



Economic Contribution of the Missouri Corn and Ethanol Industries, 2000-2011



The Commercial Agriculture Program at the University of Missouri completed this report. This program is an interdisciplinary group of faculty in agricultural economics, agricultural engineering, animal science, plant science and veterinary medicine. Their mission is to create new opportunities for Missouri entrepreneurs and develop partnerships with firms that are both dedicated to profitable and sustainable agriculture and food systems.

Faculty that contributed to this report includes:

Joe Horner	Department of Agricultural and Applied Economics
Ryan Milhollin	Department of Agricultural and Applied Economics
Seanicaa Edwards	Department of Agricultural and Applied Economics

For further information about this report, please contact:

Joe Horner - (573) 882-9339 (phone) or HornerJ@missouri.edu (e-mail)

Table of Contents

I. EXECUTIVE SUMMARY.....	1
II. MISSOURI CORN INDUSTRY.....	3
2.1. Industry Overview	3
2.2. Cost of Production	5
2.3. Receipts and Value of Production	7
2.4. Economic Contribution of the Missouri Corn Industry in 2011	9
2.5. Historical Economic Contributions of the Missouri Corn Industry	14
III. MISSOURI ETHANOL INDUSTRY	15
3.1. Industry Overview	15
3.2. Cost of Production	19
3.3. Value of Production	21
3.4. Economic Contribution of the Missouri Ethanol Industry in 2011	22
3.5. Historical Economic Contributions of the Missouri Ethanol Industry	26
3.6. Missouri’s Contribution to the Ethanol Industry	27
IV. ECONOMIC CONTRIBUTION OF MISSOURI CORN AND ETHANOL INDUSTRIES... ..	28
REFERENCES	29
ACKNOWLEDGMENT	30
GLOSSARY.....	30

I. Executive Summary

This report examines the state's corn production and ethanol production industries. Annual economic contributions for 2011 for both industries are presented. Further, this report details the development of the ethanol industry and the combined economic contributions of both industries to Missouri's economy over the past twelve years.

In 2011, Missouri's corn production industry generated \$4.3 billion in economic output, sustained 65,960 jobs and created \$1 billion in added value for Missouri. Missouri's corn industry also stimulated approximately \$112 million in state and local taxes and \$201 million in federal taxes.

Exhibit 1.1 Economic Contributions from the Missouri Corn Industry in 2011

Category	Direct Effect	Indirect Effect	Induced Effect	Total Impact
Output (millions)	\$2,240	\$1,300	\$716	\$4,256
Employment (jobs)	49,293	10,302	6,364	65,960
Value added (millions)	\$513	\$713	\$438	\$1,664
Labor income (millions)	\$410	\$350	\$244	\$1,003

Missouri's six ethanol plants currently have nameplate capacity for producing 298.5 million gallons of ethanol each year. Missouri currently ranks 14th in the U.S. in ethanol nameplate capacity.

Exhibit 1.2 Missouri Ethanol Plants, Locations and Capacity

Plant Name	Location	Ethanol Capacity (million gallons)
Golden Triangle	Craig	22.0
Lifeline Foods, LLC	St. Joseph	50.0
Mid-Missouri Energy	Malta Bend	60.0
Poet Biorefining (Missouri Ethanol)	Laddonia	56.0
Poet Biorefining (Northeast Missouri Grain)	Macon	50.0
Show Me Ethanol	Carrollton	60.5
Total Ethanol Production		298.5

In 2011, the direct, indirect and induced effects of Missouri's ethanol industry generated \$1.1 billion in economic output, sustained 1,575 jobs and added \$162 million in value to the state's economy. Additionally, the Missouri ethanol industry stimulated approximately \$15 million in state and local taxes to Missouri and \$21 million in federal taxes.

Exhibit 1.3 Economic Contributions from the Missouri Ethanol Industry in 2011

Category	Direct Effect	Indirect Effect	Induced Effect	Total Impact
Output (millions)	\$837	\$159	\$61	\$1,057
Employment (jobs)	216	824	536	1,575
Value added (millions)	\$40	\$85	\$37	\$162
Labor income (millions)	\$14	\$50	\$21	\$86

Over the past twelve years Missouri's corn production industry has added a total of \$11.1 billion in value to the state's economy, \$4.9 billion in labor income and \$2 billion in taxes when considering all economic effects.

Exhibit 1.4 Missouri Corn Industry Total Economic Contributions, by Year

Year	Output (millions)	Employment (jobs)	Value Added (millions)	Labor Income (millions)	Taxes (millions)
2000	\$1,130	30,214	\$549	\$221	\$109
2001	\$1,073	28,703	\$522	\$210	\$104
2002	\$1,080	34,032	\$518	\$141	\$89
2003	\$1,145	31,625	\$620	\$257	\$101
2004	\$1,554	31,604	\$859	\$457	\$162
2005	\$1,085	22,064	\$600	\$319	\$113
2006	\$1,664	31,216	\$729	\$315	\$168
2007	\$3,119	58,502	\$1,367	\$590	\$314
2008	\$2,251	30,119	\$1,163	\$287	\$156
2009	\$2,238	29,216	\$1,145	\$282	\$153
2010	\$3,690	56,806	\$1,405	\$847	\$259
2011	\$4,256	65,960	\$1,664	\$1,003	\$313
Total			\$11,142	\$4,928	\$2,041

Over the past twelve years Missouri's ethanol production industry has added a total of \$734 million in value to the state's economy, \$416 million in labor income and \$174 million in taxes.

Exhibit 1.5 Missouri Ethanol Industry Impacts by Year

Year	Output (millions)	Employment (jobs)	Value Added (millions)	Labor Income (millions)	Taxes (millions)
2000	\$19	65	\$4	\$2	\$1
2001	\$73	252	\$15	\$9	\$5
2002	\$69	261	\$18	\$11	\$4
2003	\$116	378	\$27	\$16	\$6
2004	\$165	474	\$34	\$20	\$10
2005	\$278	798	\$58	\$34	\$16
2006	\$420	717	\$61	\$38	\$16
2007	\$498	850	\$73	\$45	\$18
2008	\$665	901	\$87	\$50	\$19
2009	\$644	866	\$85	\$49	\$19
2010	\$743	1,069	\$108	\$57	\$24
2011	\$1,057	1,575	\$162	\$86	\$35
Total			\$734	\$416	\$174

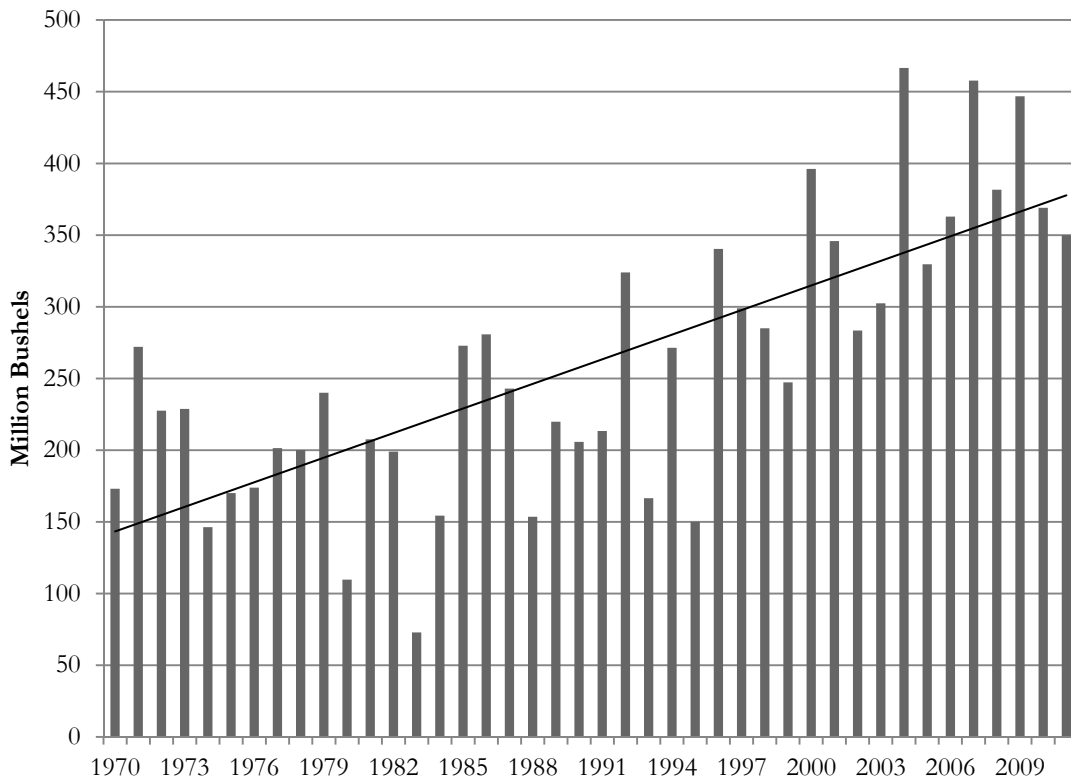
The economic contribution of both industries combined produced a cumulative \$5.3 billion in output in 2011. From the year 2000 to 2011, the Missouri corn and ethanol industries have added \$12 billion in value to the state's economy, \$5.3 billion in labor income and stimulated \$2.2 billion in local, state and federal taxes.

II. Missouri Corn Industry

2.1. Industry Overview

Missouri represents a significant corn production region in the U.S. Missouri ranked tenth in production among other U.S. states in 2011, according to the USDA. Exhibit 2.1.1 demonstrates Missouri corn production from 1970 to 2011, revealing a positive trend line. Over the past five years, Missouri has averaged approximately 400 million bushels of corn production per year.

