The 2017 Corn Refining Industry Economic Impact Study

Methodology and Documentation

Prepared for

CRA
CORN REFINERS ASSOCIATION

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Executive Summary:

The Corn Refining Economic Impact Study estimates the economic contributions made by the wet corn milling and refining industry to the U.S. economy in 2017. John Dunham & Associates conducted this research, which was funded by the Corn Refiners Association (CRA). This work used 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, Inc.

For the purpose of this study, corn refining businesses are those firms involved in the wet milling of corn. This process includes inspection and cleaning, steeping, germ separation, grinding and screening, starch gluten separation, starch conversion, and fermentation. 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 corn refining 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 at both the national and state level.

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 corn refining industry is a dynamic part of the U.S. economy, accounting for about $71.09 billion in output or roughly 0.40 percent of GDP. Wet corn milling businesses directly and indirectly employed approximately 237,662 Americans in 2017. These workers earned about $14.45 billion in wages and benefits. Members of the industry and their employees paid $5.13 billion in direct federal, state and local taxes.

Summary Results:

The Economic Impact of the Corn Refining Industry measures the impact of the those businesses engaged in wet corn milling on the entire economy of the United States. The industry contributes about $71.09 billion in economic output or 0.40 percent of GDP and, through its production and distribution linkages, impacts firms in more than 530 sectors of the US economy.[1] All told, these firms employ 8,308 people in various roles within the wet corn milling process.

Other firms are related to the corn refining industry as suppliers. These firms produce and sell a broad range of items including the machinery used in refining processes, fuel, packaging materials, and much more. In addition, supplier firms provide a broad range of services, including personnel services, financial

[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.

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 corn refining industry. All told, we estimate that the corn refining industry is responsible for 144,226 supplier jobs with these firms generating almost $34.65 billion in economic activity.

An economic analysis of the corn refining 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,[2] the spending by employees of the industry, and those of supplier firms whose jobs are directly dependent on corn refining, should surely be included. This spending includes everything from housing, to food, to educational services, to medical care and makes up what is traditionally called the "induced impact" or multiplier effect of the corn refining industry. In other words, this spending, and the jobs it creates is induced by the wet corn milling process. We estimate that the induced impact of the industry is nearly $14.44 billion, and generates about 85,128 jobs, for a multiplier of about 0.66.[3]

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 corn refining industry, the traditional direct taxes paid by the firms and their employees provide nearly $5.13 billion in revenues to the federal, state and local governments.

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 Corn Refining Industry

	Direct	Supplier	Induced	Total
Jobs	8,308	144,226	85,128	237,662
Wages	$1,004,533,100	$8,956,314,700	$4,488,869,100	$14,449,716,900
Economic Impact	$21,995,790,900	$34,652,079,600	$14,443,057,600	$71,090,928,100
Taxes				$5,128,891,500

Economic Impact Modeling – Summary:

John Dunham & Associates, Inc. produced this study for the Corn Refiners Association (CRA). 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 the CRA 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.

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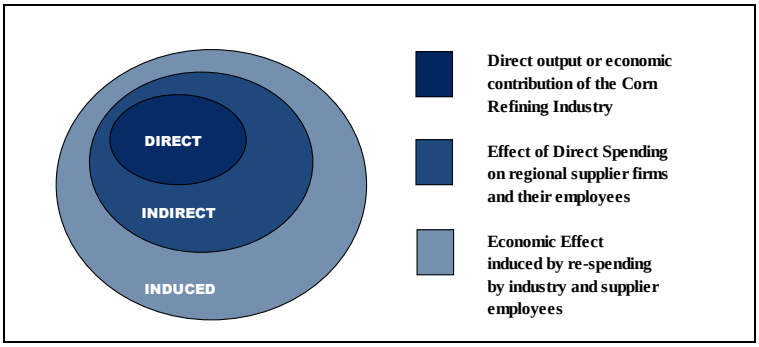
2 These firms would more appropriately be considered as part of the supplier firms' industries.

3 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.
Multipliers have fallen dramatically throughout the economy over the past few years reflecting stagnant income levels, higher levels of saving, and lower levels of spending.



The Economic Impact Study begins with an accounting of the direct employment in the U.S. corn refining industry. 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 refine corn generate direct effects on the economy. Supplier (or indirect) impacts occur when these activities require purchases of goods and services from local or regional suppliers. Additional, 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 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 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 CRA 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 Inc., the Corn Refiners Association, and the federal government. The analysis utilizes the IMPLAN Model in order to quantify the economic impact of the corn refining 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 Corn Refiners Association model, the corn refining industry is defined as businesses engaged in wet corn milling operations.

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4 The model uses 2014 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.

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 Corn Refiners Association Economic Impact Model, direct employment in the corn refining industry is the starting point for analysis. Direct employment is based directly on data provided to John Dunham & Associates by Infogroup Inc., and data from the CRA members as of December 2017. Infogroup data is recognized nationally as a premier source of micro industry data.[6]

This data is gathered at the facility level; therefore, a company with a manufacturing plant, warehouse and support 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 duplicates records, removing defunct facilities and companies, and correcting inaccurate data where possible. The data from Infogroup was then merged with member data provided by CRA. 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 are taken directly from member-provided data, except for the few non-member refiners which rely on Infogroup employment numbers. Any home-based employees without a specified territory are distributed to company facilities based on existing job splits.

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 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.

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6 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 the best quality data. The company verifies its data at the rate of almost 100,000 phone calls per day to ensure absolute accuracy.

IMPLAN Methodology:[7]

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 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.

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.

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

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.