Multiple Measures of the Role of Agriculture in Iowa's Economy

Department of Economics
College of Agriculture
Iowa State University

Prepared by

Dave Swenson and Liesl Eathington

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Introduction

Agriculture plays a prominent role in Iowa's economy. There are a variety of standard measures that are commonly used to describe agriculture. Agriculture's contribution to the gross state product (GSP) is one measure, as are the number of jobs in agriculture, the amount and kind of earnings generated in agriculture, and the composition of agricultural sales. These statistics are very useful, but they are not organized to acknowledge the complex industrial inter-relationships and dependencies that exist in the state among agriculture and other industries. To isolate those relationships, we also employ more sophisticated and rigorous methods in this study to characterize Iowa's agricultural economy and the value of its linkages with the Iowa economy.

Production agriculture, industries related to agriculture, such as chemical, fertilizer, and machinery production, and agriculture processing industries are a substantial fraction of the state's economic activity, especially when we consider their linkages to other industries in the state. Their value added economic impact was $13.4 billion in 2000 or 16.4 percent of the state total. Value added economic impact is the income and wealth that is generated in the state of Iowa from agricultural, food processing, and ag-related industrial production that is in excess of statewide sales.

There is also a spatial dimension to Iowa's agricultural economy that must be acknowledged. Though much of the economic growth in the state of late has accumulated to a distinct set of major trade and industrial centers, a substantial portion of Iowa is and will remain highly dependent on agriculture. Those dependencies are important from region-wide and county-wide perspectives. There are also spatial variations in the average dependence of farm households on earnings from the farm. While many farmers and farm family members necessarily must seek off-farm jobs, Iowa's farm households are two-and-a-half times more dependent on income from farming than the average U.S. farmer.

This report employs multiple economic measures to describe the current role of agriculture in Iowa's economy. In the first section, the size of the agricultural sector is assessed using several direct measures, such as gross state product, farm earnings, farm employment, and farm receipts. These statistics make it clear that over the years Iowa's dependence on agriculture has lessened. This decline has occurred not only at the statewide level, but also in Iowa's most farm-dependent counties, and even within farm family households. The second and third sections of this report detail current dependence on farm income and employment at the county and the farm household levels.

Many of the state's nonfarm industries link strongly to the agricultural sector. For example, an obvious major strength of Iowa's economy is the concentration of food and kindred product processing and that sector's linkage to Iowa agricultural production. There are, however, other foundations of the Iowa economy that have potent linkages with Iowa agriculture. Iowa's rail and over-the-road freight and warehousing capacity is determined in large part by the needs of agriculture. Agriculture links strongly with a variety of wholesalers. Agriculture also depends strongly on financial inputs. The last section of this report describes the total economic impacts of agriculture, taking into account the importance of such linkages with other industries. That section also compares the economic impacts of other prominent Iowa industries to agriculture's economic impacts.

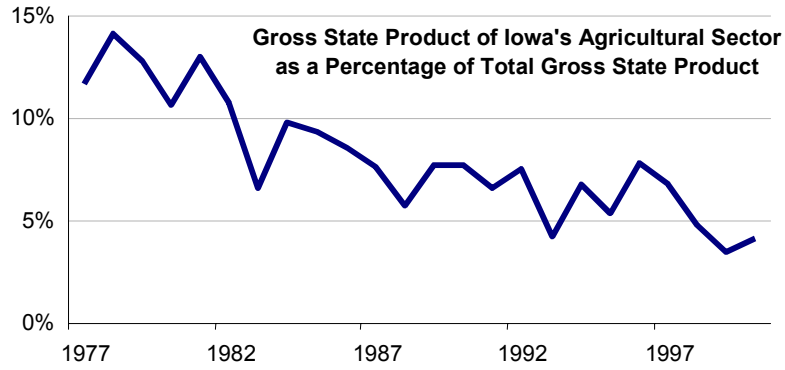
Standard Measures of the Size of Iowa's Agricultural Sector

The size of Iowa's agricultural sector can be measured in several ways, including farm earnings, farm employment, agricultural sector gross cash income, and the gross state product contribution to the economy by the agricultural sector. When these measures are adjusted for inflation or expressed as percentages of state total values over time, they tell a consistent story about the evolving nature of agriculture in Iowa's economy.[1]

Gross State Product of Iowa's Agricultural Industries

One of the ways in which an industry's size can be measured absolutely and relatively is by its Gross State Product (GSP). GSP measures the value added by labor and the use of property to commodities and services. GSP is defined as gross output of an industry (sales or receipts and other operating income) minus its intermediate inputs (goods and services purchased from other industries).

Iowa's total GSP equals the sum of GSP originating in all of the state's industries. In 2000, this value was $89.6 billion. The agricultural sector contributed $3.68 billion, or about 4.1 percent. Over time, the percentage of total gross state product from the agricultural sector has declined, as is shown in the following chart.



Industry Comparisons Using GSP

The next table compares the contributions of Iowa's major industries to the state's total gross state product in 2000.[2] Iowa farms make up 3.5 percent of state GSP. Food and kindred products manufacturing industries contributed 4.6 percent. Food and kindred product manufacturing includes meat packing, dairy processing, cereals and animal foods, grain milling, along with manufactured goods made from crop and animal by-products.

[1] Source data for all measures in this section were obtained from the Bureau of Economic Analysis.
[2] Source: Bureau of Economic Analysis, Regional Accounts Data

Iowa Gross State Product by Industry, 2000

Industry	$ millions	Percent of Total
Total Gross State Product	89,600	100.0%
Agriculture, forest., fishery	3,678	4.1%
Farms	3,094	3.5%
Agricultural services	584	0.7%
Mining	210	0.2%
Construction	3,822	4.3%
Manufacturing	19,747	22.0%
Durable goods	10,716	12.0%
Industrial machinery	3,032	3.4%
Nondurable goods	9,032	10.1%
Food & kindred products	4,146	4.6%
Transportation & utilities	7,758	8.7%
Wholesale trade	6,338	7.1%
Retail trade	7,950	8.9%
Finance, Ins., & Real Est.	13,938	15.6%
Services	15,392	17.2%
Business services	2,995	3.3%
Amusement and recreation	952	1.1%
Health services	5,267	5.9%
Legal services	623	0.7%
Educational services	661	0.7%
Social services	704	0.8%
Government	10,768	12.0%
State and local	8,934	10.0%

State Comparisons and Rankings Using Gross State Product

The accompanying table lists agricultural GSP, all food & kindred manufacturing GSP, and combined agricultural and food & kindred amounts for all states and the District of Columbia. The table also ranks GSP by category and shows the combined values as a percent of total GSP for the states. It also ranks the value of all crop and livestock marketing for all of the states. These values are merely gross commodity sales and are not related to the GSP figures.

As measured by GSP, all farm-level agricultural productivity in Iowa in 2000 was $3.1 billion. Number one is California at $13.3 billion, and number two is Texas at $5.75 billion. Iowa ranked fifth in this measure.

