

Economic Contribution of the Agricultural Sector to the Arkansas Economy in 2012



Leah English, Jennie Popp, and Wayne Miller

UofA

DIVISION OF AGRICULTURE

RESEARCH & EXTENSION

University of Arkansas System

ARKANSAS AGRICULTURAL EXPERIMENT STATION

September 2014

Research Report 994

Technical editing and cover design by Gail Halleck.

Arkansas Agricultural Experiment Station, University of Arkansas System Division of Agriculture, Fayetteville. Mark J. Cochran, Vice President for Agriculture; Clarence E. Watson, Associate Vice-President for Agriculture–Research and Director, AAES. WWW/InddCS6.

The University of Arkansas System Division of Agriculture follows a nondiscriminatory policy in programs and employment. ISSN: 1539-5944 CODEN: AKABA7

Economic Contribution of the Agricultural Sector to the Arkansas Economy in 2012

Leah English*
Jennie Popp
Wayne Miller

**Arkansas Agricultural Experiment Station
University of Arkansas System
Division of Agriculture
Fayetteville, Arkansas 72701**

* Leah English is a Graduate Student in the Department of Agricultural Economics and Agribusiness in Fayetteville; Jennie Popp is a Professor in the Department of Agricultural Economics and Agribusiness in Fayetteville; and Wayne Miller is a Professor of Economic and Community Development with the University of Arkansas System Division of Agriculture, Cooperative Extension Service in Little Rock, Ark.

CONTENTS

List of Tables, Boxes, and Figures.....	3
Acknowledgements	3
Executive Summary	4
Definitions and Styles	6
Agricultural Sectors.....	6
Economic Contribution.....	6
Style Notes	7
1: Direct, Indirect, and Induced Contributions of the Aggregate Agriculture Sector.....	8
1.1: Introduction.....	8
1.2: Methods.....	8
1.2.1: General Procedures.....	9
1.2.2: Analysis by Parts.....	10
1.2.3: Measures of Economic Contribution	10
1.3: The Aggregate Agriculture Sector	11
1.3.1: The Crops Sector	13
1.3.2: The Animal Agriculture Sector	14
1.3.3: The Forestry Sector	14
1.4: Summary of the Contribution of Agriculture in 2012	16
End Notes	16
Literature Cited.....	16
Appendix A: Description of IMPLAN Sectors and Aggregation Schemes.....	19
Appendix B: Agriculture-Generated Activity by Sector.....	22
Appendix C: IMPLAN Analysis by Parts, Technical Details.....	33

TABLES

1.	The Aggregate Agriculture Sector’s Contribution to Arkansas’ Economy, 2012	12
2.	The Contribution of Major Agricultural Sectors to Agricultural Production and Processing, 2012.....	13
3.	The Crops Sector’s Direct Contribution to Arkansas’ Economy, 2012.....	13
4.	The Animal Agriculture Sector’s Direct Contribution to Arkansas’ Economy, 2012.....	14
5.	The Forestry Sector’s Direct Contribution to Arkansas’ Economy, 2012.....	15

BOXES

B1.	Total Contribution of Arkansas Agriculture, 2012	11
B2.	Employment Generated by Agriculture, 2012—Top Five NAICS Industries	11
B3.	Value Added Generated by Agriculture, 2012—Top Five NAICS Industries	12
B4.	Labor Income Generated by Agriculture, 2012—Top Five NAICS Industries	12
B5.	Direct Contribution of the Crops Sector, 2012	14
B6.	Direct Contribution of the Rice Industry (<i>Rice Farming and Rice Milling</i>).....	14
B7.	Direct Contribution of the Animal Agriculture Sector, 2012	14
B8.	Direct Contribution of the Poultry Industry (<i>Poultry and Egg Production and Poultry Processing</i>).....	15
B9.	Direct Contribution of the Forestry Sector, 2012	15
B10.	Direct Contribution of the Top Five Forestry Industries: <i>Paper Mills, Sanitary Paper Product Manufacturing, Sawmills and Wood Preservation, Paperboard Container Manufacturing, and Paperboard Mills</i>	15

ACKNOWLEDGEMENTS

We, the authors, would like to thank the Arkansas Division of Agriculture for funding this initiative. We also extend our appreciation to several individuals in the University of Arkansas, Fayetteville, Departments of Horticulture and Poultry Science as well as the Arkansas Forestry Commission who offered their expertise for data collection and interpretation. We would like to thank our reviewers for their insightful input and suggestions. Finally, we sincerely appreciate Judy Howard’s and Gail Halleck’s publishing skills and attention to detail.

Executive Summary

Agriculture and associated agricultural activities are major contributors to the Arkansas economy. Agriculture is defined as the sum of agricultural production and processing activities, unless otherwise specified, and includes crop and animal production and processing, agricultural support industries, forestry and forest products, and textile goods. Agriculture contributes to the economy through direct agricultural production and value-added processing, and also leads to economic activity in other parts of the economy.

This report is the ninth in a series of reports examining agriculture's economic contribution on the Arkansas economy. Utilizing data from the United States Bureau of Economic Analysis (BEA), USDA Economic Research Service (ERS), USDA National Agricultural Statistics Service (NASS), and IMPLAN Group, LLC, the economic contribution of agriculture on the Arkansas economy was estimated for the most recent year available, 2012. The total economic contribution of agriculture (direct, indirect, and induced effects) on value added, employment, and labor income was estimated with the Impact Analysis for Planning System (IMPLAN). The economic contributions of agricultural production and processing were estimated for agriculture as a whole and also separately for the Crops Sector, the Animal Agriculture Sector, and the Forestry Sector. Key findings of the IMPLAN analysis are as follows:

- Aggregate Agriculture contributed \$20.1B in total value added to the state economy; this is almost \$0.18 of every \$1 in value generated in the state.
- Aggregate Agriculture accounted for 280,959 jobs, which is almost 18% of all jobs in the state. Over one-half of these (146,958), or 9.5% of all state employment, are in the agriculture production, processing and agriculture-related industries.
- *Poultry and Egg Production* and *Poultry Processing* alone provided over one in four of the state's agricultural jobs, as in previous years.
- Aggregate Agriculture paid \$11.5B in labor income, or 17% of the state's total labor income, including agriculture payrolls, which totaled \$9.3B, or 16% of total state wages.
- Aggregate Agriculture generates value added, employment, and income in all 20 of the 2-digit NAICS aggregated industries in the state. Almost half of agriculture's contribution to value added occurs in industries closely tied to agriculture but not defined as part of the agriculture sector, such as *Real Estate and Rental*, *Wholesale Trade*, and *Transportation and Warehousing*.
- The direct contribution of the Crops Sector included \$3.0B in value added, 63,976 jobs and almost \$1.8B in labor income. *Rice Farming* and *Rice Milling* accounted for 16% of jobs, 18% of labor income, and over 19% of value added in the Crops Sector.
- In direct contributions, the Animal Agriculture Sector generated \$2.8B in value added, 48,492 jobs and over \$1.8B in labor income. *Poultry and Egg Production* and *Poultry Processing* provided 75% of jobs, 82% of income, and 78% of value added in the Animal Agriculture Sector.
- The direct contribution of the Forestry Sector included \$3.2B in value added, 24,736 jobs, and over \$1.5B in income. Within the Forestry Sector, *Paper Mills*, *Sanitary Paper Product Manufacturing*, *Sawmills and Wood Preservation*, *Paperboard Container Manufacturing*, and *Paperboard Mills* contributed 50% of forestry jobs, over 58% of forestry income, and 74% of value added.

Including direct, indirect and induced effects, agriculture generates over one in six jobs and almost 18% of value added in the state. The diversity of the state's agriculture helps mitigate the effects of low world market prices or trade embargoes on commodities. Crops, animal agriculture, and forestry production and processing are all major contributors to agriculture and to the state's economy. The large and diverse natural resource base of the state provides the opportunity for agriculture to change and develop new value added and bio-energy industries. The size and diversity of the state's agriculture contribute greatly to the well-being of Arkansans and to the stability of the state's economy.

Note: In some cases, numbers reported in this research report may be different than numbers reported in its companion document, the pocket guide *Economic Contribution of Arkansas Agriculture* (English, Popp and Miller, 2014) due to rounding.

Definitions and Styles

Agricultural Sectors

Aggregate Agriculture consists of the Crops, Animal Agriculture, and Forestry Sectors' production and processing industries, plus the Agriculture-Related Sector. See Appendix A, Tables 1-4 for a complete listing of the sectors included.

Crops Sector comprises those industries directly involved in crop production and processing. See Appendix A, Table 1 for a complete listing of the industries included.

Animal Agriculture Sector comprises those industries directly involved in livestock production and processing. See Appendix A, Table 2 for a complete listing of the industries included.

Forestry Sector comprises those industries directly involved in forestry production and processing. See Appendix A Table 3, for a complete listing of the industries included.

Agriculture-Related Sector comprises those industries that support the Crops, Animal Agriculture, and Forestry Sectors. See Appendix A, Table 4 for a complete listing of the industries included.

Note: No input providers (fertilizer, pesticide and equipment manufacturers) or retail locations (restaurants, grocery stores, lawn and garden centers, etc.) are considered as direct contributors to the Aggregate Agriculture Sector in the contribution analysis. However, much or some of the economic activity in these firms is picked up as indirect and induced effects and reported as part of the total economic contribution.

Economic Contribution

The **total economic contribution** of the Aggregate Agriculture Sector includes three areas of wealth and job generation:

1. **Direct Contributions** are the sum of the contributions of farm production and processing of farm and forestry products. Only direct contributions are reported in the Crops, Animal Agriculture and Forestry Sector discussions.
2. **Indirect Contributions** result when agricultural firms purchase raw materials and services from other Arkansas businesses to produce their products.
3. **Induced Contributions** result when employees of agricultural firms and employees of the raw material and service firms spend a portion of their income on local purchases.

These contributions are reported in terms of **Employment**, **Labor Income**, and **Value Added**:

1. **Employment** includes all wage and salary employees, as well as self-employed workers (owner-operators) in a given sector.
2. **Labor Income** consists of two parts: proprietary income and wages. Proprietary income includes all income received by self-employed individuals, such as private business owners, doctors, lawyers or other professionals. Wages include all worker salaries, payments, and fringe benefits paid by employers.
3. **Value Added** includes labor income plus indirect taxes and other property-type income such as payments for rents, royalties, and dividends. Value added and Gross Domestic Product (GDP) are equivalent measures in theory but are estimated using different methods and data sources.

Style Notes

Agricultural Sectors. These comprise the areas of focus in our study. This report refers to four areas of analysis: Crops Sector, Animal Agriculture Sector, Forestry Sector, and Aggregate Agriculture Sector. The Agriculture-Related Sector is included in the analysis of the Aggregate Agriculture Sector, but is not presented individually. These terms are capitalized and underlined throughout the text.

NAICS Sectors. The North American Industry Classification Scheme (NAICS) is "...the standard for use by Federal statistical agencies in classifying business establishments for the collection, tabulation, presentation, and analysis of statistical data describing the U.S. economy....For statistical purposes, a business establishment is assigned one NAICS code, based on its primary business activity" (USCB, 2014). This report uses the 2007 NAICS sectoring scheme (IMPLAN, 2014a). Agricultural activities are classified under, or can impact, multiple sectors. Throughout the document, capitalization of sectors is used when referring to NAICS sectors. Examples include Food Manufacturing, Paper Manufacturing, and Wood Product Manufacturing.

Industries. These are defined as individual IMPLAN industries that are defined by aggregating NAICS sectors into the larger IMPLAN industries used in our analysis. These industries are capitalized and italicized. Examples include *Poultry and Egg Production* and *Paperboard Mills*.

General Descriptive Terms. These are terms used to describe agriculture throughout the text that are not related to established industry classification schemes or specific agricultural sector titles used in this analysis. These terms are presented in lowercase. Examples include agricultural production and agricultural processing.

1: Direct, Indirect, and Induced Contributions of the Aggregate Agriculture Sector

1.1: Introduction

The total economic contribution of Arkansas' Aggregate Agriculture Sector is much more than the direct contribution of agricultural production and processing. To measure agriculture's total economic contribution, the indirect and induced contributions of agriculture must also be taken into consideration. Indirect contributions occur when the Aggregate Agriculture Sector purchases goods and services from local businesses. The production of fertilizers and certain farm machinery and equipment, for example, are indirect contributions of agricultural production. Agriculture's induced contributions are measured by increases in economic activity due to personal consumption by employees of the Aggregate Agriculture Sector and by employees of firms that provide inputs to the Aggregate Agriculture Sector. The sum of direct, indirect, and induced agricultural effects provides a measure for the total economic contribution of agriculture. The report discusses the overall economic contribution of agriculture to Arkansas' economy, considering the direct, indirect, and induced effects of the Aggregate Agriculture Sector in 2012.

1.2: Methods

This report builds upon previous reports (Goodwin et al., 2002; Popp, Vickery and Miller, 2005; Popp, Kemper and Miller, 2007; Kemper, Popp and Miller, 2009; Popp et al., 2010; McGraw, Popp and Miller, 2011; McGraw, Popp and Miller, 2012; English, Popp and Miller, 2013) and utilizes data for 2012, the most recent year that relevant IMPLAN data were available.