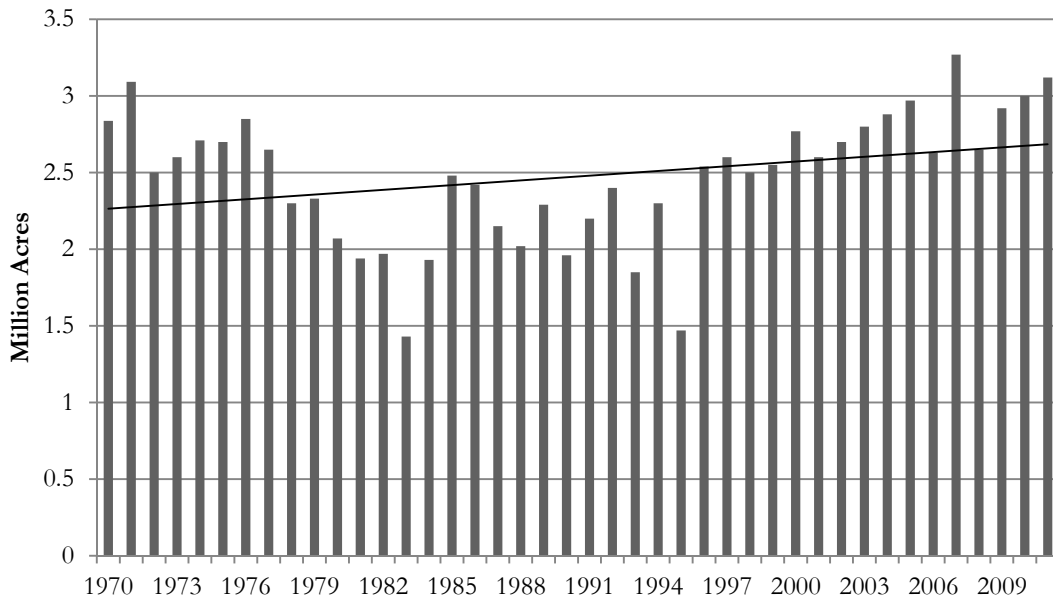
Exhibit 2.1.1 Missouri Corn Production Bushels, 1970-2011



Source: USDA-National Agricultural Statistics Service

Corn is one of the primary crops grown in Missouri. Exhibit 2.1.2 contains harvested corn acres in Missouri from the years 1970 to 2011. Harvested corn acreage in Missouri over the last five years has averaged approximately 3 million acres, which is higher than the thirty year average of 2.5 million acres. Yield improvements per acre are the driving force behind increased bushel production per year in Missouri.

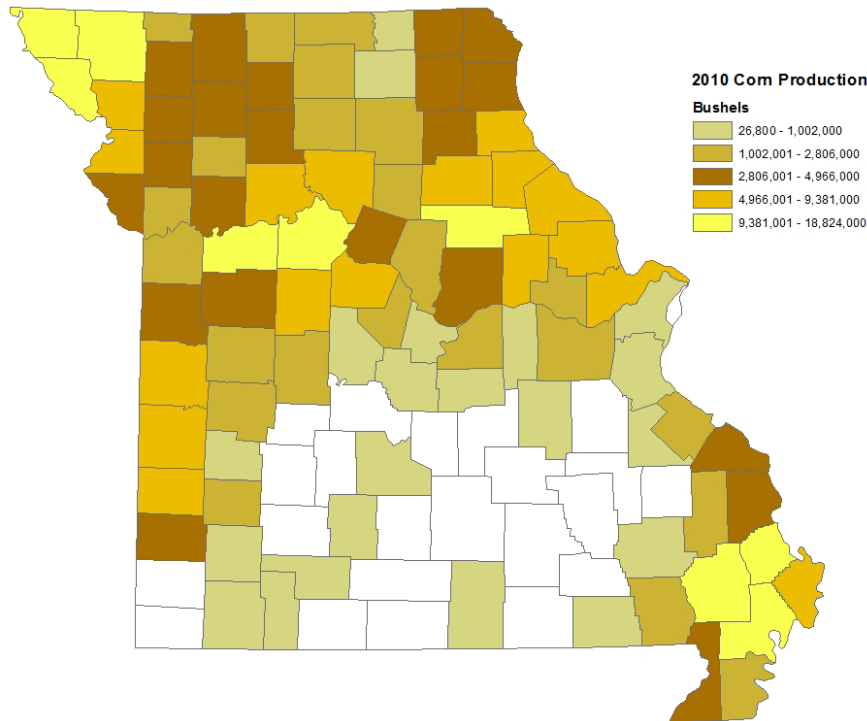
Exhibit 2.1.2 Missouri Corn Acres Harvested, 1970-2011



Source: USDA-National Agricultural Statistics Service

The location of Missouri’s corn industry can be found in Exhibit 2.1.3. Shading represents corn production, indicating the significant areas of production in the state. The southeast, northwest and central areas of Missouri have more significant production than other regions of the state.

Exhibit 2.1.3 Missouri Corn Production by County, 2010



Source: USDA-National Agricultural Statistics Service

2.2. Cost of Production

Missouri corn producers contribute to the state's economy by spending money to purchase inputs and operate their businesses. Cost of production data provided by the USDA Economic Research Service for the Heartland Region (which includes parts of Missouri, Iowa, Illinois, Nebraska, South Dakota, Kentucky, Indiana and Ohio) is shown in Exhibit 2.2.1 for the years 2009-2011. These estimates are based on the survey base year (2005) and are adjusted each year with new estimates of annual price, acreage and production changes. Total operating costs for Missouri corn production were estimated to have a three year average cost of \$295.39 per planted acre. Total allocated overhead costs amounted to an additional three year average cost of \$275.66 per planted acre.

Exhibit 2.2.1 – Missouri Corn Cost of Production, Per Acre

	2009 (\$ Per Acre)	2010 (\$ Per Acre)	2011 (\$ Per Acre)	Three-Year Average (\$ Per Acre)
Operating Costs				
Seed	\$80.61	\$85.07	\$88.04	\$84.57
Fertilizer	\$137.89	\$106.61	\$140.09	\$128.20
Chemicals	\$30.52	\$29.50	\$29.50	\$29.84
Custom operations	\$10.47	\$10.81	\$11.01	\$10.76
Fuel, lube, and electricity	\$22.13	\$26.87	\$33.99	\$27.66
Repairs	\$13.72	\$13.98	\$14.51	\$14.07
Interest on operating capital	\$0.43	\$0.27	\$0.16	\$0.29
Total operating costs	\$295.77	\$273.11	\$317.30	\$295.39
Allocated Overhead Costs				
Hired labor	\$1.59	\$1.61	\$1.62	\$1.61
Opportunity cost of unpaid labor	\$22.44	\$22.68	\$22.92	\$22.68
Capital recovery of mach. and equip.	\$77.56	\$80.35	\$84.20	\$80.70
Opportunity cost of land (rental rate)	\$142.36	\$146.58	\$158.04	\$148.99
Taxes and insurance	\$7.46	\$7.57	\$8.12	\$7.72
General farm overhead	\$13.61	\$13.87	\$14.39	\$13.96
Total, allocated overhead	\$265.02	\$272.66	\$289.29	\$275.66

Source: USDA – Economic Research Service

An indirect impact of Missouri's corn production can be estimated by multiplying total planted acres by the USDA cost of production information. Between 2009 and 2011, Missouri averaged approximately 3.2 million planted corn acres. Exhibit 2.2.2 demonstrates the total annual costs incurred in Missouri to plant corn. Approximately \$1.8 billion dollars of operating and overhead costs are spent or allocated for corn production annually in Missouri.

Exhibit 2.2.2 – Missouri Corn Cost of Production, 2009-2011 Average

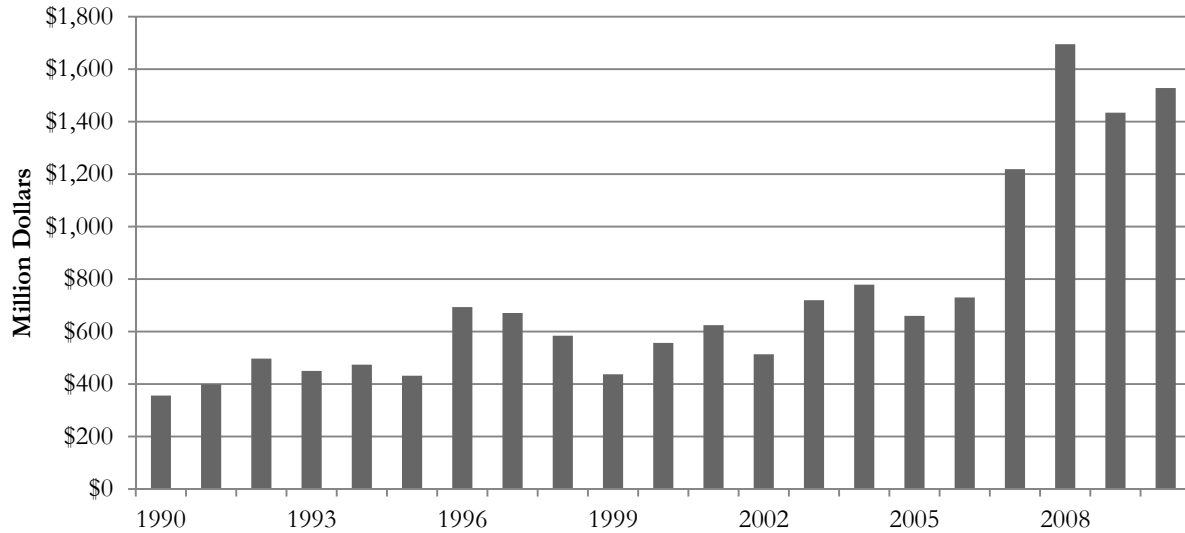
Type of Cost	State Corn Production Costs Per Year (million dollars)
Operating Costs	
Seed	\$226
Fertilizer	\$404
Chemicals	\$94
Custom operations	\$34
Fuel, lube, and electricity	\$87
Repairs	\$44
Interest on operating capital	\$1
Total operating costs	\$930
Allocated Overhead Costs	
Hired labor	\$5
Opportunity cost of unpaid labor	\$71
Capital recovery of machinery and equipment	\$254
Opportunity cost of land (rental rate)	\$469
Taxes and insurance	\$24
General farm overhead	\$44
Total, allocated overhead	\$868
Total, Operating Costs and Allocated Overhead	\$1,799

Source: Derived from USDA – Economic Research Service and National Agricultural Statistics Service Data

2.3. Receipts and Value of Production

Corn production generates cash sales for farmers, providing income to pay expenses and provide profits to operators. In 2010, corn cash receipts ranked second behind just soybeans among other Missouri agricultural commodities at \$1.5 billion, according to the USDA. Additionally, corn cash receipts represented 18.4 percent of commodity cash receipts in Missouri and 3.4 percent of the value of U.S. commodity cash receipts. Historical cash receipts for corn in Missouri can be found in Exhibit 2.3.1.

