Inc. (D&B, Inc.), AA and the federal government. The analysis utilizes the Minnesota IMPLAN Group Model in order to quantify the economic impact of the aluminum industry on the economy of the United States.⁷ 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).⁸

Every economic impact analysis begins with a description of the industry being examined. In the case of the AA model, the aluminum industry is defined as the manufacturing and wholesaling of a wide range of aluminum 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 AA Economic Impact Model, direct employment in the aluminum industry is a base starting point for the analysis. Direct employment is based directly on data provided to John Dunham and Associates by D&B, Inc. as of August 2013; and from industry data provided by AA. D&B data is recognized nationally as a premier source of micro industry data. The D&B database contains information on over 15 million businesses in the United States.⁹ It is used extensively for credit reporting, and according to the vendor, encompasses about 98 percent of all business enterprises in the country. 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 D&B data are adjusted on a continual basis, staff from John Dunham and Associates scanned the data for discrepancies. In addition, for cases where employment data for AA member firms were available, D&B employment figures were replaced with those from AA.

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.

⁷ The model uses 2010 input/output accounts.

⁸ 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.

⁹ The D&B information database updates over 1 million times a day, over 350 million payment experiences are processed annually, and over 110 million phone calls are made to businesses. In addition, D&B uses a patented matching technology and over 2,000 information computer validations to ensure a high standard of data quality.

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, D&B 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 D&B 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 D&B data.

IMPLAN Methodology¹⁰

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

¹⁰ This section is paraphrased from IMPLAN Professional: Users Guide, Analysis Guide, Data Guide, Version 2.0, MIG, Inc., June 2000.

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 sheet metal is from the purchase of aluminum, then the aluminum 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 432 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 432 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.