Farm-level GSP and food & kindred manufacturing GSP are combined in the table because these two sectors are heavily dependent on one another. Iowa's value was $7.24 billion in 2000, ranking it ninth nationally in this combined measure. One of the reasons for Iowa's lower ranking is that a large fraction of food and kindred production in the U.S. is concentrated in temperate, produce-growing areas like California, Texas, Florida, and Georgia. In addition, states with relatively large populations will also have well-developed food processing industries to take care of statewide food demand.

When the combined farm and food and kindred production values are compared as a percentage of total GSP for the states, Iowa's value is 8.7 percent, ranking it second nationally behind South Dakota. An index value to score Iowa against the national average shows Iowa is 3.7. That means the Iowa economy is 3.7 times more dependent on farm and food and kindred production as a component of its economy than the rest of the nation.

The table also lists non-GSP data on the value of agricultural receipts from all crop and livestock sales in 2000. Iowa ranked third in this category nationally, producing $11.5 billion in sales. Number one California produced $25.9 billion in sales, and number two Texas produced $15.14 billion. Fourth place Nebraska produced $9.5 billion and fifth place Kansas produced $8.6 billion.

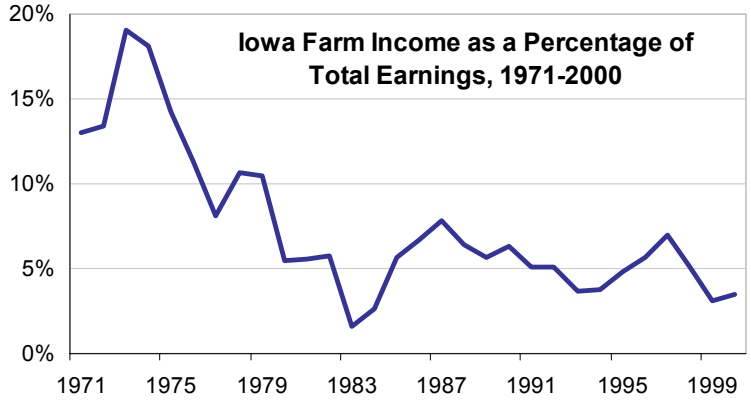
Agricultural and Agricultural Related Industry Gross State Product Comparisons, 2000

	Gross State Product Measures							Exhibit	
State	Agriculture	All Food & Kindred Manufacturing	Agriculture & Food & Kindred	Rank	Agriculture & Food & Kindred, Percent of GSP	Rank	Ag & Ag-Related GSP Index (1= U.S. Average)	Agricultural Receipts from Marketing	Rank
Alabama	1,475	1,083	2,558	28	2.7%	29	1.0	3,540	24
Alaska	24	409	433	48	3.0%	21	0.7	53	49
Arizona	1,075	814	1,889	33	2.0%	41	0.6	2,323	30
Arkansas	1,739	2,754	4,493	18	7.4%	5	3.1	5,296	11
California	13,256	16,048	29,304	1	3.0%	22	1.0	25,915	1
Colorado	1,225	2,338	3,563	23	2.7%	27	1.0	4,815	16
Connecticut	315	1,029	1,344	36	1.3%	45	0.4	540	41
Delaware	188	543	731	42	2.4%	34	0.9	734	40
District of Columbia	-	*13*	13	*51*	*0.1%*	*51*	*0.0*	-	*51*
Florida	4,157	4,542	8,699	6	2.7%	30	0.8	7,114	9
Georgia	2,412	6,778	9,190	5	3.6%	16	1.4	5,257	12
Hawaii	296	359	655	43	2.0%	38	0.7	539	42
Idaho	1,435	964	2,399	30	7.7%	3	3.0	3,719	21
Illinois	2,102	9,123	11,225	3	2.8%	25	1.1	7,306	8
Indiana	1,412	2,716	4,128	21	2.6%	31	1.0	4,818	15
Iowa	**3,094**	**4,146**	**7,240**	**9**	**8.7%**	**2**	**3.7**	**11,554**	**3**
Kansas	1,670	1,429	3,099	24	4.3%	12	1.7	8,575	5
Kentucky	1,989	3,051	5,040	16	4.8%	7	2.0	3,629	23
Louisiana	638	1,829	2,467	29	2.3%	35	0.8	1,929	33
Maine	233	533	766	40	3.4%	18	1.0	516	44
Maryland	604	2,223	2,827	26	2.1%	37	0.7	1,498	36
Massachusetts	241	1,529	1,770	34	1.1%	50	0.3	396	47
Michigan	1,388	3,041	4,429	19	1.8%	42	0.6	3,647	22
Minnesota	2,454	3,645	6,099	13	3.8%	13	1.5	8,107	6
Mississippi	1,110	1,289	2,399	30	4.3%	11	1.6	3,186	26
Missouri	1,629	5,598	7,227	10	4.5%	8	1.9	5,010	14
Montana	634	114	748	41	4.4%	9	1.6	1,815	34
Nebraska	2,112	1,809	3,921	22	7.6%	4	3.2	9,487	4
Nevada	191	283	474	45	1.2%	47	0.3	399	46
New Hampshire	82	386	468	46	1.5%	44	0.5	156	48
New Jersey	488	4,624	5,112	15	1.8%	43	0.6	834	39
New Mexico	761	306	1,067	39	2.5%	32	0.9	2,094	32
New York	1,478	5,959	7,437	8	1.2%	46	0.4	3,254	25
North Carolina	3,382	3,207	6,589	12	2.9%	23	1.1	7,999	7
North Dakota	819	376	1,195	37	7.3%	6	3.0	2,762	28
Ohio	1,849	6,711	8,560	7	2.7%	28	1.1	4,660	17
Oklahoma	1,695	1,069	2,764	27	3.5%	17	1.4	4,544	18
Oregon	1,658	1,353	3,011	25	3.7%	15	1.2	3,158	27
Pennsylvania	2,006	7,320	9,326	4	2.8%	26	1.1	4,224	19
Rhode Island	32	181	213	50	1.1%	48	0.3	49	50
South Carolina	730	906	1,636	35	2.0%	40	0.7	1,586	35
South Dakota	1,567	538	2,105	32	9.8%	1	4.2	4,138	20
Tennessee	977	3,625	4,602	17	3.0%	20	1.2	2,143	31
Texas	5,748	8,377	14,125	2	2.4%	33	0.9	15,139	2
Utah	454	666	1,120	38	2.0%	39	0.8	1,052	37
Vermont	260	292	552	44	3.8%	14	1.4	529	43
Virginia	1,077	3,308	4,385	20	2.2%	36	0.8	2,412	29
Washington	2,448	2,738	5,186	14	3.4%	19	1.1	5,205	13
West Virginia	150	156	306	49	1.1%	49	0.3	425	45
Wisconsin	1,903	4,781	6,684	11	4.4%	10	1.8	5,563	10
Wyoming	340	98	438	47	2.9%	24	1.0	954	38
U.S. Total	79,002	137,009	216,011		2.7%		1.0	204,597	

Source: U.S. Bureau of Economic Analysis. All financial values in $millions.

