

Economic Analysis of Animal Agriculture 2004-2014

MISSOURI

A Report for
United Soybean Board



September 2015



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Missouri Executive Summary

The use of soybean meal as a key feed ingredient is an important part of Missouri's animal agriculture. While the degree to which animal agriculture utilizes this versatile feed ingredient has fluctuated with time, it remains a key driver of animal agriculture's success in Missouri. The success of Missouri animal agriculture in turn has a large impact on the rest of the state and regional economies. For example, in the state of Missouri during 2014 animal agriculture contributed:

- \$14.7 billion in economic output
- 93,989 jobs
- \$2.5 billion in earnings
- \$654.1 million in income taxes paid at local, state, and federal levels
- \$193.4 million in the form of property taxes

Plus, from 2004-2014 animal agriculture in Missouri increased economic output by over \$5.3 billion, boosted household earnings by \$887.8 million, contributed 32,038 additional jobs and paid \$233.8 million in additional tax revenues.

Missouri's animal agriculture consumed about 1.1 million tons of soybean meal in 2014. This soybean meal was fed primarily to:

- Hogs (363.9 thousand tons)
- Broilers (335.4 thousand tons)
- Turkeys (144.1 thousand tons)

This report examines animal agriculture in Missouri over the last decade. While this analysis is certainly instructive and allows improved understanding of animal agriculture's impact during that time, as the next decade unfolds in Missouri, many opportunities and challenges will arise. And, if past is prologue, animal agriculture will continue to be a major contributor to the economic well-being of the people of Missouri and beyond.

Missouri Economic Impact of Animal Agriculture

Animal agriculture is an integral part of Missouri's economy. In 2014, Missouri's animal agriculture contributed the following to the economy:

- About \$14.7 billion in economic output
- \$2.5 billion in household earnings
- 93,989 jobs
- \$654.1 million in income taxes

And the animal agriculture sector has shown substantial growth during challenging economic times. During the last decade Missouri's animal agriculture has:

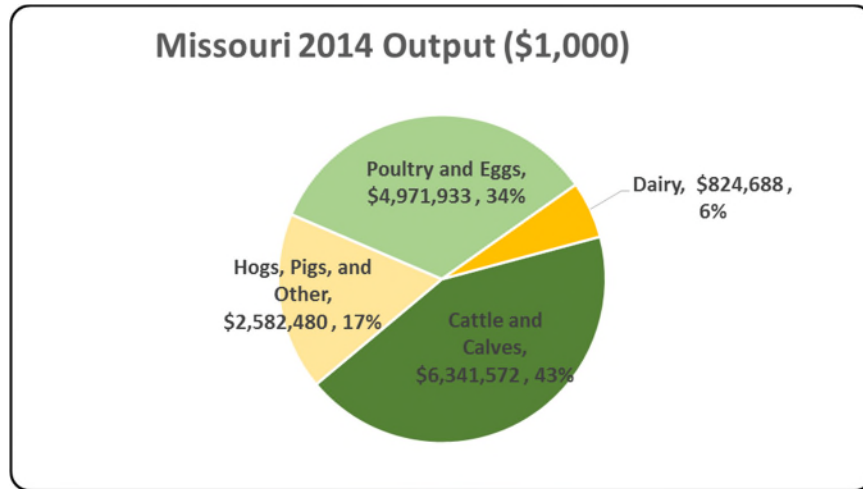
- Increased economic output by \$5.3 billion
- Boosted household earnings by \$887.8 million
- Added 32,038 jobs
- Paid an additional \$233.8 million in income taxes

Below is a table which demonstrates this decade of change.

| Measure | 2014 | Change 2004-2014 | % Change 2004-2014 |
|---------------------------------------|---------------|------------------|--------------------|
| Output (\$1,000) | \$ 14,720,673 | \$ 5,258,144 | 55.57% |
| Earnings (\$1,000) | \$ 2,484,170 | \$ 887,829 | 55.62% |
| Employment (Jobs) | 93,989 | 32,038 | 51.71% |
| Income Taxes Paid (\$1,000) | \$ 654,082 | \$ 233,765 | 55.62% |
| Property Taxes Paid in 2012 (\$1,000) | \$ 193,377 | | |

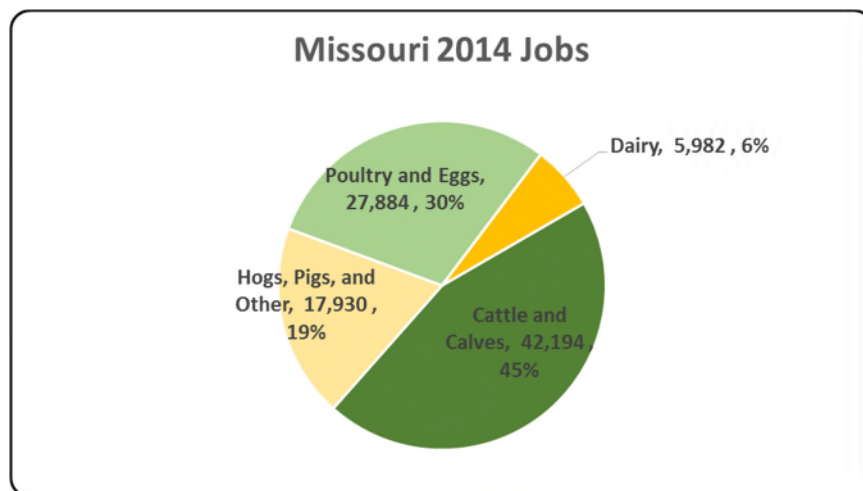
Missouri Output

“Output” refers to the total value of all the output (production or sales) of a study area and/or industry within a study area and was calculated using RIMS II multipliers. This is a gross number that does not make any deductions for the cost or origination of inputs that were used in the production process. The chart illustrates the impact of animal agriculture to the Missouri economy. Animal agriculture’s impact on Missouri total economic output is about \$14.7 billion.



