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**Economic Importance of Food and Fiber Production
Industries in the Arkansas Delta Economy, 2009**

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Economic Importance of Food and Fiber Production Industries in the Arkansas Delta Economy, 2009

The Delta region of Arkansas consists of 25 counties in the eastern third of the state. Two other regions composing the remaining two-thirds of the state are the Ozark and Ouachita regions. These two regions include the northern 25 counties as the Ozark region and the 25 southern counties as the Ouachita region. Regional designations follow University of Arkansas Division of Agriculture districts of the Cooperative Extension Service (UA, DOA 2011). Districts have unique economic characteristics determined by the structure of each economy. This report is an analysis of the Delta economy with focused investigation of food and fiber production industries.

Structure of the Arkansas Delta Economy

A measure of sector specialization and relative importance in an economy is the location quotient. A location quotient (LQ) determines the economic activity of a local economic sector relative to the corresponding economic activity in the national economy (Shaffer, Deller, and Marcouilli 2004). Methods for calculating LQ are presented in *Appendix 1*. Data applied in this analysis to calculate LQ are employment from the Minnesota IMPLAN Group (MIG 2010) for 2009. Employment represents full-time and part-time jobs and includes hired employees and proprietors. LQ values greater than 1.0 indicate that the Arkansas Delta has more employment in a sector relative to the national economy, while values less than 1.0 indicate less relative employment. *Table 1* reports LQ , employment, and percentage of total employment for each major sector of the Delta economy. Industries with the most significant LQ values greater than 1.0 are agricultural production, manufacturing, as well as transportation and warehousing.

An industrial sector with an LQ value significantly less than 1.0 is financial, insurance, and real estate services. Two other industries with significantly low LQ values are 1) specialized and technical services, and 2) recreational and hospitality services. Specialized and technical services include activities related to media, advertising, and other business related services. Recreational and hospitality services include lodging and services related to vacation travel.

Agricultural production with LQ of 6.31 in *Table 1* includes crops, animal production, forestry and products, logging, natural resources (commercial hunting, trapping, and fishing), and related support activities. Manufacturing with LQ of 1.55 in *Table 1* is presented with detailed components in *Table 2*. Electrical equipment and components with LQ of 3.51 entails industries manufacturing household appliances and other small electrical products. Metallic products with LQ of 2.26 include metal production and products such as metal containers, ammunition, machine shop products, and other fabricated metals. Food products have LQ of 2.19, while wood, paper, and other fiber products have LQ of 2.95. Employment in food products, wood, paper, and other fiber products totals 12,668 jobs which is 32% of Arkansas Delta manufacturing employment.

Table 1. Location Quotient, Employment, and Percent of Regional Employment, by Industrial Sector, Delta, 2009

Industrial Sector	LQ	Employment	Percent
Agricultural Production	6.31	45,007	12.4
Mining, Utilities, & Construction	0.96	23,364	6.4
Manufacturing	1.55	39,336	10.8
Trade, Wholesale & Retail	0.95	47,245	13.0
Transportation & Warehousing	1.25	14,675	4.0
Financial, Insurance, & Real Estate Services	0.50	16,504	4.5
Specialized & Technical Services	0.49	32,941	9.1
Health & Social Services	1.04	40,316	11.1
Recreational & Hospitality Services	0.74	23,964	6.6
Personal Services	1.01	21,537	5.9
Government	1.11	58,523	16.1

Table 2. Location Quotient, Employment, and Percent of Sector Employment for the Manufacturing Sector, by Industry, Delta, 2009

Manufacturing Industry	LQ	Employment	Percent
Food Products	2.19	7,736	19.7
Textiles	0.72	387	1.0
Apparel & Accessories	1.70	843	2.1
Wood, Paper, and Other Fiber Products	2.95	4,932	12.5
Petroleum & Coal Products	1.20	286	0.7
Chemicals	0.46	770	2.0
Nonmetallic Products	1.21	2,611	6.6
Metallic Products	2.26	8,003	20.3
Machinery	1.68	3,634	9.2
Computer & Electronic Products	0.09	201	0.5
Electrical Equipment & Components	3.51	2,741	7.0
Transportation Equipment	1.28	3,594	9.1
Furniture & Related Products	1.56	1,323	3.4
Miscellaneous Manufacturing	0.87	2,278	5.8
Total Manufacturing	1.55	39,336	100.0