Farm Income in Iowa

Farm income as a percentage of total earnings in Iowa has declined during recent decades. Farm income, which includes the earnings of farm proprietors and farm laborers, peaked in 1973 at just under 19 percent of total statewide earnings.[3] The low point of about 2 percent came a decade later in 1983 during the depths of the farm crisis. Farm income rebounded to around 7 percent of total earnings in the late 1980s, but declined again during the early 1990s. Despite a short rebound from 1995 to 1997, farm income as a percentage of total earnings in Iowa has dropped to its lowest point since 1983. In 2000, the level was just under 3.5 percent.

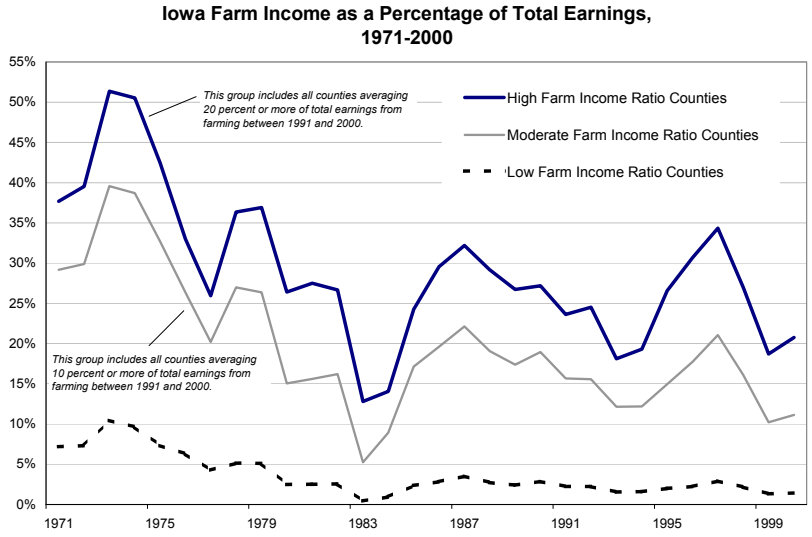


The decline in the importance of farm income has been pervasive among all of Iowa's counties. Even in the most farm-dependent counties, farm earnings as a percentage of total earnings have declined in a pattern that mirrors the statewide average. The following chart compares the farm income percentage over time for counties with high, moderate, and low fractions of total earnings from farming.[4] Iowa's highly farm-dependent counties generated 51 percent of earnings from farming in 1973, and 21 percent in 2000. Farm earnings in the moderately farm-dependent counties reached a high of 40 percent in 1973, and dropped to 11 percent by 2000. In the low farm dependence group, farm earnings declined from a high of 10 percent in 1973 to a level just below 1.5 percent in 2000.

This chart underscores the comparative variability that can occur in the farm sector. Peaks and valleys in earnings are evident over the years for the moderate to high group, while hardly noticeable for the low dependence category.

[3] Earnings are composed of wages, salaries, and profits to sole proprietors. Excluded are incomes derived from dividends, interests, rents, pension payments, and transfer payments.

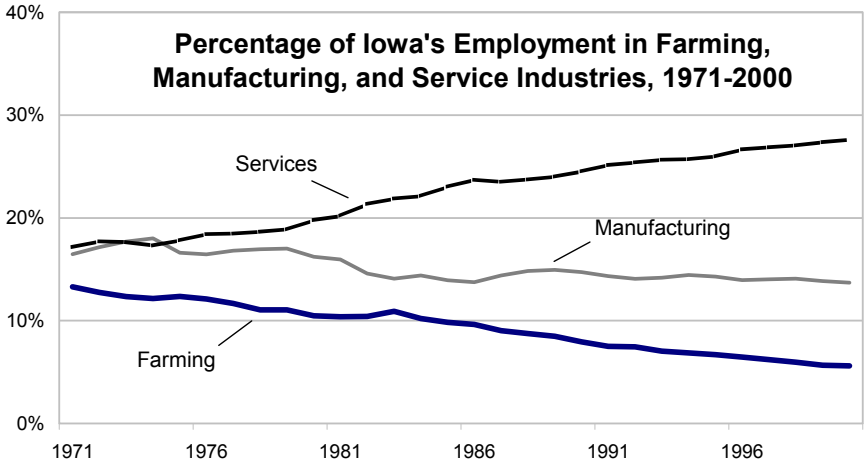
[4] County classifications were determined by the percentage of total earnings from farming between 1991 and 2000. Counties in the high farm dependence group had 20 percent or more of total earnings from farming. The moderate farm dependence group had 10 to 20 percent of total earnings from farming, and counties in the low farm dependence group had less than 10 percent of total earnings from farming.



Farm Employment in Iowa

The labor demands of agriculture have lessened markedly over the years. Between 1971 and 2000, farm employment in Iowa dropped by more than 63,000 jobs, a 37 percent decline. Nonfarm industries added 713,000 jobs to the state's economy between 1971 and 2000. Of these new jobs, 44 percent were in service industries, 21 percent were in trade industries, and about 7 percent were in manufacturing industries.

Iowa's total employment reached almost 1,947,000 jobs in the year 2000. The state had 109,285 farm proprietor and farm laborer jobs in that year. Between 1971 and 2000, farm employment dropped from 13 percent of total employment to below 6 percent. During that time, service sector employment increased from 17 to 28 percent. Even though there has been net growth in manufacturing employment, that sector's share of all jobs declined slightly from 16 to 14 percent. The next chart compares statewide farming employment shares with manufacturing and service sector shares over time.



The percentage of employment in farming varies across Iowa's counties. When the moderate and high farm income dependent counties are combined, more than 14 percent of their total employment is in farm jobs. Counties with lower dependence on farm income average just 3 percent of total employment in farming.

By sector, Iowa's employment changes have occurred unevenly across counties. Moderately and highly farm dependent counties suffered about 60 percent of Iowa's losses in farm jobs, but that loss was significantly offset by gains in manufacturing. Moderately and highly farm dependent counties gained six of every 10 new manufacturing jobs between 1971 and 2000. In contrast, fewer than one in every 10 new trade sector jobs accrued to these counties. Moderately and highly farm-dependent counties fared only slightly better in other sectors, capturing about 15 percent of new service sector jobs, and 13 percent of new jobs in all other nonfarm industries. Overall, Iowa's moderately and highly farm-dependent counties captured about 16 percent of statewide nonfarm employment growth between 1971 and 2000. The following table details employment changes by sector and by kind of county.