As in our previous reports, the economic contribution of Arkansas' Aggregate Agriculture Sector was computed using data and input-output (I-O) modeling software (IMPLAN version 3.1) from IMPLAN Group, LLC; formerly Minnesota IMPLAN Group, Inc. (MIG). Data here are reported for 2012 (IMPLAN, 2014b). Contributions are reported in terms of employment, labor income, and value added (introduced previously and described in depth in section 1.3). The only sectors included as part of the agriculture sector in the analysis are those directly producing agricultural products, processing raw agricultural products, or providing agricultural services to producers. Any sector less than 100% tied to agriculture is not included as part of the Aggregate Agriculture Sector (such as restaurants, grocery stores, fertilizer manufacturers and distributors). The Aggregate Agriculture Sector is made up of three types of industries: agricultural production industries, agricultural processing industries, and agriculture-related industries. Definitions for these industries for this analysis are provided below and in Appendix A. Additionally, the indirect and induced contributions of the non-agricultural sectors are included in the total contribution of agriculture. The contribution includes the direct, indirect and induced effects of agricultural production and processing activities, and excludes the direct effect of the food services and drinking industry. "Contribution analysis" typically describes that portion of a region's economy that can be attributed to an existing industry, event, or policy by identifying all the direct and backward linkages in the study area (Alward, 2012).

The results of the economic contributions of agriculture are presented for the following sectors: Crops Sector, Animal Agriculture Sector, Forestry Sector, and Aggregate Agriculture Sector. For the first three sectors, agriculture is defined as those production and processing sectors in IMPLAN directly related to that sector (crops, animal, or forestry). Agricultural retail is not included in IMPLAN analysis. The IMPLAN industries used to create those sectors are presented in Appendix A, Tables 1-3. Aggregate Agriculture is defined as the sum of all four sectors: Crops, Animal Agriculture, Forestry, and the Agriculture-Related Sectors (presented in Appendix A, Table 4). Aggregate Agriculture includes all of the IMPLAN industries listed in Appendix A, Tables 1-4.¹ In some cases, results are presented as production and processing contributions instead of by Sector. The Aggregate Agriculture Sector's IMPLAN industries are presented grouped by production and processing in Appendix A, Tables 5-6. State level IMPLAN data for Arkansas for 2012 (the most recent data available) were used to calculate all contributions (IMPLAN, 2014b). The relevant employment, labor income, and value added contributions of agriculture are detailed in Appendix B and are summarized below. All labor income and value added figures are reported in current (nominal) 2012 dollars, unless otherwise noted.

1.2.1 General Procedures

For the economic contribution analysis of the agriculture sector, the entire measure of economic activity in the industries that make up the Aggregate Agriculture Sector (crop, livestock, and forestry production and processing industries, and ag-related activities) are considered to be 100% agriculture. There are several key considerations in the construction of the IMPLAN I-O models used to measure the economic contribution of the Aggregate Agriculture Sector. For each step of the analysis, careful consideration was taken to ensure that the analysis reflects accurately the Arkansas Aggregate Agriculture Sector. The main steps for constructing the model were data reconciliation, selection of multipliers, editing industry production, estimating trade flows, creating activities, and editing local purchase percentages (IMPLAN, 2014c).

The Aggregate Agriculture Sector is made up of three broad categories of agricultural industries: agricultural production industries, agricultural processing industries, and agricultural-related industries. The output data for the agricultural production industries (IMPLAN sectors 1–14)² were checked for accuracy against the latest available estimates for the value of production from NASS and ERS. The agricultural production data in IMPLAN are sometimes unreliable for three reasons. First, output data for all industries outside of agriculture are estimated from a large number of sources, but data for agricultural production are derived entirely from NASS value of production data and the most recent U.S. Census of Agriculture. Due to NASS publication lags, IMPLAN data are often released using preliminary estimates for a given year. To check the accuracy of the IMPLAN data, the agricultural production industries are compared against finalized NASS/ERS data for the relevant year. Second, there are also non-disclosure problems, particularly at the county level (which is why analysis is done at the state level); this makes data reconciliation between IMPLAN and NASS data difficult at the county level. Third, employment and income data for the agriculture sectors are difficult to estimate since there are no employment and earnings data collected on a commodity basis.

IMPLAN encourages analysts with better agriculture data to use it when building models (IMPLAN, 2014d).

The default IMPLAN data for IMPLAN agricultural production sectors 1–14 were updated with the most recent NASS/ERS output estimates for the state of Arkansas, collected from the USDA Economics, Statistics and Market Information System (ESMIS; USDA NASS, 2014). The default output data was changed to reflect the NASS/ERS output estimate. For Hogs and Pigs and for Cattle and Calves, gross income is used instead of value of production or cash receipts because it is defined as cash receipts plus on-farm or home consumption of slaughtered animals, which is most similar to other commodities' measurements. For *Grain Farming* (sector 2), the value of output was calculated as the sum of only wheat, corn for grain, oats, and grain sorghum. The value of rice farming was omitted from sector 2 in order to analyze the rice industry (*Rice Farming* and *Rice Milling*) using IMPLAN's analysis by parts (ABP) methods (section 1.2.2 and Appendix C). For any sector where a change was made to the value of output, a change corresponding to the percent change in output was also made to all four components of value added. This holds the relationship between Total Industry Output and Total Value Added (a fundamental relationship in I-O analysis) constant, and the model production functions are left unchanged. Additionally, for *Poultry and Egg Production* (sector 13), output per worker estimates are edited to reflect updated poultry farm operator estimates from the 2012 USDA Census of Agriculture (USDA, 2012). These numbers are newer and more accurate than those used by MIG to estimate poultry employment; this method allows for the number of jobs in sector 13 to be changed to reflect the most recent output per worker. Output per worker is calculated by first estimating the total number of poultry production jobs using farm operator and hired labor values from the most recent census of agriculture report (USDA, 2012). Next, the data year output value divided by total poultry employment yields the updated estimate for output per worker (USDA NASS, 2014). Output and employment for *Flour*

Milling and Malt Manufacturing (sector 43) were also edited to remove the value of rice milling so that the rice industry could be analyzed using IMPLAN's ABP methods.

Multipliers describe the response of the economy to a change in economic activity and estimate changes in output, employment, income and value added. When analyzing the economic contributions of the Aggregate Agriculture Sector, type SAM (Social Accounting Matrix) multipliers are used to incorporate household expenditures into the models and to calculate the indirect and induced contributions. Type SAM multipliers are the direct, indirect and induced effects where the induced effect is based on both study area data and additional information in the social account matrix. The SAM framework tracks both market and non-market flows. Non-market flows are transactions between non-industrial institutions such as households to government, government to households, and so on. These flows are called "inter-institutional transfers" (Alward and Lindall, 1996). The SAM multiplier approach enables the model to account for commuting, social security tax payments, household income tax payments, and savings; it accounts for income that is not normally re-spent immediately within the region, such as commuting workers who live outside the region and retirement benefits. I-O models built with Type SAM multipliers usually have results that are lower than an I-O model built with Type II multipliers (also available in IMPLAN). The Type SAM is the most appropriate choice for analyzing the contributions of the agriculture sector.

Within Type SAM analysis, institutions such as households, state and local government, federal government, enterprises, capital, and inventory additions/deletions may be chosen for internalization within the model. In previous reports, only the default "household" institutions were selected for analysis. For 2012, however, it was determined that state and local government must also be included. This addition serves to more accurately account for induced effects brought about through state and local government spending.

Estimating trade flows across regional boundaries is possibly the largest source of error in non-survey I-O models (Ste-

vens and Trainor, 1980) and the selection and use of the regional purchase coefficient (RPC) is one way to eliminate some of the errors. Because of the longitudinal nature of this research series, IMPLAN's Econometric RPC model was employed to make comparisons with previous years' results more compatible. The RPC represents the proportion of intermediate demands and local demands for a specific commodity that will be satisfied by local production (Olson and Lindall, 2009). For example, a RPC value of 0.80 means that 80% of the final demand for the industry is provided by local producers. The remainder (20%) is the portion imported from outside the region. To avoid overestimation of the Aggregate Agriculture Sector, the model RPCs must be set to zero for agricultural industries (see Appendix A), instructing the model not to purchase products and services from the Aggregate Agriculture Sector. This removes the agriculture sectors from the production function and eliminates multiple counting of economic activity in these sectors.

When conducting contribution analysis, IMPLAN allows the user to edit commodities produced by industries for the change in final demand. In the study, any byproduct commodity produced in a sector included in the Aggregate Agriculture Sector was set to zero so the industry production of the primary commodity is 100%. Therefore, the sector is solely responsible for the entire value of the product being sold (e.g., *Oilseed Farming* industry is solely responsible for the entire value of soybeans produced; soybeans are not produced in any other sector). By specifying that each agricultural industry only produce its primary commodity, no byproducts exist and therefore no indirect or induced effects are calculated in the defined agricultural sectors.

In order to measure the contribution of each industry, industry change activities for each industry in the Aggregate Agriculture Sector were created. The year of each event equaled the data year, and the output values for each event equaled the industry output value previously used in data reconciliation. This method allows IMPLAN to estimate the contribution of the industry to the local economy instead of an additional impact from an industry.

The final important procedure is to

estimate the portion of activity that accrues to the local (in this case the state) economy by editing the Local Purchase Percentages (LPPs) in the industry change activities for every IMPLAN agricultural industry. Only the portion of an industry's value that is produced locally should accrue to the local economy. For instance, output in the *Oilseed Farming* industry (sector 1) involved the LPP being set to 100%, which means the entire output value of the industry accrued to the region because the goods in the sector are produced within the study region. Alternately, an activity measuring spending by tourists on gasoline and oil would involve setting the LPPs to the SAM value, an estimate of the actual percent of expenditures made in the study area. Estimating the economic contribution of the Aggregate Agriculture Sector to the state involved setting each LPP to 100% for each industry considered part of the Aggregate Agriculture Sector.

1.2.2 Analysis by Parts

Arkansas's largest grains industry is rice, unlike all other U.S. States. Differences in the makeup of the output value of the grains industry, and therefore the industry spending patterns for grains production and processing, in Arkansas warranted changes in the contribution analysis methods. Richardson and Outlaw (2010) previously reported on the U.S. rice industry's contribution to the U.S. economy using IMPLAN's analysis by parts methods (Alward, 2012). ABP allows the IMPLAN user to account for industry activity outside of the 440 sectoring scheme. For example, ABP could be used in an impact analysis to estimate effects of a new industry in an economy (e.g., switchgrass production and processing into ethanol) or in a contribution analysis to estimate the effects of a piece of an existing industry separately (e.g., rice production independently instead of as a component of *Grain Farming* sector). In this study, *Rice Farming* and *Rice Milling* comprise the rice industry. *Rice Farming* was removed from *Grain Farming* (sector 2), and *Rice Milling* was removed from *Flour Milling and Malt Manufacturing* (sector 43). Appendix C presents additional technical details about ABP.

1.2.3 Measures of Economic Contribution

Total economic contributions are made up of three separate components: 1) direct contributions: generated by farm production and processing of crops, poultry, livestock and forest products; 2) indirect contributions: generated when agricultural firms purchase materials and services from other Arkansas businesses; and 3) induced contributions: result when employees of agricultural firms and their suppliers spend a portion of their income within Arkansas. Each of these contributions makes up an important part of the total economic contribution of the Arkansas agriculture sector. The overall definition of the Aggregate Agriculture Sector in this study is limited to only those sectors considered to be 100% tied to agriculture, as defined in section 1.2. However, the indirect and induced contributions measure the contributions of those industries that are linked to agriculture but may not be entirely defined as agriculture. These industries represent important economic bases of many communities across the state and contribute to the jobs, income and value added in these communities due to their relationships with agriculture. Because sectors are interlinked throughout the state, expansion in activities in one sector may result in expansion in other sectors. Therefore, the contributions accruing in other sectors as a result of agricultural production and processing are included in the total economic contribution.

Economic contributions are often measured in terms of: 1) total industry output, 2) wages and labor income (wages, salaries, and proprietor income), 3) total value added, and 4) employment. I-O analysis can be used to assess the economic contribution of an existing sector. These measures are thought of as a sector's gross contribution to the regional economy. This is accomplished by "removing" the sector of choice from the I-O model and examining how this removal affects the economic activity in the region. This provides an estimate of the contribution of the sector by looking at the losses experienced (or activity generated) by the sector of interest.

Employment includes all wage and salary employees, as well as self-employed jobs, in a given sector. All jobs are not equal; they pay different wages, require different skills and different work hours, etc., which makes aggregate estimates or comparisons across regions and industries problematic. However, jobs as a measure of economic contribution are easily understood and an important component of economic activity. Labor income consists of two parts: first is proprietary income, which includes all income received by self-employed individuals including private business owners, owner-operators, etc.; second is wages, which includes all worker salaries, payments, and fringe benefits paid by employers. Value added represents all payments to workers (labor income) plus indirect taxes and other property-type income, such as pay-

ments for rents, royalties, and dividends. Value added is comparable to GDP by State but is measured using different data sources and methods, so the data may not be precisely equal. Value added is the income and indirect business taxes generated by the activity and offers a more complete examination of the total economic contribution of an activity on a region; therefore, economists generally prefer value added to output as the measure for assessing the contribution of a given industry or activity to a region's economy (Olson and Lindall, 2009). Income and value added are also relatively clear measures of economic contribution that can be directly compared across industries and regions that contain a range of different economic activities.