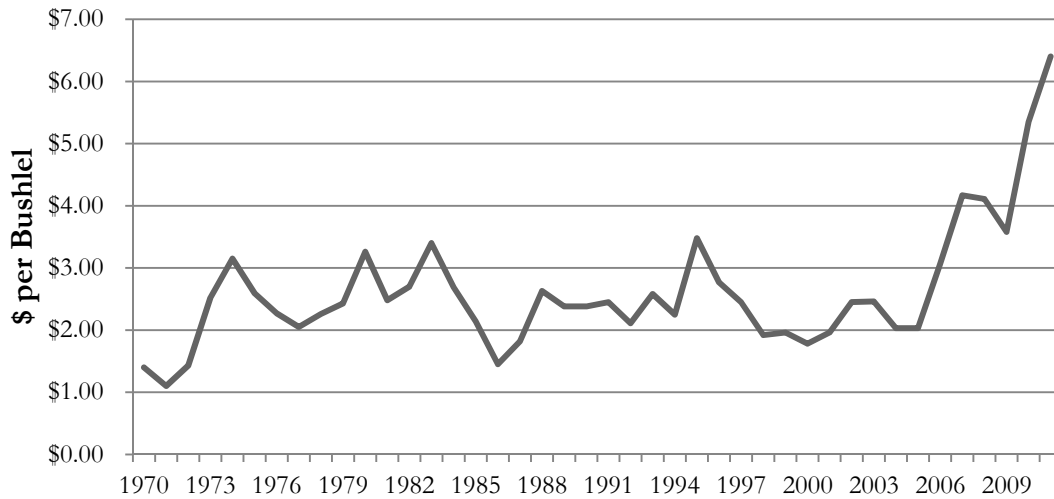
Exhibit 2.3.1 Missouri Cash Receipts for Corn, 1990-2010



Source: USDA – Economic Research Service

A significant driver in the growth of cash receipts in recent years for Missouri can be attributed to the increase in corn prices. Missouri average annual prices for corn are shown in Exhibit 2.3.2 for the past thirty years, according to the USDA. The Missouri reported price for corn in 2011 was \$6.40 per bushel, which represented a 20% increase over the previous year.

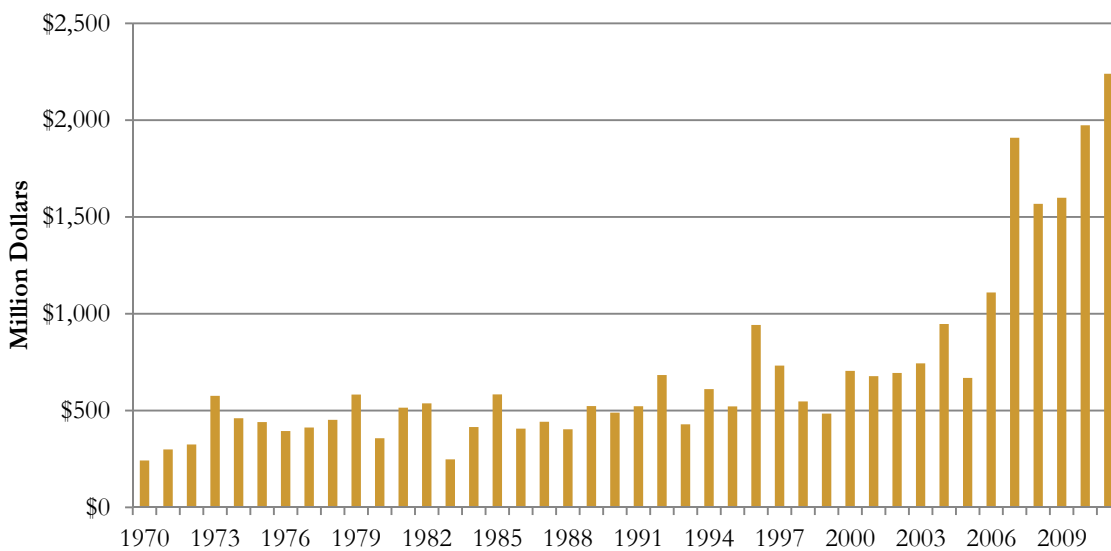
Exhibit 2.3.2 Missouri Corn Average Annual Price, 1970-2011



Source: USDA-National Agricultural Statistics Service

Value of production is another way to look at the financial importance of the Missouri corn industry. Cash receipt figures developed by USDA have had quantity adjustments for on-farm usage (feed) and other inventory/accounting corrections to more accurately represent true cash receipts of a commodity produced in a certain year. Value of production reflects the overall quantity and value of corn produced for a certain year without these adjustments. In 2011, Missouri had a corn value of production of \$2.2 billion dollars, which was based on the \$6.40 average price and close to 350 million bushels produced in Missouri. Historical corn value of production for Missouri reported by the USDA can be found in Exhibit 2.3.3. Missouri's current corn crop is worth almost \$1.5 billion more than it was ten years ago.

Exhibit 2.3.3 Missouri Corn Value of Production, 1970-2011



Source: USDA-National Agricultural Statistics Service

2.4. Economic Contribution of the Missouri Corn Industry in 2011

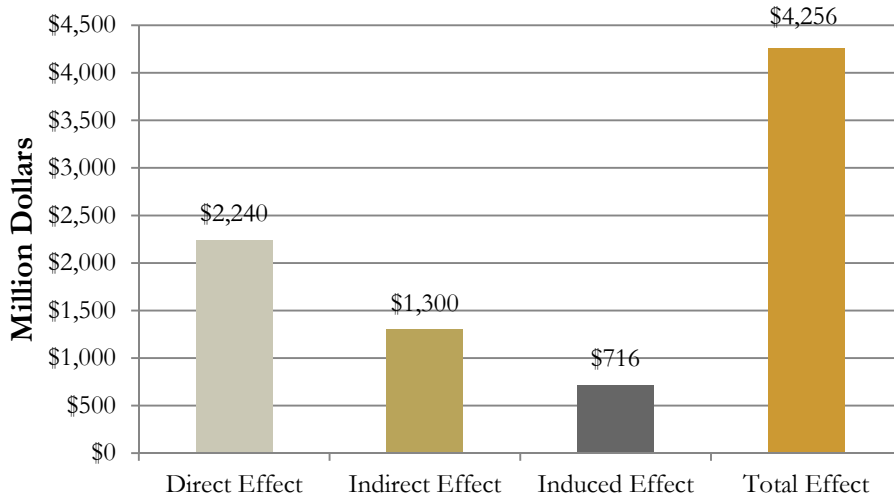
An economic contribution analysis was prepared for the Missouri corn industry using the IMPLAN economic impact software system. IMPLAN is an input-output model and includes economic data sets, multipliers, and demographic statistics for the entire U.S. economic infrastructure. It is a robust tool that can assess the effects of changes or industries and is widely used by economists and analysts.

The results from this corn industry analysis can be separated into three different categories: direct, indirect, and induced effects. A direct effect can be defined as the direct change to a respective industry. For example, the revenue generated from farmers selling corn would be considered a direct effect. Indirect effects measure the impact of buying goods and services from other local industries. An example of an indirect effect would be corn farmers purchasing supplies from other industries (fertilizer, transportation, seed, etc.). Induced effects are the responses in the local economy from proprietors and employees spending their income. For instance, corn producers and their employees will spend earnings at local grocery stores, restaurants and other retail establishments and this will create further ripples in the economy. Total effects refer to the combination of direct, indirect and induced effects.

Value of corn production in Missouri for the year 2011 was approximately \$2.2 billion, according to the USDA. In 2011, average selling price for corn was \$6.40 per bushel, and production was approximately 350 million bushels. Value of production represents a direct contribution from Missouri corn production as this corn will be sold or utilized in other industries to stimulate the state's economy. Total economic contributions based on Missouri's value of corn production in 2011 can be found in Exhibits 2.4.1-7.

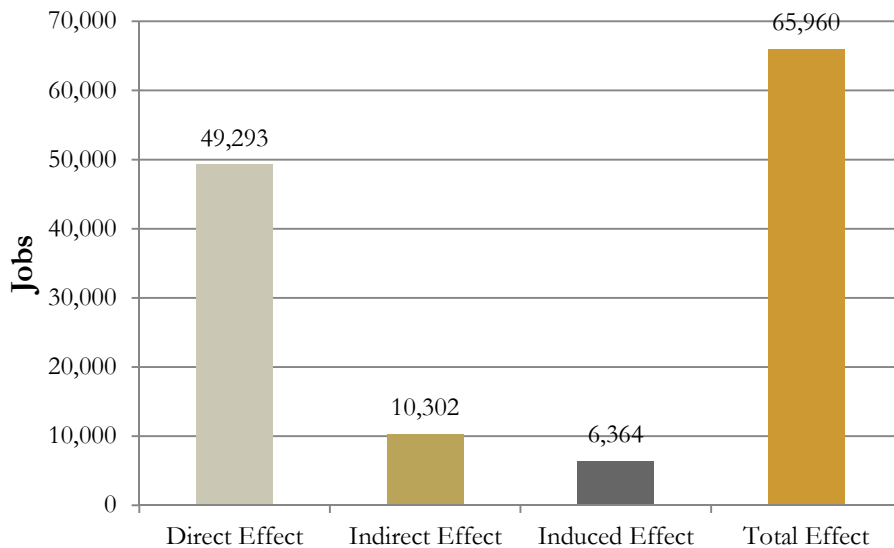
Output reflects the total value of Missouri’s corn production industry and may be broken down into direct, indirect and induced effects. The direct effect is simply the value of Missouri’s corn production in 2011 (\$2.2 billion). The indirect effects of the corn industry total \$1.3 billion, which represent the buying of goods and services to produce corn. Finally \$716 million in induced effects is added to Missouri’s economy as workers and others spend their added income in ways that continue to ripple through the state’s economy. The combination of all effects from the corn industry generated \$4.3 billion worth of economic activity in Missouri.