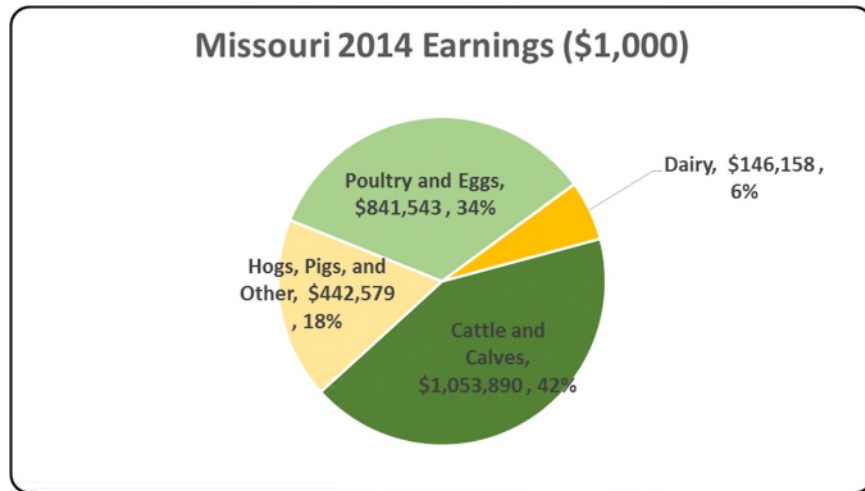
Missouri Jobs

“Jobs” represents an estimate of the number of full or part-time positions (jobs) currently filled in an area and/or industry. The chart illustrates the contribution to Missouri in terms of animal agriculture jobs. As shown, animal agriculture contributes significantly to Missouri total jobs, contributing 93,989 jobs within and outside of animal agriculture.



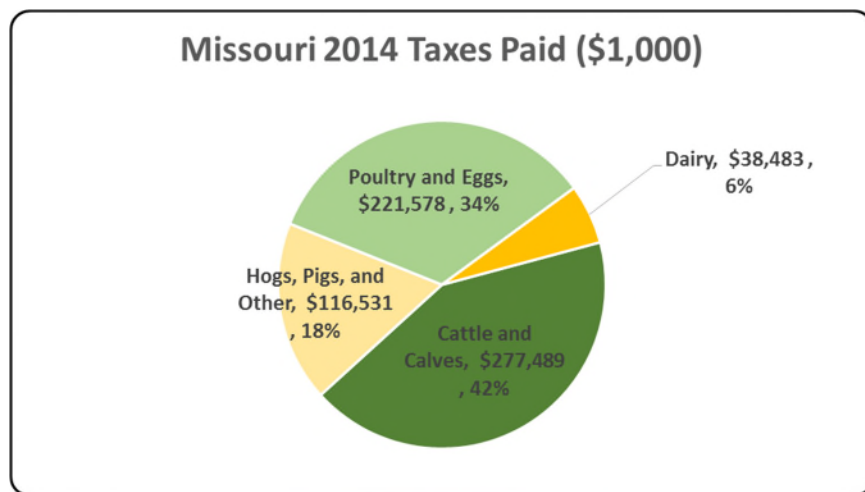
Missouri Earnings

Earnings includes wages and salaries plus proprietors' income, which is the net earnings of sole-proprietors and partnerships. The chart illustrates the impact of animal agriculture to the Missouri economy in terms of earnings. Missouri's animal agriculture contributed about \$2.5 billion to household earnings in 2014.



Missouri Taxes Paid by Animal Agriculture

Missouri's animal agriculture is also a significant source of tax revenue. In 2014, the state's animal agriculture industry paid about \$654.1 million in income taxes at local, state, and federal levels. Plus the 2012 Census of Agriculture estimated \$193.4 million in property taxes paid by all of Missouri agriculture during 2012. Estimates of income taxes paid by animal agriculture are shown in the following chart.