Measuring the economic importance of an industry using output can be mis-

leading. Output represents the dollar value of an industry's total production, but can also be thought of as the sum of the goods and services used to provide a product. Economic contribution analyses estimate the contribution of production (output) by including purchases from other industries to produce the inputs required to create this output; therefore, output includes the production of intermediate goods which are included in another industry's output. Summing the output of all industries would include multiple counting of some goods and services. Gross sales receipts overestimate the economic size of an industry because the values of inputs are recounted at each succeeding stage of production. As a result, output should not be used as a measure of economic contribution and is not reported here.

1.3: The Aggregate Agriculture Sector

In 2012, agriculture made substantial contributions to the Arkansas economy in terms of employment, labor income, wages, and value added (see Box 1). The Aggregate Agriculture Sector provided 280,959 jobs, accounting for over 18% of state employment (Table 1). That is, more than one in six Arkansas jobs can be attributed to agriculture. In that same year, agriculture paid \$11.5B, or over 16% of state labor income. Wages accounted for \$9.3B, or 81% of total labor income generated by agriculture. Additionally, the Aggregate Agriculture Sector added \$20.1B of value to the state economy, or 18% of state value added. That is, more than \$1 out of every \$6 in value added can be attributed to agriculture. Details of these contributions are presented in Appendix B, Table 1 and are summarized in Tables 2 through 4 below.

Agriculture generates employment in all 20 of the 2-digit NAICS sectors. Almost 70% of all agriculture-generated jobs are in five sectors (Box 2). The poultry industry (comprised of *Poultry Processing* and *Poultry and Egg Production*) alone provides 36,503

jobs, or one in four jobs generated by agriculture in Arkansas. *Poultry Processing* employed 27,962 of these workers. The remaining 8,541 workers were employed in *Poultry and Egg Production*.

The far-reaching contributions of agriculture are seen in the distribution of agriculture-generated value added throughout the economy. Box 3 shows the five sectors that benefit most from value added generated by agriculture. Note that three of those sectors (*Real Estate and Rental*, *Wholesale Trade*, and

Transportation and Warehousing) lie outside of the agriculture sector as defined here. Although a little more than half (54%) of all agriculture-generated value added accrues outside agricultural sectors, these sectors are closely tied to agriculture. For instance, *Wholesale Trade* contains businesses such as grain and livestock wholesalers as well as farm supply wholesalers.

Box 1. Total Contribution of Arkansas Agriculture, 2012

Employment
280,959 jobs (1 out of 5 Arkansas jobs)
Wages
\$9,316M (19% of Arkansas wages)
Labor Income
\$11,477M (20% of Arkansas labor income)
Value-Added
\$20,118M (\$1 out of \$5 Arkansas value added)

Source: IMPLAN (2014b).

NOTE: Presented in current dollars.

Box 2. Employment Generated by Agriculture, 2012 Top Five NAICS Industries^a

Agriculture, Forestry, Fishing and Hunting
77,746 jobs (87% of the jobs are in agricultural production)
Manufacturing
72,964 jobs (95% of the jobs are in agricultural processing)
Health and Social Services
15,285 jobs
Government and Non NAICS
14,365 jobs
Retail Trade
12,923 jobs
Top Five Total
193,282 jobs (69% of all jobs generated by Agriculture)

^aBased on 2-Digit NAICS aggregation (USCB, 2006).

Source: IMPLAN (2014b).

Note: presented in current dollars.

Table 1. The Aggregate Agriculture Sector's Contribution to Arkansas' Economy, 2012.

	Employment ^a			Labor Income ^b			Value Added ^c		
	Number of Jobs	% Total	% Total Arkansas Jobs	Million \$	% Total	% Total Arkansas Labor Income	Million \$	% Total	% Total Arkansas Value Added
Production ^d	67,992	24.2 %	5.2 %	1,703	14.8 %	3.0 %	2,842	14.1 %	2.9 %
Processing ^e	69,212	24.6 %	5.2 %	3,444	30.0 %	6.1 %	6,141	30.5 %	6.2 %
Ag-Related ^f	9,754	3.5 %	0.7 %	331	2.9 %	0.6 %	220	1.1 %	0.2 %
Direct Contribution	146,958	52.3 %	11.1 %	5,478	47.7 %	9.8 %	9,203	45.7 %	9.3 %
Indirect Effects	58,737	20.9 %	4.5 %	3,116	27.1 %	5.6 %	5,820	28.9 %	5.9 %
Direct + Indirect Contribution	205,695	73.2 %	15.6 %	8,593	74.9 %	15.3 %	15,023	74.7 %	15.2 %
Induced Effects	75,264	26.8 %	5.7 %	2,884	25.1 %	5.1 %	5,094	25.3 %	5.2 %
Total Contribution	280,959	100.0 %	21.3 %	11,477	100.0 %	20.5 %	20,118	100.0 %	20.4 %

Source: Computed using the 2012 Arkansas database from IMPLAN (2014b).

Note: Presented in current dollars.

a Equivalent to full- and part-time jobs (Day, 2014).

b Labor income represents all forms of employment income; it is the sum of employee compensation and proprietor income (Day, 2014).

c Value added is the sum of employee compensation, proprietary income, other property type income, and indirect business taxes.

d Appendix A, Table 3 lists sectors of direct agricultural production in terms of IMPLAN sectors.

e Appendix A, Table 3 lists sectors of direct agricultural processing in terms of IMPLAN sectors.

f Ag-related sectors include agricultural sectors not categorized as agricultural production or processing. These sectors are Fishing, Hunting, and Trapping; Agriculture and Forestry Support Activities; and New Farm Housing Units and Additions and Alterations.

Within Crops Sector production industries, *Oilseed Farming*, *Rice Farming*, and *Grain Farming* add the largest amount of value, while in the Animal Agriculture Sector, the poultry industry (*Poultry and Egg Production* and *Poultry Processing*) contributes the largest value. In the Forestry Sector, the top five contributors to value in the economy are *Paper Mills*, *Sanitary Paper Product Manufacturing*, *Sawmills and Wood Preservation*, *Paperboard Container Manufacturing*, and *Paperboard Mills*. About 33% (\$3.0B) of direct value added by agriculture accrues in Crops, 31% (\$2.8B) in Animal Agriculture, and 36% (\$3.2B) in Forestry.

As with value added, much of the income attributable to agricultural activity is generated outside of agricultural sectors. Box 4 shows the five sectors that generate the most income as the result of agricultural activity in Arkansas. In 2012, \$6.0B, or 52% of all labor income, went to workers in non-agricultural sectors. Within the agri-

cultural sectors, the top three crops production sectors, the poultry industry, and the top five forestry sectors received \$3.1B, or 27% of all labor income generated by agriculture.

Agriculture's direct contribution to the state economy is measured by the sum of the contributions of farm production, processing of farm products, and agriculture related sectors. There were 146,958 workers employed by the agricultural production, processing and agriculture re-

lated sectors (Table 1). The owners, operators, and workers of these farms and businesses received almost \$5.5B in labor income (Table 1); 63% of direct labor income went to workers and business owners in processing industries. Agricultural production, processing, and agriculture-related industries directly added value of \$9.2B to the Arkansas economy; 67% was from processing industries. The crops industries employed close to half (47%) of agricultural production and processing

Box 3. Value Added Generated by Agriculture, 2012 Top Five NAICS Industries^a

Manufacturing	\$6,583M
(93% of value added is in agricultural processing)	
Agriculture, Forestry, Fishing and Hunting	\$3,063M
(93% of the value added is in agricultural production)	
Real Estate and Rental	\$1,515M
Wholesale Trade	\$1,336M
Transportation and Warehousing	\$901M
Top Five Total	\$13,397M
(67% of all value added generated by Agriculture)	

^aBased on 2-Digit NAICS aggregation (USCB, 2006).

Source: IMPLAN (2014b).

Note: Presented in current dollars.

Box 4. Labor Income Generated by Agriculture, 2012 Top Five NAICS Industries^a

Manufacturing	\$3,681M
(94% of labor income is in agricultural processing)	
Agriculture, Forestry, Fishing and Hunting	\$2,034M
(84% of labor income is in agricultural production)	
Health and Social Services	\$745M
Government and Non NAICs	\$721M
Wholesale Trade	\$644M
Top Five Total	\$7,824M
(68% of all labor income generated by Agriculture)	

^aBased on 2-Digit NAICS aggregation (USCB, 2006).

Source: IMPLAN (2014b).

Note: Presented in current dollars.

employees, while the animal agriculture industries employed 35% and the forestry industries 18% (Table 2).

Indirect contributions result when agricultural firms purchase raw materials and services from other Arkansas businesses to produce their products. In 2012, there were 58,737 workers employed by industries supplying goods and services to the farm production and processing industries. The workers and owners of these establishments received \$3.1B in labor income and these industries added value of almost \$5.8B to the state economy (Table 1).

Induced contributions result when employees of agricultural firms and em-

ployees of the raw material and service firms spend a portion of their income on local purchases. There were 75,264 workers employed by businesses providing goods and services to the employees in agriculture and its supplying industries. These employees and the proprietors of these businesses received roughly \$2.9B in labor income and added value of almost \$5.1B to the Arkansas economy.

1.3.1 The Crops Sector

The Crops Sector includes all enterprises engaged in the production and processing of cotton, food and feed grains, oil bearing crops, fruits, nuts and

vegetables, and hay and pasture (Appendix A, Table 1). The Crops Sector's direct contribution on the state economy is measured by the sum of the contributions of crop production and processing of crops products.

In 2012, the Crops Sector provided 63,976 jobs within the Aggregate Agriculture Sector, or 4% of state employment (Table 3 and Box 5). The workers and business owners received \$1.8B in labor income (\$861M of that in wages), or 3% of state labor income. The Crops Sector added \$3.0B, or 3%, to state value-added. The rice industry (*Rice Farming*, and *Rice Milling*) represented 16% of jobs, 18% of labor income, and 19%

Table 2. The Contribution of Major Agricultural Sectors to Agricultural Production and Processing, 2012.

	Employment ^a		Labor Income ^b		Value Added ^c	
	Number of Jobs	% Total	Million \$	% Total	Million \$	% Total
Production						
<i>Crops</i>	48,946	35.7 %	920	17.9 %	1,653	18.4 %
<i>Animal Agriculture</i>	15,180	11.1 %	560	10.9 %	976	10.9 %
<i>Forestry</i>	3,866	2.8 %	224	4.3 %	213	2.4 %
Production Total	67,992	49.6 %	1,703	33.1 %	2,842	31.6 %
Processing						
<i>Crops</i>	15,030	11.0 %	839	16.3 %	1,299	14.5 %
<i>Animal Agriculture</i>	33,312	24.3 %	1,285	25.0 %	1,812	20.2 %
<i>Forestry</i>	20,870	15.2 %	1,320	25.6 %	3,030	33.7 %
Processing Total	69,212	50.4 %	3,444	66.9 %	6,141	68.4 %
Prod. + Proc. Total	137,204	100.0 %	5,147	100.0 %	8,983	100.0 %

Source: Computed using the 2012 Arkansas database from IMPLAN (2014b).

Note: Presented in current dollars.

a Equivalent to full- and part-time jobs (Day, 2014).

b Labor income represents all forms of employment income; it is the sum of employee compensation and proprietor income (Day, 2014).

c Value added is the sum of employee compensation, proprietary income, other property type income, and indirect business taxes.

Table 3. The Crops Sector's Direct Contribution to Arkansas' Economy, 2012.

	Employment ^a			Labor Income ^b			Value Added ^c		
	Number of Jobs	% Direct Impact	% Total Arkansas Jobs	Million \$	% Direct Impact	% Total Arkansas Labor Income	Million \$	% Direct Impact	% Total Arkansas Value Added
Production ^d	48,946	33.3 %	3.7 %	920	16.8 %	1.6 %	1,653	18.0 %	1.7 %
Processing ^e	15,030	10.2 %	1.1 %	839	15.3 %	1.5 %	1,299	14.1 %	1.3 %
Direct Impact	63,976	43.5 %	4.9 %	1,759	32.1 %	3.1 %	2,952	32.1 %	3.0 %

Source: Computed using the 2012 Arkansas database from IMPLAN (2014b).

Note: Presented in current dollars.

a Equivalent to full- and part-time jobs (Day, 2014).

b Labor income represents all forms of employment income; it is the sum of employee compensation and proprietor income (Day, 2014)

c Value added is the sum of employee compensation, proprietary income, other property type income, and indirect business taxes.

d Appendix A, Table 5 lists sectors of direct agricultural production in terms of IMPLAN sectors.

e Appendix A, Table 6 lists sectors of direct agricultural processing in terms of IMPLAN sectors.

of value added in the overall Crops Sector (Box 6). A summary is presented in Table 4. Details are provided in Appendix B, Table 2.

1.3.2 The Animal Agriculture Sector

The Animal Agriculture Sector includes all enterprises engaged in the production and processing of animals, including poultry and egg, cattle, dairy farm, hogs and pigs, other animal agriculture, processed meat, and dairy processing industries (Appendix A, Table 2). The Animal Agriculture Sector's direct contribution on the state economy is measured by the sum of the contributions of animal production and processing of animal products. This sector accounted for 48,492 jobs in 2012, or over 3% of state employment, and these workers and business owners received \$1.8B in labor income, or almost 3% of state labor income (Table 4). Of this labor income, 81% (\$1.5B) was attributable to

wages. In 2012, the Animal Agriculture Sector added \$2.8B of value to the state economy, accounting for over 2% of state value added (Table 4 and Box 7). Poultry and Egg Production and Poultry Processing³ provided 75% of jobs, 82% of income and 78% of value added in the Animal Agriculture Sector in 2012 (Box 8). However, overall, the Poultry and Egg Production and Poultry Processing sectors generated 1 out of 4 of all agricultural jobs, and \$1 out of every \$4 of agricultural value added. Table 5 provides a summary of the Animal Agriculture Sector's total contribution on Arkansas' economy; details can be found in Appendix B, Table 3.