2.4.1 Contribution of Missouri Corn Production in 2011 - Output



Jobs are another important economic contribution supported by the corn industry. Employment refers to the number of jobs (both full time and part time). In 2011, Missouri’s corn industry supported 65,960 jobs composed of 49,293 direct jobs, 10,302 indirect jobs and 6,364 induced jobs.

2.4.2 Contribution of Missouri Corn Production in 2011 - Jobs



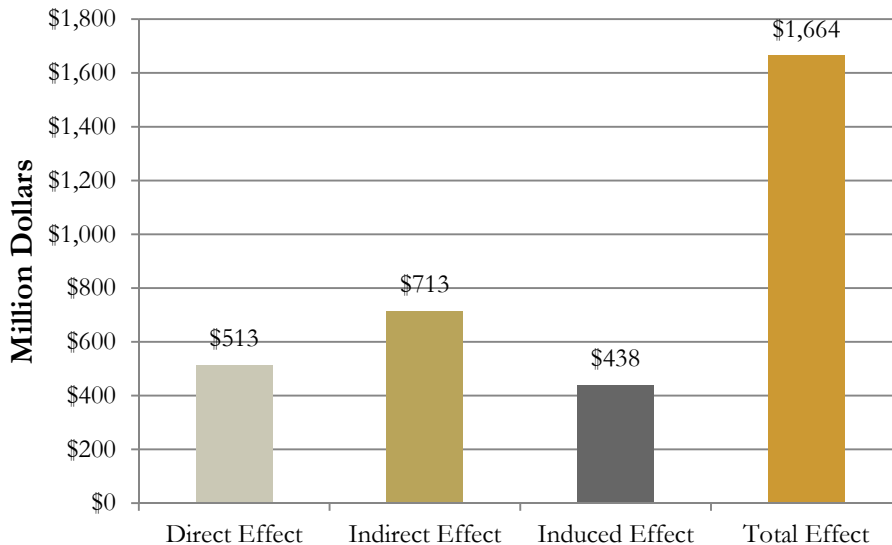
The top ten job industry sectors that were supported by the 2011 Missouri corn industry can be found in Exhibit 2.4.3. Grain farming (farmers) would be the primary industry that had the largest job impact (50,428 jobs) after considering all direct, indirect and induced effects. Real estate establishments and support activities for agriculture/forestry were second and third, respectively.

2.4.3 Contribution of Missouri Corn Production in 2011 – Total Jobs by Sector

Industry Sector	Number of Jobs
Grain farming	50,428
Real estate establishments	2,835
Support activities for agriculture and forestry	1,955
Food services and drinking places	881
Monetary authorities and depository credit intermediation activities	682
Wholesale trade businesses	638
Nondepository credit intermediation and related activities	464
Transport by truck	363
Private hospitals	339
Securities, commodity contracts, investments, and related activities	309

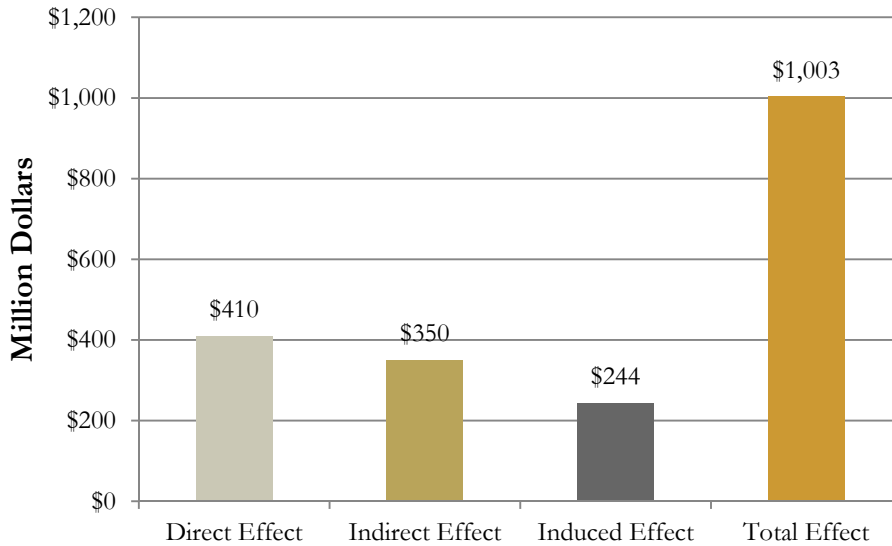
The contribution of corn to Missouri’s economy can also be analyzed by the value-added measure. Value-added refers to the difference between the industry output (value of corn) and the cost of the inputs used in its production (seed, fertilizer, etc.). This term can also be interpreted as the contribution to gross domestic product (GDP) by this industry or the summation of workers compensation, owner profits and taxes. The value added contribution to Missouri’s economy by the corn industry is estimated at \$1.7 billion, which represents approximately 0.7% of Missouri’s GDP.

2.4.4 Contribution of Missouri Corn Production in 2011 – Value Added



Labor or household income is another economic measure that is included in the value-added classification. It reflects the total of employee compensation (wages and benefits) and proprietor income (self-employment). In the year 2011, the Missouri corn industry generated over \$1.0 billion dollars in household income when considering each category of economic effects.

2.4.5 Contribution of Missouri Corn Production in 2011 - Labor Income



Tax revenues (also included in value-added classification) described in this section includes those paid to local, state, and federal entities. Tax impact values show the amount of revenue generated from employee compensation, proprietor income, indirect business taxes, households, and corporations. The Missouri corn industry stimulated approximately \$112 million in state and local taxes to Missouri and \$201 million in federal taxes in 2011 (Exhibits 2.4.6 and 2.4.7).

2.4.6 Contribution of Missouri Corn Production in 2011 – State and Local Taxes

Description	Total
Dividends	\$253,070
Social Ins Tax- Employee Contribution	\$494,044
Social Ins Tax- Employer Contribution	\$1,144,654
Indirect Bus Tax: Sales Tax	\$39,355,060
Indirect Bus Tax: Property Tax	\$33,717,604
Indirect Bus Tax: Motor Vehicle Lic	\$671,146
Indirect Bus Tax: Severance Tax	\$75
Indirect Bus Tax: Other Taxes	\$5,308,137
Indirect Bus Tax: S/L NonTaxes	\$2,707,979
Corporate Profits Tax	\$2,852,238
Personal Tax: Income Tax	\$20,776,966
Personal Tax: NonTaxes (Fines- Fees)	\$2,735,534
Personal Tax: Motor Vehicle License	\$811,935
Personal Tax: Property Taxes	\$442,800
Personal Tax: Other Tax (Fish/Hunt)	\$615,374
Total State and Local Tax	\$111,886,616

2.4.7 Contribution of Missouri Corn Production in 2011 – Federal Taxes

Description	Total
Social Ins Tax- Employee Contribution	\$53,724,744
Social Ins Tax- Employer Contribution	\$31,265,778
Indirect Bus Tax: Excise Taxes	\$7,791,206
Indirect Bus Tax: Custom Duty	\$3,056,633
Indirect Bus Tax: Fed NonTaxes	\$5,204,824
Corporate Profits Tax	\$40,552,992
Personal Tax: Income Tax	\$59,664,452
Total Federal Tax	\$201,260,629

2.5. Historical Economic Contributions of the Missouri Corn Industry

An historical account of economic contributions of Missouri's corn industry is presented by year in Exhibit 2.5.1. Value of corn production reported by the USDA for Missouri was used to estimate these impacts. The contributions illustrated include all direct, induced and induced economic effects from the corn industry to the state of Missouri. From the year 2000 to 2011, the Missouri corn industry has added a total of \$11.1 billion in value to the state's economy, \$4.9 billion in household income and stimulated \$2 billion in local, state and federal taxes.

Exhibit 2.5.1 Missouri Corn Industry Total Economic Contributions, by Year

Year	Output (millions)	Employment (jobs)	Value Added (millions)	Labor Income (millions)	Taxes (millions)
2000	\$1,130	30,214	\$549	\$221	\$109
2001	\$1,073	28,703	\$522	\$210	\$104
2002	\$1,080	34,032	\$518	\$141	\$89
2003	\$1,145	31,625	\$620	\$257	\$101
2004	\$1,554	31,604	\$859	\$457	\$162
2005	\$1,085	22,064	\$600	\$319	\$113
2006	\$1,664	31,216	\$729	\$315	\$168
2007	\$3,119	58,502	\$1,367	\$590	\$314
2008	\$2,251	30,119	\$1,163	\$287	\$156
2009	\$2,238	29,216	\$1,145	\$282	\$153
2010	\$3,690	56,806	\$1,405	\$847	\$259
2011	\$4,256	65,960	\$1,664	\$1,003	\$313
		Total	\$11,142	\$4,928	\$2,041

Note: totals may not add due to rounding

III. Missouri Ethanol Industry

3.1. Industry Overview

Missouri's ethanol industry has provided a new value-added processing opportunity for corn producers in the state. Prior to the ethanol plants, Missouri-produced corn was marketed primarily for livestock feeding, non-ethanol processing or exporting. After years of planning and support by local farmers, ethanol plants began being built in Missouri. Missouri currently ranks 14th in the U.S. in ethanol nameplate capacity (Renewable Fuels Association, 2011).