Food and Fiber Production Industries in the Delta Economy

An aggregated sector of food and fiber production industries includes those involved in crop production, animal production, forestry and natural resources, support services to agricultural and forestry, food processing, fiber processing, and extended manufacturing industries related to food and fiber. *Appendix 2* shows industries that compose the sector of food and fiber production industries. Crop production, animal production, forestry and natural resources, and support services correspond to agricultural production in *Table 1*. Food processing is identical to food products in *Table 2*. Fiber processing and extended manufacturing include

manufacturing industries in *Table 2* with selection based on previous studies of food and fiber industries (Popp et al 2010; Rephan 2008; Riall 2002; Tanjuakio, Hastings, and Tytus 1996) and NAICS definitions (U.S. Census Bureau 2007). Food and fiber production industries are described in *Appendix 2* and are listed with corresponding IMPLAN codes (MIG 2010).

Output for food and fiber production industries in *Table 3* is equivalent to sales. Crop production is the largest component of agricultural production with output of \$3.0 billion. This represents 24% of output for all food and fiber production industries. Animal production has output of \$280 million, forestry and natural resources have output of \$220 million, and support services have \$184 million of output. Total agricultural production output is \$3.7 billion, or 30% of all output for food and fiber production industries.

Total output for food and fiber production industries is \$12.2 billion in the Delta. Food processing has the greatest output in *Table 3* with \$6.1 billion which is 50% of all food and fiber production industry output. Fiber processing has output of \$1.4 billion, or 11% of total output in *Table 3*. Output for extended manufacturing is \$1.1 billion.

Table 3. Output for Food and Fiber Production Industries, Delta, 2009

Aggregated Industry	Output \$Million	Percent (%)
Crop Production	2,976	24.3
Animal Production	280	2.3
Forestry & Natural Resources	220	1.8
Support Services	184	1.5
Food Processing	6,077	49.7
Fiber Processing	1,384	11.3
Extended Food & Fiber Manufacturing	1,102	9.0
Total	12,224	100.0

Food and Fiber as Specialized Industries in the Delta Economy

LQ and employment for food and fiber production industries are presented in *Table 4*. Total employment among all Arkansas Delta industries is 363,412 jobs, and food and fiber production industry employment of 59,570 jobs in *Table 4* is 16% of total regional employment. Crop production with *LQ* of 10.88 includes 37,462 jobs. Support services for agricultural production entails 4,696 jobs and has an *LQ* of 3.74. Food processing with 7,736 jobs has an *LQ* of 2.19. Fiber processing has an *LQ* of 4.27 with 2,819 jobs.

Table 4. Location Quotient, Employment, Labor Income, and Value Added for Food and Fiber Production Industries, Delta, 2009

Aggregated Industry	Location Quotient	Employment <i>Jobs</i>	Labor Income <i>\$Million</i>	Value Added
Crop Production	10.88	37,462	1,055	1,307
Animal Production	0.70	1,380	73	68
Forestry & Natural Resources	3.15	1,469	54	82
Support Services	3.74	4,696	169	146
Food Processing	2.19	7,736	350	619
Fiber Processing	4.27	2,819	207	409
Extended Manufacturing	1.40	4,009	176	262
Total	4.20	59,570	2,084	2,892

Labor income in *Table 4* represents wages and benefits for hired employees and proprietors. Crop production has labor income of \$1.1 billion and food processing has labor income of \$350 million. Food processing has average annual labor income of \$45,221 per job. In contrast, crop production includes much part-time employment, and average labor income is \$28,160. Employment represents full-time and part-time jobs, and an individual hired employee and/or proprietor may earn income from more than one job during the year.