1.3.3 The Forestry Sector

The Forestry Sector is primarily comprised of commercial logging, forest products, furniture and wood and

paper processing enterprises (Appendix A, Table 3). The Forestry Sector's direct contribution to the state economy is measured by the sum of the contributions of forestry production and processing. Processed goods derived from forestry production are the third largest component of processed agricultural goods, in terms of employment, labor income, and value added. There were 24,736 jobs (almost 2% of state employment) in the Forestry Sector in 2012, and these workers and business owners received \$1.5B in labor income, or over 2% of state labor income. The Forestry Sector added \$3.2B of value to the state economy, or almost 3% of total state value-added (Table 5 and Box 9). Within this sector, Paper Mills, Sanitary Paper Product Manufacturing, Sawmills and Wood Preservation, Paperboard Container Manufacturing, and Paperboard Mills comprised 50% of forestry jobs, and 58% and 74% of forestry income and value added, respectively (Box 10). These contributions are summarized in Table 5. Details can be found in Appendix B, Table 4.

Box 5. Direct Contribution of the Crops Sector, 2012

Employment
63,976 jobs
Wages
\$861M
Labor Income
\$1,759M
Value-Added
\$2,952M

Source: IMPLAN (2014b).
Note: Presented in current dollars.

Box 6. Direct Contribution of the Rice Industry (Rice Farming and Rice Milling)

Employment
9,955 jobs (16% of Crops jobs)
Wages
\$85M (10% of Crops wages)
Labor Income
\$316M (18% of Crops labor income)
Value-Added
\$570M (19% of Crops value added)

Source: IMPLAN (2014b).
Note: Presented in current dollars.

Box 7. Direct Contribution of the Animal Agriculture Sector, 2012

Employment
48,492 jobs
Wages
\$1,487M
Labor Income
\$1,844M
Value-Added
\$2,788M

Source: IMPLAN (2014b).
Note: Presented in current dollars.

Table 4. The Animal Agriculture Sector's Direct Contribution to Arkansas' Economy, 2012.

	Employment ^a			Labor Income ^b			Value Added ^c		
	Number of Jobs	% Direct Impact	% Total Arkansas Jobs	Million \$	% Direct Impact	% Total Arkansas Labor Income	Million \$	% Direct Impact	% Total Arkansas Value Added
Production ^d	15,180	10.3 %	1.2 %	560	10.2 %	1.0 %	976	10.6 %	1.0 %
Processing ^e	33,312	22.7 %	2.5 %	1,285	23.5 %	2.3 %	1,812	19.7 %	1.8 %
Direct Impact	48,492	33.0 %	3.7 %	1,844	33.7 %	3.3 %	2,788	30.3 %	2.8 %

Source: Computed using the 2012 Arkansas database from IMPLAN (2014b).

Note: Presented in current dollars.

a Equivalent to full- and part-time jobs (Day, 2014).

b Labor income represents all forms of employment income; it is the sum of employee compensation and proprietor income (Day, 2014).

c Value added is the sum of employee compensation, proprietary income, other property type income, and indirect business taxes.

d Appendix A, Table 5 lists sectors of direct agricultural production in terms of IMPLAN sectors.

e Appendix A, Table 6 lists sectors of direct agricultural processing in terms of IMPLAN sectors.

Box 8. Direct Contribution of the Poultry Industry (Poultry and Egg Production and Poultry Processing)

Employment
36,503 jobs (75% of Animal Agriculture jobs) (1 out of 4 agricultural jobs)
Wages
\$1,190M (80% of Animal Agriculture wages) (30% of agricultural wages)
Labor Income
\$1,521M (82% of Animal Agriculture labor income) (28% of agricultural labor income)
Value-Added
\$2,170M (78% of Animal Agriculture value added) (\$1 out of \$4 agricultural value added)

Source: IMPLAN (2014b).
Note: Presented in current dollars.

Box 9. Direct Contribution of the Forestry Sector, 2012

Employment
24,736 jobs
Wages
\$1,411M
Labor Income
\$1,544M
Value-Added
\$3,243M

Source: IMPLAN (2014b).
Note: Presented in current dollars.

Box 10. Direct Contribution of the Top Five Forestry Industries: Paper Mills, Sanitary Paper Product Manufacturing, Sawmills and Wood Preservation, Paperboard Container Manufacturing, and Paperboard Mills

Employment
12,431 jobs (50% of Forestry jobs)
Wages
\$887M (63% of Forestry wages)
Labor Income
\$899M (58% of Forestry labor income)
Value-Added
\$2,393M (74% of Forestry value added)

Source: IMPLAN (2014b).
Note: Presented in current dollars.

Table 5. The Forestry Sector's Direct Contribution to Arkansas' Economy, 2012.

	Employment ^a			Labor Income ^b			Value Added ^c		
	Number of Jobs	% Direct Impact	% Total Arkansas Jobs	Million \$	% Direct Impact	% Total Arkansas Labor Income	Million \$	% Direct Impact	% Total Arkansas Value Added
Production ^d	3,866	2.6 %	0.3 %	224	4.1 %	0.4 %	213	2.3 %	0.2 %
Processing ^e	20,870	14.2 %	1.6 %	1,320	24.1 %	2.4 %	3,030	32.9 %	3.1 %
Direct Impact	24,736	16.8 %	1.9 %	1,544	28.2 %	2.8 %	3,243	35.2 %	3.3 %

Source: Computed using the 2012 Arkansas database from IMPLAN (2014b).

Note: Presented in current dollars.

^a Equivalent to full- and part-time jobs (Day, 2014).

^b Labor income represents all forms of employment income; it is the sum of employee compensation and proprietor income (Day, 2014).

^c Value added is the sum of employee compensation, proprietary income, other property type income, and indirect business taxes.

^d Appendix A, Table 5 lists sectors of direct agricultural production in terms of IMPLAN sectors.

^e Appendix A, Table 6 lists sectors of direct agricultural processing in terms of IMPLAN sectors.

1.4: Summary of the Contribution of Agriculture in 2011

In 2012, the Aggregate Agriculture Sector contributed 146,958 direct jobs, or almost 10% of state employment. In addition, the Aggregate Agriculture Sector contributed 134,001 indirect and induced jobs, for a total contribution of over 18% of state employment. Indirect and induced jobs were created in all 20 of the 2-digit NAICS aggregated industries. The largest production sector was the Crops Sector, accounting for almost three-fourths of direct employment and half of labor income and value added in agricultural production. The most direct

processing jobs were attributable to the Animal Agriculture Sector, which accounted for almost half of processing jobs. The Forestry Sector was the leader in agricultural processing direct labor income and value added, accounting for about \$2 in every \$5 of each. When production and processing are combined, the Crops Sector, Animal Agriculture Sector, and Forestry Sector each contributed almost equally to value added. IMPLAN data and the analysis indicate that the Arkansas Aggregate Agriculture Sector plays a significant role

in generating jobs, income, and value added throughout the state's economy. World and domestic price stability and associated agricultural and food policies will continue to have a significant impact on Arkansas agriculture and its contribution to the Arkansas economy. Continued strength of agriculture is of paramount importance if the social and economic fabric of rural Arkansas communities is to be retained and if the essential infrastructure and services that translate into an acceptable quality of life for its residents are to be maintained.

End Notes

1 *Rice Farming* and *Rice Milling* comprise the rice industry. The two are not default IMPLAN sectors, but are presented as such for clarity of results. These industries were analyzed separately from their default IMPLAN sectors, *Grain Farming* and *Flour Milling* and *Malt Manufacturing*, respectively, using IMPLAN's analysis by parts (ABP) methods. Rice farming and Rice milling are presented like IMPLAN sectors in Appendix A, Table 1; and Appendix B, Tables 1 and 2, but not in Appendix A, Tables 5 and 6. Any

references to data for the Crops Sector include the value of both *Rice Farming* and *Rice Milling*, while any references to production (processing) include the value of *Rice Farming* (*Rice Milling*).

2 Although sectors 15 and 16 are also production sectors (forestry), no newer or more accurate data is available to update these sectors.

3 One important change in recent years occurred in the poultry production sec-

tor where large productivity gains have been experienced. The amount of labor required to produce the same output on poultry farms has decreased and the majority of poultry output is increasingly produced on fewer acres. This is reflected in the employment number associated with poultry production in this report which has decreased since the 2001 report. The reason for such a drop reflects productivity gains occurring over the past 10 or more years that were only recently adjusted for in the IMPLAN data set.

Literature Cited

- Alward, A. 2012. "Estimating the contribution of a current industry using IMPLAN version 3.0." MIG (Minnesota IMPLAN Group, Inc.).
- Alward, G. and Lindall, S. 1996. "Deriving SAM multiplier models using IMPLAN." Paper presented at 1996 IMPLAN user conference.
- ADWS (Arkansas Department of Workforce Services Labor Market Information/BLS Programs). 2014. Rice milling annual average employment and total calendar wages. Data available by request only. 2 Capitol Mall, Little Rock, Ark. 72201. dws.arkansas.gov. Accessed 11 April 2014.
- Day, F. 2014. "Principles of Impact Analysis and IMPLAN Applications"; IMPLAN Group, LLC, 16740 Birkdale Commons Parkway, Suite 206, Huntersville, N.C.
- English, L., J. Popp and W. Miller. 2013. Economic contribution of the agricultural sector to the Arkansas economy in 2011. Research Report 992. Arkansas Agricultural Experiment Station University of Arkansas System Division of Agriculture; Fayetteville, Arkansas. <http://arkansasagnews.uark.edu/992.pdf>. Accessed 10 August 2014.
- English, L., J. Popp and W. Miller. 2014. Economic Contribution of Arkansas

- Agriculture 2014. Pocket guide. Arkansas Agricultural Experiment Station University of Arkansas System Division of Agriculture; Fayetteville, Arkansas.
- Flanders, A. 2011. "AG1272-2012 Crop Enterprise Budgets for Arkansas Field Crops Planted in 2012 (All Crops) (Interactive MS Excel Files)." Arkansas Agricultural Experiment Station University of Arkansas System Division of Agriculture. http://www.the-miraclebean.com/sites/default/files/attachments/Arkansas%20Crop%20Budgets%202012_0.pdf Accessed 11 August 2014.
- Goodwin, H.L., J. Popp, W. Miller, G. Vickery and Z. Clayton-Neiderman. 2002. Impact of the agricultural sector on the Arkansas economy. Research Report 969. Arkansas Agricultural Experiment Station University of Arkansas System Division of Agriculture, Fayetteville. http://agribus.uark.edu/Impact_of_the_Agricultural_Sector_on_the_Arkansas_Economy.pdf. Accessed: 10 August 2014.
- IMPLAN (IMPLAN Group, LLC). 2014a. "IMPLAN Industry Sectoring." http://www.implan.com/index.php?option=com_content&view=article&id=633:633&catid=241:KB23. Accessed 10 August 2014.
- IMPLAN (IMPLAN Group, LLC). 2014b. IMPLAN System (data and software): 2012 data for the state of Arkansas. 16740 Birkdale Commons Parkway, Suite 206, Huntersville, N.C. www.implan.com
- IMPLAN (IMPLAN Group, LLC). 2014c. IMPLAN Analysis—Frequently Asked Questions: Estimating the Contribution of a Current Industry. http://www.implan.com/index.php?option=com_content&view=article&id=660:660&catid=253:KB33. Accessed 10 August, 2014.
- IMPLAN (IMPLAN Group, LLC). 2014d. How Often Do I Need to Update My Data? IMPLAN Online Knowledge Base. http://www.implan.com/index.php?option=com_content&view=article&id=752:how-often-do-i-need-to-update-my-data&catid=269:faq&Itemid=112. Accessed 10 August 2014.
- Kemper, N., J. Popp and W. Miller. 2009. Economic contribution of the agricultural sector to the Arkansas economy in 2007 and revised estimates for 2006. Research Report 987. Arkansas Agricultural Experiment Station Division of Agriculture, Fayetteville. <http://arkansasagnews.uark.edu/987.pdf>. Accessed 10 August 2014.
- McGraw, K., J. Popp and W. Miller. 2011. Economic contribution of the agricultural sector to the Arkansas economy in 2009. Research Report 990. Arkansas Agricultural Experiment Station University of Arkansas System Division of Agriculture, Fayetteville. <http://arkansasagnews.uark.edu/990.pdf>. Accessed: 10 August 2014.
- McGraw, K., J. Popp and W. Miller. 2012. Economic contribution of the agricultural sector to the Arkansas economy in 2010. Research Report 991. Arkansas Agricultural Experiment Station University of Arkansas System Division of Agriculture, Fayetteville. <http://arkansasagnews.uark.edu/991.pdf>. Accessed 10 August 2014.
- Olson, D. and S. Lindall. 2009. IMPLAN Professional Version 2.0 Software, Analysis, and Data Guide. Minnesota IMPLAN Group, Inc. Stillwater, Minn.
- Popp, J., N. Kemper and W. Miller. 2007. Impact of the agricultural sector on the Arkansas economy in 2003. Research Report 981. Arkansas Agricultural Experiment Station University of Arkansas System Division of Agriculture, Fayetteville, Arkansas. http://agribus.uark.edu/Impact_of_the_Agriculture_Sector_on_the_Arkansas_Economy_in_2003.pdf. Accessed: 10 August 2014.
- Popp, J., N. Kemper, W. Miller, K. McGraw and K. Karr. 2010. The economic contribution of the agricultural sector to the Arkansas economy in 2008. Research Report 989. Arkansas Agricultural Experiment Station University of Arkansas System Division of Agriculture, Fayetteville, Arkansas. <http://arkansasagnews.uark.edu/989.pdf>. Accessed 10 August 2014.
- Popp, J., G. Vickery and W. Miller. 2005. Impact of the agricultural sector on the Arkansas economy in 2001. Research Report 975. Arkansas Agricultural Experiment Station University of Arkansas System Division of Agriculture, Fayetteville, Arkansas. http://agribus.uark.edu/Impact_of_the_Agriculture_Sector_on_the_Arkansas_Economy_in_2001.pdf. Accessed 10 August 2014.
- Richardson, J. and J. Outlaw. 2010. Economic Contributions of the U.S. Rice Industry to the U.S. Economy. Agricultural and Food Policy Center, Texas A&M University, College Station, Texas. <http://www.usarice.com/doclib/188/4897.pdf>. Accessed 11 August 2014
- Stevens, B. and G. Trainor. 1980. "Error generation on regional input-output analysis and its implications for non-survey models." In: Economic impact analysis: Methodology and applications, ed. S. Pleeter, 68-79. Amsterdam: Marinus Nijhoff. http://link.springer.com/chapter/10.1007/978-94-011-7405-3_5. Accessed 12 August 2014.
- USCB (U.S. Census Bureau). 2006. 2007 North American Classification System (NAICS). www.census.gov/eos/www/naics/. Accessed 19 August 2014.
- USCB (U.S. Census Bureau). 2014. "North American Industry Classification System Frequently asked questions (FAQs)." <http://www.census.gov/eos/www/naics/faqs/faqs.html#q1>. Accessed 10 August 2014.
- USDA (U.S. Department of Agriculture). 2012. Census of Agriculture. http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1_Chapter_1_US/usv1.pdf. Accessed 11 August 2014.
- USDA ERS (U.S. Department of Agriculture Economic Research Service). 2014. Rice Yearbook 2012/13: Data files. Table 2: Rough and milled rice (rough equivalent): Marketing year supply, disappearance, and price; Table 3: Long grain rough and milled rice (rough equivalent): Marketing year supply, disappearance, and price; Table 4: Medium/short grain rough and milled rice (rough equivalent): Marketing year supply, disappearance, and price; Table 17: Milled rice: Average price, fob mills, at selected milling centers. usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?docu