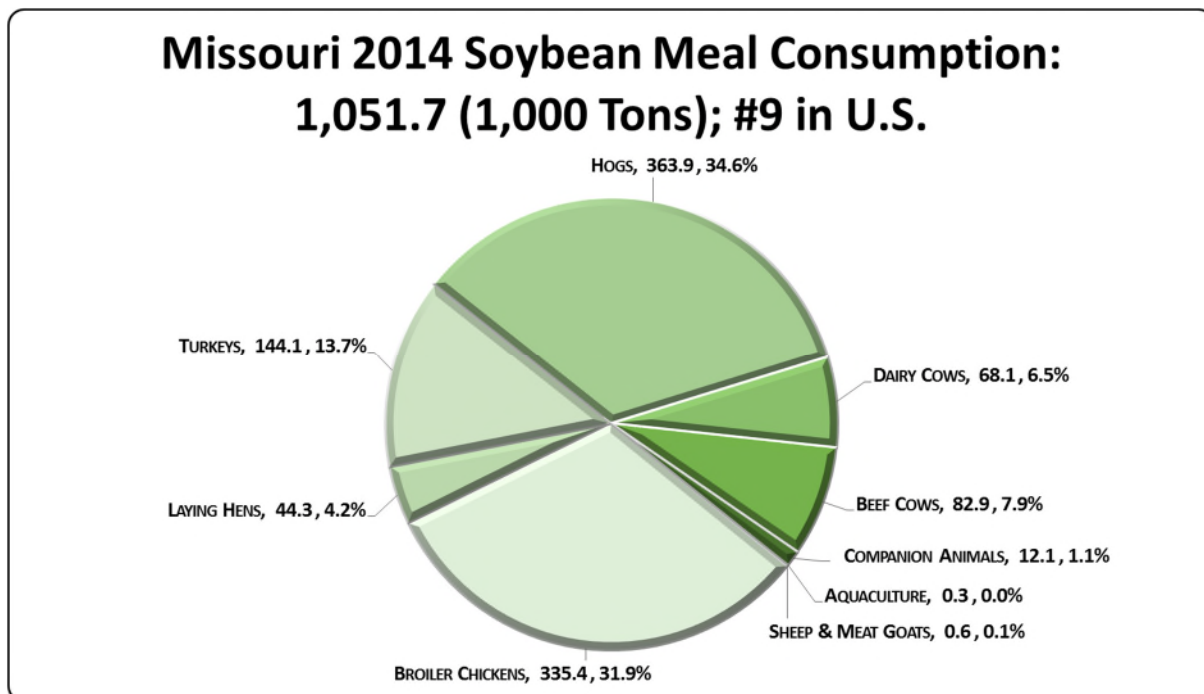
Missouri Animal Agriculture Soybean Meal Consumption

The choice to use soybean meal in animal agriculture is highly dependent upon nutritional requirements of animals (which would encompass varying life stages within an animal species), accessibility to various feed ingredients capable of competing with soybean meal (from both a nutritional and price standpoint), and consumer preferences which have influence on production practices.

Through in-depth conversations with many of the nation’s top nutritionists and researchers from both private industry and public institutions, “bottom up” estimates of soybean meal usage by animal type were determined. Using the input from these conversations and additional analysis performed by Decision Innovation Solutions, the quantity of soybean meal used during the 2013-14 soybean marketing year by up to sixteen specific animal species has been estimated.

Missouri’s animal agriculture consumed almost 1.1 million tons of soybean meal in 2014, placing the state as #9 in the nation in terms of soybean meal consumption (see figure below). The three segments of animal agriculture that led the state in estimated soybean meal consumption are:

- Hogs (363.9 thousand tons)
- Broilers (335.4 thousand tons)
- Turkeys (144.1 thousand tons)

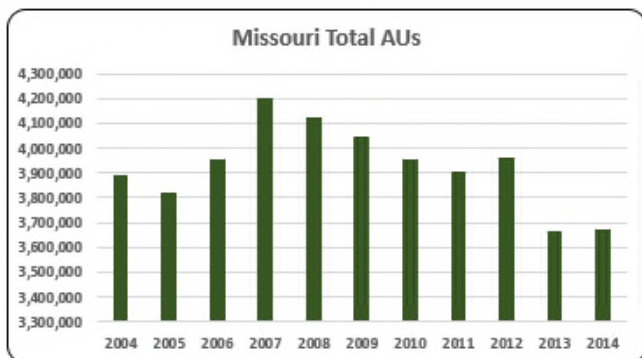
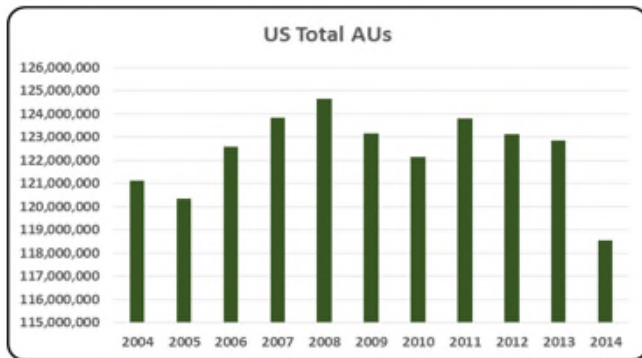