Value added in *Table 4* is defined as final sales (output) of an industry minus the value of material inputs utilized in producing the output (Shaffer, Deller, and Marcouilli 2004). Value added is a measure of the gross output of an industry or a sector less its intermediate inputs and is the contribution of an industry or sector to gross domestic product (GDP). Value added by industry is measured as the sum of employee compensation, taxes on output, consumption of fixed capital, proprietors' income, and corporate profits (BEA 2011). Value added of food and fiber production industries is \$2.9 billion with crop production consisting of \$1.3 billion, or 45% of value added for Delta food and fiber production industries.

Economic Impact Analysis of Food and Fiber Production Industries

Specialized industries in the Delta economy have economic impacts throughout the entire region. Economic impacts can be estimated with input-output models that separate the economy into various industrial sectors such as agriculture, construction, manufacturing, trade, and services. An input-output model calculates how a change in one industry leads to changes in other industries. These changes are expressed in terms of direct and indirect effects. Direct output represents initial effects in the economy. Initial production requires inputs that are outputs from other industries. Subsequent rounds of production utilized as inputs by industries related to initial production are indirect effects and determine the total impact of an industry. Indirect effects include changes in household spending due to output. Thus, the total economic impact is the sum of direct and indirect effects (Miller and Blair 2009). Input-output analysis can interpret the effects of an industry in terms of output (sales), labor income (employee compensation and proprietary income), employment (jobs), value added, and tax revenue collected by governments. This report utilizes IMPLAN

software for input-output analysis (MIG 2004). Economic impact analysis is conducted by applying output in *Table 3* as initial production in the Delta economy. Output represents flow variables that indicate output changes from 0 to total annual levels for each aggregated industry in *Table 3*.

Direct employment, labor income, and value added corresponding to crop production, animal production, forestry and natural resources, and support services in *Table 3* are presented as direct effects in *Table 5*. Initial agricultural production as output requires inputs from other industries. These intermediate inputs are outputs from other industries and lead to indirect effects. Indirect effects in *Table 5* are associated with output occurring in Delta economy. Intermediate inputs purchased from outside of the region are leakages that have no indirect effects in the regional economy. Adding direct and indirect effects results in total effects on the Delta economy due to agricultural production in *Table 5*. Direct employment of 45,007 jobs leads to 12,369 indirect jobs for a total of 57,376 jobs. Indirect labor income of \$375 million leads to total labor income of \$1.7 billion. Indirect value added of \$760 million results in \$2.4 billion of total value added.

Table 5. Direct Effects, Indirect Effects, and Total Effects for Agricultural Production, Delta, 2009

Effect Type	Direct Effect	Indirect Effect	Total Effect
Employment (Jobs)	45,007	12,369	57,376
Labor Income (\$Million)	1,352	375	1,727
Value Added (\$Million)	1,602	760	2,362

Direct effects and total effects due to agricultural production are presented as percentages of the Delta economy in *Table 6*. Agricultural production directly accounts for 12% of employment, 10% of labor income and 8% of value added. Total effects of agricultural production accounts for 16% of employment, 13% of labor income and 12% of value added in the Delta economy.

Table 6. Direct Effects, Total Effects, and Percent of Total Regional Economy for Agricultural Production, Delta, 2009

Effect Type	Direct		Total	
	Effect	Percent (%)	Effect	Percent (%)
Employment (Jobs)	45,007	12.4	57,376	15.8
Labor Income (\$Million)	1,352	10.1	1,727	13.0
Value Added (\$Million)	1,602	7.8	2,362	11.5

Direct effects of food and fiber production industries corresponding to output for all industries in *Table 3* are presented in *Table 7*. Direct employment of 59,570 jobs leads to 29,334 indirect jobs for a total of 88,904 jobs. Indirect labor income of \$1.0 billion leads to total labor income of \$3.1 billion. Indirect value added of \$1.9 billion results in \$4.8 billion of total value added.

Table 7. Direct Effects, Indirect Effects, and Total Effects for Food and Fiber Production Industries¹, Delta, 2009

Effect Type	Direct Effect	Indirect Effect	Total Effect
Employment (Jobs)	59,570	29,334	88,904
Labor Income (\$Million)	2,084	1,025	3,109
Value Added (\$Million)	2,892	1,866	4,758

¹Includes agricultural production in *Table 5*.