[mentID=1229](#). Accessed 11 August 2014.
USDA NASS (U.S. Department of Agriculture National Agricultural Statis-

tics Service). 2014. Commodity production and values data for 2007-2012. usda.mannlib.cornell.edu/MannUsda/homepage.do;jsessionid=118

[B9D6A6FF48DA1BEC379A03362B1D0](#). Accessed: 10 August 2014.

Appendix A

Description of IMPLAN Sectors and Aggregation Schemes

Table 1. Components of the Crops Sector as Defined by IMPLAN Sectors, 2012.

Aggregate Sector	Sector ID	IMPLAN Sector
CROPS PRODUCTION	1	Oilseed farming
	2	Grain farming
	N/A	Rice farming
	3	Vegetable and melon farming
	4	Fruit farming
	5	Tree nut farming
	6	Greenhouse, nursery, and floriculture production
	7	Tobacco farming
	8	Cotton farming
	9	Sugarcane and sugar beet farming
	10	All other crop farming
CROPS PROCESSING	43	Flour milling and malt manufacturing
	N/A	Rice milling
	44	Wet corn milling
	45	Soybean and other oilseed processing
	46	Fats and oils refining and blending
	47	Breakfast cereal manufacturing
	48	Sugar cane mills and refining
	49	Beet sugar manufacturing
	50	Chocolate and confectionery manufacturing from cacao beans
	51	Confectionery manufacturing from purchased chocolate
	52	Nonchocolate confectionery manufacturing
	53	Frozen food manufacturing
	54	Fruit and vegetable canning, pickling, and drying
	62	Bread and bakery product manufacturing
	63	Cookie, cracker, and pasta manufacturing
	64	Tortilla manufacturing
	65	Snack food manufacturing
	66	Coffee and tea manufacturing
	67	Flavoring syrup and concentrate manufacturing
	68	Seasoning and dressing manufacturing
	69	All other food manufacturing
	70	Soft drink and ice manufacturing
	71	Breweries
	72	Wineries
	73	Distilleries
	74	Tobacco product manufacturing
	75	Fiber, yarn, and thread mills
	76	Broadwoven fabric mills
	77	Narrow fabric mills and schiffli machine embroidery
	78	Nonwoven fabric mills
	79	Knit fabric mills
80	Textile and fabric finishing mills	
81	Fabric coating mills	
82	Carpet and rug mills	
83	Curtain and linen mills	
84	Textile bag and canvas mills	
85	All other textile product mills	
86	Apparel knitting mills	
87	Cut and sew apparel contractors	
88	Men's and boys' cut and sew apparel manufacturing	
89	Women's and girls' cut and sew apparel manufacturing	
90	Other cut and sew apparel manufacturing	
91	Apparel accessories and other apparel manufacturing	

Note: Sector ID "N/A" indicates an industry not original to the IMPLAN 440 scheme.

Table 2. Components of the Animal Agriculture Sector, Defined by IMPLAN Sectors, 2012.

Aggregated Sector	Sector ID	IMPLAN Sector
ANIMAL PRODUCTION	11	Cattle ranching and farming
	12	Dairy cattle and milk production
	13	Poultry and egg production
	14	Animal production, except cattle and poultry
ANIMAL PROCESSING	41	Dog and cat food manufacturing
	42	Other animal food manufacturing
	55	Fluid milk and butter manufacturing
	56	Cheese manufacturing
	57	Dry, condensed, and evaporated dairy product manf.
	58	Ice cream and frozen dessert manufacturing
	59	Animal (except poultry) slaughtering and rendering
	60	Poultry processing
	61	Seafood product preparation and packaging
	92	Leather and hide tanning and finishing
93	Footwear manufacturing	
94	Other leather and allied product manufacturing	

Table 3. Components of the Forestry Sector as Defined by IMPLAN Sectors, 2012.

Aggregated Sector	Sector ID	IMPLAN Sector
FORESTRY PRODUCTION	15	Forestry, forest products, and timber tract production
	16	Commercial logging
FORESTRY PROCESSING	95	Sawmills and wood preservation
	96	Veneer and plywood manufacturing
	97	Engineered wood member and truss manufacturing
	98	Reconstituted wood product manufacturing
	99	Wood windows and doors and millwork manufacturing
	100	Wood container and pallet manufacturing
	101	Manufactured home (mobile home) manufacturing
	102	Prefabricated wood building manufacturing
	103	All other miscellaneous wood product manufacturing
	104	Pulp mills
	105	Paper mills
	106	Paperboard mills
	107	Paperboard container manufacturing
	108	Coated and laminated paper, packaging paper and plastics film manf.
	109	All other paper bag and coated and treated paper manufacturing
	110	Stationery product manufacturing
	111	Sanitary paper product manufacturing
	112	All other converted paper product manufacturing
295	Wood kitchen cabinet and countertop manufacturing	
296	Upholstered household furniture manufacturing	
297	Nonupholstered wood household furniture manufacturing	
300	Office furniture manufacturing	
301	Custom architectural wood manufacturing	

Table 4. Components of the Agriculture-Related Sector as Defined by IMPLAN Sectors, 2012.

Aggregated Sector	Sector ID	IMPLAN Sector
AGRICULTURE RELATED	17	Commercial fishing
	18	Commercial hunting and trapping
	19	Support activities for agriculture and forestry

Table 5. Components of Agricultural Production as Defined by IMPLAN Sectors.

Aggregated Sector	IMPLAN Sector
CROPS PRODUCTION	Oilseed farming; Grain farming; Vegetable and melon farming; Tree nut farming; Fruit farming; Greenhouse and nursery production; Tobacco farming; Cotton farming; Sugarcane and sugar beet farming; All other crop farming
ANIMAL PRODUCTION	Cattle ranching and farming; Poultry and egg production; Animal production, except cattle and poultry
FORESTRY PRODUCTION	Forestry, forest products, and timber tract production; Commercial logging

Table 6. Components of Agricultural Processing as Defined by IMPLAN Sectors.

Aggregated Sector	IMPLAN Sector
CROPS PROCESSING	Flour milling and malt manufacturing; Wet corn milling; Soybean and other oilseed processing; Fats and oils refining and blending; Breakfast cereal manufacturing; Sugar cane mills and refining; Beet sugar manufacturing; Chocolate and confectionery manufacturing from cacao beans; Confectionery manufacturing from purchased chocolate; Nonchocolate confectionery manufacturing; Frozen food manufacturing; Fruit and vegetable canning, pickling, and drying; Bread and bakery product manufacturing; Cookie, cracker, and pasta manufacturing; Tortilla manufacturing; Snack food manufacturing; Coffee and tea manufacturing; Flavoring syrup and concentrate manufacturing; Seasoning and dressing manufacturing; All other food manufacturing; Soft drink and ice manufacturing; Breweries; Wineries; Distilleries; Tobacco product manufacturing; Fiber, yarn, and thread mills; Broadwoven fabric mills; Narrow fabric mills and schiffli machine embroidery; Nonwoven fabric mills; Knit fabric mills; Textile and fabric mills; Fabric coating mills; Carpet and rug mills; Curtain and linen mills; Textile bag and canvas mills; All other textile product mills; Cut and sew apparel contractors; Men's and boys' cut and sew apparel manufacturing; Women's and girls' cut and sew apparel manufacturing; Other cut and sew apparel manufacturing; Apparel accessories and other apparel manufacturing
ANIMAL PROCESSING	Dog and cat food manufacturing; Other animal food manufacturing; Fluid milk and butter manufacturing; Cheese manufacturing; Dry- condensed- and evaporated dairy products; Ice cream and frozen dessert manufacturing; Animal (except poultry) slaughtering and rendering; Poultry processing; Seafood product preparation and packaging; Leather and hide tanning and finishing; Footwear manufacturing; Other leather and allied product manufacturing
FORESTRY PROCESSING	Sawmills and wood preservation; Veneer and plywood manufacturing; Engineered wood member and truss manufacturing; Reconstituted wood product manufacturing; Wood windows and doors and millwork manufacturing; Wood container and pallet manufacturing; Manufactured home (mobile home) manufacturing; Prefabricated wood building manufacturing; All other miscellaneous wood product manufacturing; Pulp mills; Paper mills; Paperboard mills; Paperboard container manufacturing; Coated and laminated paper, packaging paper and plastics film manufacturing; All other paper bag and coated and treated paper; Stationery product manufacturing; Sanitary paper product manufacturing; All other converted paper product manufacturing; Wood kitchen cabinet and countertop manufacturing; Upholstered household furniture manufacturing; Non-upholstered wood household furniture manufacturing; Office furniture manufacturing; Custom architectural wood manufacturing

Appendix B

Agriculture-Generated Activity by Sector

Table 1. Agriculture-Generated Activity by Sector, 2012.