Missouri Animal Unit (AU) Trends

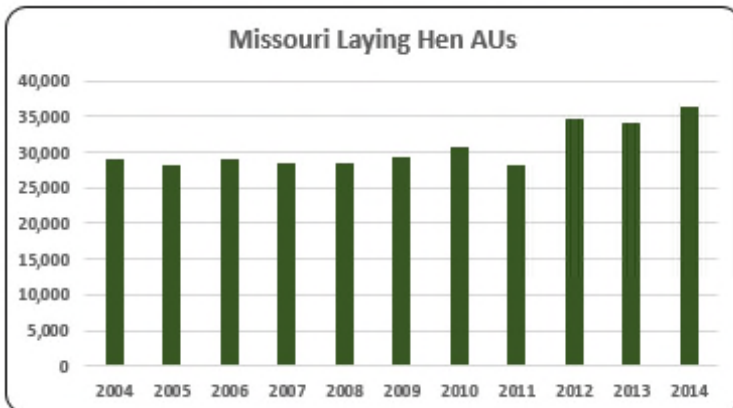
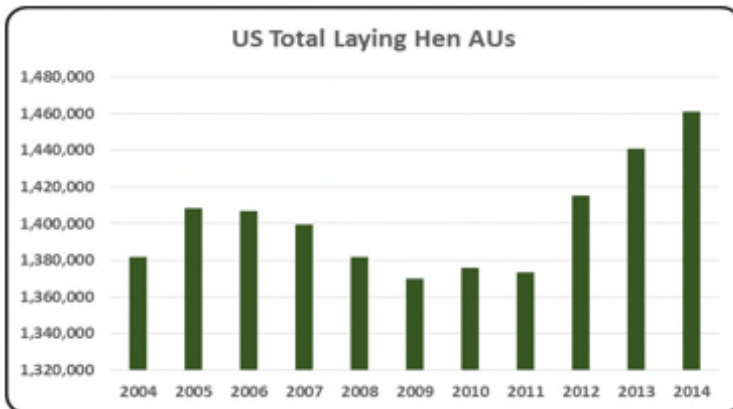
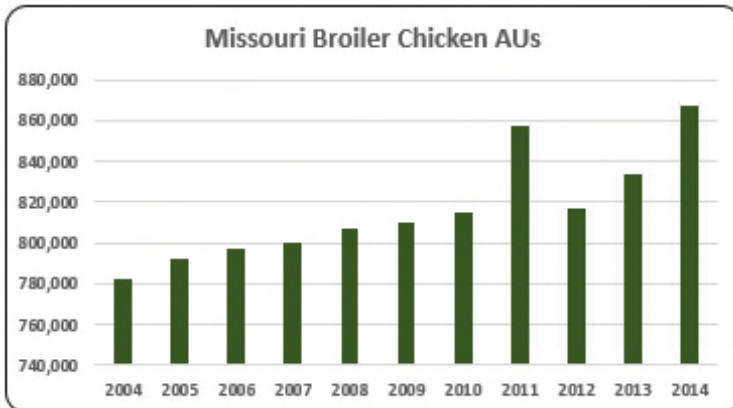
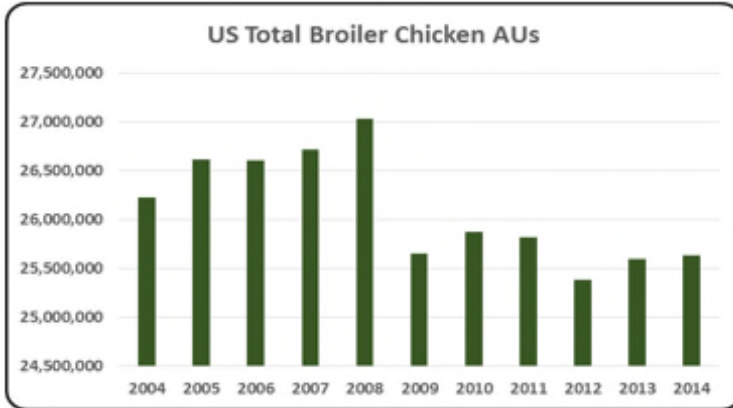
Over time, prices of feed, meat, eggs and milk, as well as levels of demand for these products in the United States and abroad have an impact on the size of animal agriculture in the State of Missouri. Due to this reality, using a single year as a measure of the presence and strength of a sector can be misleading. The use of animal units allows for a more accurate comparison of differing sizes of livestock and poultry. This section is included to bring context to the question of what animal agriculture means to Missouri and to give perspective on Missouri’s contribution to the nation’s animal agriculture industry and beyond.

Similar to using a single year to measure the presence and strength of a sector, in some circumstances AUs can be misleading. This is because AUs do not reflect important considerations like increased weights, improved livability, increased laying potential, etc.

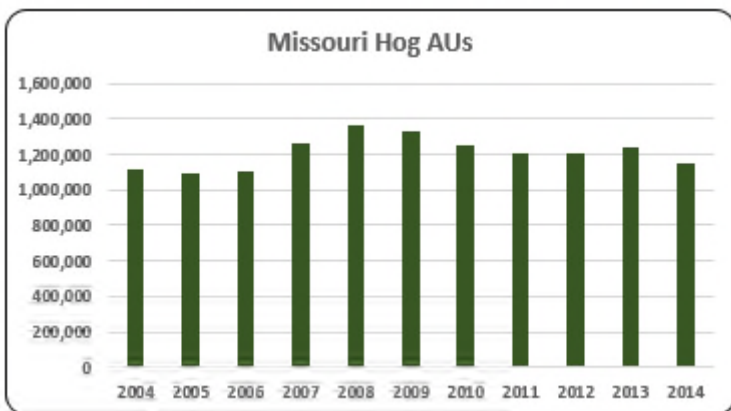
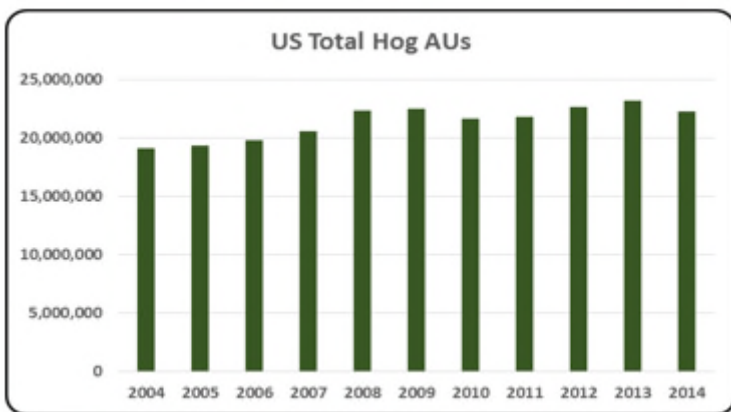
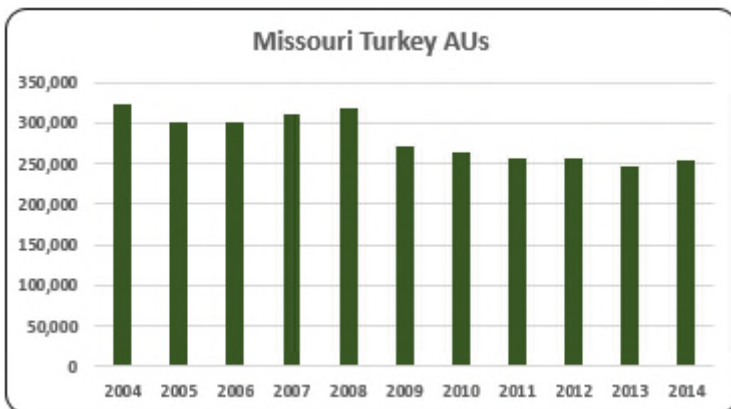
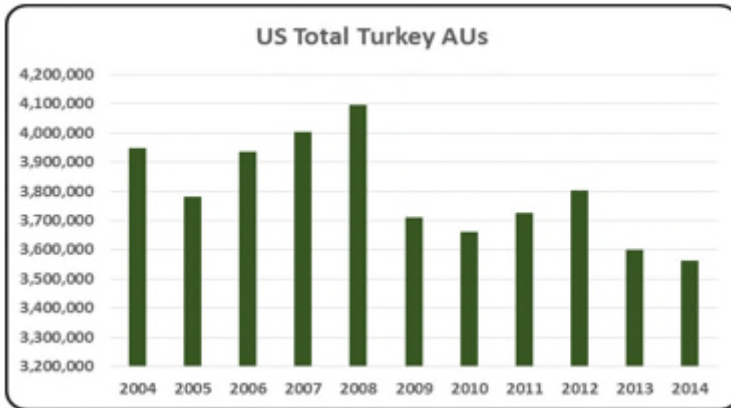
As shown in the accompanying charts and written commentary, certain components of animal agriculture are more present, and therefore more dominant than others. This is due primarily to geography (i.e., weather patterns and access to certain transportation hubs), proximity to high quality, relevant feed ingredients, and the local animal agriculture regulatory framework. In Missouri, the largest three segments of animal agriculture in terms of AUs during 2014 were: Beef Cows (1,241.9 thousand AUs), Hogs (1,146.8 thousand AUs), and Broilers (867.1 thousand AUs). Total animal units in Missouri during 2014 were 3,672.9 thousand AUs.