Employment Change by Sector in Iowa's Counties from 1971 - 2000, by Level of Farm Income Dependence

	Moderate to High Farm Dependence *	Low Farm Dependence	All Iowa Counties
Farming	(36,941)	(26,334)	(63,275)
Manufacturing	31,578	21,618	53,196
Trade	13,068	135,030	148,098
Services	46,171	268,197	314,368
All Other	24,752	172,384	197,136
Total	78,628	570,895	649,523

*Farm income in these 54 counties averaged 10 percent of total county earnings between 1991 and 2000

Iowa Farm Receipts

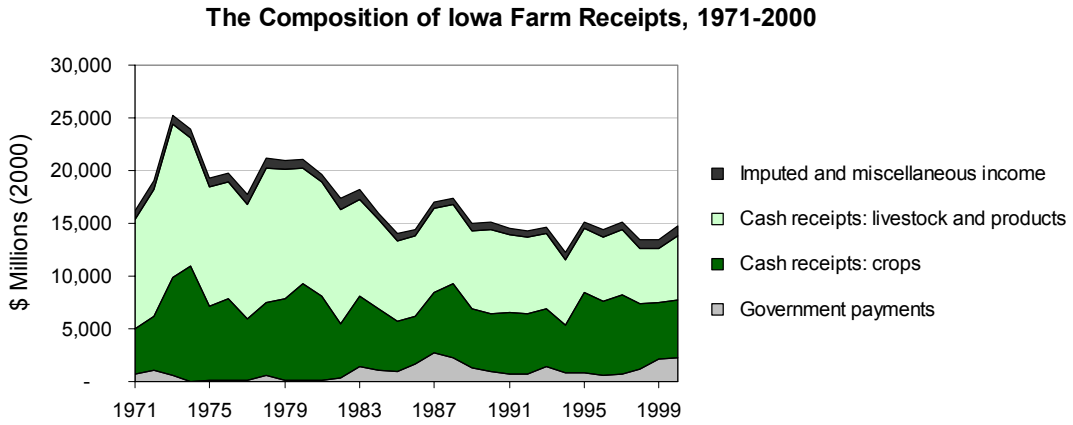
During the last 30 years, the real, or inflation-adjusted, values of Iowa's farm receipts have generally trended downward. Farm receipts include three major components: cash receipts from sales of livestock and crops, government payments, and imputed and miscellaneous farm income.[5] In 1971, the real value of farm receipts (in 2000 dollars) was just over $16 billion. Total farm receipts peaked at $25 billion in 1973. In the year 2000, total farm receipts in Iowa were just under $15 billion.

The composition of farm receipts also has changed during the last 30 years. During the 1970s, cash receipts from livestock averaged 58 percent of total farm receipts. That number dropped to an average of 52 percent during the 1980s, and dropped again to 44 percent during the 1990s. Crops averaged 36 percent of total farm receipts during the 1970s and 1980s, and increased to average 43 percent during the 1990s. Government payments averaged about 2 percent of total farm receipts during the 1970s, rose to 8 percent in the 1980s, and remained at 8 percent for the decade of the 1990s. The percentage of farm receipts from government payments

[5] Imputed income includes gross rental value of dwellings and value of home consumption. Miscellaneous income includes machine hire and custom work income, rental income, and income from forest products.

has remained at or above 5 percent every year since 1983, except in 1996 when they dipped to 4 percent.

In 2000, the cash receipts from crops were 37 percent of total farm receipts. Cash receipts from livestock and products were 41 percent. Government payments represented 16 percent of total cash receipts.



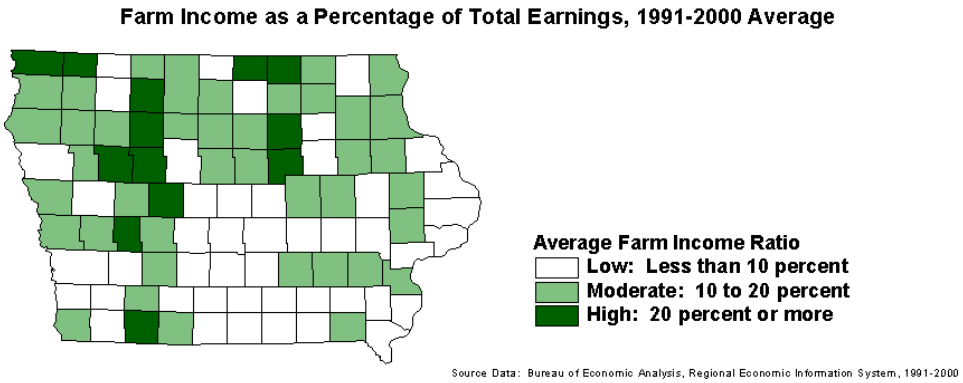
County Dependence on Farm Income and Employment

Dependence on farm income and employment varies across Iowa's counties. As a consequence there are regional differences in perceptions of the farm sector's size and its overall importance to the state's economy.

Farm Income by County

The Economic Research Service (ERS) division of the United States Department of Agriculture defines farm dependent counties as those with 20 percent or more of county total labor and proprietor income derived from farming. When the ERS last updated its county typology with data from 1987-89, there were 41 farm dependent counties in Iowa. Based on more recent county income data (1998-2000) from the U.S. Bureau of Economic Analysis, only eight of Iowa's 99 counties now meet the 20 percent criteria for farm dependence.

The following map shows three ranges for farm income dependence in Iowa's counties, based on average income data for 1991-2000. In the highest category, 13 counties derived more than 20 percent of total earnings from farming during the 1990s. In the middle category, 41 counties averaged 10 to 20 percent of total earnings from farming. The remaining 45 counties in the lowest category derived less than 10 percent of total earnings from farming.



The county with the highest farm income dependence is Osceola County, in northwestern Iowa. Farm income averaged 32 percent of total earnings in this county between 1991 and 2000. The county with the lowest farm income dependence is Polk County, where farm income was just two-tenths of one percent of total earnings. Most of the counties with moderate to high dependence are located in the northern and western portions of the state. Those with the least dependence are located in the central, southern, and the eastern, river regions of the state. Categorically,

- Counties in the group showing high farm income dependence generated 16 percent of the state's total farm earnings in 2000, but they had just 2 percent of total nonfarm earnings, 4 percent of total personal income, and 4 percent of the state's population.

- Counties with moderate dependence on farm income had 50 percent of total farm earnings, 14 percent of nonfarm earnings, 19 percent of total personal income, and 21 percent of the state's population.

- Together, the counties with moderate and high farm income ratios (all shaded counties) generated 66 percent of farm earnings, 16 percent of nonfarm earnings, 23 percent of total personal income, and had 26 percent of the state's population.

- Counties with low farm income dependence (shown in white) had 34 percent of total farm earnings, 84 percent of nonfarm earnings, 77 percent of total personal income, and 74 percent of population.