Direct effects and total effects due to food and fiber production industries are presented as percentages of the Delta economy in *Table 8*. Food and fiber industries directly account for 16% of employment, 16% of labor income and 14% of value added. Total effects of food and fiber production industries account for 25% of employment, 23% of labor income and 23% of value added in the Delta economy.

Table 8. Direct Effects, Total Effects, and Percent of Total Regional Economy for Food and Fiber Production Industries¹, Delta, 2009

Effect Type	Direct Effect	Percent (%)	Total Effect	Percent (%)
Employment (Jobs)	59,570	16.4	88,904	24.5
Labor Income (\$Million)	2,084	15.6	3,109	23.3
Value Added (\$Million)	2,892	14.1	4,758	23.2

¹Includes agricultural production in *Table 6*.

Distribution of total effects among major industries is presented in *Table 9*. Employment, labor income, and value added for agricultural production is identical to direct effects in *Table 5*. Adding employment, labor income, and value added for agricultural production to the corresponding component for food and fiber manufacturing in *Table 9* is equal to direct effects in *Table 7*. Indirect effects in *Table 7* correspond to employment, labor income, and value added for industries in *Table 9*, excluding food and fiber production industries. Thus, 39% of value added due to food and fiber production industries in the Delta is in industries other than either agricultural production or food and fiber manufacturing. Corresponding percentages for employment are 33% and 33% for labor income.

Table 9. Total Employment, Labor Income, and Value Added due to Food and Fiber Production Industries, Delta, by Major Industry, 2009

Industry	Employment		Labor Income		Value Added	
	<i>Jobs</i>	Percent %	<i>\$Million</i>	Percent %	<i>\$Million</i>	Percent %
Agricultural Production	45,007	50.6	1,352	43.5	1,602	33.7
Food & Fiber Manufacturing	14,563	16.4	732	23.5	1,290	27.1
Mining, Utilities, & Construction	890	1.0	52	1.7	137	2.9
Manufacturing, Not Food & Fiber	194	0.2	9	0.3	16	0.3
Trade, Wholesale & Retail	7,451	8.4	294	9.5	493	10.4
Transportation & Warehousing	3,072	3.5	145	4.7	196	4.1
Financial, Insurance, & RE Services	3,312	3.7	81	2.6	477	10.0
Specialized & Technical Services	4,537	5.1	147	4.7	208	4.4
Health & Social Services	3,819	4.3	154	5.0	166	3.5
Recreational & Hospitality Services	2,838	3.2	42	1.4	60	1.3
Personal Services	2,594	2.9	65	2.1	73	1.5
Government	627	0.7	36	1.2	40	0.8
Total¹	88,904	100.0	3,109	100.0	4,758	100.0

¹Totals may not sum due to rounding.

Summary

Industrial specialization as determined by location quotients indicates concentrations of economic activity in a regional economy. This report is an analysis of the Delta economy with focused investigation of food and fiber production industries. Total employment among all Arkansas Delta industries is 363,412 jobs, and food and fiber production industry employment of 59,570 jobs is 16% of total regional employment. Specialized industries of food and fiber production in the Delta economy have economic impacts throughout the entire region. Direct employment of 59,570 jobs in food and fiber production industries leads to 29,334 indirect jobs for a total of 88,904 jobs. Direct value added of food and fiber production industries is \$2.9 billion, and indirect value added of \$1.9 billion results in \$4.8 billion of total value added in the regional economy. Total effects of food and fiber production industries account for 25% of employment and 23% of value added in the Delta economy.

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Appendix 1.