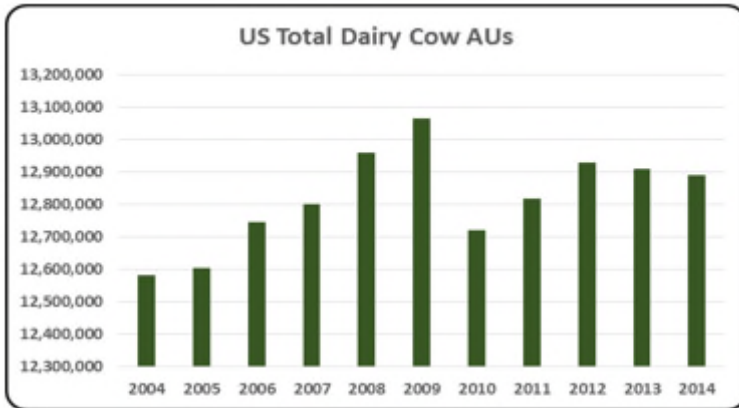
- Overall U.S. total AUs have varied from 2004 to 2014. In 2014 AUs were at an all-time low reflecting, in part, the impact of severe weather on cattle production in some parts of country. During the 2004-14 time period, total AUs in the nation peaked in 2008.
- The total AUs in Missouri in 2014 was 3,672.9 thousand. Thirty three percent of those AUs were from beef cow production whereas 31.2% were from hog production. AUs have dropped 6.0% during the 2004 to 2014 period.



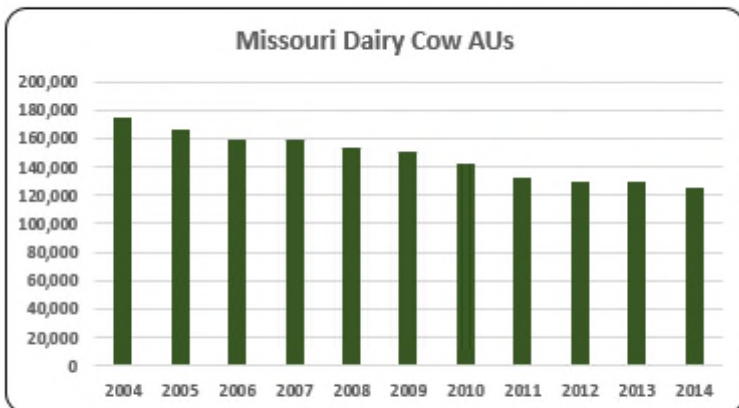
- U.S. broiler production is clustered in a number of states, with Georgia being the largest producer. On average from 2004 to 2014, broiler chicken AUs were about 26.1 million. In 2014, AUs rebounded 1% from the low AUs numbers in 2012 (25.4 million AUs).
- Broiler production in Missouri comprises the third largest animal production in the state. In 2014 there were 867,097 broiler AUs and production has risen 11.0% since the beginning of the decade. Almost 3.4% of all broiler production in the U.S. was in Missouri in 2014.
- On average, the layer AUs during 2004-2014 were 1.4 million. In 2014 layer AUs were 1.5 million, up 7% from the lowest number in 2009 (1.4 million AUs).
- Layer production represented less than 1% of animal production in Missouri in 2014. Layer production has grown 24% from 2004 to 2014.



