The Economic Impact of the Ethanol Industry on the South Dakota Economy in 2012

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Introduction

The ethanol industry in South Dakota has grown significantly since its inception in 1988 with the construction of a plant in Scotland that produced 8 million gallons annually to its current state of 15 production facilities and a production capacity of 1.012 billion gallons annually. This is nearly 7% of the national production capacity of 14.7 billion gallons of nameplate capacity, from 211 production facilities. South Dakota ranks sixth nationally in ethanol production with Iowa, Nebraska, Illinois, Indiana, and Minnesota being the top five states in order of production capacity. The average production capacity per plant in South Dakota is 67.46 million gallons. This compares favorably to the national average of 69.67 million gallons per plant. The fifteen ethanol plants in South Dakota are all east of the Missouri River, with Mina being the furthest west, and range from Rosholt, near the North Dakota border to Hudson, south of Sioux Falls.

Company	Location	Capacity (mil. Gal.)
ABE South Dakota	Aberdeen	46
ABE South Dakota	Huron	32
Dakota Ethanol, LLC	Wentworth	50
Glacial Lakes Energy, LLC	Watertown	100
Glacial Lakes Energy, LLC	Mina	107
North Country Ethanol, LLC	Rosholt	20
NuGen Energy	Marion	110
POET Biorefining	Big Stone City	79
POET Biorefining	Chancellor	110
POET Biorefining	Groton	53
POET Biorefining	Hudson	56
POET Biorefining	Mitchell	68
POET Biorefining	Scotland	11
Redfield Energy, LLC	Redfield	50
Valero Renewable Fuels	Aurora	120

TOTAL   1,012

Ethanol Production's Impact on Corn Prices

   Studies have investigated the relationship of ethanol plants on local corn prices. The majority of the literature supports the idea that ethanol plants have a positive impact on local corn prices when the plants are initially opened, with greater impacts occurring in locations where ethanol plants are located further away from terminals. Ethanol plants opened in South Dakota have a greater impact on local corn prices than plants located in other areas of the Corn Belt because of the transportation savings available in South Dakota. Also studies found that ethanol plants can impact corn prices out to a certain radius around the plant with the distance varying according to market location of the ethanol plant. The literature also supports the concept that the initial impact that ethanol plants have on local corn prices will decrease over time with the rate of decrease varying to some degree in the literature. This decrease is expected as producers, over time, increase corn production around the radius of an ethanol plant. Some of these specific findings will be discussed.

Initial Impact

   McNew, Kevin, and Griffith (2005) was one of the first studies to investigate the initial impact of ethanol plants (located in Missouri, South Dakota, Iowa, Wisconsin, and Minnesota) opened during 2001 to 2002 on local corn prices. This study used local corn price data for 2000 through 2003. On average, across ethanol plants, corn prices increased $0.125 per bushel at the plant site with a positive price response 68 miles from the plant (McNew, Kevin, and Griffith, 2005). It is concluded that ethanol plants that are located further from terminal markets can have a larger impact on local corn prices as demonstrated by South Dakota plants having a $0.125 impact on corn prices, while Iowa plants had a $0.08 impact.

Plant	Price Impact at Plant	Price Impact from Plant (Miles)
Wentworth, SD	$0.12	59
Rosholt, SD	$0.13	-
Sioux Center, IA	$0.11	101
Big Stone City, SD	$0.10	42
Watertown, SD	$0.14	82

Source- (McNew, Kevin, and Griffith, 2005)

   Lewis (2010) examined whether opening an ethanol plant impacted local basis in Michigan, Kansas, Iowa, and Indiana. Using basis data from 1998 to 2008, she found that plants opening in Michigan and Kansas had the largest increase in corn basis, while plants that opened in Iowa and Indiana had little impact on corn basis levels. In the first month that an ethanol plant opened, there was an increase in basis levels for all locations (Michigan-$0.14, Kansas-$0.11, Iowa-$0.02, and Indiana-$0.003). However, at all locations, the initial increase in corn basis in the first month declined over the one year time frame. For example, in Michigan, an ethanol plant opening had a first month impact of $0.14, while after eleven months the impact dropped to $0.11.

Impact Over-time

There has been a wide range on the findings of the impact of ethanol production on local corn prices after the initial year a plant has opened. Katchova (2009) found no evidence that ethanol production had an impact on local corn prices. This study used corn prices received by farmers using the USDA's Agricultural and Resource Management Survey (ARMS) from 2005 to 2007. The analysis uses data for Minnesota, Wisconsin, Iowa, Nebraska, Kansas, Missouri Illinois, and Indiana.

The findings of Olson, Klein, and Taylor (2007) contrast with the regional study (Katchova, 2009). Olson, Klein, and Taylor (2007) examined the impact of increased ethanol production on corn basis in South Dakota. This study used basis data from 1997 through 2005. The results showed a $0.24 increase in basis on average for the state in 2005. The findings across regions in South Dakota varied slightly (Northeast-$0.22, East Central-$0.27, Southeast-$0.23, North Central-$0.24, and Central-$0.04).