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million \$)	Value Added (Million \$)
60	Poultry processing	27,962	1,020.424	1,415.446
2	Grain farming	19,856	138.552	245.532
1	Oilseed farming	16,939	399.518	816.961
413	Food services and drinking places	10,802	199.639	303.558
19	Support activities for agriculture and forestry	9,094	313.691	197.779
319	Wholesale trade businesses	9,042	643.807	1,336.309
13	Poultry and egg production	8,541	500.128	754.108
N/A	Rice farming	8,340	164.787	310.846
335	Transport by truck	6,557	341.654	437.600
360	Real estate establishments	6,535	69.073	609.655
438	* Employment and payroll only (state & local govt, education)	6,297	328.709	381.332
437	* Employment and payroll only (state & local govt, non-education)	5,916	263.790	307.113
39	Maintenance and repair construction of nonresidential structures	4,362	199.556	228.117
95	Sawmills and wood preservation	4,329	219.155	282.969
381	Management of companies and enterprises	4,175	464.925	549.807
394	Offices of physicians, dentists, and other health practitioners	4,076	309.489	318.171
397	Private hospitals	3,820	210.281	240.420
16	Commercial logging	3,489	178.797	143.843
53	Frozen food manufacturing	3,459	167.212	215.441
11	Cattle ranching and farming	3,433	34.339	109.670
105	Paper mills	3,288	341.026	1,114.079
14	Animal production, except cattle and poultry	3,089	23.285	101.044
382	Employment services	2,852	61.174	69.453
398	Nursing and residential care facilities	2,569	79.719	93.273
388	Services to buildings and dwellings	2,539	50.193	66.079
354	Monetary authorities and depository credit intermediation activities	2,477	132.097	557.068
329	Retail Stores - General merchandise	2,410	64.843	113.673
8	Cotton farming	2,386	104.385	122.481
107	Paperboard container manufacturing	2,349	153.992	241.220
62	Bread and bakery product manufacturing	2,041	96.066	114.447
340	Warehousing and storage	1,996	85.799	110.427
425	Civic, social, professional, and similar organizations	1,922	60.641	44.317
324	Retail Stores - Food and beverage	1,873	63.092	89.974
59	Animal (except poultry) slaughtering, rendering, and processing	1,786	89.781	75.969
414	Automotive repair and maintenance, except car washes	1,769	64.693	72.014
99	Wood windows and doors and millwork manufacturing	1,731	77.584	103.942
356	Securities, commodity contracts, investments, and related activities	1,722	65.725	66.215
400	Individual and family services	1,680	39.574	38.271
N/A	Rice milling	1,615	151.219	259.218
426	Private household operations	1,611	10.611	10.611
111	Sanitary paper product manufacturing	1,584	97.042	519.969
320	Retail Stores - Motor vehicle and parts	1,582	80.469	104.322
20	Extraction of oil and natural gas	1,569	60.721	276.693
109	All other paper bag and coated and treated paper manufacturing	1,524	91.538	127.357
368	Accounting, tax preparation, bookkeeping, and payroll services	1,513	63.588	116.190
432	Other state and local government enterprises	1,465	81.590	113.421
330	Retail Stores - Miscellaneous	1,441	25.437	44.925
367	Legal services	1,237	67.415	99.775
65	Snack food manufacturing	1,215	75.530	166.663

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million \$)	Value Added (Million \$)
399	Child day care services	1,193	25.400	38.804
333	Transport by rail	1,192	117.185	230.164
96	Veneer and plywood manufacturing	1,188	67.454	126.632
411	Hotels and motels, including casino hotels	1,143	23.084	47.011
54	Fruit and vegetable canning, pickling, and drying	1,139	72.097	114.059
31	Electric power generation, transmission, and distribution	1,134	140.202	547.701
93	Footwear manufacturing	1,124	38.213	40.620
327	Retail Stores - Clothing and clothing accessories	964	18.502	36.690
357	Insurance carriers	928	56.277	106.994
10	All other crop farming	914	55.325	86.121
331	Retail Nonstores - Direct and electronic sales	904	14.967	48.104
106	Paperboard mills	881	88.037	234.714
86	Apparel knitting mills	870	22.870	24.121
386	Business support services	860	23.572	25.190
325	Retail Stores - Health and personal care	854	35.262	47.234
391	Private elementary and secondary schools	849	15.817	23.193
396	Medical and diagnostic labs and outpatient and other ambulatory care services	843	42.303	74.780
369	Architectural, engineering, and related services	833	45.186	45.823
42	Other animal food manufacturing	829	49.639	91.421
41	Dog and cat food manufacturing	824	43.939	115.762
100	Wood container and pallet manufacturing	809	27.047	38.279
326	Retail Stores - Gasoline stations	783	23.316	36.144
323	Retail Stores - Building material and garden supply	763	25.977	41.488
377	Advertising and related services	738	31.430	82.183
374	Management, scientific, and technical consulting services	730	37.496	39.475
392	Private junior colleges, colleges, universities, and professional schools	728	21.319	22.537
85	All other textile product mills	720	42.727	42.143
70	Soft drink and ice manufacturing	711	45.329	52.702
149	Other plastics product manufacturing	665	30.027	51.684
295	Wood kitchen cabinet and countertop manufacturing	648	23.105	23.721
296	Upholstered household furniture manufacturing	629	22.760	33.266
379	Veterinary services	618	16.240	19.048
387	Investigation and security services	609	14.067	14.586
419	Personal care services	598	19.622	21.525
64	Tortilla manufacturing	583	28.514	39.682
142	Plastics packaging materials and unlaminated film and sheet manufacturing	578	36.696	74.836
401	Community food, housing, and other relief services, including rehabilitation services	572	15.969	15.693
328	Retail Stores - Sporting goods, hobby, book and music	570	10.496	17.937
393	Other private educational services	567	16.546	23.469
351	Telecommunications	537	44.678	177.606
395	Home health care services	531	22.057	23.958
372	Computer systems design services	527	35.128	19.128
417	Commercial and industrial machinery and equipment repair and maintenance	519	27.932	35.917
98	Reconstituted wood product manufacturing	505	33.905	44.076
36	Construction of other new nonresidential structures	503	22.757	25.989
403	Spectator sports companies	500	7.310	5.002
424	Grantmaking, giving, and social advocacy organizations	484	17.192	13.248
427	US Postal Service	462	33.161	30.782
421	Dry-cleaning and laundry services	422	15.748	14.752

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million \$)	Value Added (Million \$)
339	Couriers and messengers	418	16.566	46.328
18	Commercial hunting and trapping	417	12.701	17.411
55	Fluid milk and butter manufacturing	416	24.028	50.004
409	Amusement parks, arcades, and gambling industries	410	7.325	9.406
322	Retail Stores - Electronics and appliances	407	16.093	25.977
32	Natural gas distribution	399	35.344	90.601
410	Other amusement and recreation industries	396	7.778	11.418
380	All other miscellaneous professional, scientific, and technical services	396	35.520	79.143
358	Insurance agencies, brokerages, and related activities	392	17.582	23.139
390	Waste management and remediation services	392	20.115	34.439
341	Newspaper publishers	386	12.270	16.355
15	Forestry, forest products, and timber tract production	377	44.852	68.891
321	Retail Stores - Furniture and home furnishings	371	12.276	17.929
407	Fitness and recreational sports centers	370	5.503	6.929
97	Engineered wood member and truss manufacturing	351	14.538	31.912
34	Construction of new nonresidential commercial and health care structures	350	15.690	18.014
355	Nondepository credit intermediation and related activities	331	25.451	23.223
88	Men's and boys' cut and sew apparel manufacturing	327	8.771	9.455
384	Office administrative services	321	16.320	14.814
404	Promoters of performing arts and sports and agents for public figures	299	3.468	6.194
68	Seasoning and dressing manufacturing	285	10.504	13.163
63	Cookie, cracker, and pasta manufacturing	281	19.160	28.461
362	Automotive equipment rental and leasing	281	24.072	50.489
376	Scientific research and development services	278	18.715	21.740
45	Soybean and other oilseed processing	274	11.808	14.405
297	Nonupholstered wood household furniture manufacturing	270	7.961	11.626
73	Distilleries	265	22.901	69.916
348	Radio and television broadcasting	263	13.615	11.438
3	Vegetable and melon farming	244	29.430	37.072
17	Commercial Fishing	243	4.207	5.083
141	All other chemical product and preparation manufacturing	237	18.076	23.431
389	Other support services	235	7.382	15.454
418	Personal and household goods repair and maintenance	232	12.927	21.595
338	Scenic and sightseeing transportation and support activities for transportation	232	8.817	9.149
336	Transit and ground passenger transportation	223	5.742	7.632
6	Greenhouse, nursery, and floriculture production	212	22.701	27.807
416	Electronic and precision equipment repair and maintenance	205	16.061	20.067
108	Coated and laminated paper, packaging paper and plastics film manufacturing	202	15.392	34.095
46	Fats and oils refining and blending	194	8.552	34.282
420	Death care services	193	8.534	9.041
69	All other food manufacturing	191	5.707	7.671
359	Funds, trusts, and other financial vehicles	191	3.611	9.948
110	Stationery product manufacturing	185	19.553	35.478
113	Printing	184	9.870	9.437
40	Maintenance and repair construction of residential structures	181	9.321	11.435
402	Performing arts companies	180	1.906	2.333
375	Environmental and other technical consulting services	177	10.540	11.408
301	Custom architectural wood manufacturing	175	12.235	14.625
415	Car washes	172	3.647	4.020
422	Other personal services	170	6.780	8.570

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million \$)	Value Added (Million \$)
47	Breakfast cereal manufacturing	158	18.630	47.770
94	Other leather and allied product manufacturing	157	7.796	8.436
365	Commercial and industrial machinery and equipment rental and leasing	157	23.295	40.107
373	Other computer related services, including facilities management	154	17.247	35.637
412	Other accommodations	150	3.471	5.795
423	Religious organizations	137	3.246	22.521
33	Water, sewage and other treatment and delivery systems	136	6.849	13.331
143	Unlaminated plastics profile shape manufacturing	131	10.656	19.416
103	All other miscellaneous wood product manufacturing	127	4.166	6.957
84	Textile bag and canvas mills	119	5.975	5.921
12	Dairy cattle and milk production	117	1.913	11.522
346	Motion picture and video industries	114	2.320	4.637
431	State and local government electric utilities	108	7.451	14.700
370	Specialized design services	106	5.525	11.050
246	Printed circuit assembly (electronic assembly) manufacturing	100	4.331	5.433
91	Apparel accessories and other apparel manufacturing	98	3.492	3.682
195	Machine shops	96	4.823	7.288
352	Data processing, hosting, ISP, web search portals and related services	96	5.133	10.989
363	General and consumer goods rental except video tapes and discs	93	8.892	7.562
332	Transport by air	91	9.571	10.424
207	Other industrial machinery manufacturing	88	5.591	9.609
125	All other basic inorganic chemical manufacturing	87	8.378	11.822
115	Petroleum refineries	82	11.219	42.307
158	Glass container manufacturing	81	4.735	10.104
78	Nonwoven fabric mills	80	2.720	2.350
283	Motor vehicle parts manufacturing	77	3.970	3.233
300	Office furniture manufacturing	76	2.792	4.470
203	Farm machinery and equipment manufacturing	76	4.099	8.047
429	Other Federal Government enterprises	72	4.321	10.844
61	Seafood product preparation and packaging	71	2.016	2.204
72	Wineries	71	5.023	6.206
371	Custom computer programming services	70	4.196	4.454
58	Ice cream and frozen dessert manufacturing	68	2.926	3.817
56	Cheese manufacturing	67	5.180	7.206
337	Transport by pipeline	67	32.715	47.804
148	Plastics bottle manufacturing	66	4.455	10.540
130	Fertilizer manufacturing	64	5.622	8.330
126	Other basic organic chemical manufacturing	61	5.836	8.201
344	Directory, mailing list, and other publishers	60	3.025	5.735
131	Pesticide and other agricultural chemical manufacturing	60	4.497	9.024
247	Other electronic component manufacturing	58	3.513	4.259
383	Travel arrangement and reservation services	52	1.997	3.864
190	Metal can, box, and other metal container (light gauge) manufacturing	51	3.061	10.973
147	Urethane and other foam product (except polystyrene) manufacturing	47	3.118	5.730
430	State and local government passenger transit	46	1.942	- 2.469
342	Periodical publishers	45	2.081	2.850
29	Support activities for oil and gas operations	44	3.086	3.034
139	Toilet preparation manufacturing	42	2.913	7.648
309	Dental laboratories manufacturing	42	2.085	2.144
406	Museums, historical sites, zoos, and parks	41	1.436	4.894

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million \$)	Value Added (Million \$)
44	Wet corn milling	41	2.508	4.567
52	Nonchocolate confectionery manufacturing	38	1.156	1.746
405	Independent artists, writers, and performers	38	0.742	2.111
197	Coating, engraving, heat treating and allied activities	37	1.602	3.651
146	Polystyrene foam product manufacturing	36	1.846	4.631
385	Facilities support services	34	1.563	3.799
137	Adhesive manufacturing	34	3.687	4.933
4	Fruit farming	33	4.141	4.666
81	Fabric coating mills	32	0.817	0.850
302	Showcase, partition, shelving, and locker manufacturing	30	1.789	2.915
71	Breweries	29	1.923	4.781
308	Ophthalmic goods manufacturing	29	1.705	3.390
220	Cutting tool and machine tool accessory manufacturing	29	1.654	2.300
43	Flour milling and malt manufacturing	28	1.647	2.823
145	Laminated plastics plate, sheet (except packaging), and shape manufacturing	26	1.730	2.977
144	Plastics pipe and pipe fitting manufacturing	26	1.085	2.405
89	Women's and girls' cut and sew apparel manufacturing	25	0.825	0.979
243	Semiconductor and related device manufacturing	25	1.320	4.189
228	Material handling equipment manufacturing	24	1.306	2.126
21	Mining coal	24	1.425	1.748
90	Other cut and sew apparel manufacturing	23	0.616	0.643
378	Photographic services	23	0.453	1.785
5	Tree nut farming	22	0.919	1.723
364	Video tape and disc rental	22	0.901	1.497
314	Sign manufacturing	22	0.955	0.927
67	Flavoring syrup and concentrate manufacturing	21	1.368	6.768
83	Curtain and linen mills	21	1.245	1.318
350	Internet publishing and broadcasting	20	0.871	0.706
80	Textile and fabric finishing mills	19	0.322	0.344
185	Handtool manufacturing	19	0.879	1.867
408	Bowling centers	19	0.298	0.448
82	Carpet and rug mills	19	1.297	1.084
118	Petroleum lubricating oil and grease manufacturing	18	2.213	9.751
140	Printing ink manufacturing	17	0.897	0.933
270	Storage battery manufacturing	17	1.473	1.705
366	Lessors of nonfinancial intangible assets	15	0.497	48.147
306	Surgical appliance and supplies manufacturing	15	1.060	2.059
267	Motor and generator manufacturing	15	1.039	1.407
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	14	0.806	0.853
240	Audio and video equipment manufacturing	14	0.722	1.036
87	Cut and sew apparel contractors	13	0.252	0.271
117	Asphalt shingle and coating materials manufacturing	13	1.321	5.262
25	Mining and quarrying stone	13	0.739	0.857
269	Relay and industrial control manufacturing	13	2.057	2.564
116	Asphalt paving mixture and block manufacturing	11	0.628	2.801
101	Manufactured home (mobile home) manufacturing	11	0.387	0.388
204	Lawn and garden equipment manufacturing	10	0.364	0.730
343	Book publishers	10	0.442	0.932
198	Valve and fittings other than plumbing manufacturing	10	0.657	3.489
303	Mattress manufacturing	9	0.315	0.678