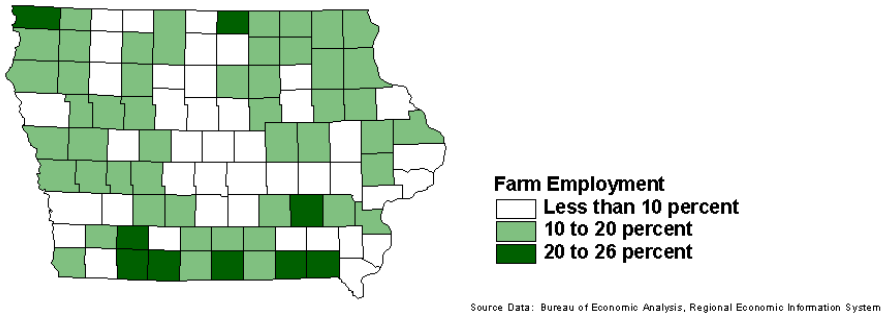
Farm Employment by County

Iowa's farm jobs are evenly distributed across the state. With 2,440 jobs, Sioux County has the highest farm employment, while nearby Dickinson County has the lowest with 541. The density of farm employment ranges from a high of 3.6 jobs per square mile in Dubuque County to a low of 1.2 jobs per square mile in Monona County.

While farm sector size varies little from county to county, the farm sector is overshadowed in many counties by a large nonfarm sector. The relative importance of the farm sector becomes much more apparent when farm employment is expressed as a percentage of total employment. The map below shows farm employment as a percentage of total employment in 2000. Values range from a low in Polk County where farm employment is three-tenths of one

percent of total employment, to a high in Taylor County, where farm employment is 26 percent of total employment. Other than the northern counties of Worth and Lyon, counties with the highest farm employment ratios are concentrated in southern regions of the state.[6]

Farm Employment as a Percentage of County Total Employment in 2000

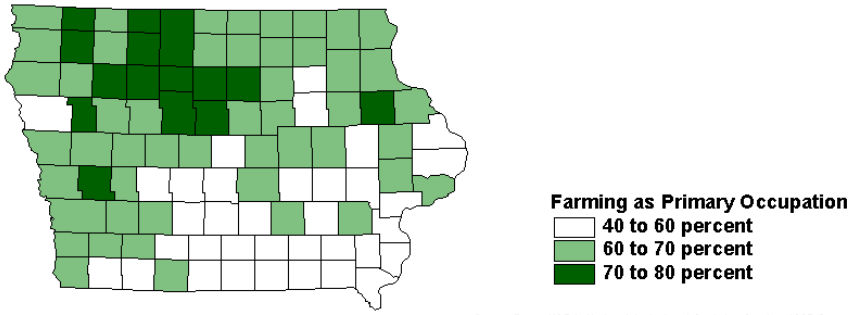


Source Data: Bureau of Economic Analysis, Regional Economic Information System

Farm Family Dependence on Farm Income and Employment

Many farm proprietors and farm workers in Iowa have turned to off-farm employment to supplement their incomes. Spouses and children of farm operators also supplement farm family household income with earnings from off-farm jobs. The degree of farm family dependence on farm income varies by region within the state. This variability is determined in large part by the availability of off-farm employment regionally, as would be found near the state's metropolitan and large urban commercial centers. The highest percentage of farm operators who report farming as their primary occupation are clustered tightly in the northwest and north central portions of the state, as displayed in the next map.

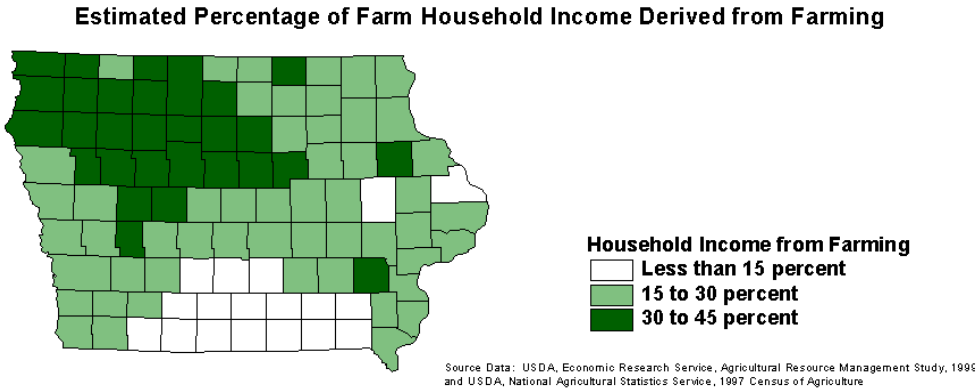
Percentage of Farm Operators Reporting Farming as Their Primary Occupation



Source Data: USDA, National Agricultural Statistics Service, 1997 Census of Agriculture

[6] Readers may note that the set of counties with the highest farm employment ratios differ from the set of counties with the highest farm income ratios. This may be due in large part to regional variation in the balance of part-time versus full-time farm jobs and other differences in average farm earnings per job. The Bureau of Economic Analysis employment statistics count any job, whether part-time or full-time, as one job.

The next map coincides strongly with the previous display – counties in which higher fractions of household income are from farming (from 30 to 40 percent) are concentrated in the northwest and north central portions of Iowa.



It is important to underscore another fact. Among farm households in Iowa, 24.5 percent of farm household income is derived directly from farming. The remaining 75 percent comes from other sources. Nationally, farmer households average 10 percent of their income from farming. Comparatively, Iowa's farmer households are two and a half times more dependent on income from farming than the national average.[7]

Total Farm Economic Impacts

When we look at the Iowa economy and the role of agriculture in it, it is helpful to think of upstream relationships and downstream relationships. To produce agricultural products, farmers need inputs. That means agriculture has important upstream linkages to suppliers of fuel, equipment, chemicals, seed, and livestock-related services. After production, agriculture has important downstream linkages to the transportation sectors, warehousing, meat and grain processing industries, and to exports. Historically, these linkages helped shape Iowa's economy, and the state's agricultural heritage is evident in its comparatively large transportation and warehousing sector and manufacturing sectors such as food processing, agricultural chemicals and agricultural machinery production.

Direct Measures of the Farm Economy

Industrial output and value added are two traditional measures of the size of major industries in the Iowa economy. The following table shows the value and the distribution of total industrial output in Iowa by major industry. Total industrial output, for the most part, simply represents the value of all goods sold or produced for inventory in the state. All production

[7] United States Department of Agriculture, Economic Research Service, Agricultural Resource Management Study, 1999.

agriculture and agricultural services by this measure accounted for 6.6 percent of total state industrial output in 1999. Farther along the commodity processing chain, the food and kindred manufacturing industries accounted for another 11.0 percent of industrial output. All other industries that are affiliated with agriculture include farm machinery manufacturing, agricultural chemical production, and agricultural fertilizer production. These accounted for 1.6 percent of state industrial output. All remaining, non ag-related manufacturing in the state accounted for 21.2 percent of the state's industrial output.

