

# **2016 Poultry and Egg Economic Impact Study**

**Methodology**



**Prepared for**

**The US Poultry & Egg Association  
425 Third Street, SW, Suite 950  
Tucker, Georgia 30084**

**By**

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

**November 4, 2016**

## The Poultry and Egg Industry Economic Impact Study: 2016

### Summary Results:

The 2016 Poultry and Egg Industry Economic Impact Study measures the combined impact of the chicken, turkey, egg and other poultry growing and processing industries including renderers, hatcheries, integrated feed producers and secondary processors in 2016 (hereafter the poultry and egg industry). The industry as defined below contributes \$441.15 billion in total to the US Economy, or 2.4 percent of GDP and, through its production and distribution linkages, impacts firms in 536 sectors of the US economy.<sup>1</sup> The production process is defined in this study to include farms that hatch and/or raise chickens, turkeys, and other commercially produced fowl, and farms that produce eggs both for consumption and for hatcheries. Processing for this study was defined to include primary processing and secondary value added processing. Primary processing includes the slaughtering and butchering of live birds, packing of primary products (like breasts, thighs or whole birds), rendering of fats and separation of other poultry materials like feathers and offal, integrated feed producers, genetic poultry labs, and poultry by-product meal producers. Secondary processors, which were not included in the 2014 study, were added due to a redefinition of the poultry industry. They are defined as any value-added processing, manufacturers of poultry based nuggets, sausages, patties and other manufactured food products.

The 6,344 firms that raise or convert poultry and eggs into products employ 497,700 people in production, sales, primary processing, packaging, direct distribution and value-added processing.<sup>2</sup>

Other firms are related to the poultry and egg industry as suppliers. These firms produce and sell a broad range of items including coops, barns, fuel, packaging materials, or machinery. In addition, supplier firms provide a broad range of services, including personnel services, financial services, advertising services, consulting services and even transportation services. Finally, a number of people are employed in government enterprises responsible for the regulation of the poultry industry. All told, we estimate that the poultry and egg industry is responsible for 605,005 supplier jobs with these firms, generating \$171.12 billion in economic activity.

Industries are linked to each other when one industry buys from another to produce its own products, and an economic analysis of the poultry and egg industry will take additional linkages into account. While it is inappropriate to claim that suppliers to the supplier firms are part of the industry being analyzed<sup>3</sup>, the spending by employees of the industry and those of supplier firms whose jobs are directly dependent on egg and poultry sales and production 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 industry. In other words, this spending and the jobs it creates is induced by the production and processing of poultry and eggs. We estimate that the induced impact of the industry generates 579,564 jobs and an economic output of \$96.53 billion, for a multiplier of about 0.56.<sup>4</sup>

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 poultry and egg products industry, this contribution comes from the traditional direct taxes paid by the firms and their employees. In total, these taxes provide \$34.04 billion in revenues to the federal, state and local governments. This is in addition to sales taxes, restaurant

---

<sup>1</sup> Based on GDP of \$18.1118 trillion. See: *Gross Domestic Product: Third Quarter 2016 (Advance Estimate)*, News Release, US Department of Commerce, Bureau of Economic Analysis, October 28, 2016. Economic sectors based on IMPLAN sectors.

<sup>2</sup> Throughout this study, the term “firms” actually refers to physical locations. One egg producer, for example, may have facilities in 10 or 12 locations throughout the country. Each of these facilities is included in the count.

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

<sup>4</sup> 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.

taxes and other taxes paid by consumers who eat poultry and egg products.

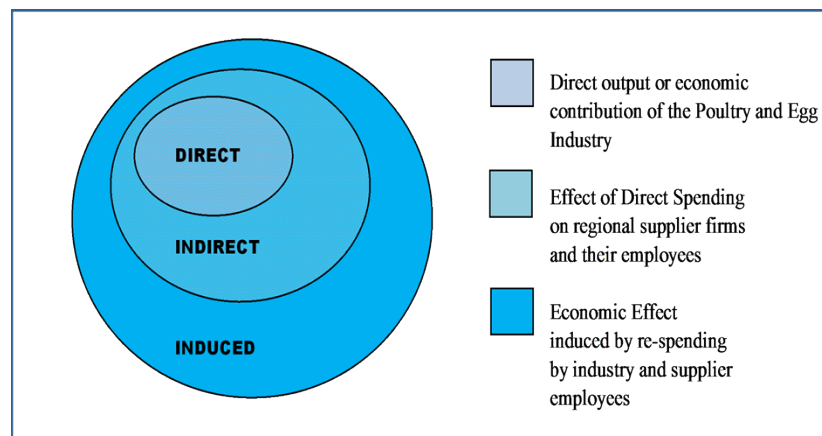
Table 1 below presents a summary of the total economic impact of the industry in the United States.

