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DIVISION OF AGRICULTURE
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ACKNOWLEDGEMENTS

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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[1] is the seventh 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 Minnesota IMPLAN Group, Inc. (MIG), the economic contribution of agriculture on the Arkansas economy was estimated for the most recent year available, 2010. Gross Domestic Product (GDP) by State information for Arkansas in 2010 was compared with those of other states in the Southeast U.S. to give a measure of the relative importance of agriculture in Arkansas.[2] 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:

- When comparing the GDP contributions of agriculture, forestry and many food related industries, Arkansas Agriculture and Food accounts for a larger percentage of total economic activity in the state than any other state in the Southeast U.S. – 10.8% of total GDP by State or $11.0B.[3]

- Aggregate Agriculture contributed $16.0B in total value added to the state economy; this is almost $0.17 of every $1 in value generated in the state.

- Aggregate Agriculture accounted for 256,244 jobs, which is almost 17% of all jobs in the state. Over one-half of these (148,566), or 10% 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 $9.8B in labor income, or 16% of the state's total labor income, including agriculture payrolls, which totaled $7.9B, or 14% 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 $2.8B in value added, 60,431 jobs and $1.7B in labor income. *Rice Farming* and *Rice Milling* represented 16% of jobs, 20% of labor income, and 20% of value added in the Crops Sector.

- In direct contributions, the Animal Agriculture Sector generated $2.6B in value added, 52,050 jobs and $1.8B in labor income. *Poultry and Egg Production* and *Poultry Processing* provided 72% of jobs, 82% of income, and 72% of value added in the Animal Agriculture Sector.

- The direct contribution of the Forestry Sector included $2.6B in value added, 27,081 jobs, and $1.5B in income. Within the Forestry Sector, *Paper Mills, Sanitary Paper Product Manufacturing, Paperboard Mills, Paperboard Container Manufacturing, Sawmills and Wood Preservation*, and *Commercial Logging* contributed 60% of forestry jobs, almost two-thirds of forestry income, and 68% of value added.

Arkansas' agriculture continues to be a critical component of Arkansas' economy. The Agriculture and Food Sector in Arkansas contributes a larger share to the state's economy than does agriculture in its neighboring states and in the U.S. Including direct, indirect and induced effects, agriculture generates over one in six jobs and almost 17% 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 documents, the pocket guide *Economic Contribution of Arkansas Agriculture* (McGraw, Popp and Miller 2012a) and the fact sheet "Economic Contribution of Agriculture to the Arkansas Economy in 2010" (McGraw, Popp and Miller, 2012b), due to rounding.

Definitions and Styles

Gross Domestic Product by State (Formerly Gross State Product)

Gross Domestic Product by State is the state equivalent of the national measure of GDP, the most comprehensive measure of U.S. economic activity. Gross Domestic Product by State is derived as the sum of the GDP originating in all the industries in a state (USDC BEA, 2012). As described in Kemper, Popp, and Miller (2009), BEA's 2009 revisions to GDP by state made it necessary to include two additional industries to bring this study in line with that new methodology used by ERS to measure agriculture and food's contribution to GDP (Sundell, 2011). One NAICS industry was added to agricultural processing (Apparel, Leather, and Allied Products Manufacturing), and agricultural retail was newly added and consists of the NAICS industry Food Services and Drinking Places. **It is important to note that agriculture retail is included as a direct effect in the GDP by State portion of the report (Part 1), but not in the contribution analysis (Part 2)**. Some retail activity is picked up as part of the induced effect and included in the total economic contribution.

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: It is important to note that agricultural retail is included as a component of the Agriculture and Food Sector in the GDP comparisons but is not included as a direct economic contribution when estimating the contribution of the Aggregate Agriculture Sector to the state economy (Part 2). 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. See "Gross Domestic Product" discussion under "Style Notes" (page 7) for further explanation.

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 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

This report consists of two parts. In Part 1, information about Arkansas agriculture is presented in a historical context. These data are available for 1997 through 2010. Also presented in Part 1 are crops and animal production data that are available from 1987 to 2010. In Part 2, the contributions of agriculture to the Arkansas economy are presented for 2010. Throughout the report, agriculture is defined in terms of agricultural sectors, NAICS sectors, industries, and general descriptive terms that can be applied to agriculture. Different font styles are used throughout the text to distinguish these terms.

Agricultural Sectors. These comprise the areas of focus in our study. Part 1 of the report refers to the Agriculture and Food Sector. Part 2 of the report refers to the 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, 2011a). This report uses the 2007 NAICS sectoring scheme (USCB, 2006). 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 throughout the text to describe agriculture that is 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, agricultural processing, and agricultural retail.

1: The Economic Contribution of Agriculture and Food to Arkansas' GDP

1.1: Introduction

Agricultural production, processing, and retail industries are major contributors to the Arkansas economy in terms of GDP. Agriculture contributes to the economy through direct agricultural production, value-added processing, and agricultural retail activities, and it also plays an important role through its interactions with other sectors. The use of non-agricultural goods and services as inputs into the agricultural sector promotes diversified growth in Arkansas' economy; thus agriculture remains a vital part of Arkansas' economy. Part 1 of the report compares the relative size of the Agriculture and Food Sector in Arkansas with those of neighboring states, the Southeastern region of the United States, and the nation; provides an overview of Arkansas' economy and discusses Arkansas' agricultural sector in relation to the state economy; and examines components of agricultural production and processing, including a review of historical sales trends for raw and processed agricultural output.

1.2: Methods

The most recent estimates (2010 data) from BEA for agricultural production, processing, and retail are reported for the GDP by State portion of this report. The Agriculture and Food Sector is defined to include eight sectors of BEA's GDP by State data set: 1) Agriculture, Forestry, Fishing, and Hunting; 2) Wood Product Manufacturing; 3) Furniture and Related Products Manufacturing; 4) Food Manufacturing; 5) Textile and Textile Product Mills; 6) Apparel, Leather, and Allied Products Manufacturing; 7) Paper Manufacturing; and 8) Food Services and Drinking Places. The Bureau of Economic Analysis' terminology is used to emphasize the important differences in what is being measured in the GDP portion (Part 1) of this report in comparison to the economic contribution analysis (Part 2) portion. Furthermore, in Part 1, "contribution" is used to describe the percent or dollar values' portion of the whole, e.g., the part of agricultural processing attributable to Paper Manufacturing.

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) and utilizes data for 2010, the most recent year that relevant GDP and IMPLAN data were available. Production amounts, values, and cash receipts data were available through 2011. All dollar values in Part 1 are expressed in 2010 constant dollar terms, unless otherwise noted. Data in Figs. 6 and 7 and their corresponding sections are expressed in constant 1990-1992 dollars. Constant dollar values were calculated using industry-specific deflators derived from BEA's chained 2005 dollar GDP by State series, except for the data presented in Figs. 6 and 7. For Figs. 6 and 7 data, deflators from NASS's data series "Index for Price Received, 1990-1992" are used to calculate constant dollar values (USDA NASS, 2012b).

Percentages presented are *percentage* changes, not *absolute* changes. Percentage changes quantify increases or decreases relative to the initial values and are appropriate for describing time series data, such as BEA's GDP by State data. For example, a change from 15% in 2004 to 11% in 2009 results in a 27% decrease, not a 4% decrease. Likewise, a change from $11M in 2004 to $15M in 2009 results in a 36% increase.

1.2.1: A Note Regarding Presentation of GDP by State (Formerly Gross State Product) Estimates

Gross Domestic Product by State is the state-level analog to national GDP. Early reports (Goodwin et al., 2002; Popp, Vickery and Miller, 2005) presented historical gross state product (GSP)[4] data and trends from BEA using a starting year of 1986. However, there is a discontinuity in the GSP (now known as GDP by State) time series at 1997. This discontinuity results from the BEA's change in methods for classifying data from the Standard Industrial Classification (SIC) to the North American Industrial Classification System (NAICS) scheme. Gross Domestic Product by State data estimates for 1997 forward are now prepared for 81 NAICS industries. Estimates for earlier data years remain in only the 63 SIC industry format. The differences between SIC- and NAICS-based industries are many, including the facts that these estimates are based on different source data and different estimation methodologies.[5] Additionally, the NAICS-based GDP by State estimates are consistent with U.S. gross domestic product (GDP), while the SIC-based GSP estimates were consistent with U.S. gross domestic income (GDI). The data discontinuity affects the dollar values, industry categories—particularly with respect to manufacturing components and growth rates of the GDP by State estimates. The BEA strongly cautions analysts using the GDP by State estimates against appending the SIC and NAICS data series in an attempt to construct a single time series of GDP by State estimates for 1977 to the present (USDC BEA, 2012). Therefore, following Kemper, Popp and Miller (2009), this study reports only GDP by State estimates since 1997.

1.3: Agriculture and Food–The Regional Context

In the following GDP by State discussion, the Agriculture and Food Sector is defined as the sum of agricultural production, processing, and retail, unless otherwise stated.[6] Arkansas' Agriculture and Food Sector, expressed as a percentage of total GDP, has exceeded those of contiguous states since at least 1969, when the BEA began publishing regional GDP information. In 2010, the Agriculture and Food Sector accounted for almost 11% of Arkansas' GDP (Table 1), which was almost unchanged from 2009. The Agriculture and Food Sector in the Southeast region[7] only experienced a miniscule decrease (0.01%) as a percentage of GDP from 2009 to 2010. From 2009 to 2010, the greatest increase in Agriculture and Food Sector percentage of GDP was in Oklahoma (0.6%), while the greatest decrease was in Missouri (0.2%). Arkansas' agricultural production, processing, and retail as percentage of GDP is two times greater than that of the U.S. and one and a half times greater than that of the Southeast agricultural sector as a percentage of their respective GDPs in 2010.

The individual contributions of agricultural production and processing also comprised a greater percentage of Arkansas' GDP than agricultural production and processing did in neighboring states, the Southeast region, or nationally (Fig. 1). Agricultural production contributed over 2% to Arkansas' GDP in 2010, followed closely by agricultural production in Mississippi. Agricultural processing's contribution to GDP in Arkansas is over 6% whereas it is just over 4% in Mississippi, the southern state whose contribution comes closest to Arkansas'. However, Arkansas' agricultural retail contributed 2% to GDP by State, behind every state in the Southeast except Louisiana, the Southeast region, and the U.S. GDP (Fig. 1).

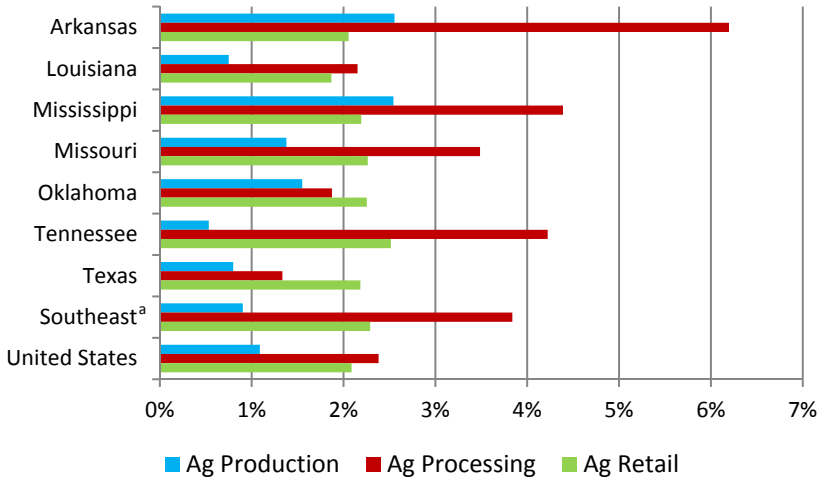
Table 1. The Agriculture and Food Sector as a Percentage of GDP by State, 2010.

State/Region	Percent of GDP by State
Arkansas	10.81
Louisiana	4.77
Mississippi	9.12
Missouri	7.13
Oklahoma	5.68
Tennessee	7.27
Texas	4.32
Southeast [a]	7.03
U.S.	5.56

Source: USDC BEA, (2012).

[a] The BEA includes Ala., Ark., Fla., Ga., Ky., La., Miss., N.C., S.C., Tenn., Va., and W. Va. in the Southeast region.

Fig. 1. Production, Processing, and Retail as a Percentage of Arkansas GDP, 2010.



Source: USDC BEA, (2012).

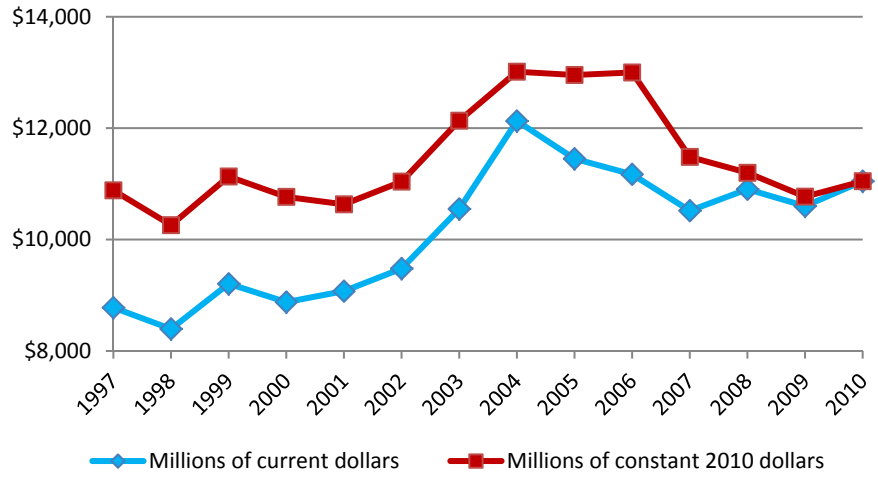
Note: Calculated from current dollars.

[a] The BEA includes Ala., Ark., Fla., Ga., Ky., La., Miss., N.C., S.C., Tenn., Va., and W.V. in the Southeast region.

The diversity of Arkansas' Agriculture and Food Sector is the foundation of its strength. Arkansas' varied climate and terrain allows for row crops in the east, livestock and poultry in the west, and forestry in the south. Forestland comprised 56% of Arkansas' total land base in 2011 (USDA Forest Service, 2012). Relatively low-valued timber is processed to produce higher-valued products (e.g., lumber, paper, and furniture). States that are more than half forested, including Arkansas, Mississippi, and Tennessee, tend to have high values of agricultural processing (Fig. 1; Mississippi Forestry Association, 2010; Oswalt et al., 2009).

Arkansas remains number one of seven contiguous states in terms of the Agriculture and Food Sector as a percentage of GDP in 2010. While the value of the Agriculture and Food Sector GDP has increased almost 3% from 2009 to 2010, the importance of the Agriculture and Food Sector has remained constant in terms of its share of the Arkansas GDP, as overall Arkansas GDP also increased almost 3% from 2009 to 2010.

Fig. 2. Arkansas' Agriculture and Food Sector GDP, 1997 to 2010.



Source: USDC BEA, (2012).