Direct Measures of Industrial Productivity in Iowa in 1999: Selected Industries

	Output	Percent of Total	Value Added	Percent of Total
All Production Agriculture	10,952.80	6.6%	2,892.65	3.5%
Food & Kindred Mfg.	18,183.48	11.0%	3,403.62	4.2%
All Other Ag Affilliated Mfg	2,698.32	1.6%	1,072.07	1.3%
Manufacturing	34,928.08	21.2%	12,079.94	14.8%
Fin., Ins., & Real Est.	17,427.96	10.6%	11,922.42	14.6%
Trans., Comm. & Util.	11,903.13	7.2%	6,370.06	7.8%
Trade	20,261.24	12.3%	14,762.54	18.0%
Service	24,627.44	14.9%	14,596.32	17.8%
All Other	23,827.18	14.5%	14,734.01	18.0%
	164,809.64	100.0%	81,833.65	100.0%

This table also displays value added in Iowa. Value added represents the payments made to workers as wages and salaries, normal profits to sole proprietors (like farmers and merchants), returns to investors (rents, dividends, interests, etc.), and indirect tax payments to governments. Value added is analogous to state (or regional) gross product, and it gives us a good idea of the earnings and wealth that are generated by different industrial activities. By this measure, production agriculture accounted for 3.5 percent of value added in the state in 1999. Value added linked to the output of the food and kindred processing industries is 4.2 percent of the state total. All other ag-affiliated manufacturing made up 1.3 percent.

Production agriculture, food and kindred processing, and other manufacturing industries are capital intensive industries that must take advantage of significant scale economies to be competitive. Consequently, their labor demands are comparatively low relative to the value of output. This is the reason that output shares are higher than the value added shares.

Estimating Actual Economic Impacts

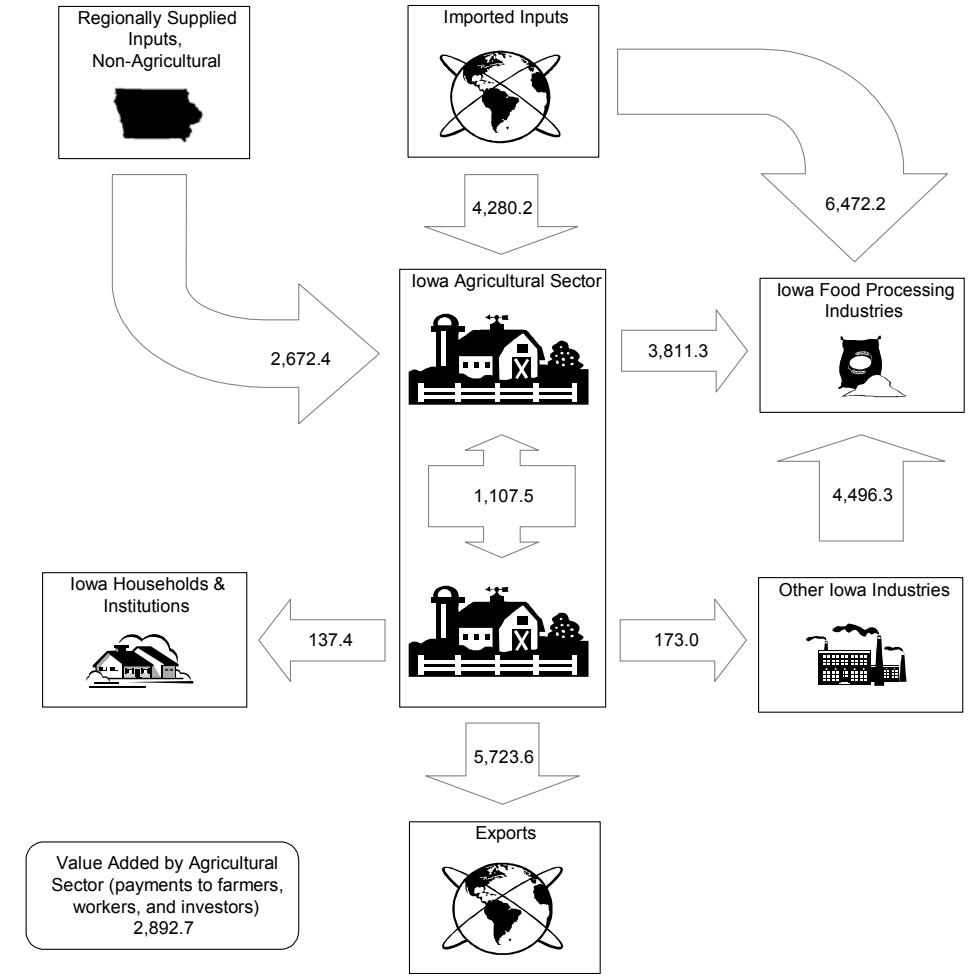
Iowa's agricultural commodities go to one of four places: inputs into additional agricultural production (as in livestock feeding), directly consumed by households, inputs into other value added processing (food/grain processing industries, primarily), or exported to other states or nations.

The accompanying flow chart was constructed to help readers understand the path of production inputs into agriculture and the sales that agriculture makes to other industries, households, and institutions in Iowa and to the rest of the world. In 1999, Iowa agriculture produced $10.95 billion in total industrial output, which was about 6.6 percent of total economic output in the state that year. To generate that output required production inputs. Iowa agriculture

purchased $2.7 billion in regionally supplied non-agricultural inputs. These would include wholesale goods, fuels, utilities, transportation services, and financial inputs mostly. Iowa's farmers required $1.11 billion in agriculturally-supplied inputs. These include purchases of grains and other feed stocks directly from other farmers and the sale of livestock. Iowa farmers also purchased $4.3 billion in inputs originating outside of Iowa. Iowa farmers also paid $2.89 billion to value added in producing its output. These value added payments would include salaries and wages paid to farm workers and managers, normal returns to owner-operators, and payments to investors.

The Flow of Iowa Agricultural Sector Inputs and Outputs

(Transaction values are shown in millions of dollars)



Liesl Eathington. Department of Economics, ISU

Of the $10.95 billion in agricultural output for that year, $3.81 billion was purchased by the state's food and kindred manufacturing industries, and $5.72 billion in sales were destined for export to the rest of the world. The remaining $300 million was sold to either households, institutions, or other Iowa industries. Iowa agriculture's unique contribution to statewide economic impact is linked primarily to its production of commodities for export. Most of what remains serves as inputs into other sectors of the economy, primarily the food and kindred products sectors.

In 1999,the food and kindred products sector purchased $3.81 billion in Iowa agricultural commodities, $4.5 billion in industrial inputs from other Iowa industries, and $6.5 billion in inputs that were imported into the state. Iowa agricultural commodity sales accounted for just under 21 percent of the input purchases made by Iowa food and kindred manufacturing firms.