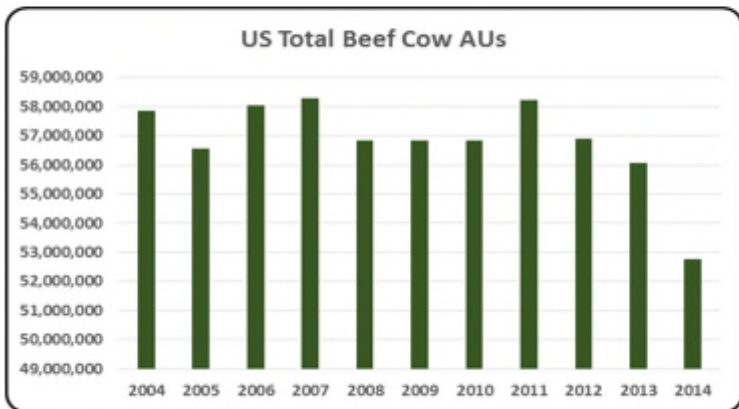
- From 2004 to 2014, the U.S. accounted for 50% of the world’s turkey production. However, in 2014 turkey AUs were the lowest of the decade at 3.5 million, decreasing 13% compared to 2008 (4.1 million turkey AUs) the largest turkey AUs of the decade.
- Turkey production has decreased 21% throughout the decade. However, turkey AUs in 2014 climbed 3.5% to 254,918 relative to 2013. About 7.2% of all turkey AUs in the country were in Missouri in 2014.
- On average from 2004 to 2014, hog AUs were about 21.4 million. In 2013 hog AUs reached a high of 23.2 million AUs as prices of main feed ingredients, particularly corn, decreased to pre-2010 price levels. Hog AUs in 2014 decreased 4.4% to 22.3 million AUs year-over-year, primarily due to the porcine epidemic diarrhea virus (PEDv) outbreak. Despite the fluctuation in AUs, the pork supply was relatively stable.
- Hog production shrunk 7.4% to 1,146.8 thousand hog AUs in 2014 and remained 16% below the record high level achieved in 2008 (1,360.8 thousand hog AUs).



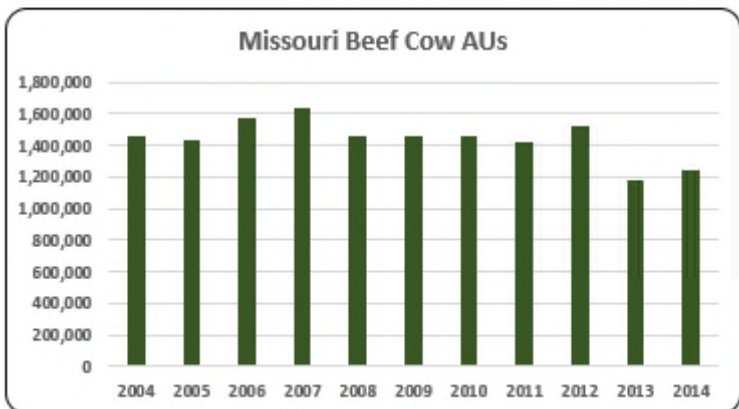
- From 2004 to 2014 dairy cow AUs averaged 12.8 million. In 2014, dairy cow AUs (12.9 million) remained about the same as the previous year but still below the high of 13.1 million AUs, the level in 2009. Despite the fluctuation in AUs, milk supplied has steadily risen.



- The average number of dairy cow AUs during 2004-2014 was 148,018. In general, dairy production has trended downward during the decade.



- From 2004 to 2014 beef cow AUs averaged 56.8 million. In 2014 beef cow AUs decreased to 52.8 million, the lowest of the decade. States that raise a large number of cattle and calves like Texas and Oklahoma were plagued with drought conditions during 2014.



- There were 1,241.9 thousand beef cow AUs in 2014. Beef cow AUs increased 5.0% in 2014 year-over-year.

Missouri Additional Information and Methodology

Animal agriculture is an important part of Missouri's current and future economic health. To quantify the connection between animal agriculture and local economies, the United Soybean Board commissioned [Decision Innovation Solutions](#), an economic research firm in Urbandale, Iowa, to conduct an in-depth analysis of several aspects of animal agriculture. This analysis includes the following components:

- Economic impact of animal agriculture to local (state) economies during the 2004-2014 time period
- Soybean meal usage by animal species during the 2013/14 soybean marketing year
- Animal Unit (AU) trends from 2004-2014

Given the long-term presence of animal agriculture in Missouri, of interest is the degree to which the industry impacts the Missouri economy. Estimates of output, jobs, earnings, taxes paid, and multipliers for Missouri animal agriculture are presented in this report. Methodology for this section of the report closely mirrors that followed in years' past. Also presented are estimates of the change in how animal agriculture has impacted Missouri's economy over the last decade. Differences, to the extent they are present, are noted within the larger national report which accompanies this state report.

As with any industry across the economic spectrum, there are ebbs and flows in activity that have implications for other parts of the economy. Again using the same 2004-2014 time period as with the economic impact section of this state report, the "Animal Unit Trends" seeks to quantify production changes in animal agriculture in Missouri which have occurred. As shown in this state report, Missouri has seen changes within its animal agriculture industry. Expectations are that animal agriculture will continue to evolve over the next decade.

Animal agriculture is the single largest user of soybean meal in Missouri. Through in-depth conversations with many of the nation's top nutritionists and researchers, "bottom up" estimates of soybean meal usage by animal type were determined. Using the input from these conversations and additional analysis performed by Decision Innovation Solutions, the quantity of soybean meal used during the 2013-14 soybean marketing year for up to sixteen specific animal species has been estimated.