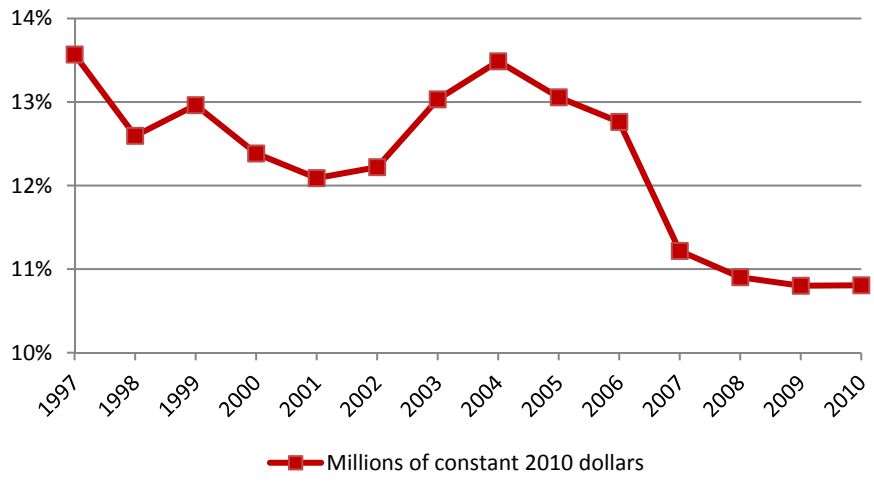
1.4: Agriculture and Food and the Arkansas Economy

In 2010, Arkansas' total GDP was $102.2B (constant 2010 dollars are used throughout this section, unless otherwise noted) with the Agriculture and Food Sector contributing $11.0B to the total (USDC BEA, 2012). During the 1997 to 2010 period, the GDP of Agriculture and Food gained 1% of its value. However, the period was also marked by volatility. From 2001 to 2004, the GDP of Agriculture and Food increased to its peak of $13.0B in 2004 and remained almost constant until 2007, when it declined sharply to $11.3B (Fig. 2). The value of the Agriculture and Food Sector declined 17% from 2006 to 2009 due predominantly to decreases in GDP of agricultural processing sectors. (More details are provided throughout Part 1 of this document). However, the Agriculture and Food Sector recovered part of its value from 2009 to 2010, increasing almost 3%, due to increases in the GDP of both agricultural processing and agricultural retail (Fig. 2). However, the GDP of agricultural production decreased. In real dollars, Arkansas 2010 agricultural cash receipts for all commodities were valued at $7.7B, down from $7.8B in 2009, a 2% decrease in value (USDA ERS, 2012b; USDA NASS, 2012b).

From 1997 to 2010, the percentage change in the share of Arkansas GDP attributable to the Agriculture and Food Sector decreased 20%. In 1997, the Agriculture and Food Sector's contribution to GDP was approaching 14%, the highest share from 1997 to 2010. Much of the contraction through 2002 is explained by falling prices for agricultural products between 1997 and 2002. The percent contribution of the Agriculture and Food Sector rebounded in 2004 to near the 1997 level. After a period of rebound, the portion of state GDP attributed to Agriculture and Food fell sharply from 2004 (13.5%) to 2008 (10.9%), but remained fairly constant until 2010 (10.8%). The percent contribution in 2009 marked Agriculture and Food's lowest contribution to Arkansas GDP since 1997 at 10.8% ($10.80B), and 2010 was the second lowest contribution, at 10.81% ($11.0B) (Fig. 3).

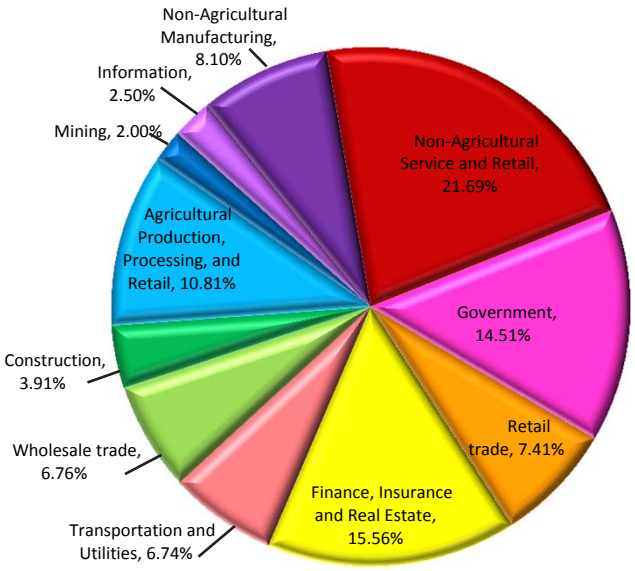
Arkansas' total GDP only experienced a 3% decrease during the recession from 2007 to 2009. In fact, 2007 and 2008 were the first and second highest GDPs recorded in Arkansas since 1997. As is reflected by its declining share of Arkansas

Fig. 3. The Agriculture and Food Sector's Share of Arkansas GDP, 1997 to 2010.



Source: USDC BEA, (2012).

Fig. 4. Sector Components of Arkansas' GDP, 2010.



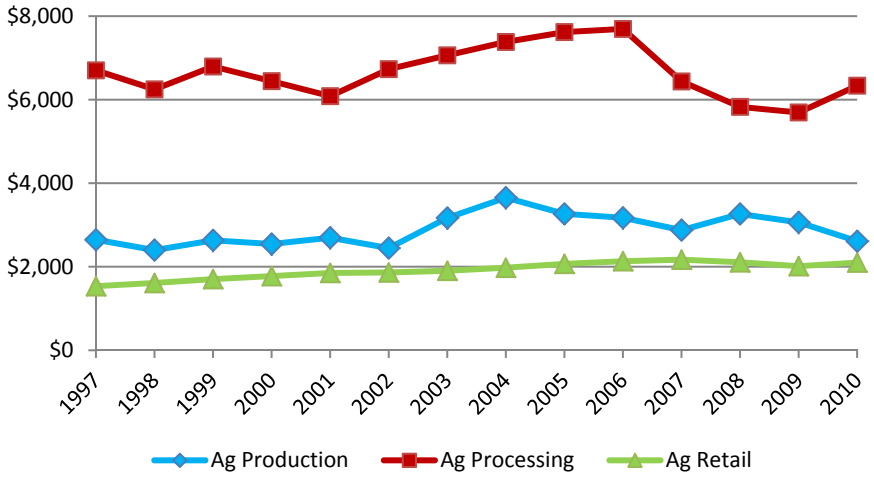
Source: USDC BEA, (2012).
Note: Calculated from constant 2010 dollars.

GDP, Agriculture and Food lost 6% of its value from 2007 to 2009, pointing toward deeper recession effects for agriculture than the economy as a whole. However, 2010 estimates for the GDP of Agriculture and Food point toward slight recovery of lost value.

On a U.S. level, agriculture was supported through the 2007-2009 recession by a growing export market, a low real trade-weighted dollar exchange rate, a robust agricultural lending sector, strong farm real estate values, and a lower debt-to-asset ratio for many farms than many nonfarm businesses. Although exports declined during the recession, they have begun to recover and are expected to continue to increase. Agricultural loans in the Farm Credit System, while still increasing in delinquency rate, have fared better than nonagricultural loans during and after the recession. Farm loan delinquencies decreased in 2010, and farm income increased, suggesting that the sector is moving back toward long term trends (Sundell and Shane, 2012). In 2010, Arkansas boasted an average value per acre of farm real estate of $2,500 (nominal dollars), which was 17% higher than the national average of $2,140 (nominal dollars). Of Arkansas's contiguous states, only Tennessee ($3,450; nominal dollars) claimed a higher per acre value than Arkansas in 2010 USDA ERS, 2012c).

The diversity of Arkansas's GDP components may provide additional partial insulation from recession effects. As in previous years, the Agriculture and Food Sector ranks as the fourth largest sector in the state (Fig. 4). The only sectors larger were Non-Agricultural Service and Retail (22%), Finance, Insurance, and Real Estate (16%) and Government (15%). The three major components of the Agriculture and Food Sector—agricultural production, agricultural processing and agricultural retail—totaled $2.6B, $6.3B, and $2.1B GDP, respectively (Fig. 5). Both agricultural processing and retail showed an increase from 2009 (11% and 4%, respectively), but agricultural production lost 15% of its GDP value.

Fig. 5. GDP for Arkansas' Agricultural Production, Processing, and Retail, 1997 to 2010.

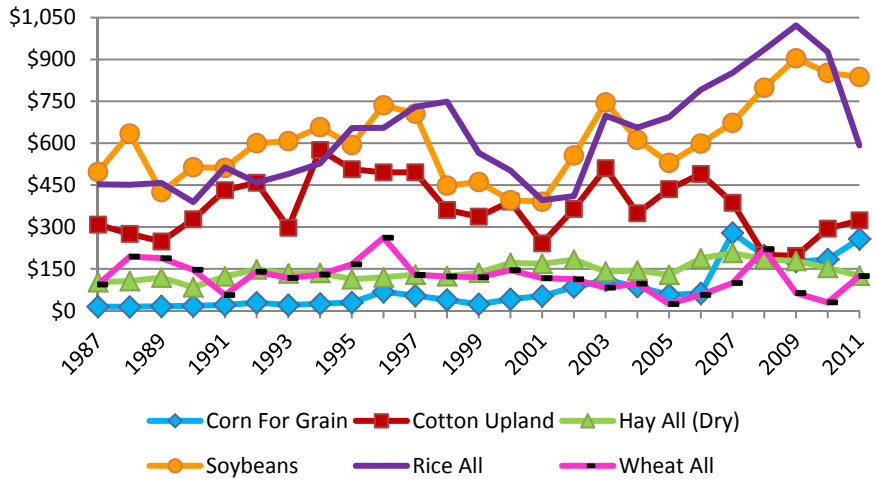


Source: USDC BEA, (2012).
Note: Presented in millions of constant 2010 dollars.

1.4.1: Agricultural Production

Crop and animal production, forestry, aquaculture, and horticulture are the primary agricultural production industries found in Arkansas. Arkansas was ranked in the top 25 producing states for 24 commodities in 2010, including first in rice, second in broilers, and third in cotton, turkeys, and catfish (Haydu, Hodges and Hall, 2006; USDA, 2007; USDA NASS, 2012a). Overall, agricultural production declined only 1% between 1997 and 2010, but its production rose and fell several times during this fourteen year period (Fig. 5). From 1997 to 2002, agricultural production was fairly constant and fell to its lowest level ($2.4B) in 1998. Growth stalled in these years due to low agricultural prices in the world market, especially in the Crops Sector. Barriers to poultry exports also contributed to the decline (Childs and Kiawu, 2008). However, the value of the GDP of agricultural production then rebounded in 2003 and reached $3.7B in 2004, which was the highest value for the 1997 to 2010 period, representing a 52% increase over 1998. In 2003 and 2004, farmers experienced consecutive years of large har-

Fig. 6. Arkansas' Crops Value of Production, 1987 to 2011.



Source: USDA, NASS (2012a, 2012b).
Note: Presented in millions of constant 1990-1992 dollars.
For selected crops: rice, soybeans, cotton, hay, wheat, and corn.

vests for major crops and unusually high prices for livestock and milk. These factors combined to yield record net farm income (NFI) for Arkansas in 2004 ($3.6B) (USDA ERS, 2012d). Although the value of animal agriculture production increased in 2005, these increases did not prevent a decrease in agricultural production GDP from 2004 to 2007, when it fell to $2.9B. However, the value of the GDP of agricultural production increased in 2008. The rally was short-lived, as by 2010, agricultural production had lost 29% of its 2004 value and declined to $2.6B. Although many commodities reached record nominal prices in 2011, the real prices (in 1990-1992 dollars) for commodities in Arkansas remained relatively constant, and in some cases, even declined (USDA NASS, 2012a, 2012b; Trostle, Marti, Rosen and Westcott, 2011). In 2011, total real cash receipts in Arkansas were down 2% from 2010, but U.S. total real cash receipts increased 1% (USDA ERS, 2012b, 2012e). Cash receipts in Arkansas declined in 2011 for many commodities possibly due to a decrease in livestock production and resulting decreased demand for feed crops as inputs. Many crops real prices decreased or remained steady in 2011, while many major crops production increased markedly from 2010 (soybean 13%, grain sorghum 140%, corn for grain 30%, wheat 272%; USDA NASS, 2012a, 2012b).

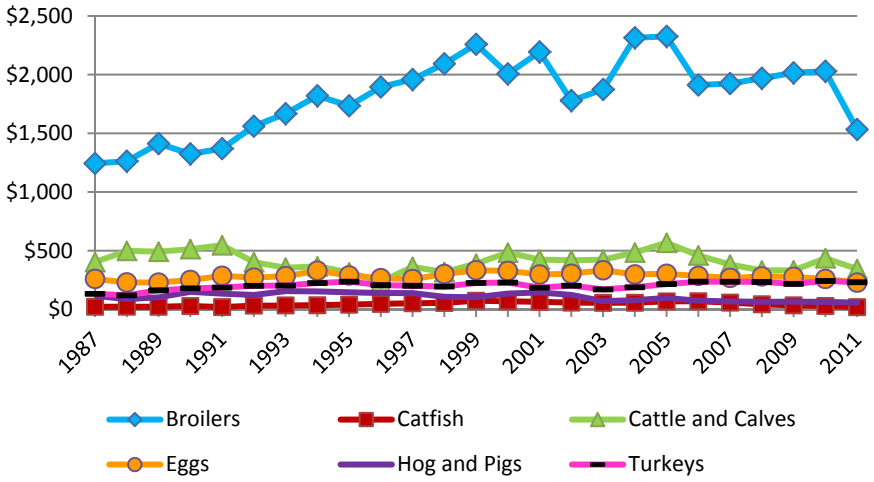
1.4.1.1: Crops Production

A time-series graph of major crops in Arkansas shows trends in value of production from 1987-2011 (Fig. 6). Despite volatility and a substantial decline of the value of field crop production from 1996 to 2001, the value of crop production increased overall by 52% from 1987 to 2011. Over this period, rice and soybean have consistently been the highest valued crops, with each representing an average of 30% of the total value of field and miscellaneous crops[8] over the years. Third is upland cotton, representing 19% of field and miscellaneous crops on average (USDA NASS, 2012a). In 2001, total field crops value of production fell to the lowest level since 1987, down to $1.5B. This decrease was due mostly to the downward trends of the top three crops' values (rice, soybeans, and cotton) in Arkansas. From 1998 to 2001, rice lost 47% of its value, and from 1996 to 2001, soybeans and cotton lost 47% and 51%, respectively. However, from 2001 to 2003 crops' prices and exports increased, and domestic and international demand for products was strong. As a result, the total value of crops production jumped 65% between 2001 and 2003. The gains were partly erased as the total market value (in constant 1990-1992 dollars) of crop production in Arkansas dropped in 2004 and again in 2005. During that time there was a general increase in output and prices for agricultural products in the U.S.; however, in Arkansas, cotton, rice, and soybean output increased, but prices did not. In 2008, Arkansas' crop value of production increased to the highest level over the period to $2.6B. Much of the value can be attributed to record high global rice prices, due to export barriers from other rice-producing countries, record high prices for fuel and fertilizer, and a weak U.S. dollar. Additionally, soybeans, the second largest crop in Arkansas, also experienced record prices (Trostle, 2008). From the peak in 2008, the total field crops' value of production began declining, losing 11% of its value between 2008 and 2011. The total field crops' value of production was lower in 2011 than any year of the 2007-2009 recession. Although production, prices, and cash receipts for corn were up in 2011, possibly due to ethanol policies and increased ethanol demand (Trostle, Marti, Rosen and Westcott, 2011), corn is only tied for fifth in acreage (behind soybean, rice, hay, cotton, and tied with wheat) in Arkansas and fourth in cash receipts (behind soybean, rice, and cotton), so these increases did little to offset declines in other crops. Some of the decrease may be due to declines in the livestock production sector, as feed crops are a main input in livestock production. Additionally, cotton cash receipts increased 10% from 2010 to 2011. Increased cotton acreage (22% from 2010 to 2011) left less area to produce food and feed crops (USDA NASS, 2012b; USDA ERS, 2012b).

1.4.1.2: Animal Production

Animal production is also a major component of Arkansas' agricultural production. In terms of constant 1990-1992 dollars, animal production cash receipts (which measure income and sales from marketing) in Arkansas increased from $2.3B in 1987 to $3.1B in 2010, representing a 34% gain in value (USDA ERS, 2012b; USDA NASS, 2012b). However, from 2010 to 2011, animal production cash receipts decreased 21%. The 2007-2009 recession and its resulting high unemployment negatively affected domestic animal protein demand. Cash receipts for Arkansas' cattle and calves declined 28%, hogs and pigs fell 12%, and turkeys fell 8% from 2006 to 2009 (Fig. 7). However, cash receipts for broilers actually in-

Fig. 7. Arkansas' Livestock and Livestock Products Value of Cash Receipts, 1987 to 2011.