Missouri's six ethanol plants have the current capacity to produce 298.5 million gallons of ethanol each year, according to the Missouri Department of Natural Resources. Plant names, location and annual nameplate capacity can be found in Exhibit 3.1.1. In addition to ethanol, these ethanol plants also produce distillers grains that are marketed to livestock producers and exported.

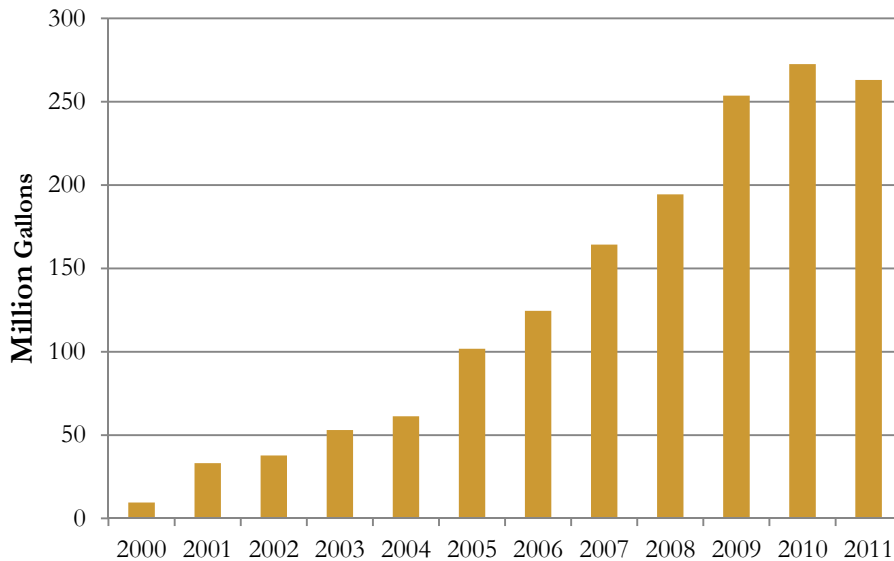
Exhibit 3.1.1 Missouri Ethanol Plants, Locations and Capacity

Plant Name	Location	Ethanol Capacity (million gallons)
Golden Triangle	Craig	22.0
Lifeline Foods, LLC	St. Joseph	50.0
Mid-Missouri Energy	Malta Bend	60.0
Poet Biorefining (Missouri Ethanol)	Ladsonia	56.0
Poet Biorefining (Northeast Missouri Grain)	Macon	50.0
Show Me Ethanol	Carrollton	60.5
Total Ethanol Production		298.5

Source: Missouri Department of Natural Resources (2012)

Actual ethanol production from these plants is reported in Exhibit 3.1.2 for years 2000 to 2011. Significant growth has occurred since the first Missouri plant (Macon) began operations in 2000.

Exhibit 3.1.2 Missouri Ethanol Production (2000-2011)



Source: Missouri Department of Natural Resources (2012)

Distillers grains are produced as a co-product of the dry mill ethanol industry. Dry mill ethanol production uses corn to produce ethanol, carbon dioxide and distillers grains. Several forms of distillers grains co-products are available to livestock producers depending on ethanol plant production system, marketing objectives and proximity to livestock feeding operations. Distillers grains products differ due to variation in production and drying methods, the largest difference is related to dry matter of the finished product.

Dried distillers grains (DDG) are generally more expensive on a dry matter basis than wetter forms of distillers grains but will not spoil as rapidly when stored under cover. DDG can be marketed worldwide like other dry commodity feeds because there are fewer spoilage issues.

Wet distiller grains (WDG) are a high-moisture, palatable product that can aid in conditioning feedlot rations. WDG will spoil in 10-14 days during the winter and in 5-7 days during the summer, therefore they must be used quickly or ensiled with a roughage source for preservation.

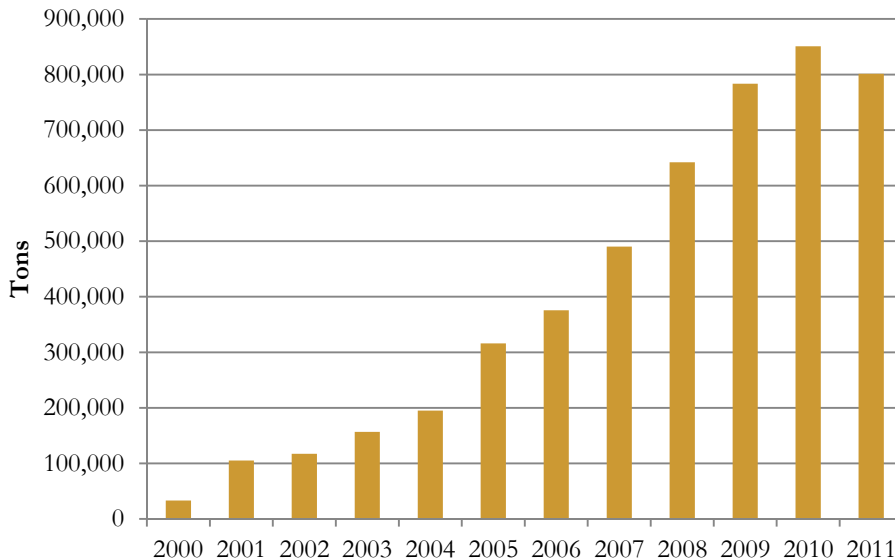
Condensed distillers solubles (CDS) is the dried syrup centrifuged from whole stillage after the distilling process. CDS is a liquid feed that can be added to distillers grains to make distillers grains with solubles or it can be marketed separately. Comparative nutrient contents for distillers grains co-products are listed in Exhibit 3.1.3.

Exhibit 3.1.3 Comparative Nutrient Content for Distillers Grains Co-products

Co-Products as Feedstuffs (common abbreviation)	Dry matter %	% Protein	% Total Digestible Nutrients
Dry distillers grains + solubles (DDGS)	88-90	25-32	85-90
Wet distillers grains + solubles (WDGS)	25-35	28-32	70-110
Condensed distillers solubles (CDS or syrup)	30-50	20-30	75-120
Corn	88	9	88
Soybean meal (44%)	89	49	84

Missouri’s production of DDG over the past eleven years is estimated in Exhibit 3.1.4. This analysis was based on actual corn usage reported from Missouri ethanol plants and using a conservative industry conversion factor of 16.5 lbs. of DDG per bushel of corn. Additionally, some plants have sold wet or modified wet distillers grains, but there is no reported data so the estimation in Exhibit 3.1.4 is based solely if all plants were selling DDG.

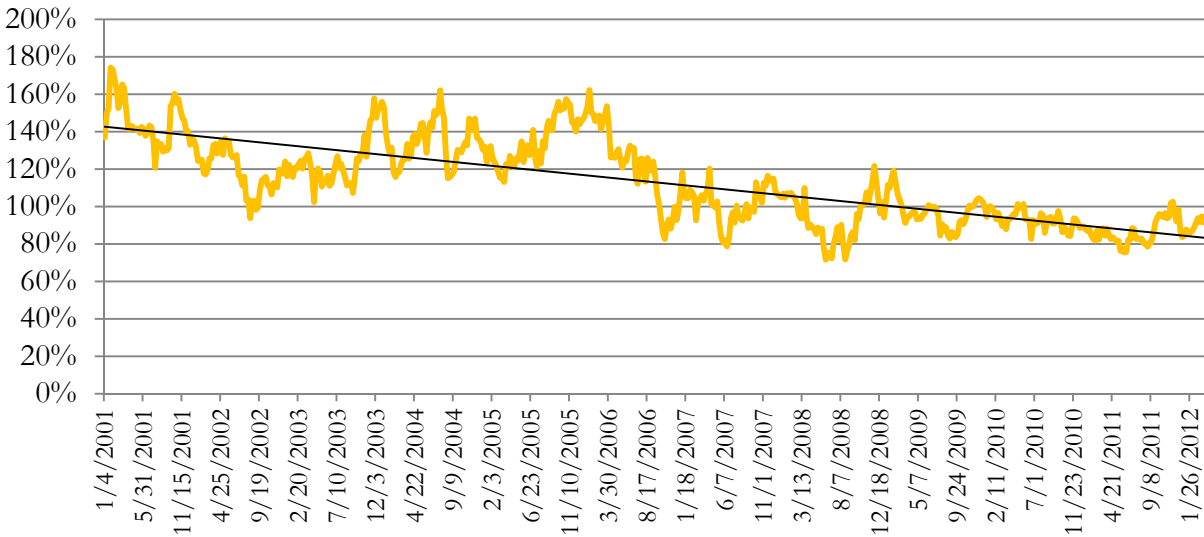
Exhibit 3.1.4 Missouri Dried Distillers Grains Production (2000-2011)



Source: Derived from Missouri Department of Natural Resources (2012)