The intricacies of this chart underscore the need to carefully account for agricultural inputs and outputs when describing agriculture's importance to the state. As outputs from the agricultural sector feed into other sectors as inputs, their value is subsumed within those other downstream sectors' total industrial outputs. To keep from double counting industrial productivity in Iowa and to truly document the flow of commodities and labor into industrial production in Iowa, input-output techniques are used to account for the *net* flow of industrial output and the generation of value added in the state. Input-output accounts of the entire Iowa economy are maintained at the Department of Economics at Iowa State University and updated annually. These accounts track the linkages that Iowa industries have with each other and with the rest of the nation and the world.

The next table shows the industrial output and the value added amounts of economic impact that are attributable to major industries in Iowa after we have accounted for all inter-industrial transactions. Agriculture uniquely accounts for nearly 6 percent of the state's total industrial output and 4.7 percent of its value added. Food and kindred production in the state, which used about 35 percent of agricultural commodities produced in Iowa, accounted uniquely for 16.4 percent of the total industrial output in the state and 9.8 percent of value added. Other ag-affiliated industries – those that make machinery, fertilizers, and chemicals – were 2.1 percent of the total industrial output and 1.9 percent of value added.

When combined, agricultural industries and agricultural-related industries in Iowa produced $40.1 billion in industrial output, 24.3 percent of the state's total industrial output. This industrial output yielded $13.4 billion in value added, or 16.4 percent of the state total.

In comparison, all other manufacturing in Iowa, those firms not affiliated with agriculture product processing or other agricultural inputs, produced $18.4 billion in statewide value added economic impact, 22.4 percent of the total.

A Summary of Agricultural, Ag-Related, and All Other Industrial Economic Values In Iowa

	Economic Impacts			
	Output		Value Added	
	Total	Percent of Total	Total	Percent of Total
All Production Agriculture*	9,678	5.9%	3,829	4.7%
Food & Kindred	27,042	16.4%	8,013	9.8%
All Other Ag Affilliated	3,404	2.1%	1,588	1.9%
Subtotal Ag and Ag Related Industries	40,123	24.3%	13,430	16.4%
All Other Manufacturing	43,618	26.5%	18,368	22.4%
FIRE	6,797	4.1%	4,442	5.4%
TCPU	7,275	4.4%	3,919	4.8%
Trade	5,184	3.1%	3,499	4.3%
Service	9,185	5.6%	5,434	6.6%
All Other	52,719	32.0%	32,748	40.0%
Total	164,902	100.0%	81,840	100.0%

Note: All financial amounts in $ millions. Data are for 1999.

*This total includes all production agriculture jobs, along with agriculture service employment and forestry jobs.

Agriculture's Multipliers

To round out any discussion of agriculture's importance to the Iowa economy, it is helpful to explain economic multipliers. Multipliers are derived from our input-output accounts and isolate the value of linkages that agricultural production has with the remainder of the economy. A multiplier is a simple ratio of the total change in the economy as related to a unit change in some agricultural economic measure. In producing a dollar's worth of agricultural products, a farmer must make purchases of land, equipment, seed, animals, chemicals, fertilizers, fuels, etc. When farm families and suppliers receive paychecks for their direct or indirect contribution to producing that dollar's worth of agricultural product they turn around and spend that paycheck on household goods and services. All of these transactions link to the original dollar of agricultural production. The suppliers to the farmers are the *indirect effects.* The sales made to households are the *induced effects*. The sum of the original agricultural production, the *direct effect*, plus the indirect and induced values gives us the *total economic effect.* Following is an illustration of agriculture's relationship to the remainder of the economy.

The Iowa input-output model was "shocked" with a million dollars worth of agricultural output in proportion to each subsector's average contribution to the total output of the agricultural sector. As a consequence, the results are a weighted average for the entire agricultural industry in Iowa that weights much more heavily feed grains, oil crops, swine production, and cattle production. We have displayed the values for industrial output (sales, primarily), labor income (the wages, salaries, and sole proprietor profits component of value added), and jobs.

Accordingly, a million dollars of Iowa agricultural output requires $468,473 in production inputs that are supplied by Iowa firms. When workers in agriculture and in the

supplying firms receive their paychecks they induce $160,115 in additional spending. The total amount of industrial output produced is $1.63 million, leaving us an output multiplier of 1.63. That multiplier means that for every dollar's worth of output in the agriculture sector, $.63 in additional sales accrue to the rest of the Iowa economy.

Average Multipliers Per $1,000,000 of Agricultural Output

	Direct	Indirect	Induced	Total	Multiplier Index
Industrial output	1,000,000	468,473	160,115	1,628,588	1.63
Labor income	149,819	131,601	58,199	339,620	2.27
Jobs	11.1	5.3	2.5	19.0	1.71
Labor income per job	*13,497*	*24,830*	*23,280*	*17,875*	

Per million dollars of agricultural sales, $149,819 in labor income is generated to farm workers and to farm owners. The reader will notice that the supplying sectors pay $131,601 in labor income in supplying inputs to the ag sector, and that the induced sectors that take care of household goods and services pay $58,199 in labor income. Total labor income generated in Iowa per $1,000,000 of agricultural output or sales is $339,620. The labor income multiplier is relatively robust at 2.27. That multiplier means that for every dollar's worth of labor income generated from farming, $1.27 in labor income is sustained in the remainder of the economy. It is worth noting that the supplying sectors to agriculture account for the vast majority of this robust multiplier. The inputs that agriculture requires tend to come from firms that have relatively high wages.

The final multiplier is for jobs. A million dollars of agricultural output sustains 11.1 jobs in agriculture, 5.3 jobs in the supplying industries, 2.5 jobs in the induced sectors and 19 jobs in total for a jobs multiplier of 1.71. This means that for every job in agriculture, 71/100^{ths} of another job is sustained in the rest of the economy. The table also shows average earnings per job stimulated. Average labor income per job in agriculture is $13,500, in the supplying sectors average earnings are $24,830, and in the induced sectors $23,280. The weighted average labor income for all jobs associated with agricultural production in Iowa is $17,875.

To illustrate the range of multipliers that exist among Iowa's major industries, we have compiled the attached table to compare and contrast agriculture with these other key sectors in the state's economy: all food and kindred processing, farm machinery manufacturing, and Iowa's large insurance industry. As with the figures just presented, all industries are profiled per $1,000,000 of industrial output. This allows a comparison and contrast of the labor income and job production effects of the industries that are portrayed. Also included is the multiplier index.

The food and kindred sector was compiled by allocating $1,000,000 of industrial output in all sectors in proportion to their composition of this broad category. This industry requires $648,707 in inputs, a third of which come from the agricultural sector. Per million dollars of output, this industry sustains $1.81 million in output. This means the output multiplier is 1.81, which is significantly higher than all of the other output multipliers displayed. This higher value is based on the strength of this sector's linkage with not only the Iowa agricultural sector, but also the specialized production inputs that have evolved over the years to service the food and kindred processing industries in the state. This output level also supports a total of $314,564 in labor

income and 11.2 jobs. The reader will notice that both the labor income and the jobs multipliers are very high. They are high because this sector requires significantly less direct labor per million dollars of direct output than most manufacturing firms yet has strong linkages to supplying industries in the state. Only 2.8 direct workers are required per million dollars of output, but that output stimulates 6 indirect jobs from suppliers. Consequently, the multipliers are high for both the job and the income measure. Total jobs supported, however, per $1,000,000 of output are 11.2, which is only slightly less than some of the other manufacturing sectors profiled.