**Table 1: Economic Impact of the Poultry and Egg Industry**

	Direct	Supplier	Induced
Jobs	497,700	605,005	579,564
Wages	\$28,960,637,600	\$37,785,382,700	\$29,983,596,600
Output	\$173,488,436,200	\$171,124,142,200	\$96,533,397,700
Taxes			\$34,044,946,700

Methodology:

The economic impact of the poultry and egg industry begins with an accounting of the direct employment in the various sectors. The poultry and egg industry encompasses slaughterhouses, packers, company-owned distribution and supply operations as well as primary fowl and egg farmers and producers. It also includes rendering and feather operations, poultry feed manufacturing and secondary, value-added processing. The data comes 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 broiler chicken or a carton of eggs from butchering, to packaging, 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 building materials from local or regional suppliers. Additional, induced impacts occur when workers involved in direct and indirect activities spend their wages in the region. The ratio between total economic impact 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 poultry and egg model, only the most conservative estimate of the induced impact has been used.

## Model Description and Data

This Poultry and Egg Industry Economic Impact Model (Model) was developed by John Dunham & Associates based on data provided by Dun & Bradstreet Inc., Infogroup, the US Department of Agriculture, a number of trade associations and various state agriculture departments. The analysis utilizes the Minnesota IMPLAN Group LLC (2014 Tables) in order to quantify the economic impact of the poultry and egg 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 computed. This model can show the impact of a given economic decision – such as a factory opening or other operation of 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).<sup>5</sup>

The analysis begins with the identification of companies and facilities engaged in the poultry and egg industry. This is defined for the purpose of the study as those firms involved in the production and processing of:

- Chicken;
- Eggs;
- Turkey;
- Other commercially produced fowl; and
- Rendered products such as fat, feathers or poultry meal.

Also included in the definition of the industry are integrated poultry feed producers, hatcheries, and other agricultural support activities involved in the development of fowl.

The industry is defined to include not only the production eggs and birds but also primary and secondary processing. It also includes commercial butchering into primary products such as wings, thighs, or breasts. Secondary processors, which were not included in the 2014 study, were added due to a redefinition of the poultry industry. They are defined as any value-added processing, manufacturers of poultry based nuggets, sausages, omelets, patties and other manufactured food products.<sup>6</sup>

Individual poultry and egg facility location data was gathered from a number of sources. The primary source used was the Federal government. Lists of licensed processing facilities inspected by the US Department of Agriculture were solicited from those two agencies in September of 2016. These facility lists do not include detailed information on the type of meat or poultry produced or if the facility is involved in primary production and slaughter or secondary processing.<sup>7</sup> In addition, these data do not include any information on the level of employment at a given facility.

The Federal facilities lists were supplemented with information from state licensing agencies, and from the sponsoring organizations.<sup>8</sup> Again, these data did not include employment data and often did not

---

<sup>5</sup> 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.

<sup>6</sup> Facilities that perform both primary and secondary processing are included and jobs were allocated based on a 50/50 ratio of primary and secondary processing. These jobs were then allocated to the facility's determined poultry products (chicken, turkey, etc.).

<sup>7</sup> When unable to determine the type of poultry production being processed at a USDA licensed facility, chicken and turkey were assumed to be the primary products and the job estimations were allocated evenly across both.

<sup>8</sup> In addition to federal licensing, 25 states (Alabama, Arizona, Delaware, Illinois, Indiana, Iowa, Kansas, Louisiana, Maine, Minnesota, Mississippi, Missouri, Montana, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, Texas, Utah, Vermont, Virginia, West Virginia, Wisconsin and Wyoming) license facilities that process and slaughter

include detailed location (or address) information. To ensure that information on non-inspected facilities (for example sales offices) was also included, data from Dun & Bradstreet's Hoovers system as of March 2016 was also included in the analysis. Dun & Bradstreet (D&B) data is recognized nationally as a premier source of micro industry data. The D&B database contains information on over 17 million businesses in the United States.<sup>9</sup> 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 & Associates scanned the data for discrepancies.