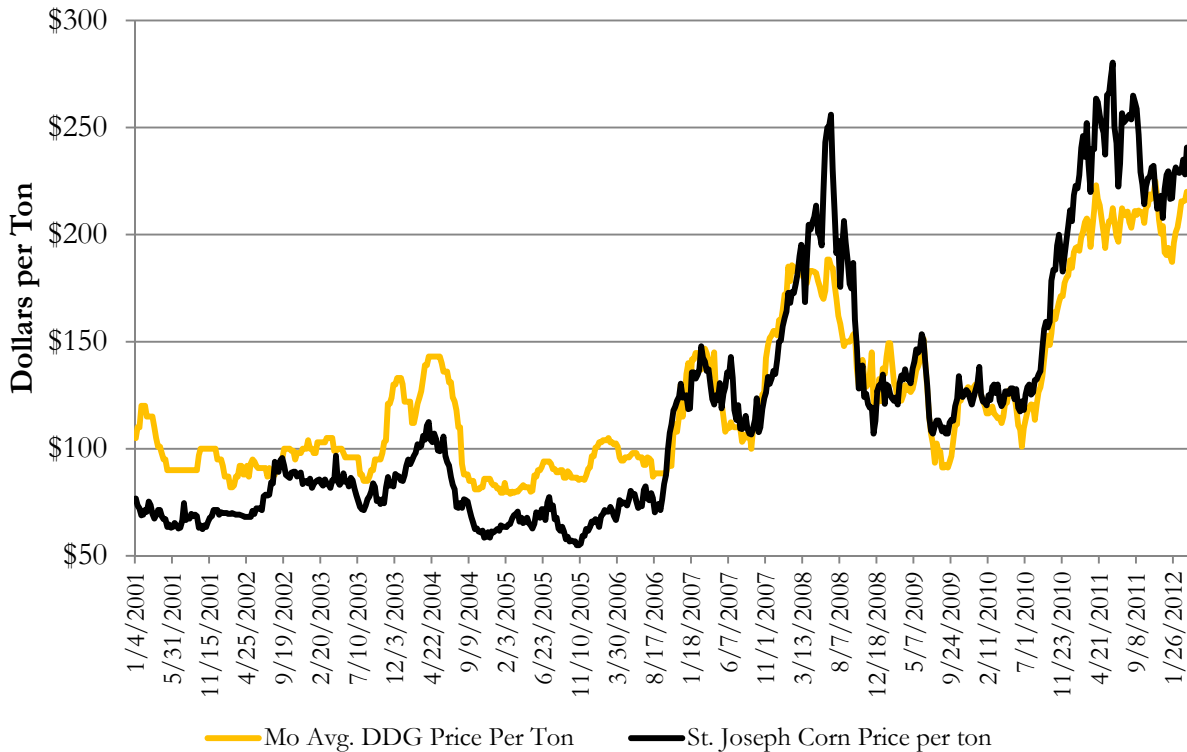
As the United States ethanol industry developed, the quantity of distillers grains produced increased dramatically. The price per ton of dried distillers grains compared to the price per ton of other principal feed ingredients has decreased as more ethanol industry co-products became available. Exhibit 3.1.5 details the price per ton of DDG in relation to corn in Missouri. In early 2001, a ton of dried distillers grains was roughly 150% of the price per ton of corn. By early 2012, this percentage is closer to 90%. Due to the buildup in the ethanol industry, producers and nutritionists are challenging ration inclusion rates due to the cost advantages from using DDGs.

Exhibit 3.1.5 Price of a Ton of DDG Relative to Corn



DDG prices were based on average Missouri reported prices from the University of Missouri By-Product Feed Price listings. Corn price was based on the St. Joseph cash grain bids paid to producers over this time period reported by the Missouri Department of Agriculture Market News Service. Exhibit 3.1.6 demonstrates both DDG and corn prices from 2001 to early 2012.

Exhibit 3.1.6 Corn Prices versus Dried Distillers Grains Prices



3.2. Cost of Production

Cost of production information from Missouri plants is not reported or publically available. Iowa State University Extension (Hofstrand, 2012) developed an economic model of a dry mill ethanol plant and reported cost of production information by month that is representative of northern Iowa ethanol plants. An estimation of average annual production expenditures for Missouri plants was developed in Exhibit 3.2.1 based on three-year average (2009-2011) of Iowa cost of production data, Missouri corn prices and Missouri ethanol production.

Exhibit 3.2.1 Estimated Annual Operating Expenses for Missouri Ethanol Plants

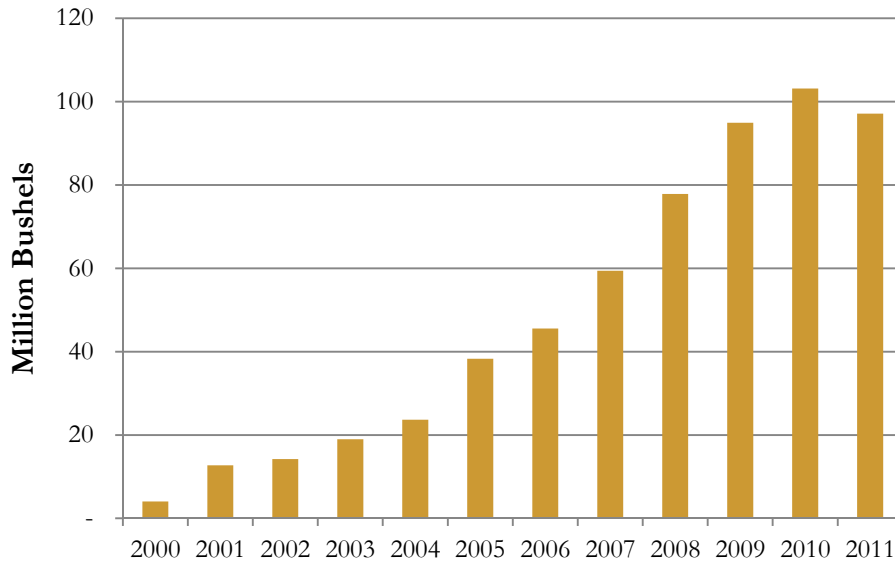
Production Costs	Cost per Gallon (\$)	Total Missouri Plant Costs (Million Dollars)	% of Total
Corn	\$1.825	\$480.2	75.5%
Natural gas	\$0.170	\$44.7	7.0%
Enzymes	\$0.035	\$9.2	1.4%
Yeasts	\$0.020	\$5.3	0.8%
Chemicals	\$0.015	\$3.9	0.6%
Denaturant	\$0.036	\$9.5	1.5%
Repairs and maintenance	\$0.025	\$6.6	1.0%
Transportation	\$0.008	\$2.0	0.3%
Water	\$0.012	\$3.2	0.5%
Electricity	\$0.039	\$10.1	1.6%
Other direct costs	\$0.020	\$5.3	0.8%
Depreciation	\$0.110	\$28.9	4.5%
Interest	\$0.063	\$16.7	2.6%
Labor and management	\$0.038	\$10.0	1.6%
Property taxes	\$0.002	\$0.6	0.1%
Total Costs	\$2.418	\$636.1	100.0%

Source: Cost per gallon data excluding corn originated from Hofstrand (2012)

Corn cost per gallon of ethanol produced was based on the market price for corn and not on actual cost of production. Corn and natural gas are the two largest variable expenses for dry mill ethanol plants. Other variable costs include chemicals, repairs/maintenance, transportation, water, electricity and miscellaneous costs. Fixed costs represent depreciation, insurance, labor/management and property taxes. Approximately \$636 million in total operating costs were estimated to be spent by Missouri's ethanol industry in an average year. The purchase of corn represents 76% of the total cost of production for a plant.

Actual corn bushels that were consumed by the Missouri ethanol industry are reported in Exhibit 3.2.2 by year. As ethanol plants have begun operations and increased production, corn utilization by the ethanol industry has increased significantly. In 2011, Missouri ethanol plants produced 263.1 million gallons of ethanol and consumed approximately 97 million bushels of corn.

Exhibit 3.2.2 Actual Corn Bushel Usage by Missouri Ethanol Plants (2000-2011)



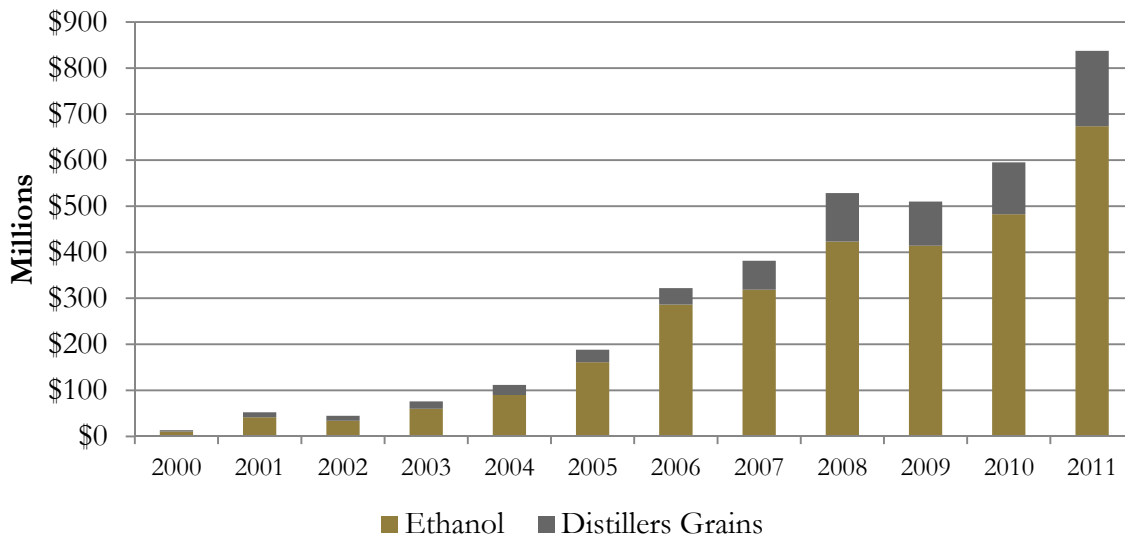
Source: Missouri Department of Natural Resources (2012)

3.3. Value of Production

The value of ethanol production in Missouri was derived using reported ethanol production and reported corn usage from Missouri plants for the years 2000 to 2011. For this analysis, it was assumed that these plants produced 16.5 pounds of distillers grains for each bushel of corn consumed and each plant was selling only a dried distillers grains product. While some plants might sell other products such as carbon dioxide, this was considered to be a minor revenue item and thus not used to estimate sales revenue. The estimated value of production for Missouri's ethanol plants was based solely on ethanol and distillers grains.