Behnke and Fortenbery (2001) provide the longest term perspective on the impact of ethanol production on corn basis since their data spans from 1999 to 2009. They examined the impact of ethanol production (located in Illinois, Iowa, Kansas, Minnesota, Nebraska, South Dakota, and Wisconsin) on local corn basis. They found that the estimated impact of a 50 million gallon ethanol plant on basis is an increase of $0.004 cent per bushel per year. They found a price impact by ethanol production that reached out to 50 miles. Long-term price impacts are much less than the initial short-term price response when an ethanol plant opens.

Conclusion

This literature review points to the need for more research into the area of ethanol production's impact on corn prices because of the range of findings in this area. Overall, the research appears to support the idea that initially ethanol plants can have a positive impact on local corn prices when the plant is located far from terminals, such as the case in South Dakota. The literature shows that initially ethanol plants may have increased local corn prices in South Dakota from $0.10 to $0.20 with the impact averaging 60 miles (McNew, Kevin, and Griffith, 2005) from the ethanol plant. Research examining the relationship between ethanol production and corn prices in other states suggest that the initial impact will be decreased over time. The most recent study (Behnke and Fortenbery, 2011) utilizes data from 1999 to 2009. However, there needs to be research that uses corn prices from 2009 to present to examine the further long term impact of ethanol production's impact on corn prices, especially since in 2010 through 2012 the United States has been below the fifteen-year-average for corn ending stocks.

Ethanol Production's Impact on Land Prices

Studies have estimated the relationship of ethanol plants on local land prices. The literature suggests that there is a positive relationship between the location of an ethanol plant and land prices within a specified distance from the plant. Zhang, Irwin, and Nickerson (2012) studied the effect on land prices in western Ohio before and after 2007. Their work estimated a $419/acre benefit after 2007 for parcels of land within 13 kilometers (7.8 miles) of an ethanol plant.

In 2012 Kropp and Peckham presented a study of the effects of ethanol policies and agricultural support policies on land prices found that having an ethanol plant in a county increases the value of the land parcel from $226 to $741 per acre. They also found that farmland values decrease from $26 to $37 per acre for each mile between the parcel of land and the ethanol plant. They also found that multiple plants in a county, two vs one, can increase the value of a land parcel up to $1,869.52 per acre. The data for this study is from the USDA Agricultural Resource Managerial Survey (ARMS) collected from 1998 to 2008 for the Heartland region which includes part of South Dakota.

Henderson and Gloy, in 2008, examined the relationship between land price changes and the presence of an ethanol plant. This study used data from Nebraska and Oklahoma on non-irrigated cropland. Data from the last two quarters of 2006 and the first two quarters of 2007 were used in the study. Their results indicated that for every mile away from the ethanol plant land prices dropped $2.14 in 2007. Land values were obtained through a survey of ag bankers in the Kansas City Federal Reserve District and the survey farmland prices were from $119 to $158 per acre for parcels within 50 miles of an ethanol plant.

In these three studies land prices are from $119 to $741 per acre higher for parcels that are within 50 miles of an ethanol plant, and may be up to $1,869 higher for land parcels that are near more than one ethanol plant. It should be noted that some of this data is old, 1998, and that there has been a structural change in the land market in the last few years, making it difficult to determine whether the increases in land prices are a result of the ethanol plants or other factors in the market.

IMPLAN Analysis of the Ethanol Industry

The ethanol industry in South Dakota makes a significant contribution to economic development in the state. The fifteen biorefineries in the state have the potential to produce 1.012 billion gallons of ethanol in 2012. The average price of ethanol in South Dakota for 2012 was $2.21 per gallon (Agricultural Marketing Resource Center). This results in a value for the ethanol produced in 2012 of $2,236,520,000. The ethanol production process will also produce 3,207,678 tons of DDG's. At an average price of $232.84/ton (Agricultural Marketing Resource Center) the DDG value is $746,875,877. The total value of the outputs from the production process is $2,983,395,877. Producing the 1.012 billion gallons of ethanol would require approximately 361,429,000 bushels of corn, 67.5% of the 2012 corn production in South Dakota (NASS).

Methodology

The IMPLAN Pro 3 software package was used to estimate the impact of the ethanol industry on the economy of South Dakota. This software was originally developed for the National Forest Service and has been adapted for commercial use by the Minnesota IMPLAN Group (MIG). The relationships between industries in the state, the production functions, are imbedded within the program. After constructing a baseline model of the South Dakota the impact of the ethanol will then be analyzed to determine the size of the economic impacts and how they are distributed among the other industries in South Dakota.

The IMPLAN model estimates the effects of the ethanol industry and divides them into three different categories, direct, indirect, and induced. The direct effect is the actual value of the ethanol produced during the analysis period. The indirect effect is the effect on the other economic sectors in the state due to the input purchases by the ethanol industry to produce the direct effect. The induced effect is the increase in household spending resulting from the increased economic activity in the state. The total effect is the summation of the direct, indirect, and induced effects.