The farm machinery sector has much lower indirect linkages per million of output. It only requires $298,235 in regionally supplied inputs, which indicates that it must purchase a large fraction of its production requirements from outside of the region. Consequently, it has a lower output multiplier. This sector produces twice as many direct jobs per million dollars of output as the food and kindred sector, and the pay level is very high per job at $53,413.

A Comparison of Major Industrial Multipliers

Average Multipliers Per $1,000,000 of Agricultural Output

	Direct	Indirect	Induced	Total	Multiplier Index
Industrial output	1,000,000	468,473	160,115	1,628,588	1.63
Labor income	149,819	131,601	58,199	339,620	2.27
Jobs	11.1	5.3	2.5	19.0	1.71
Labor income per job	*13,497*	*24,830*	*23,280*	*17,875*	

Average Multipliers Per $1,000,000 of Food & Kindred Output

	Direct	Indirect	Induced	Total	Multiplier Index
Industrial output	1,000,000	648,707	148,242	1,806,949	1.81
Labor income	108,555	152,060	53,949	314,564	2.90
Jobs	2.8	6.0	2.4	11.2	4.00
Labor income per job	*38,770*	*25,343*	*22,479*	*28,086*	

Average Multipliers Per $1,000,000 of Farm Machinery Manufacturing Output

	Direct	Indirect	Induced	Total	Multiplier Index
Industrial output	1,000,000	298,876	229,429	1,528,306	1.53
Labor income	299,114	104,224	83,527	486,865	1.63
Jobs	5.6	3.0	3.7	12.3	2.20
Labor income per job	*53,413*	*34,741*	*22,575*	*39,583*	

Average Multipliers Per $1,000,000 of Insurance Carrier Output

	Direct	Indirect	Induced	Total	Multiplier Index
Industrial output	1,000,000	237,285	282,445	1,539,730	1.54
Labor income	351,713	144,867	102,818	599,398	1.70
Jobs	7.2	5.0	4.5	16.6	2.31
Labor income per job	*48,849*	*28,973*	*22,848*	*36,108*	

Iowa's large insurance industry has an output multiplier that is similar to farm machinery manufacturing. It produces more direct labor income per $1,000,000 of output and more jobs than the previous two industrial examples. In all, nearly $600,000 of labor income evolves in this

sector per $1,000,000 of output, and almost 17 jobs. This sector has a relatively robust jobs multiplier at 2.3 and a comparatively strong labor income multiplier.

A high multiplier index may not translate into a high multiplier when the values are expressed per million dollars of production. Agriculture directly sustains 11.1 jobs per million of output, but the average labor income per job (labor income includes returns to proprietors) is just $13,497. Food and kindred production produces much better compensation per job ($38,770) but only allows 2.8 jobs per million dollars of sales. On the other hand, both agriculture and food and kindred manufacturing have very strong linkages with in-state suppliers of goods and services, which helps to boost their respective output multipliers.

Appendix: Summary of Agricultural, Food Manufacturing, and Ag-Related Economic Impacts in Iowa*

Agriculture and the industries that are linked to agriculture are important to the Iowa economy. The accompanying table gives us direct measures of industrial output (gross sales, primarily) and value added attributable to agriculture and related industries in Iowa. This table also summarizes the estimated economic impact of agriculture, food and kindred manufacturing, and all other agriculture-affiliated industries in Iowa. This latter measure is based on a precise accounting of all inter-industrial transactions among these industries and those that supply goods and services to them in the state. The details of that accounting and appropriate explanations are contained in the body of the report.

Using direct measures of the agricultural economy, including food processing and related industries, agriculture accounts for 19.3 percent of industrial output (gross sales) and 9 percent of value added (the income and wealth made from those sales). Using economic impact measures, which track all inter-industrial relationships, the numbers are substantially higher:

- Production agriculture (which also includes all agriculture services) generated 4.7 percent of all value added.
- Food and kindred product manufacturing, which has very strong linkages to the Iowa agriculture economy, generated 9.8 percent of value added.
- All other agriculture-affiliated industries in Iowa generated 1.9 percent of value added.
- Combined, these three industrial groupings generated $13.4 billion or 16.4 percent of Iowa's total value added (the accumulated income and wealth made from the sale of outputs).

A Summary of Agricultural, Ag-Related, and All Other Industrial Economic Values In Iowa

	Direct Economic Measures				Economic Impacts			
	Output		Value Added		Output		Value Added	
	Total	Percent of Total	Total	Percent of Total	Total	Percent of Total	Total	Percent of Total
All Production Agriculture*	10,953	6.6%	2,893	3.5%	9,678	5.9%	3,829	4.7%
Food & Kindred	18,183	11.0%	3,404	4.2%	27,042	16.4%	8,013	9.8%
All Other Ag Affilliated	2,698	1.6%	1,072	1.3%	3,404	2.1%	1,588	1.9%
Subtotal Ag and Ag Related Industries	31,834	19.3%	7,369	9.0%	40,123	24.3%	13,430	16.4%
All Other Manufacturing	34,928	21.2%	12,080	14.8%	43,618	26.5%	18,368	22.4%
FIRE	17,428	10.6%	11,922	14.6%	6,797	4.1%	4,442	5.4%
TCPU	11,903	7.2%	6,370	7.8%	7,275	4.4%	3,919	4.8%
Trade	20,261	12.3%	14,763	18.0%	5,184	3.1%	3,499	4.3%
Service	24,627	14.9%	14,596	17.8%	9,185	5.6%	5,434	6.6%
All Other	23,827	14.5%	14,734	18.0%	52,719	32.0%	32,748	40.0%
Total	164,810	100.0%	81,834	100.0%	164,902	100.0%	81,840	100.0%

Note: All financial amounts in $ millions. Data are for 1999.

*This total includes all production agriculture jobs, along with agriculture service employment and forestry jobs.

* An economic impact accounting assures that inter-industrial purchases are tracked and considered in the compilations. For example, all transportation, warehousing, utility, financial, and wholesale services that are purchased by agriculture or agriculture-related industries have already been accounted and factored into the final economic impact values that are reported.

This accounting does not include the values of agriculture associations, trade groups, or marketing organizations that may be classified outside of the agricultural sectors by normal industrial accounting procedures. These numbers would have to be generated using survey methods. This accounting also does not include the values of spending by state or federal agencies, institutions, or universities that may contribute directly or indirectly to the agriculture economy, food safety, agriculture education, nutritional programs, rural economic development, rural infrastructure enhancement, rural housing, or land stabilization and environmental protection.