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million \$)	Value Added (Million \$)
353	Other information services	9	0.299	0.499
345	Software publishers	9	0.609	1.325
222	Turbine and turbine generator set units manufacturing	9	0.569	1.430
75	Fiber, yarn, and thread mills	8	0.163	0.148
213	Other commercial and service industry machinery manufacturing	8	0.544	1.114
133	Pharmaceutical preparation manufacturing	8	0.763	1.725
334	Transport by water	8	0.602	1.229
102	Prefabricated wood building manufacturing	8	0.280	0.381
51	Confectionery manufacturing from purchased chocolate	8	0.141	0.237
38	Construction of other new residential structures	7	0.350	0.385
127	Plastics material and resin manufacturing	7	0.623	0.884
151	Rubber and plastics hoses and belting manufacturing	7	0.440	0.816
66	Coffee and tea manufacturing	7	0.084	0.137
114	Support activities for printing	7	0.244	0.240
266	Power, distribution, and specialty transformer manufacturing	6	0.317	0.386
237	Telephone apparatus manufacturing	6	0.485	1.162
135	Biological product (except diagnostic) manufacturing	6	0.371	0.496
138	Soap and cleaning compound manufacturing	6	0.333	1.185
305	Surgical and medical instrument, laboratory and medical instrument manufact	6	0.345	0.553
57	Dry, condensed, and evaporated dairy product manufacturing	6	0.702	0.954
199	Plumbing fixture fitting and trim manufacturing	6	0.316	0.730
159	Glass product manufacturing made of purchased glass	6	0.331	0.515
193	Hardware manufacturing	6	0.302	0.811
196	Turned product and screw, nut, and bolt manufacturing	5	0.261	0.581
219	Special tool, die, jig, and fixture manufacturing	5	0.288	0.349
272	Communication and energy wire and cable manufacturing	5	0.521	0.714
122	Synthetic dye and pigment manufacturing	5	0.464	0.618
242	Bare printed circuit board manufacturing	5	0.267	0.321
37	Construction of new residential permanent site single- and multi-family struct	5	0.234	0.309
349	Cable and other subscription programming	5	0.194	0.209
282	Travel trailer and camper manufacturing	5	0.198	0.192
27	Mining and quarrying other nonmetallic minerals	5	0.199	0.216
187	Ornamental and architectural metal products manufacturing	5	0.269	0.456
231	Packaging machinery manufacturing	5	0.278	0.337
299	Institutional furniture manufacturing	5	0.208	0.480
157	Other pressed and blown glass and glassware manufacturing	5	0.214	0.406
317	All other miscellaneous manufacturing	5	0.156	0.244
171	Steel product manufacturing from purchased steel	4	0.318	0.400
174	Aluminum product manufacturing from purchased aluminum	4	0.294	0.341
121	Industrial gas manufacturing	4	0.279	0.502
201	Fabricated pipe and pipe fitting manufacturing	4	0.209	0.417
311	Sporting and athletic goods manufacturing	4	0.159	0.320
208	Plastics and rubber industry machinery manufacturing	4	0.202	0.257
280	Truck trailer manufacturing	4	0.170	0.156
152	Other rubber product manufacturing	4	0.211	0.401
273	Wiring device manufacturing	4	0.202	0.286
244	Electronic capacitor, resistor, coil, transformer, and other inductor manufactur	3	0.156	0.253
134	In-vitro diagnostic substance manufacturing	3	0.207	0.248
170	Iron and steel mills and ferroalloy manufacturing	3	0.401	0.561
347	Sound recording industries	3	0.164	0.492

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million \$)	Value Added (Million \$)
194	Spring and wire product manufacturing	3	0.174	0.429
274	Carbon and graphite product manufacturing	3	0.205	0.274
205	Construction machinery manufacturing	3	0.205	0.424
202	Other fabricated metal manufacturing	3	0.177	0.505
76	Broadwoven fabric mills	3	0.072	0.068
291	Boat building	3	0.122	0.139
225	Other engine equipment manufacturing	3	0.160	0.315
224	Mechanical power transmission equipment manufacturing	3	0.118	0.186
24	Mining gold, silver, and other metal ore	3	0.209	0.259
210	Vending, commercial, industrial, and office machinery manufacturing	3	0.142	0.183
256	Watch, clock, and other measuring and controlling device manufacturing	3	0.127	0.192
289	Railroad rolling stock manufacturing	2	0.142	0.208
184	Cutlery, utensil, pot, and pan manufacturing	2	0.214	0.542
245	Electronic connector manufacturing	2	0.124	0.186
263	Household refrigerator and home freezer manufacturing	2	0.163	0.223
172	Alumina refining and primary aluminum production	2	0.161	0.208
186	Plate work and fabricated structural product manufacturing	2	0.125	0.254
260	Lighting fixture manufacturing	2	0.142	0.181
275	All other miscellaneous electrical equipment and component manufacturing	2	0.131	0.160
298	Metal and other household furniture (except wood) manufacturing	2	0.051	0.057
279	Motor vehicle body manufacturing	2	0.106	0.092
183	Crown and closure manufacturing and metal stamping	2	0.095	0.266
252	Totalizing fluid meters and counting devices manufacturing	2	0.063	0.098
268	Switchgear and switchboard apparatus manufacturing	2	0.123	0.171
313	Office supplies (except paper) manufacturing	2	0.103	0.249
236	Computer terminals and other computer peripheral equipment manufacturing	2	0.066	0.095
35	Construction of new nonresidential manufacturing structures	2	0.068	0.079
278	Heavy duty truck manufacturing	1	0.104	0.186
286	Other aircraft parts and auxiliary equipment manufacturing	1	0.090	0.106
251	Industrial process variable instruments manufacturing	1	0.053	0.077
284	Aircraft manufacturing	1	0.091	0.103
217	Industrial mold manufacturing	1	0.045	0.055
214	Air purification and ventilation equipment manufacturing	1	0.060	0.115
307	Dental equipment and supplies manufacturing	1	0.099	0.207
192	Arms, ordnance, and accessories manufacturing	1	0.050	0.204
119	All other petroleum and coal products manufacturing	1	0.112	0.481
180	Nonferrous metal foundries	1	0.053	0.057
169	Miscellaneous nonmetallic mineral product manufacturing	1	0.072	0.151
150	Tire manufacturing	1	0.074	0.149
92	Leather and hide tanning and finishing	1	0.054	0.060
304	Blind and shade manufacturing	1	0.021	0.022
229	Power-driven handtool manufacturing	1	0.050	0.089
249	Search, detection, and navigation instruments manufacturing	1	0.051	0.085
162	Concrete pipe, brick, and block manufacturing	1	0.035	0.066
206	Mining and oil and gas field machinery manufacturing	1	0.048	0.072
218	Metal cutting and forming machine tool manufacturing	1	0.033	0.051
191	Ammunition manufacturing	1	0.039	0.128
318	Broom, brush, and mop manufacturing	1	0.038	0.094
216	Air conditioning, refrigeration, and warm air heating equipment manufacturin	1	0.027	0.035
166	Cut stone and stone product manufacturing	1	0.017	0.021

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million \$)	Value Added (Million \$)
200	Ball and roller bearing manufacturing	0	0.034	0.100
153	Pottery, ceramics, and plumbing fixture manufacturing	0	0.019	0.030
257	Software, audio, and video media for reproduction	0	0.003	0.004
227	Air and gas compressor manufacturing	0	0.023	0.033
177	Copper rolling, drawing, extruding and alloying	0	0.021	0.032
211	Optical instrument and lens manufacturing	0	0.020	0.027
221	Rolling mill and other metalworking machinery manufacturing	0	0.026	0.036
254	Analytical laboratory instrument manufacturing	0	0.017	0.024
163	Other concrete product manufacturing	0	0.018	0.026
315	Gasket, packing, and sealing device manufacturing	0	0.009	0.013
294	All other transportation equipment manufacturing	0	0.021	0.026
50	Chocolate and confectionery manufacturing from cacao beans	0	0.011	0.015
285	Aircraft engine and engine parts manufacturing	0	0.024	0.030
161	Ready-mix concrete manufacturing	0	0.015	0.021
132	Medicinal and botanical manufacturing	0	0.012	0.019
178	Nonferrous metal (except copper and aluminum) rolling, drawing, extruding a	0	0.006	0.008
310	Jewelry and silverware manufacturing	0	0.008	0.016
165	Abrasive product manufacturing	0	0.012	0.036
239	Other communications equipment manufacturing	0	0.011	0.017
189	Metal tank (heavy gauge) manufacturing	0	0.011	0.022
261	Small electrical appliance manufacturing	0	0.009	0.013
230	Other general purpose machinery manufacturing	0	0.010	0.014
253	Electricity and signal testing instruments manufacturing	0	0.009	0.014
312	Doll, toy, and game manufacturing	0	0.006	0.013
233	Fluid power process machinery manufacturing	0	0.011	0.017
250	Automatic environmental control manufacturing	0	0.004	0.008
316	Musical instrument manufacturing	0	0.004	0.005
136	Paint and coating manufacturing	0	0.007	0.010
226	Pump and pumping equipment manufacturing	0	0.004	0.007
238	Broadcast and wireless communications equipment manufacturing	0	0.005	0.004
164	Lime and gypsum product manufacturing	0	0.005	0.011
154	Brick, tile, and other structural clay product manufacturing	0	0.003	0.007
182	Custom roll forming	0	0.003	0.006
287	Guided missile and space vehicle manufacturing	0	0.005	0.005
168	Mineral wool manufacturing	0	0.001	0.003
179	Ferrous metal foundries	0	0.002	0.003
290	Ship building and repairing	0	0.002	0.002
292	Motorcycle, bicycle, and parts manufacturing	0	0.001	0.002
160	Cement manufacturing	0	0.001	0.002
30	Support activities for other mining	0	0.000	0.001
173	Secondary smelting and alloying of aluminum	0	0.000	0.001
167	Ground or treated mineral and earth manufacturing	0	0.001	0.002
181	All other forging, stamping, and sintering	0	0.000	0.000
259	Electric lamp bulb and part manufacturing	0	0.000	0.000
7	Tobacco farming	0	0.000	0.000
9	Sugarcane and sugar beet farming	0	0.000	0.000
22	Mining iron ore	0	0.000	0.000
23	Mining copper, nickel, lead, and zinc	0	0.000	0.000
28	Drilling oil and gas wells	0	0.000	0.000
48	Sugar cane mills and refining	0	0.000	0.000

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million \$)	Value Added (Million \$)
49	Beet sugar manufacturing	0	0.000	0.000
74	Tobacco product manufacturing	0	0.000	0.000
77	Narrow fabric mills and schiffli machine embroidery	0	0.000	0.000
79	Knit fabric mills	0	0.000	0.000
104	Pulp mills	0	0.000	0.000
112	All other converted paper product manufacturing	0	0.000	0.000
120	Petrochemical manufacturing	0	0.000	0.000
123	Alkalies and chlorine manufacturing	0	0.000	0.000
124	Carbon black manufacturing	0	0.000	0.000
128	Synthetic rubber manufacturing	0	0.000	0.000
129	Artificial and synthetic fibers and filaments manufacturing	0	0.000	0.000
155	Clay and nonclay refractory manufacturing	0	0.000	0.000
156	Flat glass manufacturing	0	0.000	0.000
175	Primary smelting and refining of copper	0	0.000	0.000
176	Primary smelting and refining of nonferrous metal (except copper and aluminum)	0	0.000	0.000
188	Power boiler and heat exchanger manufacturing	0	0.000	0.000
209	Semiconductor machinery manufacturing	0	0.000	0.000
212	Photographic and photocopying equipment manufacturing	0	0.000	0.000
215	Heating equipment (except warm air furnaces) manufacturing	0	0.000	0.000
223	Speed changer, industrial high-speed drive, and gear manufacturing	0	0.000	0.000
232	Industrial process furnace and oven manufacturing	0	0.000	0.000
234	Electronic computer manufacturing	0	0.000	0.000
235	Computer storage device manufacturing	0	0.000	0.000
241	Electron tube manufacturing	0	0.000	0.000
248	Electromedical and electrotherapeutic apparatus manufacturing	0	0.000	0.000
255	Irradiation apparatus manufacturing	0	0.000	0.000
258	Magnetic and optical recording media manufacturing	0	0.000	0.000
262	Household cooking appliance manufacturing	0	0.000	0.000
264	Household laundry equipment manufacturing	0	0.000	0.000
265	Other major household appliance manufacturing	0	0.000	0.000
271	Primary battery manufacturing	0	0.000	0.000
276	Automobile manufacturing	0	0.000	0.000
277	Light truck and utility vehicle manufacturing	0	0.000	0.000
281	Motor home manufacturing	0	0.000	0.000
288	Propulsion units and parts for space vehicles and guided missiles manufacturing	0	0.000	0.000
293	Military armored vehicle, tank, and tank component manufacturing	0	0.000	0.000
361	Imputed rental activity for owner-occupied dwellings	0	0.000	757.701
428	Federal electric utilities	0	0.000	0.000
433	* Not an industry (Used and secondhand goods)	0	0.000	0.000
434	* Not an industry (Scrap)	0	0.000	0.000
435	* Not an industry (Rest of the world adjustment)	0	0.000	0.000
436	* Not an industry (Noncomparable foreign imports)	0	0.000	0.000
439	* Employment and payroll only (federal govt, non-military)	0	0.000	0.000
440	* Employment and payroll only (federal govt, military)	0	0.000	0.000
Total		280,959	11,477.209	20,117.635

Note: Sorted by total number of jobs descending. Sector ID "N/A" indicates an industry not original to the IMPLAN 440 scheme.