All of the data sources were combined and duplicate records, or records for companies that did not handle poultry or eggs (miscoded records) were eliminated. The D&B data were used for facility based employment estimates where they existed, with missing data replaced by the lower of the median or average of the state/facility type pair.

Since most of the data sources do not have information on the type of product processed or raised at a given facility, JDA staff performed extensive research using Google reviews, Google Maps, examined company websites, or used SIC and NAICS listings provided by Dun & Bradstreet to allocate products by type. In addition, certain lists were submitted to the sponsoring organizations to verify the industry or product produced.

In the case of firms included on membership lists, the main product was assumed to be that represented by the organization (turkey for turkey, eggs for eggs, etc.). Each record was listed by all of the products produced/handled including chicken, turkey, eggs, feed and grains, other birds (duck, quail, etc.), rendering/feathers, etc. Jobs in each facility were then allocated based on the percentage of production of each type of product in the state where the facility was located. For example if a facility produced both chicken and turkey and was located in Arkansas, then jobs were allocated to chicken and turkey based on the share of chicken and turkey to Arkansas's overall poultry production industry. Missing data were replaced by the lower of either the median or average for the state/product pair.

Once these allocations were completed a dataset was compiled for each of the product lines being analyzed: eggs, chicken, turkey, and other birds.

Feed operations and hatcheries that supplied turkey operations were allocated to the turkey dataset, feed operations that supplied chicken operations were allocated to the chicken dataset, and so forth. Similarly, rendering and feather operations were allocated to the respective type of bird that was rendered or used for feathers.

Whenever poultry operations could not be classified by any available data, employment was allocated based on the percentage of overall production of each bird in each state.<sup>10</sup> So if 50 percent of a state's bird production was chicken, one half of the unclassified poultry jobs were allocated to chicken in that 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 in each of the two sectors: production and processing, as well as the supplier and induced impacts of the industry on the larger economy. IMPLAN was originally developed by the US Forest Service, the Federal

---

animals. Many of these companies slaughter individual animals for farmers or hunters. They tend to be smaller localized operations.

<sup>9</sup> 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.

<sup>10</sup> See: *Poultry – Production and Value: 2016 Summary*, US Department of Agriculture, National Agricultural Statistics Service, April 28, 2016.

Emergency Management Agency and the Bureau of Land Management. It was converted to a user-friendly model by the Minnesota IMPLAN Group in 1993. The IMPLAN data and model closely follow the conventions used in the “Input-Output Study of the US Economy,” which was developed by the BEA.

- ❖ **Wages:** Data from the US Department of Labor’s ES-202 reports are used 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 employees, 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 employees. Further details are available from the Minnesota IMPLAN Group at <http://www.implan.com>.
- ❖ **Output:** 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.
- ❖ **Taxes:** 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 and state legislative district, and county 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.

It should be noted that when comparing the numbers in this study with those calculated in 2014, JDA noticed an inconsistency. In 2014, the economic output per employee in poultry processing was \$468,800. In the 2016 study, this had fallen to \$306,000 – a 34.7 percent drop when compared to the 2014 Study. While output per employee can fluctuate wildly for agricultural products (for example, poultry production), in the case of manufacturing industries it generally rises over time. The sizable decline is a result of an overestimation of poultry processing output in 2011 and 2012.<sup>11</sup> This error makes it appear that while there is an increase in jobs and wages, there is a distinct decrease in economic output and activity created by these plants. In fact, the new 2016 measures of poultry processing economic output, while lower, are a more accurate representation of the economic activity created by the industry while the 2014 figures were simply incorrect due to the data problem.

---

<sup>11</sup> The 2014 Economic Impact uses 2012 IMPLAN data tables. IMPLAN Group responded with corrected and more appropriate estimations for 2011 and 2012 which are \$52.94 billion and \$56.02 billion, respectively. These changes result in an output per employee in 2012 of \$227,417 rather than the reported \$434,613.

## IMPLAN Methodology:<sup>12</sup>

Francois 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 such 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 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 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. If, for example, 10 percent of the consumer price of a carton of eggs is from the purchase of electricity, then the electricity 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

---

<sup>12</sup> This section is paraphrased from IMPLAN Professional: Users Guide, Analysis Guide, Data Guide, Version 2.0, MIG, Inc., June 2000.

of recognized bounds. The final datasets and matrices are not released before extensive testing takes place.