Table 1. Ethanol Industry Output Impact

	(in nominal dollars)
Direct	$2,983,395,840
Indirect	$615,077,639
Induced	$210,526,993
TOTAL	**$3,809,000,472**

The output multiplier for the ethanol industry is 1.28, meaning that each dollar of output in the industry generates an additional $0.28 of economic activity in the South Dakota economy.

Table 2. Ethanol Industry Total Value Added

(in nominal dollars)

Direct	$214,948,111
Indirect	$286,740,703
Induced	$121,032,936
TOTAL	**$622,721,750**

The total value added is a measure of the contribution to Gross Domestic Product (GDP) made by the ethanol industry. This is the difference between total output and the value of the intermediate inputs. It consists of the compensation to employees, taxes on production and imports less subsidies, and gross operating surplus.

Table 3. Ethanol Industry Employment Effects

Direct	1,941
Indirect	3,776
Induced	1,937
TOTAL	**7,654**

The employment numbers are listed as the number of jobs in the industry. This data comes from the ES202 employment security data. This data is from the Department of Labor as part of the Unemployment Insurance ES-202 Covered Employment and Wages Program. This data set provides annual average wage and salary establishment counts, employment counts, and payrolls by county. There is no differentiation between full and part-time employment in this number.

Table 4. Ethanol Industry Indirect Business Taxes

(in nominal dollars)

Direct	$18,793,070
Indirect	$26,629,286
Induced	$12,239,251
TOTAL	**$57,661,607**

Indirect business taxes are all the taxes collected (sales, property, excise, etc.). The direct effect is the tax revenue generated by the ethanol industry, the indirect effect results from the increased business to business activity, and the induced effect is from the increased consumer activity in the state.

Table 5. Ethanol Industry Employee Compensation

(in nominal dollars)

Direct	$123,244,888
Indirect	$141,500,984
Induced	$55,571,863
TOTAL	**$320,317,735**

Employee compensation is the total payroll costs of the ethanol industry. It includes the wages and salaries as well as the other benefits including insurance, retirement, and any non-cash compensation. It is derived from the ES202 data and the Regional Economic Information System (REIS) data from the Bureau of Economic Analysis (BEA). Using this data and the employment numbers estimated in the model, average employee compensation is calculated at $63,496.

Table 6. Ethanol Industry Labor Income

(in nominal dollars)

Direct	$128,286,737
Indirect	$179,970,165
Induced	$66,574,305
TOTAL	**$374,831,207**

Labor income is income from all sources, including employment compensation (wages and benefits), and proprietor income. These numbers again come from the REIS and BEA data used in Table 5.

Comparisons to the 2004 study

In 2004 the ethanol industry in South Dakota had a total estimated output of $675.5 million. The figure includes revenue from ethanol, distillers grains, and carbon dioxide sales. In 2012 sales of ethanol and dried distillers grains are estimated to be in excess of $2.983 billion, a 441% increase since 2004. The total economic activity generated by the ethanol industry increased from $1.055 billion in 2004, to $3.809 billion in 2012, a 361% increase. Approximately 145 million bushels of corn were used in ethanol production in 2004. That amount has increased to more than 361 million bushels in 2012. In 2004 the ethanol industry employed 473 people. In 2012 that number has increased to 1,941 directly employed in the industry and a total of 7,654 jobs in the state are a result of impacts from the ethanol industry.

	2004	2012
Industry Output	**$675.5 million**	**$2.983 billion**
Total Economic Activity	**$1.055 billion**	**$3.809 billion**
Corn Used	**145 million bushels**	**361 million bushels**
Industry Jobs Created	**473**	**1,941**
Value added		**$215 million**
Indirect Business Taxes		**$19 million**
Employee Compensation		**$123 million**

Summary

The ethanol industry in South Dakota has a very significant, positive impact on the state's economy in 2012. The corn basis is narrowed by $0.10 to $0.14 per bushel due to the increase in demand for corn in the state. Land prices are from $119 to $741 per acre higher for parcels that are within 50 miles of an ethanol plant, and may be up to $1,869 higher for land parcels that are near more than one ethanol plant. It should be noted that for both the corn basis and the land price impacts that there is limited data, some of it being rather old,

 and especially for the land price issue there is no data from South Dakota. Both of these issues may be affected by structural changes in the corn and land markets.

The industry produces 1.012 billion gallons of ethanol annually, along with 3,207,678 tons of Dried Distillers Grains, with a total value of $2,983,395,877. The production process uses 361,428,571 bushels of corn annually. The industry also contributes $214,948,111 in direct value added to the state economy.

Employee compensation in the ethanol industry is estimated to be $123,244,888 and 1,941 jobs have been added in the state due to the activity in the industry. Average employee compensation in the industry is $63,496.

Indirect business tax revenue was $18,793,070 in 2012 and labor income was $128,286,737.

	Direct	Total
Industry output	**$2,983,395,840**	**$3,809,000,472**
Value added	**$214,948,111**	**$622,721,750**
Employment	**1,941**	**7,654**
Indirect business taxes	**$18,793,070**	**$57,661,607**
Employee compensation	**$123,244,888**	**$320,317,735**
Labor income	**$128,286,737**	**$374,831,207**

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