Source: USDA, ERS (2012b); USDA, NASS (2012b).
Note: Presented in millions of constant 1990-1992 dollars.
For selected products: broilers, cattle and calves, eggs, turkeys, hogs and pigs, and catfish.

creased 5% over the same period (USDA ERS, 2012b; USDA NASS, 2012b), as consumers substituted lower-priced poultry products for pork and beef (Trostle, Marti, Rosen and Westcott, 2011). Since the official end of the recession in 2009, livestock cash receipts on the whole rallied in 2010, but experienced significant declines in 2011 in every major livestock product (Fig. 7). Catfish and broilers had the largest losses from 2010-2011: 34% and 24%, respectively. Lower production of hogs and pigs and catfish also contributed to the declines in cash receipts, even though real prices for these commodities increased (USDA ERS, 2012b; USDA NASS, 2012b). The losses in broilers cash receipts explain much of the decrease in the value of animal production, as broilers have consistently been the largest portion of animal cash receipts in Arkansas. Broilers accounted for an average of 60% of animal production value over the 1987-2011 period, but in 2011, both the production and price of broilers decreased (Fig. 7). Furthermore, cattle and calves lost 21%, eggs 12%, hogs and pigs 8%, and turkeys 5% from 2010 to 2011. The value of animal production in Arkansas in 2011 was markedly lower than any year of the 2007-2009 recession, and in fact was the third lowest production year since 1987. The downturn may be a product of readjustment in livestock markets to the decreased demand between 2007 to 2009. Biological lags prevented livestock producers and marketers from swiftly adjusting supply to meet decreased demand, resulting in a market surplus during the recession, thus lower prices more recently to adjust for the surplus (Trostle, Marti, Rosen and Westcott, 2011).

1.4.1.3: Forestry Production

Arkansas' land base was composed of approximately 18.8M acres of forest in 2011 (56% of total land base) (USDA Forest Service, 2012). The state was ranked fourth in the production of sawlogs in the South[9] in 2007, the latest year for which data are available (Johnson, Bentley and Howell, 2009). There were 20.0M tons of timber (soft- and hardwood) removed from forests in Arkansas in 2011, valued at $352M. Data for 2011 show an increase in softwood production (5%) but a decrease in hardwood production (4%) from 2010. Total value of timber declined 15% from 2010 to 2011. The five-year (2007 to 2011) high in both production and value was in 2007 (22.6M tons removed valued at $566M; Arkansas Forestry Commission, 2012). Forestry production is integral to Arkansas' economy. Foresters supply wood product manufacturers with raw materials. Arkansas' timber is fundamental to such industries as paper, lumber and wood, and furniture and fixtures.

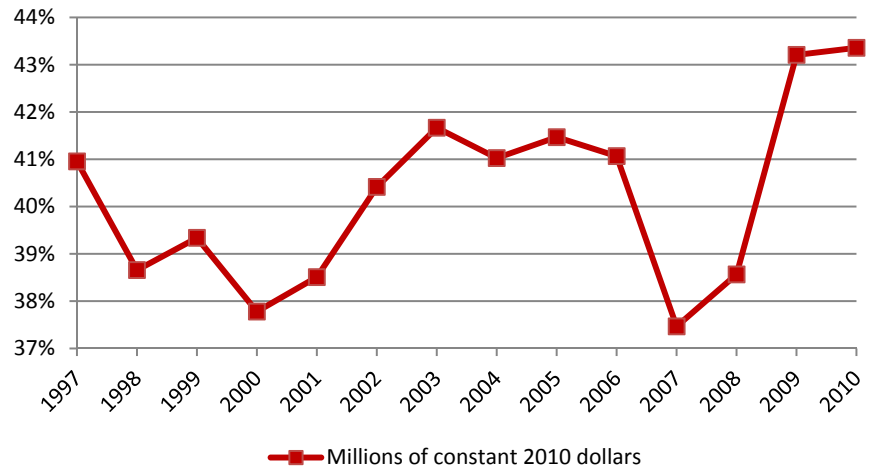
1.4.1.4: Agriculture-Related and Support Industries

Agriculture-related industries include commercial fishing, hunting and trapping from the natural environment (not farm-raised), and agriculture and forestry support activities. In pre-2007 reports, on-farm construction was also included; however, the data are no longer available and have been dropped from the analysis. The largest of these industries is agriculture and forestry support activities. These activities may be performed by an independent firm as an input required for the production process for a given crop, animal, or forestry industry. Typical activities include, but are not limited to, cotton ginning; soil preparation, planting, and cultivating; breeding services and livestock sprayers. A smaller portion of the sector is made up of commercial fishing, hunting, and trapping activities. In 2010, 3,202 commercial licenses were issued: 966 hunting and trapping and 2,225 fishing. Additionally, 11 wildlife management business licenses and 411 resident hunting guide licenses were issued in 2010 (AGFC, 2011). Commercial license issuances in 2010 were up 19% from 2009. The overall increase was due to a 178% increase in commercial hunting and trapping licenses.

1.4.2: Agricultural Processing

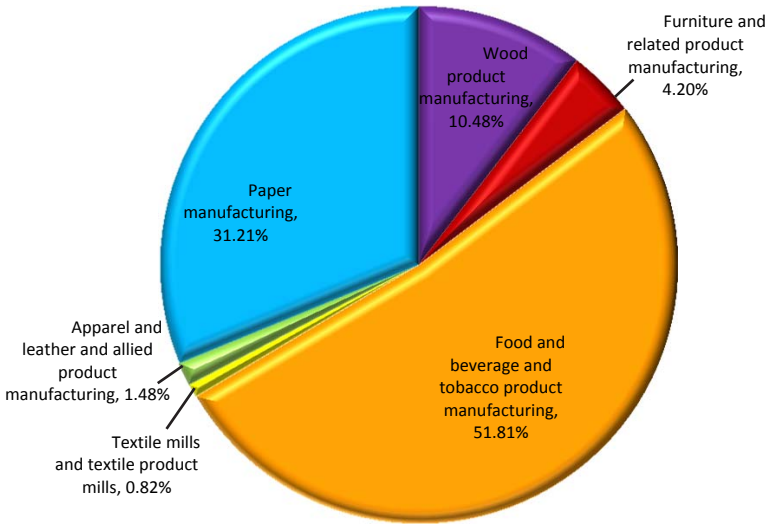
Processed crop, livestock, and forestry products are an integral part of agriculture in Arkansas. Arkansas' manufacturing sector depends upon raw materials from the crops, animal agriculture, and forestry sectors for use in many of its largest industries. Poultry production and processing, for example, may lead to such processed goods as frozen chicken, eggs, animal feed, and animal oils; cotton production may lead to ginning and processing of materials to be used in the textile industry. Fig. 5 details the trend of agricultural processing in Arkansas from 1997 to 2010. Over the fourteen year period, the value of agricultural processing has declined by 5%. From 2001 to 2006, agricultural processing was on an upward trend, peaking at almost $7.7B in

Fig. 8. Agricultural Processing's Share of Arkansas' Manufacturing GDP, 1997 to 2010.



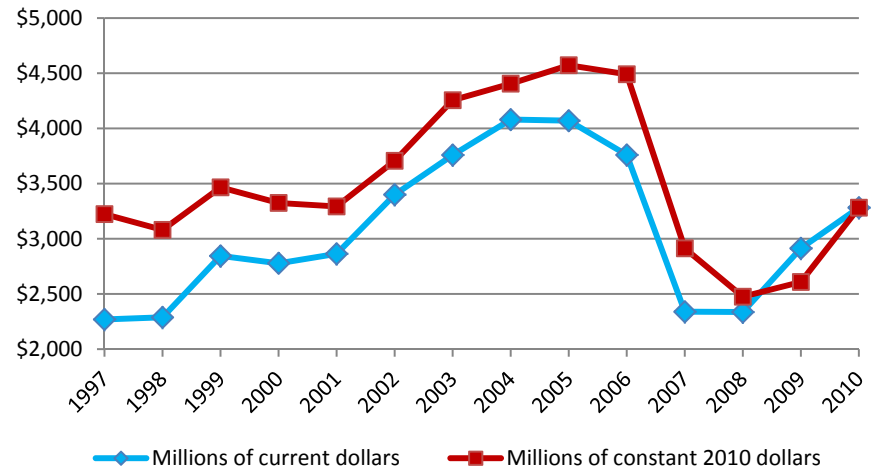
Source: USDC BEA, (2012).

Fig. 9. Components of Arkansas' Agricultural Processing Sector GDP, 2010.



Source: USDC BEA, (2012).

Fig. 10. The GDP of Arkansas Food Product Manufacturing, 1997 to 2010.



Source: USDC BEA, (2012).

2006. Since 2006, agricultural processing decreased 26% to $5.7B in 2009. The value of processing rebounded 11% to $6.3B from 2009 to 2010 (USDC BEA, 2012).

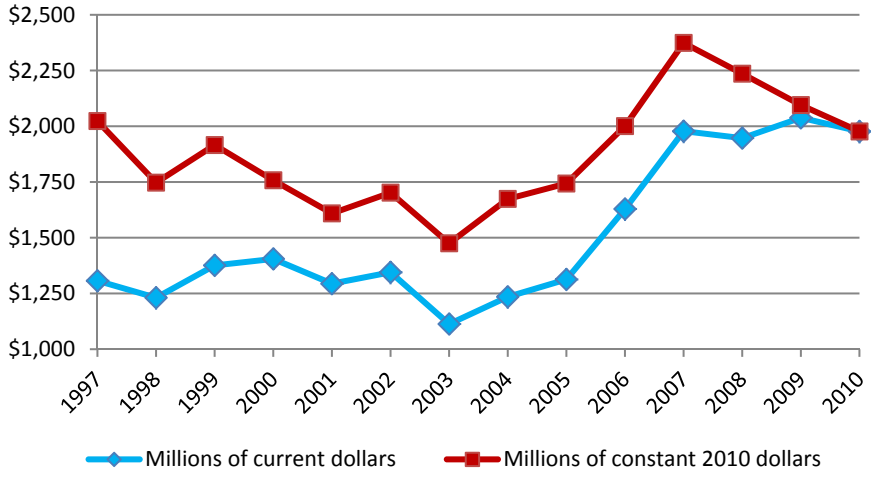
Since 1997, agricultural processing's share of manufacturing GDP has ranged from a low of 37% in 2007 to a high of 43% in 2010. Agricultural processing's share of manufacturing declined from 41% in 1997 to 37% in 2007, except for the steady years of 2002 to 2006 when its share was higher than the 1997 level. Since reaching its period low in 2007, agricultural processing rebounded to its highest share in 2010 (Fig. 8). Agricultural processing's average share over the fourteen year period was 40%, suggesting that it continues to be important to the value of manufacturing. Agricultural processing accounted for about $2 of every $5 of manufacturing in Arkansas.

Food Product Manufacturing, Paper Manufacturing, and Wood Product Manufacturing accounted for 93% of Arkansas' processed agricultural goods in 2010. The contribution of individual agricultural processing industries to agricultural processing in 2010 is shown in Fig. 9. Three of six agricultural processing sectors declined from 2009 to 2010. However, the 26% increase in the value of the largest sector, Food Product Manufacturing, more than offset other agricultural processing declines. A discussion of each industry's percentage of GDP over time follows.

1.4.2.1: Food Product Manufacturing

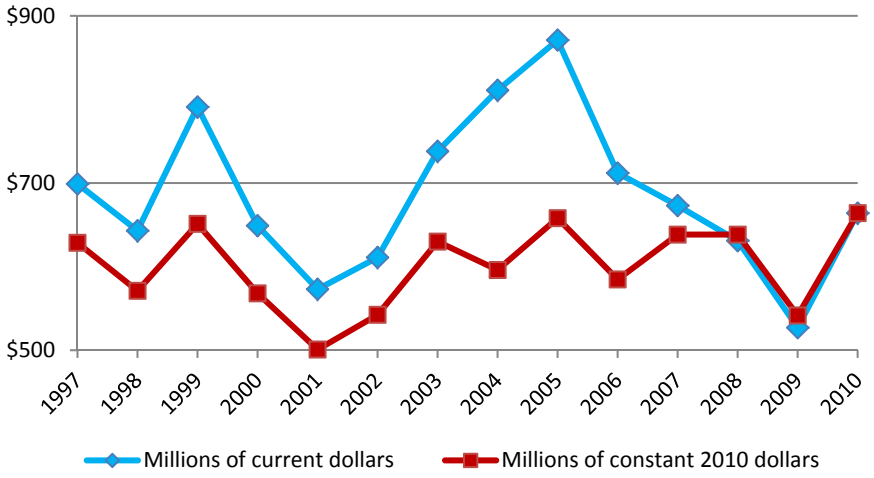
The Food Product Manufacturing Sector has consistently been the largest agricultural processing sector in Arkansas since 1997, accounting for 52% of agricultural processing's GDP in 2010. This sector increased 2% over the 1997 to 2010 period. The decelerating global economic growth from 1997 to 2003, attributable to the Asian financial crisis, significantly impacted the industry in the 2001-2004 period due to a combination of record high levels of production and lower commodity prices for a number of commodities. The Food Product Manufacturing sector's experienced rapid growth from 2001 to 2005, when it increased 39% from $3.3B to $4.6B, the period high (Fig. 10). The sector declined from 2005 to 2008, dropping 46% (Fig. 10; USDC BEA, 2012). The sector experienced its

Fig. 11. The GDP of Arkansas Paper Manufacturing, 1997 to 2010.



Source: USDC BEA, (2012).

Fig. 12. The GDP of Arkansas Wood Manufacturing, 1997 to 2010.



Source: USDC BEA, (2012).

lowest value during the fourteen year period in 2008, in the midst of the 2007 to 2009 recession period. These losses may be attributable to national adjustments in household food spending trends. The recession period resulted in a decrease in food expenditures, especially from middle income households (average income $46,012 per year). Although the majority of the adjustment came from a decrease in food away from home spending, food at home spending also decreased. As well as an absolute decrease in food at home spending, consumers have begun economizing purchases more since 2007. For the Food Product Manufacturing sector in Arkansas, substitutions for comparable but less expensive alternative foodstuffs may have caused some of the GDP losses. For example, sales of convenience foods, such as pre-washed and packaged greens, were eroded by purchases of unpackaged greens. Private label (store brand) items were increasingly substituted for brand name items. Additionally, consumers increasingly took advantage of sales, lower-priced store formats, and coupons when purchasing food for home consumption (Kumcu and Kaufman, 2011; Martinez, 2011). Since 2008, the sector showed a rebound from $2.5B in 2008 to $3.3B in 2010, a 33% increase. Although the most recent GDP estimates suggest that Food Product Manufacturing is returning to pre-recession levels, longer-term effects remain to be seen, as consumer behavior determines the immediate future gains or losses in the sector.

1.4.2.2: Paper Manufacturing

The Paper Manufacturing Sector has been the second-largest processing industry in Arkansas since 1997. This sector decreased 2% from 1997 to 2010 (Fig. 11). However, while pulp and paper manufacturers in North America were affected by the Asian financial crisis during the mid-to-late 1990s (Simard, 1999), which continued to impact manufacturers through 2001, impact to Arkansas manufacturing was minimal. The value of Paper Manufacturing in Arkansas has remained relatively steady over the fourteen year period. The sector's lowest GDP in the period occurred in 2003 ($1.5B), but until 2007 the sector experienced strong growth. By 2007 the GDP of the Paper Manufacturing Sector had improved by 61%. In 2007, its GDP was at its period high of $2.4B (Fig. 11). Since 2007 the GDP has declined 17%, and in 2010 its value was down to $2.0B (USDC BEA, 2012).