Should readers have comments or questions regarding methodology, results and interpretation, please contact the authors at info@decision-innovation.com or 515.257.6077.

Missouri Multipliers

Economic multipliers give a sense for how economic activity in a given industry is related to other industries in the same study area. To estimate the impact of animal agriculture on Missouri’s economy, we applied RIMS II multipliers from the Department of Commerce, Bureau of Economic Analysis for cattle ranching and farming, dairy cattle and milk production, poultry and egg production, and other animal production (primarily hogs and pigs), where applicable.

Multipliers are generally stated in the form of “per million dollars” of output. As it relates to this analysis, multipliers are stated as the activity related to every million dollars of economic output in animal agriculture. Referring to the multipliers below, for every million dollars in output generated by the various segments of animal agriculture in Missouri, \$2.123 to \$3.241 million in total economic activity, \$0.364 to \$0.549 in household wages and 15 to 20 additional jobs are generated in the economy at large.

| | Animal Type | Output(\$) | Earnings (\$) | Employment (Jobs) |
|---------------------|-----------------------|------------|---------------|-------------------|
| RIMS II Multipliers | Cattle and Calves | \$ 2.9918 | \$ 0.4972 | 19.9 |
| | Hogs, Pigs, and Other | \$ 2.1228 | \$ 0.3638 | 14.7 |
| | Poultry and Eggs | \$ 3.2406 | \$ 0.5485 | 18.2 |
| | Dairy | \$ 2.4240 | \$ 0.4296 | 17.6 |

Appendix

| | | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | |
|--------------------------------------|------------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------|
| Animal Units (AUs) | Beef Cattle AUs | 1,463,700 | 1,436,700 | 1,567,200 | 1,637,700 | 1,456,950 | 1,456,950 | 1,456,950 | 1,425,450 | 1,522,500 | 1,183,050 | 1,241,850 | |
| | Hog and Pig AUs | 1,119,150 | 1,097,250 | 1,101,300 | 1,264,950 | 1,360,800 | 1,329,600 | 1,249,290 | 1,208,100 | 1,201,575 | 1,238,025 | 1,146,825 | |
| | Broiler AUs | 782,649 | 792,314 | 796,733 | 800,087 | 806,764 | 809,692 | 814,422 | 856,891 | 816,372 | 833,767 | 867,097 | |
| | Turkey AUs | 322,500 | 301,584 | 301,653 | 309,534 | 317,039 | 271,084 | 263,316 | 255,619 | 255,635 | 246,209 | 254,918 | |
| | Egg Layer AUs | 29,140 | 28,096 | 29,084 | 28,512 | 28,472 | 29,176 | 30,840 | 28,112 | 34,791 | 34,025 | 36,230 | |
| | Dairy AUs | 175,000 | 166,600 | 159,600 | 159,600 | 154,000 | 151,200 | 142,800 | 133,000 | 130,200 | 130,200 | 130,200 | 126,000 |
| | Total Animal Units | 3,892,139 | 3,822,544 | 3,955,570 | 4,200,383 | 4,124,025 | 4,047,702 | 3,957,618 | 3,907,172 | 3,961,073 | 3,665,276 | 3,672,920 | |
| Value of Production (\$1,000) | Cattle and Calves (\$1,000) | \$ 1,370,355 | \$ 1,499,574 | \$ 1,407,082 | \$ 1,320,059 | \$ 1,275,340 | \$ 1,166,923 | \$ 1,249,386 | \$ 1,573,612 | \$ 1,592,860 | \$ 1,569,300 | \$ 2,119,651 | |
| | Hogs and Pigs (\$1,000) | \$ 551,601 | \$ 539,175 | \$ 589,434 | \$ 716,030 | \$ 759,846 | \$ 674,301 | \$ 698,685 | \$ 934,293 | \$ 905,013 | \$ 960,080 | \$ 1,200,854 | |
| | Broilers (\$1,000) | \$ 88,190 | \$ 168,364 | \$ 231,656 | \$ 303,386 | \$ 381,101 | \$ 448,472 | \$ 520,742 | \$ 628,371 | \$ 651,850 | \$ 808,221 | \$ 882,118 | |
| | Turkeys (\$1,000) | \$ 279,930 | \$ 282,600 | \$ 317,000 | \$ 361,620 | \$ 371,070 | \$ 305,250 | \$ 361,584 | \$ 385,501 | \$ 420,163 | \$ 361,760 | \$ 399,840 | |
| | Eggs (\$1,000) | \$ 101,395 | \$ 74,570 | \$ 74,213 | \$ 128,026 | \$ 173,788 | \$ 133,665 | \$ 160,143 | \$ 173,429 | \$ 173,312 | \$ 225,228 | \$ 252,305 | |
| | Milk (\$1,000) | \$ 302,908 | \$ 290,625 | \$ 244,720 | \$ 325,532 | \$ 305,235 | \$ 203,840 | \$ 239,870 | \$ 287,316 | \$ 264,704 | \$ 276,545 | \$ 340,218 | |
| | Other | \$ 11,286 | \$ 12,314 | \$ 12,139 | \$ 12,519 | \$ 12,438 | \$ 13,069 | \$ 14,745 | \$ 14,385 | \$ 14,820 | \$ 15,255 | \$ 15,690 | |
| | Sheep and Lambs (\$1,000) | \$ 4,179 | \$ 5,170 | \$ 4,958 | \$ 5,302 | \$ 5,184 | \$ 5,778 | \$ 7,418 | \$ 7,021 | \$ 7,420 | \$ 7,818 | \$ 8,217 | |
| | Aquaculture (\$1,000) | \$ 7,107 | \$ 7,144 | \$ 7,181 | \$ 7,217 | \$ 7,254 | \$ 7,291 | \$ 7,327 | \$ 7,364 | \$ 7,400 | \$ 7,437 | \$ 7,474 | |
| | Total (\$1,000) | \$ 2,705,666 | \$ 2,867,222 | \$ 2,876,244 | \$ 3,167,173 | \$ 3,278,818 | \$ 2,945,519 | \$ 3,245,155 | \$ 3,996,907 | \$ 4,022,722 | \$ 4,216,389 | \$ 5,210,676 | |