Estimated sales prices for ethanol and distillers grains were estimated from various sources. Prices for ethanol at Northern Iowa plants (Hofstrand, 2012) were used in the years 2005-2011. Earlier years were estimated based on the relationship between these ethanol prices and Omaha, Nebraska ethanol rack prices (Nebraska Ethanol Board, 2012). Distillers grains prices were based on Missouri reported prices from the University of Missouri (2012) By-Product Feed Price listings in earlier years (2000-2005) and the Livestock Marketing Information Center (2012) in later years. Exhibit 3.3.1 shows the estimated sales revenue for all Missouri plants from ethanol and distillers grains by year.

Exhibit 3.3.1 Estimated Sales Revenues for Missouri Ethanol Plants (2000-2011)



Sources: Missouri Department of Natural Resources (2012), Hofstrand (2012), Nebraska Ethanol Board (2012), University of Missouri (2012), Livestock Marketing Information Center (2012).

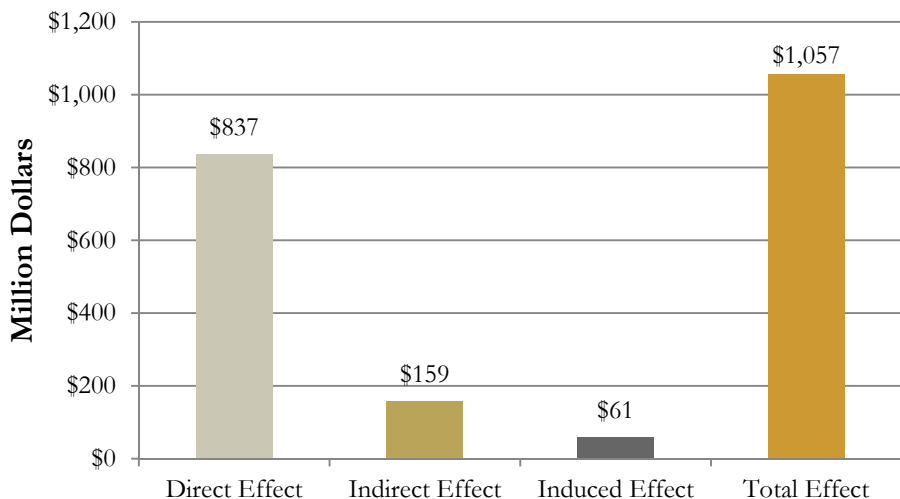
3.4. Economic Contribution of the Missouri Ethanol Industry in 2011

An economic contribution analysis was prepared for the Missouri ethanol industry based on the use of IMPLAN economic impact software. IMPLAN is an input-output model and includes economic data sets, multipliers, and demographic statistics for the entire U.S. economic infrastructure. It is a robust tool that can assess the effects of changes or industries and is widely used by economists and analysts.

The results from this ethanol industry analysis can be separated into three different categories: direct, indirect, and induced effects. A direct effect can be defined as the direct change to a respective industry. For example, the revenue generated from selling ethanol and distiller's grains would be considered a direct effect. Indirect effects measure the impact of buying goods and services from other local industries. An example of an indirect effect would be ethanol plants purchasing supplies from other industries (chemicals, natural gas, water, etc.). While technically an indirect impact would be the purchase and transport of corn to these plants, it was not included in this analysis to avoid double counting issues since it was included in the earlier impact analysis on the Missouri corn industry. Induced effects are the responses in the local economy from proprietors and employees spending their income. For instance, management and labor will spend earnings at local grocery stores, restaurants and other retail establishments and this will create further ripples in the economy. Total effects refer to the combination of direct, indirect and induced effects. Total economic contributions based on the estimated Missouri's ethanol and distillers grains value of production in 2011 can be found in Exhibits 3.4.1-6.

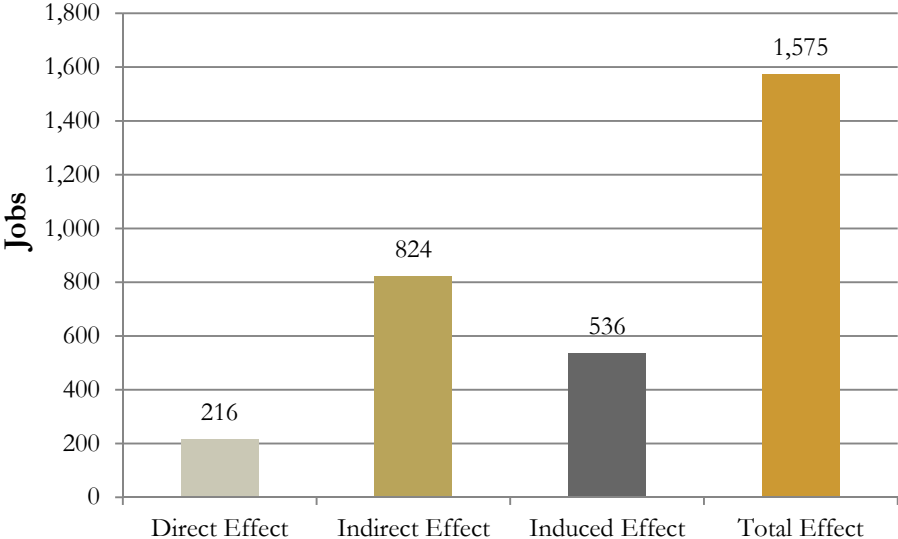
Output reflects the total value of industry production. Missouri's ethanol and distiller's grains production in 2011 directly contributed output worth \$837 million. Additionally, the ethanol industry generated \$159 million in indirect effects and \$61 million in induced effects to Missouri's economy. The combination of all effects from the ethanol industry generated \$1.1 billion worth of economic activity in Missouri in 2011.

3.4.1 Contribution of Missouri Ethanol Production in 2011 – Output



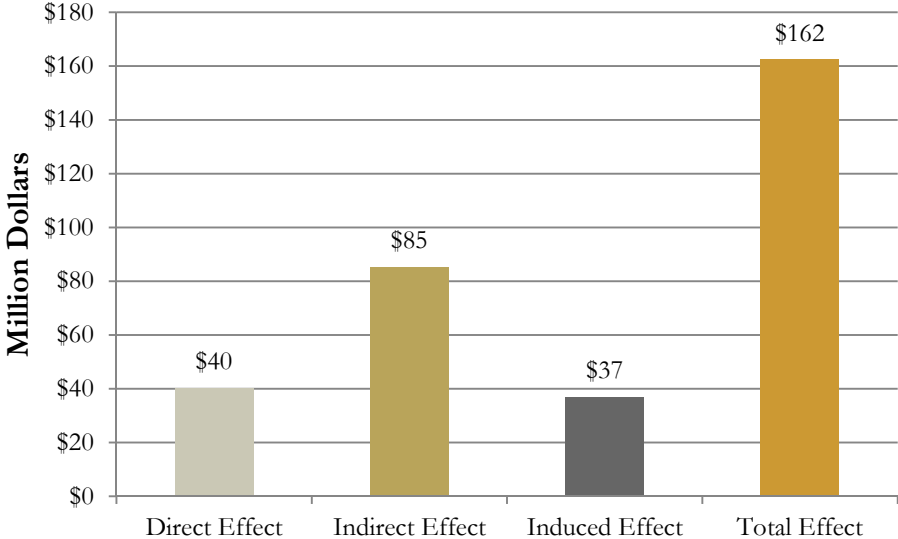
Another indicator for evaluating the economic contribution of Missouri’s ethanol industry is the number of jobs supported by the industry. In this indicator, employment refers to the number of jobs (both full time and part time). Total employment supported by Missouri’s ethanol industry in 2011 totaled 1,575 composed of 216 direct jobs, 824 indirect jobs and 536 induced jobs.

3.4.2 Contribution of Missouri Ethanol Production in 2011 - Jobs



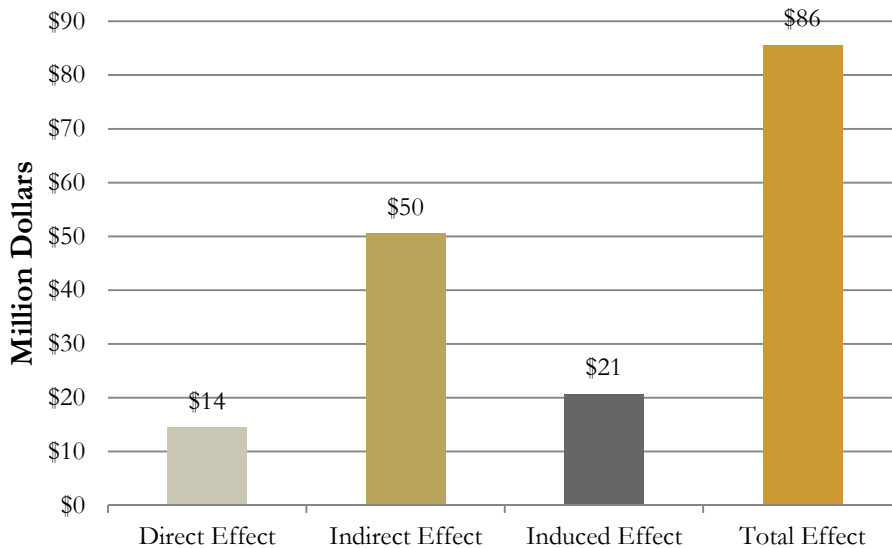
The contribution of ethanol to Missouri’s economy can also be analyzed by the value-added measure. Value-added refers to the difference between the industry output (value of ethanol and distiller’s grains) and the cost of the inputs used in its production (natural gas, chemicals, etc.). This term can also be interpreted as the contribution to gross domestic product (GDP) by Missouri’s ethanol industry. The value-added measure is the summation of workers compensation, owner profits and taxes. The value added contribution to Missouri’s economy by the ethanol industry is estimated at \$162 million when considering all economic effects.

3.4.3 Contribution of Missouri Ethanol Production in 2011 – Value Added



Labor or household income is another economic measure that is included in the value-added category. It reflects the total of employee compensation (wages and benefits) and proprietor income (self-employment). In the year 2011, the Missouri ethanol industry stimulated over \$86 million dollars in household income when considering each economic effect.