1.4.2.3: Wood Product Manufacturing

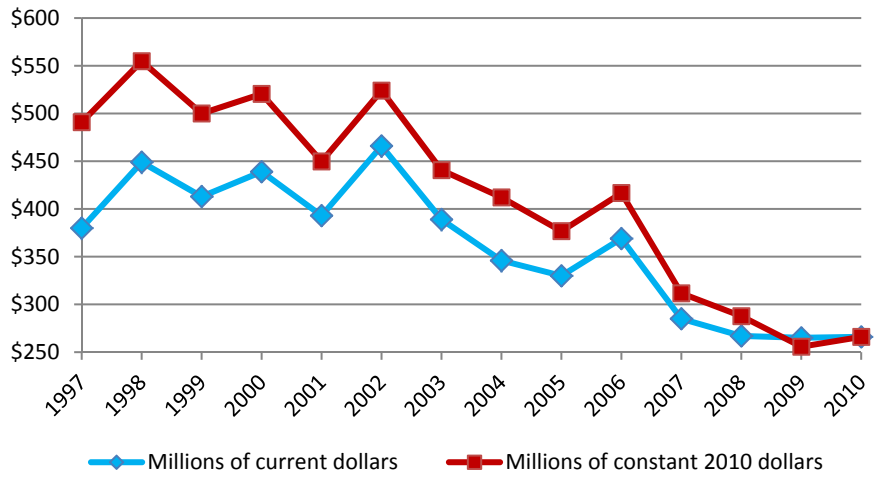
Arkansas' third largest agricultural processing sector gained 6% in value from 1997 to 2010. After a brief increase from 1998 to 1999, the GDP of Wood Product Manufacturing fell 23% from 1999 to 2001 (Fig. 12). As explained in detail in Popp, Vickery and Miller (2005), most of this decline was attributed to a slow-down in the international market for U.S. wood chips and a drop in soft wood prices that followed an influx of Canadian wood on the market. The sector returned to 1999 levels in 2003 and remained relatively steady until 2009, when it decreased 15% from 2008 to $542M. The 2009 year marked the second lowest value of the fourteen year period; only 2001 was lower ($501M). Much of this decline may be attributable to families planning to stay in their homes longer than originally anticipated (Bumgardner, Buehlmann, Schuler and Koenig, 2012). The value of U.S. private construction declined markedly from 2006 to 2009, especially in single family housing. Since 2009, the value has been almost flat (Bumgardner, Buehlmann, Schuler and Koenig, 2012). In 2010, the Wood Product Manufacturing showed

signs of recovery and gained 23% from $542M in 2009 to $664M in 2010 (USDC BEA, 2012). In 2009, 81% of surveyed wood product manufacturers reported losing sales volume. In 2010, only 50% reported lost sales volume, which may account for the tepid signs of recovery in the sector. This "recovery" may be due in part to some manufacturers closing, shifting remaining demand to a smaller number of manufacturers (Bumgardner, Buehlmann, Schuler and Koenig, 2012).

1.4.2.4: Furniture and Related Products Manufacturing

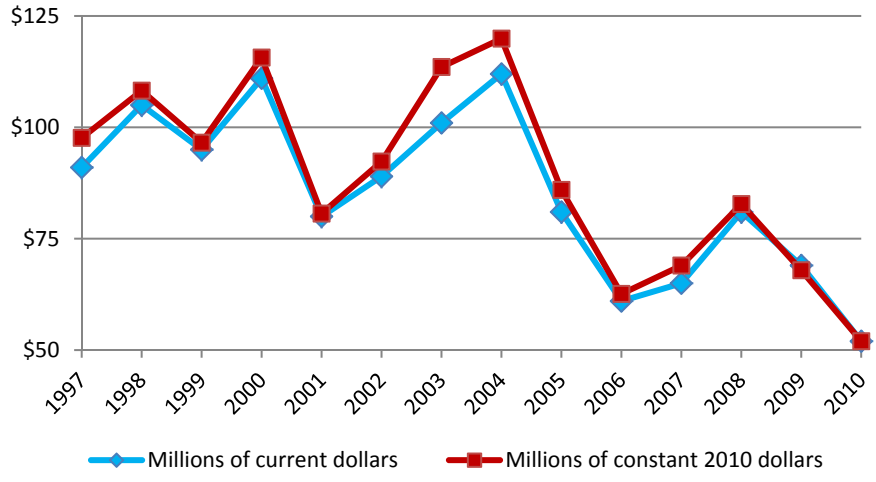
Over the 1997 to 2010 period, Furniture and Related Products Manufacturing lost 46% of its value. Its GDP was volatile from 1997 to 2002 and reached the period high level of $555M in 1998. This sector benefited from a strong resale housing market throughout the 1990s. The resale housing market is a leading indicator of demand for the furniture industry (Schuler, Taylor and Araman, 2001). The housing and real estate markets gained momentum in 2002; however, imports of furniture and other wood producers were also on the rise, flooding the market with less expensive substitutes for U.S. manufactured products. A flooded market partially led to the 28% drop from 2002 to 2005 to $377M. Since 2002, except for limited recovery in 2006, the sector has been on a marked path of decline from $524M in 2002 to $256M in 2009, a 51% decrease (Fig. 13; USDC BEA, 2012). In 2010, however, the sector experienced a slight increase of 4% to $266M. Much of the decline since 2006 may be attributed to recession effects, as Furniture and Related Products Manufacturing is closely tied to the housing construction and real estate markets. These markets have been anemic, as the 2007-2009 recession resulted in declining new construction and existing home sales, as families were staying in their homes longer (Bumgardner, Buehlmann, Schuler and Koenig, 2012). The U.S. in 2009 had the fewest new housing starts since 1959, but starts increased slightly in 2010 (554,000 starts in 2009; 586,900 starts in 2010) (USCB, 2012b).

Fig. 13. The GDP of Arkansas Furniture and Related Products Manufacturing, 1997 to 2010.



Source: USDC BEA, (2012).

Fig. 14. The GDP of Arkansas Textile and Textile Product Mills, 1997 to 2010.



Source: USDC BEA, (2012).

1.4.2.5: Textile and Textile Product Mills

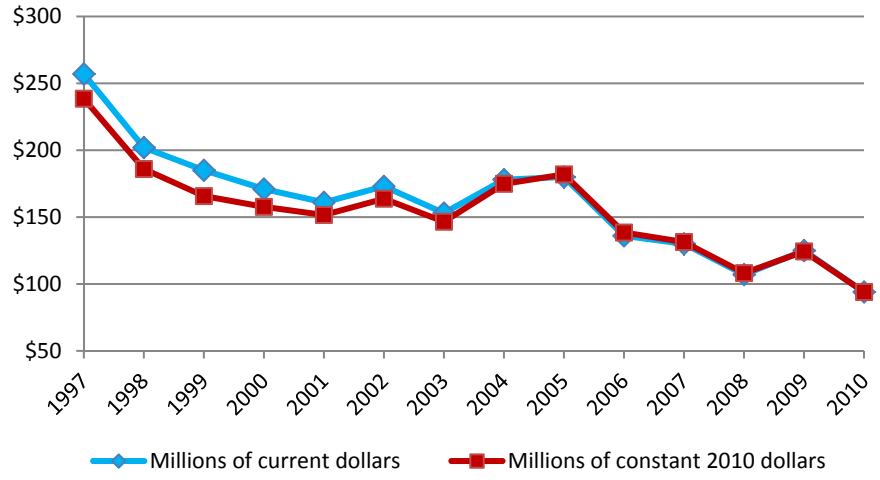
The Textile and Textile Product Mills Sector has been in decline for three decades. From 1997 to 2010, its value declined 47%. Technological improvements and import competition have reduced the industry's activity in the U.S. The decline in textile and apparel industries accelerated following the implementation of the North American Free Trade Agreement (NAFTA) with Canada and Mexico in 1994. The overall effect of NAFTA on the U.S. economy is controversial. Some studies have concluded that NAFTA has actually increased demand for U.S. textiles in Mexico and Canada, which may explain some of the growth in 2002 and 2003 (USDA FAS, 2001; Wall, 2000). Furthermore, in March 2001, the economy slipped into recession, which ended in November 2001 (NBER, 2011). The end of the 2001 recession may have also contributed to the growth in the following years. In Arkansas, the sector has been the smallest component of agricultural processing during the period from 1997 to 2010 but has been somewhat volatile. Much of the steep decline in 2001 occurred because a major textile manufacturer closed its last plant in Arkansas in 2000. From 2004 to 2006, Textile and Textile Product Mills declined in value by almost half (48%) to $63M (Fig. 14). The sector recovered briefly from 2006 to 2008, but since 2008 the value of its

GDP decreased 37% from $83M in 2008 to the fourteen year low of $52M in 2010 (USDC BEA, 2012).

1.4.2.6: Apparel, Leather, and Allied Products Manufacturing

As seen in Fig. 15, the GDP for Apparel, Leather, and Allied Products Manufacturing has experienced alternating periods of growth and decline but has experienced a general overall decline in GDP from 1997 to 2010. During this period, the sector has declined from a high of $239M in 1997 to a low of $94M in 2010, representing a 61% drop over the fourteen year period (USDC BEA, 2012). Much like the textile industry, apparel manufacturing has been in decline in the U.S. for over thirty years. The decline has also been partly attributed to NAFTA, which possibly accelerated the drop in apparel manufacturing in the late 1990s and the shifting of apparel manufacturing out of the state to countries with lower wage rates.

Fig. 15. The GDP of Arkansas' Apparel, Leather, and Allied Products Manufacturing, 1997-2010.



Source: USDC BEA, (2012).

Fig. 16. The GDPs of Arkansas' Agricultural Processing Sectors, 1997 to 2010.

Source: USDC BEA, (2012).
Note: Presented in millions of constant 2010 dollars.

1.4.2.7: Agricultural Processing Summary

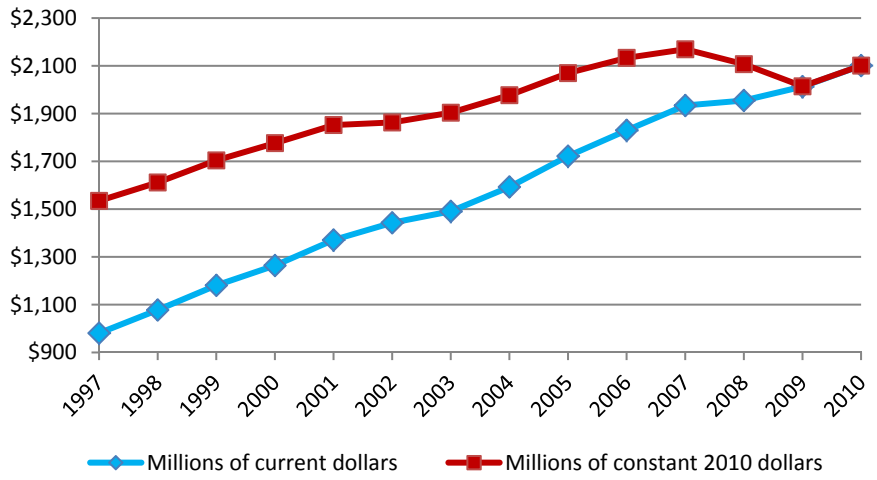
Fig. 16 shows all components of agricultural processing to better compare the sectors and their contributions over time to agricultural processing. Food Product Manufacturing has consistently contributed the largest share of agricultural processing, but has shown substantial volatility over the period, including a substantial decline in value from 2004 to 2008. The second largest component, Paper Manufacturing, has shown signs of volatility, but its pattern is almost perfectly anti-cyclical to Food Product Manufacturing, partially insulating agricultural processing. The remaining sectors contribute the least to the GDP of agricultural processing, and have either been relatively stable over the period or in steady decline.

1.4.3: Agricultural Retail

1.4.3.1: Food Services and Drinking Places

GDP in agricultural retail in 2010 was $2.1B (Fig. 17). From 1997 to 2007, agricultural retail increased 41%. Until 2007, there was an increase in the GDP of agricultural retail each year since 1997. Food service operations, including restaurants, have steadily increased their share of total food expenditures over time, contributing to the steady increases in the sector.[10] Long-term trends show that as household incomes have increased, and more women have entered the workforce, the share of household spending for prepared foods and meals has risen. Since estimates began in 1953, food expenditures away from home have been consistently increasing. In 1953, 33% of food expenditures were spent on food away from home, and by 2006 had risen to 49% of food expenditures, further evidence of the market forces behind the increases in agricultural retail GDP (calculated from constant 1988 dollars; USDA ERS, 2011). From 2007 to 2009, the sector lost 7% of its value of GDP, its first period of decline

Fig. 17. The GDP of Arkansas Food Services and Drinking Places, 1997 to 2010.



Source: USDC BEA, (2012).

since 1997. The recession from December 2007 to June 2009 resulted in downward food spending adjustments by households of all income levels in the U.S., but especially middle-income households (average income $46,012 per year). Most of the reductions were in food away from home spending. The decrease shown in the Arkansas Food Services and Drinking Places suggest Arkansas households followed the national trend; however, national data suggest that even food at home spending decreased slightly during the recession period (NBER, 2010; Kumcu and Kaufman, 2011). In 2010, the sector showed signs of recovery from this brief decline when it increased 4% from 2009.

1.5: Summary of the Trends in Gross Domestic Product by State for Agriculture and Food

The GDP by State data from BEA indicate that since 1969, Arkansas' Agriculture and Food Sector has contributed a larger share of GDP by State to the overall Arkansas state economy than does the Agriculture and Food Sector in other states of the southeastern U.S. However, Arkansas' agricultural production declined again in 2010. The decline is contributing to decreasing NFI in Arkansas. Since its record high in 2004 ($3.6B), NFI in Arkansas has been on a general downward trend, with consecutive years of decline: 2009 and 2010. In 2010, Arkansas' NFI fell to $1.3B, a decline of 49% since 2008 (USDA ERS, 2012d; USDA NASS, 2012b). Three of six agricultural manufacturing sectors gained in 2010, including the first and third largest processing sectors: Food Product Manufacturing and Wood Product Manufacturing, respectively. The increase in Food Product Manufacturing was the largest gain in absolute and percentage change ($673M; 26%) of any production, processing, or retail sector. In 2010, agricultural retail began to recover from two years of slight decline (2008 and 2009) whereas 2008 and 2009 marked the first contraction in agricultural retail in the 1997-2010 period, most likely due to changes in consumer spending habits during the 2007-2009 recession (Kumcu and Kaufman, 2011; NBER, 2010).

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

2.1: 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. Part 2 of 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 2010.

2.2: Methods

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 3.0) from Minnesota IMPLAN Group, Inc. (MIG; Stillwater, Minn.). Data here are reported for 2010 (MIG, 2011). Contributions are reported in terms of employment, labor income, and value added (introduced previously and described in depth in section 2.3). 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. Note that what is called "contribution" in Part 1 of this document is calculated differently than in Part 2. The "contribution" as used in Part 1 only includes the direct agriculture production and processing activities plus Food Services and Drinking Places. The "contribution" in Part 2 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 the 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.[11] 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 2010 (the most recent data available) were used to calculate all contributions (MIG, 2011). 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 in Part 2 are reported in current (nominal) 2010 dollars, unless otherwise noted.

2.2.1 General Procedures

For the economic contribution analysis of the agriculture sector, Part 2, 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 anal ysis 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 (MIG, 2000).

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)[12] 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. The only farm employment and income data are derived from BEA's Regional Economic Information System (REIS) program but these are only single farm employment and income numbers for all agriculture sectors combined. MIG collects estimates of output and creates vectors of employment and income to allocate the single REIS value to the separate IMPLAN agricultural production sectors (Lindall, 1998). MIG encourages analysts with better agriculture data to use it when building models (Olson and Lindall, 2009).