Table 2. Crops Contributions by Sector, 2012.

Sector ID	Crops Sector Contribution to	Employment (Jobs)	Income (Million \$)	Value Added (Million \$)
2	Grain farming	19,856	138.552	245.532
1	Oilseed farming	16,939	399.518	816.961
N/A	Rice farming	8,340	164.787	310.846
53	Frozen food manufacturing	3,459	167.212	215.441
8	Cotton farming	2,386	104.385	122.481
62	Bread and bakery product manufacturing	2,041	96.066	114.447
N/A	Rice milling	1,615	151.219	259.218
65	Snack food manufacturing	1,215	75.530	166.663
54	Fruit and vegetable canning, pickling, and drying	1,139	72.097	114.059
10	All other crop farming	914	55.325	86.121
86	Apparel knitting mills	870	22.870	24.121
85	All other textile product mills	720	42.727	42.143
70	Soft drink and ice manufacturing	711	45.329	52.702
64	Tortilla manufacturing	583	28.514	39.682
88	Men's and boys' cut and sew apparel manufacturing	327	8.771	9.455
68	Seasoning and dressing manufacturing	285	10.504	13.163
63	Cookie, cracker, and pasta manufacturing	281	19.160	28.461
45	Soybean and other oilseed processing	274	11.808	14.405
73	Distilleries	265	22.901	69.916
3	Vegetable and melon farming	244	29.430	37.072
6	Greenhouse, nursery, and floriculture production	212	22.701	27.807
46	Fats and oils refining and blending	194	8.552	34.282
69	All other food manufacturing	191	5.707	7.671
47	Breakfast cereal manufacturing	158	18.630	47.770
84	Textile bag and canvas mills	119	5.975	5.921
91	Apparel accessories and other apparel manufacturing	98	3.492	3.682
78	Nonwoven fabric mills	80	2.720	2.350
72	Wineries	71	5.023	6.206
44	Wet corn milling	41	2.508	4.567
52	Nonchocolate confectionery manufacturing	38	1.156	1.746
4	Fruit farming	33	4.141	4.666
81	Fabric coating mills	32	0.817	0.850
71	Breweries	29	1.923	4.781
43	Flour milling and malt manufacturing	28	1.647	2.823
89	Women's and girls' cut and sew apparel manufacturing	25	0.825	0.979
90	Other cut and sew apparel manufacturing	23	0.616	0.643
5	Tree nut farming	22	0.919	1.723
67	Flavoring syrup and concentrate manufacturing	21	1.368	6.768
83	Curtain and linen mills	21	1.245	1.318
80	Textile and fabric finishing mills	19	0.322	0.344
82	Carpet and rug mills	19	1.297	1.084
87	Cut and sew apparel contractors	13	0.252	0.271
75	Fiber, yarn, and thread mills	8	0.163	0.148
51	Confectionery manufacturing from purchased chocolate	8	0.141	0.237
66	Coffee and tea manufacturing	7	0.084	0.137
76	Broadwoven fabric mills	3	0.072	0.068
50	Chocolate and confectionery manufacturing from cacao beans	0	0.011	0.015
7	Tobacco farming	0	0.000	0.000
9	Sugarcane and sugar beet farming	0	0.000	0.000
48	Sugar cane mills and refining	0	0.000	0.000
49	Beet sugar manufacturing	0	0.000	0.000
74	Tobacco product manufacturing	0	0.000	0.000
77	Narrow fabric mills and schiffli machine embroidery	0	0.000	0.000
79	Knit fabric mills	0	0.000	0.000
Total		63,976	1,759.014	2,951.745

Note: Sorted by total number of jobs descending. Sector ID "N/A" indicates an industry not original to the IMPLAN 440 scheme.

Table 3. Animal Agriculture Contributions by Sector, 2012.

Sector ID	Animal Agriculture Sector Contribution to:	Employment (Jobs)	Income (Million \$)
60	Poultry processing	27,962	1,020.424
13	Poultry and egg production	8,541	500.128
11	Cattle ranching and farming	3,433	34.339
14	Animal production, except cattle and poultry	3,089	23.285
59	Animal (except poultry) slaughtering, rendering, and processing	1,786	89.781
93	Footwear manufacturing	1,124	38.213
42	Other animal food manufacturing	829	49.639
41	Dog and cat food manufacturing	824	43.939
55	Fluid milk and butter manufacturing	416	24.028
94	Other leather and allied product manufacturing	157	7.796
12	Dairy cattle and milk production	117	1.913
61	Seafood product preparation and packaging	71	2.016
58	Ice cream and frozen dessert manufacturing	68	2.926
56	Cheese manufacturing	67	5.180
57	Dry, condensed, and evaporated dairy product manufacturing	6	0.702
92	Leather and hide tanning and finishing	1	0.054
Total		48,492	1,844.364

Note: Sorted by total number of jobs descending.

Table 4. Forestry Contributions by Sector, 2012.

Sector ID	Forestry Sector Contribution to:	Employment (Jobs)	Income (Million \$)
95	Sawmills and wood preservation	4,329	219.155
16	Commercial logging	3,489	178.797
105	Paper mills	3,288	341.026
107	Paperboard container manufacturing	2,349	153.992
99	Wood windows and doors and millwork manufacturing	1,731	77.584
111	Sanitary paper product manufacturing	1,584	97.042
109	All other paper bag and coated and treated paper manufacturing	1,524	91.538
96	Veneer and plywood manufacturing	1,188	67.454
106	Paperboard mills	881	88.037
100	Wood container and pallet manufacturing	809	27.047
295	Wood kitchen cabinet and countertop manufacturing	648	23.105
296	Upholstered household furniture manufacturing	629	22.760
98	Reconstituted wood product manufacturing	505	33.905
15	Forestry, forest products, and timber tract production	377	44.852
97	Engineered wood member and truss manufacturing	351	14.538
297	Nonupholstered wood household furniture manufacturing	270	7.961
108	Coated and laminated paper, packaging paper and plastics film manufacturing	202	15.392
110	Stationery product manufacturing	185	19.553
301	Custom architectural wood manufacturing	175	12.235
103	All other miscellaneous wood product manufacturing	127	4.166
300	Office furniture manufacturing	76	2.792
101	Manufactured home (mobile home) manufacturing	11	0.387
102	Prefabricated wood building manufacturing	8	0.280
104	Pulp mills	0	0.000
112	All other converted paper product manufacturing	0	0.000
Total		24,736	1,543.597

Note: Sorted by total number of jobs descending.

Appendix C

IMPLAN Analysis by Parts, Technical Details

The contribution of the two industries was estimated using ABP instead of traditional IMPLAN contribution methods (section 1.2.1). Using the direct effects as inputs, IMPLAN can estimate the indirect and induced effects attributable to the rice industry, instead of estimating the rice industry's contribution as a part of the *Grains Farming* and *Flour Milling and Malt Manufacturing* sectors. In order to measure the total contribution of agriculture when using these methods, the direct effects of an industry analyzed by parts must be manually added into the IMPLAN results at the end of the contribution analysis. The main steps in ABP within a contribution analysis for an industry were collection/estimation of direct effects of the industry, data reconciliation, and estimating the industry spending pattern of the industry.

The first step in ABP is the calculation of direct effects to be used as inputs and presented as the direct contributions in the study results. The optimal method for estimating the direct effects for an industry is to collect data for each of the following measurements: employment, output, employee compensation and proprietor income, indirect business taxes, other property type income, intermediate expenditures, and an industry spending pattern (or production budget). In some cases, exact data may be unavailable and effects must be estimated using available measurements. The integral relationships between these measurements were used to maintain the IMPLAN definitions and assumptions, specifically

- total value added plus intermediate expenditures equals output;
- employee compensation plus proprietor income equals labor income; and
- labor income plus other property type income plus indirect business taxes equals total value added.

Employment and employee compensation for *Rice Milling* were collected from

the Arkansas Department of Workforce Services Labor Market Information/BLS Programs (ADWS, 2014). *Rice Milling* output was calculated from the 2013 *Rice Yearbook* data for milling year 2012/13 as Arkansas rough rice total disappearance times the U.S. average milling rate times the weighted average of the Arkansas milled rice price (USDA ERS, 2014). This calculated output value times IMPLAN's intermediate expenditures absorption coefficient (0.880; IMPLAN, 2014b) from the 2007 IMPLAN 509 sectoring scheme that last included *Rice Milling* as a separate industry were used to calculate *Rice Milling's* intermediate expenditures and total value added (output times the valued added absorption coefficient). The 2012 sector 43, *Flour Milling and Malt Manufacturing*, ratio of labor income to total value added (0.583; IMPLAN, 2014) was retained to estimate the value of labor income for *Rice Milling*: 0.583 times total value added. Any labor income not attributable to employee compensation was considered to be proprietor income. Similarly, the ratios from 2012 sector 43 for other property type income and indirect business taxes to total value added were used to estimate the values of *Rice Milling's* other property type income and indirect business taxes.

Rice Farming output was collected from NASS along with all other production data used in data reconciliation described in section 1.2.1 (USDA NASS, 2014). To estimate employment, 2009 Arkansas output per worker from Richardson and Outlaw (2010) was first adjusted for inflation using the IMPLAN output deflator (0.773; IMPLAN, 2014b) for sector 2, *Grain Farming*. Employment for *Rice Farming* was calculated by dividing 2012 output by the adjusted output per worker value. The value of employee compensation for *Rice Farming* was collected from a weighted average (conventional and hybrid varieties, flood irrigation) production budget for Arkan-

sas rice in 2012 (Flanders, 2011). The output value times IMPLAN's 2012 intermediate expenditures absorption coefficient from sector 2, *Grain Farming*, were used to calculate *Rice Farming's* intermediate expenditures and total value added (output times valued added absorption coefficient). The 2012 sector 2, *Grain Farming*, ratio of proprietor income to total value added (0.487; IMPLAN, 2014b) was retained to estimate the value of proprietor income for *Rice Farming*: 0.487 times total value added. *Rice Farming's* labor income estimate was therefore reported as the sum of employee compensation collected from the production budget and the calculated proprietor income value. Similarly, the ratio from 2012 sector 2 for indirect business taxes to total value added was used to estimate the value of *Rice Farming's* indirect business taxes. IMPLAN considers other property type income to be a leakage, so any leftover total value added was attributed to other property type income.

Data reconciliation for ABP is applicable for contribution analysis, but is not necessary for impact analyses. In a contribution analysis, data reconciliation involves removing the value of the industries being analyzed from their original sectors to avoid double counting and overestimation. As stated in section 1.2.1, the value of output of sector 2, *Grain Farming*, was calculated as the sum of only wheat, corn for grain, oats, and grain sorghum, and employment and value added components were adjusted accordingly. Output, employment, and value added components for sector 43, *Flour Milling and Malt Manufacturing* were edited to remove the value of *Rice Milling* by subtracting the known employment of *Rice Milling* from IMPLAN's original employment estimate for sector 43 to calculate the new number of employees in sector 43. Sector 43 in Arkansas comprises rice milling and flour milling (a measurable malt manufacturing industry does

not exist in Arkansas). However, editing this sector by using output and adjusting components of value added was not possible because flour milling data could not be disclosed, and the output estimate for rice milling was greater than IMPLAN's original estimate for sector 43. These factors resulted in the estimated value of flour milling being zero, which was known to be inaccurate.

The industry spending pattern is the first of two activities required by ABP. Common sources for industry spending patterns are current IMPLAN sectors, the IMPLAN 509 sectoring scheme sectors, external production budgets, or data

from other sources. The industry spending pattern is composed of events detailing the percent of each dollar of output attributable to intermediate expenditures in each sector. This activity generates the "first round" of spending due to industry activity: indirect effects due to industry purchases and the induced effects from those industries' proprietors' and employees' spending. The events were set to occur in 2012, LPPs were set to the SAM value, and the activity level was set to the industry output value. For *Rice Milling* the industry spending pattern from the 2007 IMPLAN 509 sectoring scheme that last included *Rice Milling*

as a separate industry was used. For *Rice Farming*, the current 2012 industry spending pattern for sector 2, *Grain Farming*, was used. The second type of activity required to complete the ABP is the labor income change activity. This activity simply has two events for 2012: employee compensation and proprietor income. Each event was set to each respective industry's values for employee compensation and proprietor income. This activity generates the "second round" of spending in the ABP: the induced effects due to the industry's proprietors' and employees' spending.

UofA

DIVISION OF AGRICULTURE

RESEARCH & EXTENSION

University of Arkansas System