Industry Specialization

A measure of sector specialization and relative importance in an economy is the location quotient. A location quotient (LQ) determines the economic activity of a local economic sector relative to the corresponding economic activity in the national economy. The location quotient is computed as:

$$(1) \quad LQ_i^l = \frac{\text{percent of local, } l, \text{ economic activity in sector } i}{\text{percent of national, } n, \text{ economic activity in sector } i} .$$

Local economic activity can be for any economy such as a state, region, or county. Economic activity in this report is measured by employment, e . The LQ for major industrial sectors, i , in the state, s , of Arkansas is determined by:

$$(2) \quad LQ_s^i = \frac{\left(\frac{e_s^i}{e_s^t} \right)}{\left(\frac{e_n^i}{e_n^t} \right)} ,$$

where t indicates total for the state or the nation. LQ values greater than 1.0 indicate that the Arkansas Delta has more employment in a sector relative to the national economy, while values less than 1.0 indicate less relative employment. An LQ greater than 1.0 indicates a specialized sector and relative dependency of an industry for a local economy (Shaffer, Deller, and Marcouilli 2004).

Appendix 2. IMPLAN Code and Industry Description for Food and Fiber Production Industries

Code	Description	Code	Description
	Crop Production		Fiber Processing
1	Oilseed farming	75	Fiber, yarn, and thread mills
2	Grain farming	92	Leather and hide tanning and finishing
3	Vegetable and melon farming	95	Sawmills and wood preservation
4	Fruit farming	96	Veneer and plywood manufacturing
5	Tree nut farming	97	Engineered wood member and truss manufacturing
6	Greenhouse, nursery, and floriculture production	104	Pulp mills
7	Tobacco farming	105	Paper mills
8	Cotton farming	106	Paperboard mills
9	Sugarcane and sugar beet farming		Extended Food and Fiber Manufacturing
10	All other crop farming	76	Broadwoven fabric mills
	Animal Production	77	Narrow fabric mills and schiffli machine embroidery
11	Cattle ranching and farming	78	Nonwoven fabric mills
12	Dairy cattle and milk production	79	Knit fabric mills
13	Poultry and egg production	80	Textile and fabric finishing mills
14	Animal production, except cattle and poultry and eggs	81	Fabric coating mills
	Forestry and Natural Resources	82	Carpet and rug mills
15	Forestry, forest products, and timber tract production	83	Curtain and linen mills
16	Commercial logging	84	Textile bag and canvas mills
17	Commercial fishing	85	All other textile product mills
18	Commercial hunting and trapping	86	Apparel knitting mills
	Support Services	87	Cut and sew apparel contractors
19	Support activities for agriculture and forestry	88	Men's and boys' cut and sew apparel
	Food Processing	89	Women's and girls' cut and sew apparel
41	Dog and cat food manufacturing	90	Other cut and sew apparel
42	Other animal food manufacturing	91	Apparel accessories and other apparel
43	Flour milling and malt manufacturing	93	Footwear
44	Wet corn milling	94	Other leather and allied products
45	Soybean and other oilseed processing	98	Reconstituted wood products
46	Fats and oils refining and blending	99	Wood windows, doors and millwork
47	Breakfast cereal manufacturing	100	Wood containers and pallets
48	Sugar cane mills and refining	101	Manufactured homes (mobile homes)
49	Beet sugar manufacturing	102	Prefabricated wood buildings
50	Chocolate and confectionery from cacao beans	103	All other miscellaneous wood products
51	Confectionery products from purchased chocolate	107	Paperboard containers
52	Nonchocolate confectionery manufacturing	108	Coated and laminated paper, packaging
53	Frozen food manufacturing	109	All other paper bags, coated and treated paper
54	Fruit and vegetable canning, pickling, and drying	110	Stationery products
55	Fluid milk and butter manufacturing	111	Sanitary paper products
56	Cheese manufacturing	112	All other converted paper products
57	Dry, condensed, and evaporated dairy products	130	Fertilizers
58	Ice cream and frozen dessert manufacturing	131	Pesticides, other agricultural chemicals
59	Animal (except poultry) slaughtering and rendering	203	Farm machinery and equipment
60	Poultry processing	204	Lawn and garden equipment
61	Seafood product preparation and packaging	295	Wood kitchen cabinets and countertops
62	Bread and bakery product manufacturing	296	Upholstered household furniture
63	Cookie, cracker, and pasta manufacturing	297	Nonupholstered wood household furniture
64	Tortilla manufacturing	300	Wood television, radio, and sewing machine cabinets
65	Snack food manufacturing	301	Office furniture, custom woodwork and millwork
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		