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, 2012a). 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 2.2.2 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 the 2010 poultry farm estimates from Arkansas Natural Resources Commission (ANRC, 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 and multiplying the number of farms by 2.49; this method presumes one operator per farm plus 1.49 additional workers per operator (USDA, 2007). Then, the data year output value divided by total poultry employment yields the updated estimate for output per worker for that year. 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.

Estimating trade flows across regional boundaries is possibly the largest source of error in non-survey I-O models (Stevens and Trainor, 1980) and the se-

lection 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.

2.2.2 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 (ABP; 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 Grains 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.

2.2.3 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 2.2. 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 payments 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 misleading. 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.

2.3: The Aggregate Agriculture Sector

In 2010, 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 256,244 jobs, or 17%, of state employment (Table 2). That is, more than one in six Arkansas jobs can be attributed to agriculture. In that same year, agriculture paid $9.8B, or 16% of state labor income. Wages accounted for $7.9B, or 80% of total labor income generated by agriculture. Additionally, the Aggregate Agriculture Sector added $16.0B of value to the state economy, or 17% of state value added. That is, more than $1 out of every $6 in value added can be attributed to agriculture (MIG, 2011). 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 three-quarters 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 37,343 jobs, or one in four jobs generated by agriculture in Arkansas. *Poultry Processing* employed 29,139 of these workers. The remaining 8,204 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 (*Wholesale Trade, Transportation and Warehousing*, and *Real Estate and Rental*) lie outside of the agriculture sector as defined here. Although almost half 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, 2010

Employment	256,244 jobs (1 out of 6 Arkansas jobs)
Wages	$7,859M (15% of Arkansas wages)
Labor Income	$9,767M (16% of Arkansas labor income)
Value-Added	$16,003M ($1 out of $6 Arkansas value added)

Source: MIG (2011).
NOTE: Presented in current dollars.

Box 2. Employment Generated by Agriculture, 2010 Top Five NAICS Industries[a]

Manufacturing	76,781 jobs (95% of the jobs are in agricultural processing)
Agriculture, Forestry, Fishing and Hunting	75,359 jobs (88% of the jobs are in agricultural production)
Health and Social Services	12,386 jobs
Retail Trade	12,035 jobs
Transportation and Warehousing	11,782 jobs
Top Five Total	188,343 jobs (74% of all jobs generated by Agriculture)

[a]Based on 2-Digit NAICS aggregation (USCB, 2006).
Source: MIG (2011).
Note: presented in current dollars.

Table 2. The Aggregate Agriculture Sector's Contribution to Arkansas' Economy, 2010.

	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]	66,355	25.9	4.3	1,752	17.9	2.8	2,274	14.2	2.4
Processing [e]	73,206	28.6	4.7	3,316	34.0	5.3	5,637	35.2	5.8
Ag-Related [f]	9,004	3.5	0.6	319	3.3	0.5	332	2.1	0.3
Direct Contribution	**148,566**	**58.0**	**9.6**	**5,387**	**55.2**	**8.6**	**8,243**	**51.5**	**8.5**
Indirect Effects	54,610	21.3	3.5	2,658	27.2	4.3	4,526	28.3	4.7
Direct + Indirect Contribution	**203,176**	**79.3**	**13.1**	**8,045**	**82.4**	**12.9**	**12,769**	**79.8**	**13.2**
Induced Effects	53,067	20.7	3.4	1,722	17.6	2.8	3,234	20.2	3.3
Total Contribution	**256,244**	**100.0**	**16.5**	**9,767**	**100.0**	**15.7**	**16,003**	**100.0**	**16.6**

Source: Computed using the 2010 Arkansas database from MIG (2011).

Note: Presented in current dollars.

[a] Equivalent to full- and part-time jobs (MIG, 2000).

[b] Labor income represents all forms of employment income; it is the sum of employee compensation and proprietor income (MIG, 2000).

[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 *Cotton 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 *Commercial Logging*. About 34% ($2.8B) of direct value added by agriculture accrues in Crops, 31% ($2.6B) in Animal Agriculture, and 31% ($2.6B) in Forestry. The remaining 4% accrues in the Agriculture-Related Sector.

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 2010, $4.4B, or 45% of all labor income, went to workers in non-agricultural sectors. Within the agricultural sectors, the top three crops production sectors, the poultry industry, and the top five forestry sectors received $3.2B, or 32% 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 148,566 workers employed by the agricultural production, processing and agriculture related sectors (Table 2). The owners, operators, and workers of these farms and

Box 3. Value Added Generated by Agriculture, 2010 Top Five NAICS Industries[a]

Manufacturing
$5,997M
(94% of the value added is in agricultural processing)

Agriculture, Forestry, Fishing and Hunting
$2,606M
(87% of the value added is in agricultural production)

Real Estate and Rental
$1,308M

Wholesale Trade
$1,132M

Transportation and Warehousing
$841M

Top Five Total
$11,884M
(74% of all value added generated by Agriculture)

[a]Based on 2-Digit NAICS aggregation (USCB, 2006).
Source: MIG (2011).
Note: Presented in current dollars.

Box 4. Labor Income Generated by Agriculture, 2010 Top Five NAICS Sectors[a]

Manufacturing
$3,522M
(94% of labor income is in agricultural processing)

Agriculture, Forestry, Fishing and Hunting
$2,071M
(89% of labor income is in agricultural production)

Wholesale Trade
$636M

Transportation and Warehousing
$628M

Health and Social Services
$549M

Top Five Total
$7,406M
(76% of all labor income generated by Agriculture)

[a]Based on 2-Digit NAICS aggregation (USCB, 2006).
Source: MIG (2011).
Note: Presented in current dollars.

businesses received nearly $5.4B in labor income (Table 2); 62% of direct labor income went to workers and business owners in processing industries. Agricultural production, processing, and agriculture-related industries directly added value of $8.2B to the Arkansas economy, of which 68% was from processing industries. The crops industries employed close to half (43%) of agricultural production and processing employees, while the animal agriculture industries employed 37% and the forestry industries 19% (Table 3).

Indirect contributions result when agricultural firms purchase raw materials and services from other Arkansas businesses to produce their products. In 2010, there were 54,610 workers employed by industries supplying goods and services to the farm production and processing industries. The workers and owners of these establishments received $2.7B in labor income and these industries added value of over $4.5B to the state economy (Table 2).

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. There were 53,067 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 $1.7B in labor income and added value of almost $3.2B to the Arkansas economy.

2.3.1 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 2010, the Crops Sector provided 60,431 jobs within the Aggregate Agriculture Sector, or 4% of state employment (Table 4 and Box 5). The workers and business owners received $1.7B in labor income ($871M of that in wages), or 3%

Table 3. The Contribution of Major Agricultural Sectors to Agricultural Production and Processing, 2010.

	Employment [a]		Labor Income [b]		Value Added [c]	
	Number of Jobs	% Total	Million $	% Total	Million $	% Total
Production						
Crops	44,143	31.6	921	18.2	1,109	14.0
Animal Agriculture	17,326	12.4	614	12.1	884	11.2
Forestry	4,886	3.5	217	4.3	282	3.6
Production Total	**66,355**	**47.5**	**1,752**	**34.6**	**2,274**	**28.7**
Processing						
Crops	16,287	11.7	810	16.0	1,679	21.2
Animal Agriculture	34,724	24.9	1,231	24.3	1,681	21.2
Forestry	22,195	15.9	1,276	25.2	2,277	28.8
Processing Total	**73,206**	**52.5**	**3,316**	**65.4**	**5,637**	**71.3**
Prod. + Proc. Total	**139,561**	**100.0**	**5,069**	**100.0**	**7,911**	**100.0**

Source: Computed using the 2010 Arkansas database from MIG (2011).
Note: Presented in current dollars.

[a] Equivalent to full- and part-time jobs (MIG, 2000).

[b] Labor income represents all forms of employment income; it is the sum of employee compensation and proprietor income (MIG, 2000).

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

Table 4. The Crops Sector's Direct Contribution to Arkansas' Economy, 2010.

	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]	44,143	29.7	2.8	921	17.1	1.5	1,109	13.4	1.1
Processing [e]	16,287	11.0	1.1	810	15.0	1.3	1,679	20.4	1.7
Direct Impact	**60,431**	**40.7**	**3.9**	**1,731**	**32.1**	**2.8**	**2,788**	**33.8**	**2.9**

Source: Computed using the 2010 Arkansas database from MIG (2011).
Note: Presented in current dollars.

[a] Equivalent to full- and part-time jobs (MIG, 2000).

[b] Labor income represents all forms of employment income; it is the sum of employee compensation and proprietor income (MIG, 2000).

[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 state labor income. The Crops Sector added $2.8B, or 3%, to state value-added (MIG, 2011). The rice industry (*Rice Farming*, and *Rice Milling*) represented 16% of jobs, 20% of labor income, and 20% 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.

2.3.2 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 52,050 jobs in 2010, or over 3% of state employment, and these workers and business owners received $1.8B in labor income, or 3% of state labor income (MIG, 2011). Of this labor income, 82% ($1.5B) was attributable to wages. In 2010, the Animal Agriculture Sector added $2.6B of value to the state economy, or almost 3% of state value added (Table 5 and Box 7). 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. *Poultry and Egg Production* and *Poultry Processing*[13] provided 72% of jobs, 82% of income and 72% of value added in the Animal Agriculture Sector in 2010 (Box 8).

2.3.3 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 27,081 jobs (almost 2% of state employment) in the Forestry Sector in 2010, and these workers and business owners received $1.5B in labor income, or just over 2% of state labor income (MIG, 2011). The Forestry Sector added $2.6B of value to the state economy, or almost 3% of total state value-added (Table 6 and Box 9). Within this sector, *Paper Mills*, *Sanitary Paper Product Manufacturing*, *Sawmills and Wood Preservation*, *Paperboard Container Manufacturing*, and *Commercial Logging* comprised 60% of forestry jobs, and 65% and 68% of forestry income and value added, respectively (Box 10). Details can be found in Appendix B, Table 4. These contributions are summarized in Table 6.

Box 5. Direct Contribution of the Crops Sector, 2010

Employment
60,431 jobs
Wages
$871M
Labor Income
$1,731M
Value-Added
$2,788M

Source: MIG (2011).
Note: Presented in current dollars.

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

Employment
9,540 jobs
(16% of Crops jobs)
Wages
$81M
(9% of Crops wages)
Labor Income
$342M
(20% of Crops labor income)
Value-Added
$548M
(20% of Crops value added)

Source: MIG (2011).
Note: Presented in current dollars.

Box 7. Direct Contribution of the Animal Agriculture Sector, 2010

Employment
52,050 jobs
Wages
$1,512M
Labor Income
$1,844M
Value-Added
$2,565M

Source: MIG (2011).
Note: Presented in current dollars.

Table 5. The Animal Agriculture Sector's Direct Contribution to Arkansas' Economy, 2010.

	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]	17,326	11.7	1.1	614	11.4	1.0	884	10.7	0.9
Processing [e]	34,724	23.4	2.2	1,231	22.8	2.0	1,681	20.4	1.7
Direct Impact	**52,050**	**35.0**	**3.4**	**1,844**	**34.2**	**3.0**	**2,565**	**31.1**	**2.7**

Source: Computed using the 2010 Arkansas database from MIG (2011).
Note: Presented in current dollars.

[a] Equivalent to full- and part-time jobs (MIG, 2000).

[b] Labor income represents all forms of employment income; it is the sum of employee compensation and proprietor income (MIG, 2000).

[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
37,343 jobs
(72% of Animal Agriculture jobs)
(1 out of 4 agricultural jobs)

Wages
$1,196M
(79% of Animal Agriculture wages)
(30% of agricultural wages)

Labor Income
$1,507M
(82% of Animal Agriculture labor income)
(28% of agricultural labor income)

Value-Added
$1,846M
(72% of Animal Agriculture value added)
($2 out of $9 agricultural value added)

Source: MIG (2011).
Note: Presented in current dollars.

Box 9. Direct Contribution of the Forestry Sector, 2010

Employment
27,081 jobs

Wages
$1,381M

Labor Income
$1,494M

Value-Added
$2,559M

Source: MIG (2011).
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 *Commercial Logging*

Employment
16,300 jobs
(60% of Forestry jobs)

Wages
$880M
(64% of Forestry wages)

Labor Income
$971M
(65% of Forestry labor income)

Value-Added
$1,736M
(68% of Forestry value added)

Source: MIG (2011).
Note: Presented in current dollars.

Table 6. The Forestry Sector's Direct Contribution to Arkansas' Economy, 2010.

	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]	4,886	3.3	0.3	217	4.0	0.3	282	3.4	0.3
Processing [e]	22,195	14.9	1.4	1,276	23.7	2.0	2,277	27.6	2.4
Direct Impact	**27,081**	**18.2**	**1.7**	**1,494**	**27.7**	**2.4**	**2,559**	**31.0**	**2.6**

Source: Computed using the 2010 Arkansas database from MIG (2011).
Note: Presented in current dollars.

[a] Equivalent to full- and part-time jobs (MIG, 2000).

[b] Labor income represents all forms of employment income; it is the sum of employee compensation and proprietor income (MIG, 2000).

[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.

2.4: Summary of the Contribution of Agriculture in 2010

In 2010, the Aggregate Agriculture Sector contributed 148,566 direct jobs, or almost 10% of state employment. In addition, the Aggregate Agriculture Sector contributed 107,677 indirect and induced jobs, for a total contribution of 17% of state employment (MIG, 2011). 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 two-thirds 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.

3: Report Summary

The GDP by State data from BEA indicates that Arkansas' Agriculture and Food Sector continues to contribute a larger share of GDP by State to the overall Arkansas state economy than does Agriculture and Food in other states of the southeastern U.S. According to 2010 IMPLAN data and subsequent analyses, over $0.16 of every $1 of the total state value added and 1 in 6 jobs can be attributed to agriculture. One in six dollars of labor income can be attributed to agriculture as well.

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] This report presents two economic analyses of the agricultural sector in Arkansas. The analyses have separate and distinct scopes, definitions, and methodologies and the results of each analysis should not be compared as they are different measures of economic contribution. Please see the Definitions and Styles section for more.

[2] GDP by State data are for years 1997-2010. IMPLAN data for Arkansas are for 2010. The value of production data from USDA, ERS, and NASS used in Figs. 6 and 7 are for 1987-2011.

[3] Throughout this report, all numerical references to agricultural trends are calculated using constant dollars, unless noted otherwise. The use of constant dollars factors in the effects of inflation, other economic fluctuations on price, and changes in the costs of inputs and allows for a value comparison over time. Constant dollars are derived from BEA's 2005 chained-dollar series, adjusted to a base year of 2010. BEA uses industry-specific deflators to adjust current dollars to constant dollars.

[4] GDP by State is a measurement of economic activity in the state economy. GDP by State is a similar measure to value added as defined by MIG, or the sum of employee compensation, proprietary income (e.g., rent payments), other property-type income, and indirect business taxes (e.g., sales taxes paid by individuals to firms). GDP by State is also equivalent to gross output minus the cost of intermediate output. However, GDP by State and value added are based on different data and estimated using different methodologies. Thus, while they are essentially the same measure, the estimated values are different.

[5] SIC definitions, used to categorize GDP by State and IMPLAN data in some previous reports, were based upon what was produced. It paid particular attention to manufacturing industries, as was appropriate for the economy of the 1930s when these definitions were created. The service sector of the economy has since developed in inconceivable ways. NAICS is designed to focus on how products and services are created resulting in major differences in industry groupings. NAICS categorizes data into one of two domains: goods producing or service providing. These domains are further divided into 12 super sectors and then broken into 20 industry sectors designated by two digits, compared with the eleven alphabetically designated divisions of SIC. Because of its increased number of sectors, NAICS allows for greater precision in data assignment and analyses. Only six of the twenty NAICS sectors had changes during the 2007 revision of NAICS. The sectors with changes in 2007 had no impact on the analyses presented here and the only sector of interest with any revision was: Sector 11 Agriculture, Forestry, Fishing and Hunting, in which sweet potato and yam farming was moved to sub-sector Potato Farming and algae, seaweed, and other plant aquaculture were moved to sub-sector Other Aquaculture. These were simply re-allocations within sectors and had no impact on overall totals.