| Ag Census Data Category | Animal Type | 1997 | 2002 | 2007 | 2012 | |
|--------------------------|--|--------------------|------------------|------------------|------------------|---------|
| Number of Farms by NAICS | Beef cattle ranching and farming (112111) | 49,947 | 48,441 | 44,336 | 40,724 | |
| | Cattle feedlots (112112) | 2,024 | 3,029 | 1,300 | 730 | |
| | Dairy cattle and milk production (11212) | 2,599 | 2,664 | 1,705 | 1,153 | |
| | Hog and pig farming (1122) | 2,444 | 1,469 | 1,056 | 689 | |
| | Poultry and egg production (1123) | 1,162 | 1,362 | 2,245 | 1,645 | |
| | Sheep and goat farming (1124) | 646 | 922 | 1,595 | 2,086 | |
| | Animal aquaculture and other animal production (1125,1129) | 3,859 | 8,047 | 9,216 | 7,265 | |
| Value of Sales (\$1,000) | Cattle and Calves | 1,143,320 | 1,285,288 | 1,676,632 | 1,968,617 | |
| | Hogs and Pigs | 841,644 | 570,551 | 725,738 | 882,526 | |
| | Poultry and Eggs | 755,708 | 784,986 | 1,265,166 | 1,441,676 | |
| | Milk and Other Dairy Products | 293,411 | 300,460 | 302,684 | 246,358 | |
| | Aquaculture | 5,374 | 11,107 | 9,506 | 10,256 | |
| | Other (calculated) | 36,613 | 38,417 | 38,262 | 25,866 | |
| | Total | 3,076,070 | 2,990,809 | 4,017,988 | 4,575,299 | |
| Input Purchases | Livestock and poultry purchased | (Farms) 29,162 | 30,120 | 25,620 | 27,112 | |
| | | \$1,000 | 574,610 | 546,196 | 761,333 | 906,474 |
| | Breeding livestock purchased | (Farms) <i>n/a</i> | 19,512 | 17,469 | 18,367 | |
| | | \$1,000 | <i>n/a</i> | 97,217 | 142,362 | 209,880 |
| | Other livestock and poultry purchased | (Farms) <i>n/a</i> | 14,508 | 11,591 | 12,517 | |
| | | \$1,000 | <i>n/a</i> | 448,979 | 618,971 | 696,594 |
| Feed purchased | (Farms) | 61,570 | 69,368 | 59,938 | 63,616 | |
| | \$1,000 | 1,056,896 | 1,136,939 | 1,383,506 | 1,989,225 | |

| | Animal Type | Output (\$1,000) | Earnings (\$1,000) | Employment (Jobs) | Taxes Paid (\$1,000) |
|---------------------------------|-----------------------------------|------------------|--------------------|-------------------|----------------------|
| 2014 Animal Agriculture | Cattle and Calves | \$ 6,341,572 | \$ 1,053,890 | 42,194 | \$ 277,489 |
| | Hogs, Pigs, and Other | \$ 2,582,480 | \$ 442,579 | 17,930 | \$ 116,531 |
| | Poultry and Eggs | \$ 4,971,933 | \$ 841,543 | 27,884 | \$ 221,578 |
| | Dairy | \$ 824,688 | \$ 146,158 | 5,982 | \$ 38,483 |
| | Total | \$ 14,720,673 | \$ 2,484,170 | 93,989 | \$ 654,082 |
| Change from 2004 to 2014 | Cattle and Calves | \$ 1,203,526 | \$ 200,011 | 8,008 | \$ 52,663 |
| | Hogs, Pigs, and Other | \$ 1,084,994 | \$ 185,943 | 7,533 | \$ 48,959 |
| | Poultry and Eggs | \$ 3,065,123 | \$ 518,799 | 17,190 | \$ 136,600 |
| | Dairy | \$ (95,498) | \$ (16,925) | (693) | \$ (4,456) |
| | Total | \$ 5,258,144 | \$ 887,829 | 32,038 | \$ 233,765 |
| | Animal Type | Output(\$) | Earnings (\$) | Employment (Jobs) | |
| RIMS II Multipliers | Cattle and Calves | \$ 2.9918 | \$ 0.4972 | 19.9 | |
| | Hogs, Pigs, and Other | \$ 2.1228 | \$ 0.3638 | 14.7 | |
| | Poultry and Eggs | \$ 3.2406 | \$ 0.5485 | 18.2 | |
| | Dairy | \$ 2.4240 | \$ 0.4296 | 17.6 | |
| Tax Rates | Federal effective income tax rate | | | | 12.7% |
| | Federal Social Security tax rate | | | | 7.7% |
| | State Effective Rate | | | | 6.0% |
| | Total | | | | 26.3% |

Sources: 1997, 2002, 2007 and 2012 Census of Agriculture, USDA/NASS Survey Data, RIMS II Multipliers (U.S. Bureau of Economic Analysis), Tax Policy Institute and Tax Foundation.