3.4.4 Contribution of Missouri Ethanol Production in 2011 - Labor Income



Tax revenues (also included in value-added category) described in this section includes those taxes paid to local, state, and federal entities. Tax impact values detail the amount of revenue generated from employee compensation, proprietor income, indirect business taxes, households, and corporations. The Missouri ethanol industry stimulated approximately \$15 million in state and local taxes to Missouri and \$21 million in federal taxes in the year 2011 (Exhibits 3.4.5 and 3.4.6).

3.4.5 Contribution of Missouri Ethanol Production in 2011 – State and Local Taxes

Description	Total
Dividends	\$27,459
Social Ins Tax- Employee Contribution	\$70,696
Social Ins Tax- Employer Contribution	\$163,796
Indirect Bus Tax: Sales Tax	\$5,733,862
Indirect Bus Tax: Property Tax	\$4,912,509
Indirect Bus Tax: Motor Vehicle Lic	\$97,783
Indirect Bus Tax: Severance Tax	\$11
Indirect Bus Tax: Other Taxes	\$773,372
Indirect Bus Tax: S/L NonTaxes	\$394,541
Corporate Profits Tax	\$309,478
Personal Tax: Income Tax	\$1,673,970
Personal Tax: NonTaxes (Fines- Fees)	\$220,398
Personal Tax: Motor Vehicle License	\$65,416
Personal Tax: Property Taxes	\$35,676
Personal Tax: Other Tax (Fish/Hunt)	\$49,580
Total State and Local Tax	\$14,528,547

3.4.6 Contribution of Missouri Ethanol Production in 2011 – Federal Taxes

Description	Total
Social Ins Tax- Employee Contribution	\$4,922,187
Social Ins Tax- Employer Contribution	\$4,474,018
Indirect Bus Tax: Excise Taxes	\$1,135,145
Indirect Bus Tax: Custom Duty	\$445,338
Indirect Bus Tax: Fed NonTaxes	\$758,320
Corporate Profits Tax	\$4,400,149
Personal Tax: Income Tax	\$4,807,080
Total Federal Tax	\$20,942,237

3.5. Historical Economic Contributions of the Missouri Ethanol Industry

Based on methodology used in sections 3.3 and 3.4, an historical account of economic contributions is presented by year for the Missouri ethanol industry in Exhibit 3.5.1. The results presented include all direct, induced and induced economic effects from the ethanol industry. From the year 2000 to 2011, the Missouri ethanol and supporting industries have provided a total of \$734 million in added value to the state's economy and \$416 million in household income. These industries have also generated \$174 million in local, state and federal taxes.

Exhibit 3.5.1 Missouri Ethanol Industry Impacts by Year

Year	Output (millions)	Employment (jobs)	Value Added (millions)	Labor Income (millions)	Taxes (millions)
2000	\$19	65	\$4	\$2	\$1
2001	\$73	252	\$15	\$9	\$5
2002	\$69	261	\$18	\$11	\$4
2003	\$116	378	\$27	\$16	\$6
2004	\$165	474	\$34	\$20	\$10
2005	\$278	798	\$58	\$34	\$16
2006	\$420	717	\$61	\$38	\$16
2007	\$498	850	\$73	\$45	\$18
2008	\$665	901	\$87	\$50	\$19
2009	\$644	866	\$85	\$49	\$19
2010	\$743	1,069	\$108	\$57	\$24
2011	\$1,057	1,575	\$162	\$86	\$35
		Total	\$734	\$416	\$174

Note: totals may not add due to rounding

3.6. Missouri's Contribution to the Ethanol Industry

The state of Missouri has been actively involved in encouraging the development of the state's ethanol industry. Several forms of financial support were provided to ethanol plants and investors to stimulate the new industry in this state.

The Missouri Ethanol Producer Incentive Fund was established in 1988 to encourage ethanol production within the state. This program is administered by the Missouri Department of Agriculture. Under the guidelines for the grant program, the facility must be majority owned by farmers (51% or greater) and use Missouri grain feedstocks to be eligible. The financial support provided would be equal to 20 cents per gallon for the first 12.5 million gallons of production and 5 cents for the next 12.5 million gallons, with a maximum annual grant of \$3.1 million. This financial support would only be provided for sixty months of operation. According to the Missouri Department of Agriculture, the cumulative total of producer incentive payments made under this program totaled \$96 million through the end of February 2012.

Another program that has benefited the Missouri ethanol industry is the New Generation Cooperative Incentive Tax Credit Program. These tax credits were used to induce farmer investment into new generation processing entities such as ethanol plants. Before tax credits could be issued, the processing entity must be organized, file an application and receive approval by the Missouri Agricultural and Small Business Development Authority (MASBDA). Up to \$7,500 of tax credits could be received by a member of the new generation entity. A total of 3,098 tax credits were issued to farmers investing in these new generation, Missouri farmer-owned ethanol projects as of February 2012. The value of these tax credits issued to farmers totaled \$10.5 million according to MASDBA.

The Missouri Value-Added Grant program also provided grants for feasibility and other assistance to ethanol plants. This program gave out \$1.4 million to ethanol industry stakeholders to assist them in the development of ethanol plants.

A total net benefit to Missouri from the ethanol industry was estimated to be \$625 million, based on these Missouri financial assistance program costs and factoring in the value that the ethanol industry has created in the state (see section 3.5 for more details).

Exhibit 3.6.1 Missouri's Benefits and Costs Related to the Ethanol Industry (2000-2011)

	Total (Million)
Benefits	
Value Added by Ethanol Industry	\$733.6
Costs	
Ethanol Producer Incentive Fund	\$96.4
New Generation Coop. Tax Credits	\$10.5
Value-Added Grant Program	\$1.4
Net Benefit to Missouri	\$625.3

IV. Economic Contribution of Missouri Corn and Ethanol Industries

The corn and ethanol industry together are significant economic contributors to the state's economy. While the previous chapters discussed the Missouri corn and ethanol industries independently, this section will provide a summary of both industries since they are interlinked.

It was estimated that the combined contribution of the Missouri corn and ethanol industries produced \$5.313 billion in sales or output (Exhibit 4.1) in 2011. From the year 2000 to 2011, the Missouri corn and ethanol industries have contributed a combined total of approximately \$12 billion in value to the state's economy, \$5.3 billion in labor income and stimulated \$2.2 billion in local, state and federal taxes.

Exhibit 4.1 Total Economic Contribution of the Missouri Corn and Ethanol Industries

Year	Output (millions)	Employment (jobs)	Value-Added (millions)	Labor Income (millions)	Taxes (millions)
2000	\$1,149	30,279	\$553	\$223	\$111
2001	\$1,146	28,955	\$537	\$219	\$109
2002	\$1,149	34,294	\$536	\$152	\$94
2003	\$1,260	32,002	\$647	\$273	\$107
2004	\$1,719	32,078	\$893	\$477	\$171
2005	\$1,363	22,861	\$658	\$353	\$129
2006	\$2,084	31,933	\$791	\$352	\$183
2007	\$3,617	59,352	\$1,440	\$634	\$333
2008	\$2,916	31,019	\$1,251	\$337	\$175
2009	\$2,881	30,082	\$1,231	\$332	\$172
2010	\$4,433	57,875	\$1,513	\$904	\$283
2011	\$5,313	67,535	\$1,827	\$1,089	\$349
		Total	\$11,875	\$5,344	\$2,215

References

Hofstrand, D. 2012. "Ethanol Profitability Spreadsheet." Ag Decision Maker, D1-10. Iowa State Extension. Accessed at <http://www.extension.iastate.edu/agdm/energy/xls/d1-10ethanolprofitability.xls> on 3/19/2012.

Livestock Marketing Information Center. 2012. "Cornbelt Feedstuffs Distillers Dried Grains – Monthly". Accessed at <http://www.lmic.info> on 3/20/2012.

Missouri Department of Natural Resources. 2012. Contacted by E-mail. Air Pollution Control Program. <http://www.dnr.mo.gov/ethanol/> .

Nebraska Ethanol Board. 2012. "Ethanol and Unleaded Gasoline Average Rack Prices." Nebraska Energy Office, Lincoln, NE. Accessed at <http://www.neo.ne.gov/statshtml/66.html>.

Renewable Fuels Association. 2011. "Biorefinery Locations." Accessed at <http://www.ethanolrfa.org/bio-refinery-locations/>.

United States Department of Agriculture, Economic Research Service. Various Data Sets. Accessed at <http://www.ers.usda.gov/>.

United States Department of Agriculture, National Agricultural Statistics Services. Various Data Sets. Accessed at <http://www.nass.usda.gov/> .

University of Missouri. 2012. Contacted by E-mail. Agricultural Electronic Bulletin Board. Distillers grains data originated from <http://agebb.missouri.edu/dairy/byprod/bplist.asp>.

Acknowledgment

“Employment and Economic Benefits of Ethanol Production in Missouri”, which was completed by Donald L. Van Dyne at the University of Missouri, discussed the impacts that the ethanol industry had in 2002 on the state of Missouri and estimations about future scenarios that may occur within the state. Some of Van Dyne’s original assumptions are incorporated into this updated paper. We appreciate his foundational work on the subject.

Glossary

Direct effect: The direct change in industry output, expenditure or employment applied to the predictive model for impact analysis.

Employment: Annual average of monthly jobs for that industry. Jobs can be either full-time or part-time.

Indirect effects: The impact of local industries buying goods and services from other local industries due to direct effects.

Induced effects: The responses in the local economy from proprietors and employees spending their household income, which generates further local economic activity.

Labor income: All forms of employment income, which includes employee compensation (wages and benefits) and proprietor income (self-employment).

Output: Represents the value of industry production.

Value added: Refers to the difference between the industry’s total output and the cost of its intermediate inputs. This term can also be interpreted as the contribution to gross domestic product (GDP). Value added consists of the summation of workers compensation, owner profits and taxes.