[6] The BEA defines agricultural production as Agriculture, Forestry, and Fishing and Hunting. They define agricultural processing as: Wood Product Manufacturing; Furniture and Related Products Manufacturing; Food Manufacturing; Textile and Textile Product Mills; Apparel, Leather, and Allied Products Manufacturing; and Paper Manufacturing. Agricultural retail is Food Services and Drinking Places.

[7] The BEA includes Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia in the Southeast region. It is not equivalent to either Johnson, Bentley and Howell's (2009) definition of the South or the South census region.

[8] For purposes of this report, field and miscellaneous crops is the total value of crop production. Specifically, field and miscellaneous crops includes grains and hay, oilseeds, cotton, tobacco, sugar, dry beans, peas, lentils, potatoes, and other miscellaneous crops, but explicitly does not include fruits, nuts, or vegetables.

[9] For forestry reporting, the South includes 13 states: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Oklahoma, North Carolina, South Carolina, Tennessee, Texas, and Virginia. It is not equivalent to either BEA's Southeast region or the South census region.

[10] GDP by State is reported for agricultural retail but the output from this sector is not included in the economic contribution analysis and is not used to calculate direct contributions of the agriculture sector. However, this sector does represent an important contribution through the purchases made from direct agricultural sectors and these contributions are captured in the indirect contributions analysis.

[11] *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*).

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

[13] One important change in recent years occurred in the poultry production sector 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

AGFC (Arkansas Game and Fish Commission). 2011. Data for commercial hunting and trapping, fishing, wildlife management business, and resident hunting guide (GLH) licenses for 2011. Data available by request only. 2 Natural Resources Drive, Little Rock, AR 72205. www.agfc.com. Accessed 21 Sept. 2012.

ANRC (Arkansas Natural Resources Commission). 2012. Number of poultry farms in Arkansas. Data available by request only. 101 East Capitol, Suite 350, Little Rock, AR 72201. www.anrc.arkansas.gov. Accessed 18 Sept. 2012.

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). 2012. Rice milling annual average employment and total calendar wages. Data available by request only. 2 Capitol Mall, Little Rock, AR 72201. dws.arkansas.gov. Accessed 18 Sept. 2012.

Arkansas Forestry Commission. 2012. Production and value data for 2011. Data available by request only. 3821 West Roosevelt Road, Little Rock, AR 72204. www.forestry.state.ar.us. Accessed 18 Sept. 2012.

Bumgardner, M., Buehlmann, U., Schuler, A. and K. Koenig. 2012. "Housing trends and impact on wood products manufacturing." *Wood and Wood Products* 117(5): 17-18, 20, 22, 24.

Childs, N. and J. Kiawu. 2008. "What's behind the surge in global rice prices?" USDA ERS (U.S. Department of Agriculture Economic Research Service). *Amber Waves*, 6(3), September. webarchives.cdlib.org/sw1vh5dg3r/http://ers.usda.gov/AmberWaves/September08/PDF/RicePrices.pdf. Accessed 24 Sept. 2012.

Flanders, A. 2010. "AG1259-2010 Crop Enterprise Budgets for Arkansas Field Crops Planted in 2010 (All Crops) (Interactive MS Excel Files)." Arkansas Agricultural Experiment Station, University of Arkansas System Division of Agriculture. www.uaex.edu/depts/ag_economics/previous_budgets.htm. Accessed 21 Sept. 2012.

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.

Haydu, J. J., A. W. Hodges and C. R. Hall. 2006. Economic impact of the turfgrass and lawncare industry in the United States. EDIS document FE632. Food and Resource Economics Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL. April. www.edis.ifas.ufl.edu/pdffiles/FE/FE63200.pdf. Accessed 18 Sept. 2012.

Johnson, T.G., J.W. Bentley and M. Howell. 2009. The South's timber industry—An assessment of timber product output and use, 2007. USDA Forest Service. Resource Bulletin SRS-164. Southern Research Station. www.srs.fs.usda.gov/pubs/rb/rb_srs164.pdf. Accessed 18 Sept. 2012.

Kemper, N., J. Popp and W. Miller. 2009. Economic contribution of the agriculture sector to the Arkansas economy in 2007 and revised estimates for 2006. Research Report 987. Arkansas Agricultural Experiment Station Division of Agriculture, Fayetteville.

Kumcu, A. and P. Kaufman. 2011. "Food spending adjustments during recessionary times." *Amber Waves* 9(3), September. www.ers.usda.gov/media/206423/foodspending_1_.pdf. Accessed 18 Sept. 2012.

Lindall, S. 1998. "How does MIG estimate that pesky agricultural data anyway?" An MIG Knowledge Base Article. Minnesota IMPLAN Group, Inc., Stillwater, Minn.

Martinez, S. 2010. "Recession brings record number of new store-brand offerings." *Amber Waves*. 8(2), June. webarchives.cdlib.org/sw1vh5dg3r/http://www.ers.usda.gov/AmberWaves/June10/PDF/NewStoreBrand.pdf. Accessed 18 Sept. 2012.

McGraw, K., J. Popp and W. Miller. 2011. Economic contribution of the agriculture sector to the Arkansas economy in 2009. Research Report 990. Arkansas Agricultural Experiment Station, University of Arkansas System Division of Agriculture, Fayetteville.

McGraw, K., J. Popp and W. Miller. 2012a. Economic contribution of agriculture. Pocket guide. UA Division of Agriculture, Little Rock.

McGraw, K., J. Popp and W. Miller. 2012b. "Economic contribution of agriculture to the Arkansas economy in 2010." Fact sheet. University of Arkansas System Division of Agriculture, Little Rock.

MIG (Minnesota IMPLAN Group, Inc.). 2000. IMPLAN Professional Version 2.0 Social Accounting and Impact Analysis Software User Guide, Analysis Guide, and Data Guide. 2nd edition. Stillwater, Minn.

MIG (Minnesota IMPLAN Group, Inc.). 2011. IMPLAN data files: 2010 data for state of Arkansas. Stillwater, Minn.

Mississippi Forestry Association. 2010. "Mississippi Forest Facts." www.msforestry.net. Accessed 18 Sept. 2012.

NBER (National Bureau for Economic Research). 2010. "September 20, 2010 announcement." www.nber.org/cycles/sept2010.pdf. Accessed 18 Sept. 2012.

NBER (National Bureau for Economic Research). 2011. "U.S. business cycle expansions and contractions." www.nber.org/cycles.html. Accessed 18 Sept. 2012.

Olson, D. and S. Lindall. 2009. IMPLAN Professional Version 2.0 Software, Analysis, and Data Guide. Minnesota IMPLAN Group, Inc. Stillwater, Minn.

Oswalt, C.M., S.N. Oswalt, T.G. Johnson, J.L. Chamberlain, K.C. Randolph and J.W. Coulston. 2009. Tennessee's forests, 2004. USDA Forest Service. Resource Bulletin SRS-144. Southern Research Station. www.treesearch.fs.fed.us/pubs/32506. Accessed 18 Sept. 2012.

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.

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.

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.

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.

Schuler, A., R. Taylor and P. Araman. 2001. "Competitiveness of U.S. wood furniture manufacturers: Lessons learned from the softwood molding industry." *Forest Production*, 55: 14-20.

Simard, G. 1999. "Logging Industry: Manufacturing, Construction and Energy Division." www.statcan.gc.ca/pub/25f0002m/25f0002m1999001-eng.htm. Accessed 18 Sept. 2012.

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.

Sundell, P. 2011. "Measuring agriculture's contribution to gross domestic product." Methodology Notes for *Amber Waves* Indicators. webarchives.cdlib.org/wayback.public/UERS_ag_1/20111129033246/http://www.ers.usda.gov/AmberWaves/About/IndicatorsNotes.htm. Accessed 21 Sept. 2012.

Sundell, P. and M. Shane. 2012. The 2009-09 recession and recovery: Implications for the growth and financial health of U.S. agriculture. WRS-1201. www.ers.usda.gov/media/619162/wrs1201_1_.pdf. Accessed 24 Sept. 2012.

Trostle, R. 2008. "Global agricultural supply and demand: Factors contributing to the recent increase in food commodity prices/ WRS-0801." www.ers.usda.gov/Publications/WRS0801/WRS0801.pdf. Accessed 21 Sept. 2012.

Trostle, R., D. Marti, S. Rosen and P. Westcott. 2011. Why have commodity prices risen again? WRS-1103. www.ers.usda.gov/media/126752/wrs1103.pdf. Accessed 21 Sept. 2012.

USCB (U.S. Census Bureau). 2006. 2007 North American Classification System (NAICS). www.census.gov/eos/www/naics/. Accessed 18 Sept. 2012.

USCB (U.S. Census Bureau). 2012a. "Frequently asked questions (FAQs)." www.census.gov/eos/www/naics/faqs/faqs.html. Accessed 18 Sept. 2012.

USCB (U.S. Census Bureau). 2012b. "New privately owned housing units started: Annual data, 1959 to 2011."

New Residential Construction: Historical data. www.census.gov/construction/nrc/pdf/startsan.pdf. Accessed 18 Sept. 2012.

USDA (U.S. Department of Agriculture). 2007. Census of Agriculture. www.agcensus.usda.gov/Publications/2007/Full_Report/index.asp. Accessed 18 Sept. 2012.

USDA ERS (U.S. Department of Agriculture Economic Research Service). 2011. Food expenditures: Data files. "Table 12—Food expenditures at constant prices." www.ers.usda.gov/data-products/food-expenditures.aspx. Accessed 21 Sept. 2012.

USDA ERS (U.S. Department of Agriculture Economic Research Service). 2012a. Rice Yearbook 2010/11: 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?documentID=1229. Accessed 18 Sept. 2012.

USDA ERS (U.S. Department of Agriculture Economic Research Service). 2012b. U.S. and state farm income and wealth statistics: Data files for Arkansas. "Annual cash receipts, by commodity groups and selected commodities, by State, 2000-2011." www.ers.usda.gov/data-products/farm-income-and-wealth-statistics.aspx. Accessed 21 Sept. 2012.

USDA ERS (U.S. Department of Agriculture Economic Research Service). 2012c. U.S. and state farm income and wealth statistics: Data files for states and U.S. "Farm real estate values." www.ers.usda.gov/data-products/farm-income-and-wealth-statistics.aspx. Accessed 21 Sept. 2012.

USDA ERS (U.S. Department of Agriculture Economic Research Service). 2012d. U.S. and state farm income and wealth statistics: Data files for states and U.S. "Tabs in this workbook summarize data from 1949 to 2011 on net value added, net farm income, net cash income, value of crop/livestock production, value of direct government payments, and more." www.ers.usda.gov/data-products/farm-income-and-wealth-statistics.aspx. Accessed 21 Sept. 2012.

USDA ERS (U.S. Department of Agriculture Economic Research Service). 2012e. U.S. and state farm income and wealth statistics: Data files for U.S. "Cash receipts, by commodity groups and selected commodities, 1924-2011." www.ers.usda.gov/data-products/farm-income-and-wealth-statistics.aspx. Accessed 21 Sept. 2012.

USDA FAS (U.S. Department of Agriculture Foreign Agricultural Service). 2001. "Trade and agriculture: What's at stake for Arkansas?" www.fas.usda.gov/info/factsheets/WTO/states/ar.asp. Accessed 21 Sept. 2012.

USDA (U.S. Department of Agriculture) Forest Service. 2012. Forest Inventory and Analysis National Program FIDO (Forest Inventory Data Online) database. "Arkansas: Area, in acres, by county and forest-type group." Data for 2011. apps.fs.fed.us/fido/. Accessed 18 Sept. 2012.

USDA NASS (U.S. Department of Agriculture National Agricultural Statistics Service). 2012a. Commodity production and values data for 2007-2011. usda.mannlib.cornell.edu/MannUsda/homepage.do;jsessionid=118B9D6A6FF48DA1BEC379A03362B1D0. Accessed 18 Sept. 2012.

USDA NASS (U.S. Department of Agriculture National Agricultural Statistics Service). 2012b. "Index for price received, annual average, 1990-1992." Data for 1987-2011. quickstats.nass.usda.gov/. Accessed 18 Sept. 2012.

USDC BEA (U.S. Department of Commerce Bureau of Economic Analysis). 2012. Gross domestic product by state database. Chained and nominal data for 1997-2010. www.bea.gov/iTable/iTable.cfm?ReqID=70&step=1. Accessed 18 Sept. 2012.

Wall, H. J. 2000. "Now and forever NAFTA." research.stlouisfed.org/publications/regional/00/04/NAFTA.pdf. Accessed 18 Sept. 2012.

Appendix A
Description of IMPLAN Sectors and Aggregation Schemes

Table 1. Components of the Crops Sector as Defined by IMPLAN Sectors, 2010.

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, 2010.

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, 2010.

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, 2010.

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 acessories 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, 2010.

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million $)	Value Added (Million $)
60	Poultry processing	29,139	976.530	1,169.247
2	Grain farming	19,267	61.525	69.906
1	Oilseed farming	13,300	307.504	519.504
319	Wholesale trade businesses	9,976	636.019	1,131.667
413	Food services and drinking places	8,556	129.704	202.342
19	Support activities for agriculture and forestry	8,274	313.407	306.783
13	Poultry and egg production	8,204	530.952	676.817
N/A	Rice farming	7,942	233.764	290.884
335	Transport by truck	7,194	343.483	414.391
360	Real estate establishments	6,623	71.974	527.477
53	Frozen food manufacturing	4,561	202.371	309.455
11	Cattle ranching and farming	4,553	45.047	103.746
14	Animal production, except cattle and poultry	4,396	36.043	93.685
95	Sawmills and wood preservation	4,394	196.839	221.834
16	Commercial logging	4,327	185.220	181.380
394	Offices of physicians, dentists, and other health practitioners	3,481	243.710	251.667
105	Paper mills	3,470	333.976	778.679
381	Management of companies and enterprises	3,039	309.264	354.757
39	Maintenance and repair construction of nonresidential structures	2,904	101.575	122.741
397	Private hospitals	2,709	134.282	146.627
107	Paperboard container manufacturing	2,510	149.922	192.316
355	Nondepository credit intermediation and related activities	2,441	120.706	126.561
398	Nursing and residential care facilities	2,298	63.265	72.791
329	Retail Stores - General merchandise	2,211	53.207	82.938
62	Bread and bakery product manufacturing	2,121	94.053	127.057
388	Services to buildings and dwellings	1,925	37.885	49.968
8	Cotton farming	1,914	140.523	101.498
382	Employment services	1,887	38.388	41.371
59	Animal (except poultry) slaughtering, rendering, and processing	1,877	83.751	96.189
324	Retail Stores - Food and beverage	1,807	45.120	65.056
340	Warehousing and storage	1,738	62.836	80.406
96	Veneer and plywood manufacturing	1,735	97.181	113.324
354	Monetary authorities and depository credit intermediation activities	1,697	68.610	193.770
414	Automotive repair and maintenance, except car washes	1,676	58.215	66.707
99	Wood windows and doors and millwork manufacturing	1,657	64.748	74.133
111	Sanitary paper product manufacturing	1,599	104.833	362.075
N/A	Rice milling	1,598	108.729	257.321
333	Transport by rail	1,553	149.245	252.538
426	Private household operations	1,537	13.852	13.852
400	Individual and family services	1,475	31.509	29.958
109	All other paper bag and coated and treated paper manufacturing	1,447	75.675	100.524
320	Retail Stores - Motor vehicle and parts	1,399	58.675	65.264
20	Extraction of oil and natural gas	1,392	59.347	107.435
356	Securities, commodity contracts, investments, and related activities	1,288	35.654	37.551
368	Accounting, tax preparation, bookkeeping, and payroll services	1,272	55.639	73.906
31	Electric power generation, transmission, and distribution	1,219	128.239	502.700
93	Footwear manufacturing	1,215	35.049	43.904
432	Other state and local government enterprises	1,207	66.195	50.534
425	Civic, social, professional, and similar organizations	1,201	35.630	35.535

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million $)	Value Added (Million $)
54	Fruit and vegetable canning, pickling, and drying	1,197	66.270	141.985
330	Retail Stores - Miscellaneous	1,181	20.037	30.611
65	Snack food manufacturing	1,151	64.079	235.242
10	All other crop farming	1,092	90.073	70.870
367	Legal services	1,080	58.268	89.032
42	Other animal food manufacturing	951	62.995	165.493
331	Retail Nonstores - Direct and electronic sales	949	10.575	19.471
327	Retail Stores - Clothing and clothing accessories	922	15.035	21.635
411	Hotels and motels, including casino hotels	904	15.791	31.174
399	Child day care services	872	17.188	21.595
296	Upholstered household furniture manufacturing	840	31.574	45.824
100	Wood container and pallet manufacturing	819	23.882	31.608
63	Cookie, cracker, and pasta manufacturing	816	41.200	91.430
325	Retail Stores - Health and personal care	796	29.096	38.606
357	Insurance carriers	780	39.891	116.743
85	All other textile product mills	757	39.734	63.483
369	Architectural, engineering, and related services	751	41.172	41.853
86	Apparel knitting mills	740	21.175	26.515
295	Wood kitchen cabinet and countertop manufacturing	735	24.021	21.670
106	Paperboard mills	729	67.172	137.983
323	Retail Stores - Building material and garden supply	725	22.717	32.874
326	Retail Stores - Gasoline stations	714	16.189	27.552
70	Soft drink and ice manufacturing	712	49.588	66.462
374	Management, scientific, and technical consulting services	668	37.659	39.489
41	Dog and cat food manufacturing	660	29.889	138.993
386	Business support services	653	16.796	16.622
396	Medical and diagnostic labs and outpatient and other ambulatory care services	606	29.090	36.006
149	Other plastics product manufacturing	586	24.459	35.696
15	Forestry, forest products, and timber tract production	559	32.264	100.541
142	Plastics packaging materials and unlaminated film and sheet manufacturing	555	31.733	53.306
328	Retail Stores - Sporting goods, hobby, book and music	548	9.239	13.889
98	Reconstituted wood product manufacturing	527	31.085	80.705
380	All other miscellaneous professional, scientific, and technical services	517	15.790	47.823
339	Couriers and messengers	512	16.875	29.509
351	Telecommunications	501	36.058	122.496
393	Other private educational services	498	15.969	15.661
338	Scenic and sightseeing transportation and support activities for transportation	495	31.996	35.607
391	Private elementary and secondary schools	488	12.462	9.033
401	Community food, housing, and other relief services, including rehabilitation services	485	12.705	12.219
377	Advertising and related services	467	18.780	31.189
419	Personal care services	464	12.764	13.613
395	Home health care services	460	17.615	17.970
392	Private junior colleges, colleges, universities, and professional schools	445	14.186	14.539
97	Engineered wood member and truss manufacturing	440	17.534	22.810
417	Commercial and industrial machinery and equipment repair and maintenance	432	20.842	25.326

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million $)	Value Added (Million $)
55	Fluid milk and butter manufacturing	422	22.609	37.136
32	Natural gas distribution	420	35.772	113.213
18	Commercial hunting and trapping	415	2.092	21.010
427	US Postal Service	414	31.579	30.856
387	Investigation and security services	409	9.762	9.942
403	Spectator sports companies	409	3.895	4.067
322	Retail Stores - Electronics and appliances	398	14.262	18.653
424	Grantmaking, giving, and social advocacy organizations	397	13.536	13.061
108	Coated and laminated paper, packaging paper and plastics film manufacturing	396	25.994	44.458
321	Retail Stores - Furniture and home furnishings	385	11.589	18.659
410	Other amusement and recreation industries	368	5.400	10.135
379	Veterinary services	364	10.047	10.085
46	Fats and oils refining and blending	363	18.083	53.859
88	Men's and boys' cut and sew apparel manufacturing	361	10.178	13.079
409	Amusement parks, arcades, and gambling industries	359	5.247	7.223
341	Newspaper publishers	355	11.223	15.373
372	Computer systems design services	354	26.143	14.569
421	Dry-cleaning and laundry services	344	12.136	12.374
407	Fitness and recreational sports centers	339	3.746	5.687
6	Greenhouse, nursery, and floriculture production	326	46.580	27.393
17	Commercial Fishing	316	3.242	3.967
390	Waste management and remediation services	282	11.805	22.818
68	Seasoning and dressing manufacturing	280	9.427	13.842
297	Nonupholstered wood household furniture manufacturing	277	8.807	12.578
358	Insurance agencies, brokerages, and related activities	273	14.017	16.797
362	Automotive equipment rental and leasing	260	10.534	30.169
71	Breweries	256	24.530	112.430
91	Apparel accessories and other apparel manufacturing	227	5.251	5.030
348	Radio and television broadcasting	226	12.412	17.256
141	All other chemical product and preparation manufacturing	220	15.725	22.803
3	Vegetable and melon farming	213	32.536	22.453
404	Promoters of performing arts and sports and agents for public figures	210	2.847	3.442
40	Maintenance and repair construction of residential structures	210	6.151	7.406
58	Ice cream and frozen dessert manufacturing	195	8.999	15.730
359	Funds, trusts, and other financial vehicles	195	5.333	10.355
402	Performing arts companies	192	2.086	1.985
376	Scientific research and development services	184	11.538	11.544
420	Death care services	183	8.433	7.596
384	Office administrative services	181	9.445	8.734
103	All other miscellaneous wood product manufacturing	181	5.330	8.420
45	Soybean and other oilseed processing	180	9.531	26.571
69	All other food manufacturing	178	5.888	10.288
12	Dairy cattle and milk production	174	1.587	9.582
389	Other support services	169	5.428	9.003
365	Commercial and industrial machinery and equipment rental and leasing	168	11.837	25.850
110	Stationery product manufacturing	158	5.762	8.062
418	Personal and household goods repair and maintenance	158	4.953	6.524
336	Transit and ground passenger transportation	157	3.330	4.751
113	Printing	153	6.932	8.502

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million $)	Value Added (Million $)
300	Office furniture manufacturing	149	5.617	12.269
47	Breakfast cereal manufacturing	146	7.936	38.578
431	State and local government electric utilities	145	9.045	14.411
415	Car washes	142	2.594	2.838
158	Glass container manufacturing	131	7.085	14.061
422	Other personal services	130	4.082	4.729
84	Textile bag and canvas mills	125	5.559	7.850
416	Electronic and precision equipment repair and maintenance	123	6.136	8.159
412	Other accommodations	119	2.553	3.903
423	Religious organizations	113	3.036	3.410
61	Seafood product preparation and packaging	113	3.032	3.658
195	Machine shops	109	4.985	6.018
373	Other computer related services, including facilities management	106	7.622	17.848
346	Motion picture and video industries	106	1.805	3.918
370	Specialized design services	102	4.728	8.952
125	All other basic inorganic chemical manufacturing	101	9.354	15.310
283	Motor vehicle parts manufacturing	100	5.029	6.442
33	Water, sewage and other treatment and delivery systems	100	4.584	10.835
363	General and consumer goods rental except video tapes and discs	96	4.329	5.367
246	Printed circuit assembly (electronic assembly) manufacturing	96	3.866	4.802
332	Transport by air	82	4.432	7.761
94	Other leather and allied product manufacturing	80	3.215	3.952
126	Other basic organic chemical manufacturing	79	7.860	11.509
352	Data processing, hosting, ISP, web search portals and related services	78	3.894	10.905
115	Petroleum refineries	76	8.170	37.538
207	Other industrial machinery manufacturing	76	4.721	5.547
190	Metal can, box, and other metal container (light gauge) manufacturing	75	4.517	11.573
78	Nonwoven fabric mills	74	5.110	10.741
429	Other Federal Government enterprises	72	3.165	4.333
148	Plastics bottle manufacturing	68	4.045	7.778
301	Custom architectural wood manufacturing	68	3.582	4.131
56	Cheese manufacturing	67	4.163	5.571
72	Wineries	66	5.023	8.765
4	Fruit farming	66	7.380	4.871
344	Directory, mailing list, and other publishers	61	3.165	7.273
364	Video tape and disc rental	57	0.975	1.918
143	Unlaminated plastics profile shape manufacturing	56	2.986	4.296
203	Farm machinery and equipment manufacturing	56	2.478	5.461
43	Flour milling and malt manufacturing	53	2.773	6.564
147	Urethane and other foam product (except polystyrene) manufacturing	53	3.482	5.480
130	Fertilizer manufacturing	51	4.641	8.221
247	Other electronic component manufacturing	51	2.759	2.980
371	Custom computer programming services	46	2.691	2.532
302	Showcase, partition, shelving, and locker manufacturing	43	2.244	2.902
197	Coating, engraving, heat treating and allied activities	41	1.627	2.493
29	Support activities for oil and gas operations	40	2.614	2.743
228	Material handling equipment manufacturing	40	1.938	2.891
44	Wet corn milling	39	3.080	8.237
430	State and local government passenger transit	39	1.539	0.443
375	Environmental and other technical consulting services	38	2.282	2.290

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million $)	Value Added (Million $)
52	Nonchocolate confectionery manufacturing	37	1.196	2.237
342	Periodical publishers	37	1.594	2.381
112	All other converted paper product manufacturing	36	1.742	2.499
90	Other cut and sew apparel manufacturing	36	0.768	0.825
145	Laminated plastics plate, sheet (except packaging), and shape manufacturing	33	2.238	3.237
337	Transport by pipeline	33	14.099	13.567
309	Dental laboratories manufacturing	32	1.510	1.572
146	Polystyrene foam product manufacturing	32	1.517	3.222
67	Flavoring syrup and concentrate manufacturing	32	2.133	19.065
51	Confectionery manufacturing from purchased chocolate	31	0.375	0.935
405	Independent artists, writers, and performers	30	0.936	1.389
383	Travel arrangement and reservation services	30	0.908	1.632
308	Ophthalmic goods manufacturing	29	1.363	3.201
139	Toilet preparation manufacturing	28	2.340	6.530
89	Women's and girls' cut and sew apparel manufacturing	28	0.770	1.161
220	Cutting tool and machine tool accessory manufacturing	26	1.455	1.702
185	Handtool manufacturing	26	1.209	2.173
406	Museums, historical sites, zoos, and parks	26	0.958	1.736
243	Semiconductor and related device manufacturing	26	1.271	2.910
101	Manufactured home (mobile home) manufacturing	25	0.790	0.776
140	Printing ink manufacturing	25	2.592	2.209
5	Tree nut farming	24	1.142	1.178
87	Cut and sew apparel contractors	24	0.712	0.848
80	Textile and fabric finishing mills	23	0.503	0.702
131	Pesticide and other agricultural chemical manufacturing	22	1.729	7.029
378	Photographic services	21	0.402	1.144
144	Plastics pipe and pipe fitting manufacturing	21	1.135	1.750
118	Petroleum lubricating oil and grease manufacturing	21	1.488	4.208
73	Distilleries	20	1.761	15.431
267	Motor and generator manufacturing	18	1.135	2.278
314	Sign manufacturing	18	0.718	0.648
334	Transport by water	18	1.270	2.774
270	Storage battery manufacturing	16	1.033	1.582
366	Lessors of nonfinancial intangible assets	16	0.520	21.917
21	Mining coal	16	1.304	2.790
83	Curtain and linen mills	15	0.435	0.774
350	Internet publishing and broadcasting	15	0.740	0.716
81	Fabric coating mills	14	0.613	0.829
198	Valve and fittings other than plumbing manufacturing	13	0.781	1.516
269	Relay and industrial control manufacturing	13	0.863	1.428
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	13	0.721	0.874
240	Audio and video equipment manufacturing	12	0.582	0.682
242	Bare printed circuit board manufacturing	12	0.619	0.645
385	Facilities support services	12	0.462	0.640
137	Adhesive manufacturing	12	1.411	1.806
27	Mining and quarrying other nonmetallic minerals	11	0.537	0.972
135	Biological product (except diagnostic) manufacturing	11	0.585	1.053
122	Synthetic dye and pigment manufacturing	9	0.712	0.955

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million $)	Value Added (Million $)
219	Special tool, die, jig, and fixture manufacturing	9	0.454	0.498
345	Software publishers	9	0.629	1.381
64	Tortilla manufacturing	9	0.300	0.501
306	Surgical appliance and supplies manufacturing	9	0.600	1.403
127	Plastics material and resin manufacturing	8	0.743	1.145
303	Mattress manufacturing	8	0.261	0.572
343	Book publishers	8	0.360	0.828
117	Asphalt shingle and coating materials manufacturing	8	0.537	2.336
307	Dental equipment and supplies manufacturing	8	0.381	0.786
25	Mining and quarrying stone	8	0.442	1.366
196	Turned product and screw, nut, and bolt manufacturing	8	0.340	0.523
114	Support activities for printing	7	0.274	0.317
82	Carpet and rug mills	7	0.270	0.566
194	Spring and wire product manufacturing	7	0.285	0.511
193	Hardware manufacturing	7	0.311	0.575
222	Turbine and turbine generator set units manufacturing	7	0.389	1.022
133	Pharmaceutical preparation manufacturing	7	0.560	1.621
116	Asphalt paving mixture and block manufacturing	6	0.559	1.775
174	Aluminum product manufacturing from purchased aluminum	6	0.413	0.577
66	Coffee and tea manufacturing	6	0.153	0.313
317	All other miscellaneous manufacturing	6	0.195	0.344
305	Surgical and medical instrument, laboratory and medical instrument manufacturing	6	0.400	0.720
266	Power, distribution, and specialty transformer manufacturing	6	0.345	0.640
57	Dry, condensed, and evaporated dairy product manufacturing	6	0.381	0.870
408	Bowling centers	6	0.076	0.160
208	Plastics and rubber industry machinery manufacturing	6	0.274	0.344
151	Rubber and plastics hoses and belting manufacturing	6	0.356	0.525
121	Industrial gas manufacturing	6	0.533	1.258
353	Other information services	5	0.212	0.352
349	Cable and other subscription programming	5	0.237	0.597
204	Lawn and garden equipment manufacturing	5	0.162	0.312
159	Glass product manufacturing made of purchased glass	5	0.263	0.362
272	Communication and energy wire and cable manufacturing	5	0.361	0.668
201	Fabricated pipe and pipe fitting manufacturing	5	0.262	0.456
213	Other commercial and service industry machinery manufacturing	5	0.285	0.429
199	Plumbing fixture fitting and trim manufacturing	5	0.223	0.705
245	Electronic connector manufacturing	5	0.234	0.273
157	Other pressed and blown glass and glassware manufacturing	5	0.198	0.321
138	Soap and cleaning compound manufacturing	4	0.269	1.006
24	Mining gold, silver, and other metal ore	4	0.451	1.686
273	Wiring device manufacturing	4	0.204	0.385
263	Household refrigerator and home freezer manufacturing	4	0.232	0.442
187	Ornamental and architectural metal products manufacturing	4	0.218	0.288
171	Steel product manufacturing from purchased steel	4	0.269	0.327
170	Iron and steel mills and ferroalloy manufacturing	4	0.436	0.648
102	Prefabricated wood building manufacturing	4	0.120	0.142
347	Sound recording industries	4	0.136	0.638
282	Travel trailer and camper manufacturing	3	0.110	0.108
183	Crown and closure manufacturing and metal stamping	3	0.178	0.259

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million $)	Value Added (Million $)
278	Heavy duty truck manufacturing	3	0.207	0.246
252	Totalizing fluid meters and counting devices manufacturing	3	0.107	0.138
152	Other rubber product manufacturing	3	0.162	0.244
274	Carbon and graphite product manufacturing	3	0.180	0.301
311	Sporting and athletic goods manufacturing	3	0.113	0.204
202	Other fabricated metal manufacturing	3	0.161	0.248
260	Lighting fixture manufacturing	3	0.152	0.246
275	All other miscellaneous electrical equipment and component manufacturing	3	0.176	0.211
279	Motor vehicle body manufacturing	3	0.147	0.193
251	Industrial process variable instruments manufacturing	3	0.150	0.170
244	Electronic capacitor, resistor, coil, transformer, and other inductor manufacturing	2	0.109	0.132
256	Watch, clock, and other measuring and controlling device manufacturing	2	0.117	0.140
286	Other aircraft parts and auxiliary equipment manufacturing	2	0.138	0.177
132	Medicinal and botanical manufacturing	2	0.141	0.202
298	Metal and other household furniture (except wood) manufacturing	2	0.070	0.114
186	Plate work and fabricated structural product manufacturing	2	0.114	0.174
280	Truck trailer manufacturing	2	0.086	0.090
172	Alumina refining and primary aluminum production	2	0.164	0.221
238	Broadcast and wireless communications equipment manufacturing	2	0.127	0.142
225	Other engine equipment manufacturing	2	0.092	0.158
224	Mechanical power transmission equipment manufacturing	2	0.067	0.099
237	Telephone apparatus manufacturing	2	0.136	0.216
291	Boat building	2	0.060	0.068
134	In-vitro diagnostic substance manufacturing	1	0.073	0.084
268	Switchgear and switchboard apparatus manufacturing	1	0.085	0.176
289	Railroad rolling stock manufacturing	1	0.070	0.122
229	Power-driven handtool manufacturing	1	0.073	0.140
184	Cutlery, utensil, pot, and pan manufacturing	1	0.068	0.145
230	Other general purpose machinery manufacturing	1	0.068	0.087
264	Household laundry equipment manufacturing	1	0.105	0.303
76	Broadwoven fabric mills	1	0.064	0.105
153	Pottery, ceramics, and plumbing fixture manufacturing	1	0.049	0.064
231	Packaging machinery manufacturing	1	0.063	0.073
192	Arms, ordnance, and accessories manufacturing	1	0.079	0.226
214	Air purification and ventilation equipment manufacturing	1	0.054	0.074
284	Aircraft manufacturing	1	0.073	0.110
200	Ball and roller bearing manufacturing	1	0.066	0.152
75	Fiber, yarn, and thread mills	1	0.036	0.050
299	Institutional furniture manufacturing	1	0.038	0.062
250	Automatic environmental control manufacturing	1	0.038	0.052
150	Tire manufacturing	1	0.069	0.107
216	Air conditioning, refrigeration, and warm air heating equipment manufacturing	1	0.042	0.078
313	Office supplies (except paper) manufacturing	1	0.044	0.099
169	Miscellaneous nonmetallic mineral product manufacturing	1	0.058	0.115
50	Chocolate and confectionery manufacturing from cacao beans	1	0.028	0.045
254	Analytical laboratory instrument manufacturing	1	0.037	0.045

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million $)	Value Added (Million $)
236	Computer terminals and other computer peripheral equipment manufacturing	1	0.027	0.032
205	Construction machinery manufacturing	1	0.031	0.056
221	Rolling mill and other metalworking machinery manufacturing	1	0.042	0.051
162	Concrete pipe, brick, and block manufacturing	1	0.029	0.052
249	Search, detection, and navigation instruments manufacturing	1	0.037	0.050
191	Ammunition manufacturing	1	0.037	0.115
180	Nonferrous metal foundries	1	0.025	0.028
206	Mining and oil and gas field machinery manufacturing	0	0.026	0.040
177	Copper rolling, drawing, extruding and alloying	0	0.025	0.042
218	Metal cutting and forming machine tool manufacturing	0	0.021	0.024
217	Industrial mold manufacturing	0	0.020	0.022
315	Gasket, packing, and sealing device manufacturing	0	0.023	0.032
119	All other petroleum and coal products manufacturing	0	0.028	0.075
178	Nonferrous metal (except copper and aluminum) rolling, drawing, extruding and alloying	0	0.023	0.040
211	Optical instrument and lens manufacturing	0	0.017	0.021
290	Ship building and repairing	0	0.017	0.020
318	Broom, brush, and mop manufacturing	0	0.016	0.039
166	Cut stone and stone product manufacturing	0	0.010	0.011
210	Vending, commercial, industrial, and office machinery manufacturing	0	0.009	0.010
188	Power boiler and heat exchanger manufacturing	0	0.018	0.029
261	Small electrical appliance manufacturing	0	0.015	0.040
161	Ready-mix concrete manufacturing	0	0.013	0.019
163	Other concrete product manufacturing	0	0.014	0.020
227	Air and gas compressor manufacturing	0	0.014	0.021
285	Aircraft engine and engine parts manufacturing	0	0.016	0.024
226	Pump and pumping equipment manufacturing	0	0.010	0.017
312	Doll, toy, and game manufacturing	0	0.007	0.014
233	Fluid power process machinery manufacturing	0	0.012	0.016
165	Abrasive product manufacturing	0	0.010	0.022
310	Jewelry and silverware manufacturing	0	0.007	0.011
136	Paint and coating manufacturing	0	0.008	0.012
316	Musical instrument manufacturing	0	0.003	0.004
189	Metal tank (heavy gauge) manufacturing	0	0.004	0.005
164	Lime and gypsum product manufacturing	0	0.004	0.010
253	Electricity and signal testing instruments manufacturing	0	0.004	0.004
257	Software, audio, and video media for reproduction	0	0.001	0.002
168	Mineral wool manufacturing	0	0.002	0.003
287	Guided missile and space vehicle manufacturing	0	0.003	0.003
294	All other transportation equipment manufacturing	0	0.001	0.002
179	Ferrous metal foundries	0	0.001	0.002
128	Synthetic rubber manufacturing	0	0.003	0.004
154	Brick, tile, and other structural clay product manufacturing	0	0.001	0.003
182	Custom roll forming	0	0.001	0.002
181	All other forging, stamping, and sintering	0	0.001	0.001
160	Cement manufacturing	0	0.001	0.002
30	Support activities for other mining	0	0.001	0.001
129	Artificial and synthetic fibers and filaments manufacturing	0	0.001	0.001
259	Electric lamp bulb and part manufacturing	0	0.000	0.000

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million $)	Value Added (Million $)
292	Motorcycle, bicycle, and parts manufacturing	0	0.000	0.001
173	Secondary smelting and alloying of aluminum	0	0.000	0.000
167	Ground or treated mineral and earth manufacturing	0	0.000	0.001
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
34	Construction of new nonresidential commercial and health care structures	0	0.000	0.000
35	Construction of new nonresidential manufacturing structures	0	0.000	0.000
36	Construction of other new nonresidential structures	0	0.000	0.000
37	Construction of new residential permanent site single- and multi-family structures	0	0.000	0.000
38	Construction of other new residential structures	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
92	Leather and hide tanning and finishing	0	0.000	0.000
104	Pulp mills	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
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
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
239	Other communications equipment 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
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

Table 1. (Continued).

Sector ID	Aggregate Agriculture Contribution to	Employment (Jobs)	Income (Million $)	Value Added (Million $)
293	Military armored vehicle, tank, and tank component manufacturing	0	0.000	0.000
304	Blind and shade manufacturing	0	0.000	0.000
361	Imputed rental activity for owner-occupied dwellings	0	0.000	695.762
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
437	* Employment and payroll only (state & local govt, non-education)	0	0.000	0.000
438	* Employment and payroll only (state & local govt, education)	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		**256,244**	**9,767.041**	**16,003.372**

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, 2010.

Sector ID	Crops Sector Contribution to	Employment (Jobs)	Income (Million $)	Value Added (Million $)
2	Grain farming	19,267	61.525	69.906
1	Oilseed farming	13,300	307.504	519.504
N/A	Rice farming	7,942	233.764	290.884
53	Frozen food manufacturing	4,561	202.371	309.455
62	Bread and bakery product manufacturing	2,121	94.053	127.057
8	Cotton farming	1,914	140.523	101.498
N/A	Rice milling	1,598	108.729	257.321
54	Fruit and vegetable canning, pickling, and drying	1,197	66.270	141.985
65	Snack food manufacturing	1,151	64.079	235.242
10	All other crop farming	1,092	90.073	70.870
63	Cookie, cracker, and pasta manufacturing	816	41.200	91.430
85	All other textile product mills	757	39.734	63.483
86	Apparel knitting mills	740	21.175	26.515
70	Soft drink and ice manufacturing	712	49.588	66.462
46	Fats and oils refining and blending	363	18.083	53.859
88	Men's and boys' cut and sew apparel manufacturing	361	10.178	13.079
6	Greenhouse, nursery, and floriculture production	326	46.580	27.393
68	Seasoning and dressing manufacturing	280	9.427	13.842
71	Breweries	256	24.530	112.430
91	Apparel accessories and other apparel manufacturing	227	5.251	5.030
3	Vegetable and melon farming	213	32.536	22.453
45	Soybean and other oilseed processing	180	9.531	26.571
69	All other food manufacturing	178	5.888	10.288
47	Breakfast cereal manufacturing	146	7.936	38.578
84	Textile bag and canvas mills	125	5.559	7.850
78	Nonwoven fabric mills	74	5.110	10.741
72	Wineries	66	5.023	8.765
4	Fruit farming	66	7.380	4.871
43	Flour milling and malt manufacturing	53	2.773	6.564
44	Wet corn milling	39	3.080	8.237
52	Nonchocolate confectionery manufacturing	37	1.196	2.237
90	Other cut and sew apparel manufacturing	36	0.768	0.825
67	Flavoring syrup and concentrate manufacturing	32	2.133	19.065
51	Confectionery manufacturing from purchased chocolate	31	0.375	0.935
89	Women's and girls' cut and sew apparel manufacturing	28	0.770	1.161
5	Tree nut farming	24	1.142	1.178
87	Cut and sew apparel contractors	24	0.712	0.848
80	Textile and fabric finishing mills	23	0.503	0.702
73	Distilleries	20	1.761	15.431
83	Curtain and linen mills	15	0.435	0.774
81	Fabric coating mills	14	0.613	0.829
64	Tortilla manufacturing	9	0.300	0.501
82	Carpet and rug mills	7	0.270	0.566
66	Coffee and tea manufacturing	6	0.153	0.313
76	Broadwoven fabric mills	1	0.064	0.105
75	Fiber, yarn, and thread mills	1	0.036	0.050
50	Chocolate and confectionery manufacturing from cacao beans	1	0.028	0.045
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		**60,431**	**1,730.717**	**2,787.730**

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, 2010.

Sector ID	Animal Agriculture Sector Contribution to:	Employment (Jobs)	Income (Million $)	Value Added (Million $)
60	Poultry processing	29,139	976.530	1,169.247
13	Poultry and egg production	8,204	530.952	676.817
11	Cattle ranching and farming	4,553	45.047	103.746
14	Animal production, except cattle and poultry	4,396	36.043	93.685
59	Animal (except poultry) slaughtering, rendering, and processing	1,877	83.751	96.189
93	Footwear manufacturing	1,215	35.049	43.904
42	Other animal food manufacturing	951	62.995	165.493
41	Dog and cat food manufacturing	660	29.889	138.993
55	Fluid milk and butter manufacturing	422	22.609	37.136
58	Ice cream and frozen dessert manufacturing	195	8.999	15.730
12	Dairy cattle and milk production	174	1.587	9.582
61	Seafood product preparation and packaging	113	3.032	3.658
94	Other leather and allied product manufacturing	80	3.215	3.952
56	Cheese manufacturing	67	4.163	5.571
57	Dry, condensed, and evaporated dairy product manufacturing	6	0.381	0.870
92	Leather and hide tanning and finishing	0	0.000	0.000
Total		**52,050**	**1,844.243**	**2,564.572**

Note: Sorted by total number of jobs descending.

Table 4. Forestry Contributions by Sector, 2010.

Sector ID	Forestry Sector Contribution to:	Employment (Jobs)	Income (Million $)	Value Added (Million $)
95	Sawmills and wood preservation	4,394	196.839	221.834
16	Commercial logging	4,327	185.220	181.380
105	Paper mills	3,470	333.976	778.679
107	Paperboard container manufacturing	2,510	149.922	192.316
96	Veneer and plywood manufacturing	1,735	97.181	113.324
99	Wood windows and doors and millwork manufacturing	1,657	64.748	74.133
111	Sanitary paper product manufacturing	1,599	104.833	362.075
109	All other paper bag and coated and treated paper manufacturing	1,447	75.675	100.524
296	Upholstered household furniture manufacturing	840	31.574	45.824
100	Wood container and pallet manufacturing	819	23.882	31.608
295	Wood kitchen cabinet and countertop manufacturing	735	24.021	21.670
106	Paperboard mills	729	67.172	137.983
15	Forestry, forest products, and timber tract production	559	32.264	100.541
98	Reconstituted wood product manufacturing	527	31.085	80.705
97	Engineered wood member and truss manufacturing	440	17.534	22.810
108	Coated and laminated paper, packaging paper and plastics film manufactu	396	25.994	44.458
297	Nonupholstered wood household furniture manufacturing	277	8.807	12.578
103	All other miscellaneous wood product manufacturing	181	5.330	8.420
110	Stationery product manufacturing	158	5.762	8.062
300	Office furniture manufacturing	149	5.617	12.269
301	Custom architectural wood manufacturing	68	3.582	4.131
112	All other converted paper product manufacturing	36	1.742	2.499
101	Manufactured home (mobile home) manufacturing	25	0.790	0.776
102	Prefabricated wood building manufacturing	4	0.120	0.142
104	Pulp mills	0	0.000	0.000
Total		**27,081**	**1,493.670**	**2,558.739**

Note: Sorted by total number of jobs descending.

Appendix C
IMPLAN Analysis by Parts, Technical Details

The contribution of *Rice Farming* and *Rice Milling* was estimated using ABP instead of traditional IMPLAN contribution methods (section 2.2.1). 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 scenario to estimate 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: 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, 2012). *Rice Milling* output was calculated from the 2012 *Rice Yearbook* data for milling year 2010/11 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, 2012a). This calculated output value times IMPLAN's intermediate expenditures absorption coefficient (0.880; MIG, 2011) 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 2010 sector 43, *Flour Milling and Malt Manufacturing*, ratio of labor income to total value added (0.423; MIG, 2011) was retained to estimate the value of labor income for *Rice Milling*: 0.423 times total value added. Any labor income not attributable to employee compensation was considered to be proprietor income. Similarly, the ratios from 2010 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 2.2.1 (USDA NASS, 2012a). To estimate employment, 2009 Arkansas output per worker from Richardson and Outlaw (2010) was first adjusted for inflation using the IMPLAN output deflator (1.023; MIG, 2011) for sector 2, *Grain Farming*. Employment for *Rice Farming* was calculated by dividing 2010 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 Arkansas rice in 2010 (Flanders, 2010). The output value times IMPLAN's 2010 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 2010 sector 2, *Grain Farming*, ratio of proprietor income to total value added (0.749; MIG, 2011) was retained to estimate the value of proprietor income for *Rice Farming*: 0.749 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 2010 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 2.2.1, 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 2010, 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 2010 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 2010: 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.

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