The Impact of Increased Ethanol Production on Corn Basis in South Dakota

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Abstract

A basis model is used to empirically estimate the impact of ethanol production on the South Dakota corn basis on the district and “State” levels. Monthly data is used to estimate basis as a function of futures price, supply, demand, storage, and transportation costs. The independent variables used are corn futures prices, corn production, corn usage for ethanol production, corn usage by cattle, Midwest No. 2 Diesel retail sales prices, storage availability, and unit train transportation

The regression results show the impact on corn basis varies by district from $0.04 to $0.27 per bushel, with a “State” impact of $0.24 in 2005. The impact from an additional 40 million gallon per year (MGY) ethanol plant ranges from $0.06 to $0.16 per bushel, with a “State” impact of $0.03. The impact from an additional 100 MGY ethanol plant ranges from $0.16 to $0.40 per bushel, with a “State” impact of $0.08.

Introduction

The U.S. ethanol industry has grown substantially over the last few years as concerns have increased regarding high energy costs, pollution, and foreign oil dependency. Ethanol production has expanded across states in order to meet greater energy needs and has improved technology for greater efficiency. It is estimated that in 2006 the ethanol industry increased gross output to the American economy by $41.9 billion, supported the creation of 160,034 new jobs in all sectors of the economy, including more than 20,000 in the manufacturing sector, and put an additional $6.7 billion in the pockets of American consumers (Urbanchuk, 2007). As ethanol continues to play a greater role in everyday life, it is important to understand the effects that ethanol production has had and will continue to have on the economy.

Ethanol production is significant in the state of South Dakota for many reasons. Ethanol production creates a value-added incentive for farmers, generates revenue for the state and local areas, and affects the overall state economy. As ethanol usage increases in the United States, ethanol plants like those in South Dakota will most likely increase production to meet ethanol demand.

In February of 2007, 114 ethanol plants were in operation across the United States, with a productive capacity of over 5.5 billion gallons per year. With seven existing plants under expansion and an additional 78 plants under construction, the total ethanol production capacity for the country will be over 11.8 billion gallons per year when the expansion and construction projects are completed (Renewable Fuels Association, February 2007). That is over double the current production capacity for the country.

Since 1998, South Dakota has built twelve ethanol plants, giving the state a productive capacity of more than 500 million gallons of ethanol annually. With two of the existing plants under expansion and an additional four plants under construction, South Dakota will be producing over 900 million gallons of ethanol per year after the construction and expansion projects are completed (Renewable Fuels Association, February 2007). South Dakota will supply over seven percent of the ethanol produced in the United States when the construction and expansion projects are completed, making it the nation's fourth largest ethanol producer (Renewable Fuels Association, February 2007). Table 1.1 and Table 1.2 show the current South Dakota ethanol plants and their associated production capacities.

Table 1.1 Current South Dakota Ethanol Production

Million Gallons per Year (MPY)

Company Name	Location	County	District	Capacity (MGY)	Online
Broin Enterprises, Inc.	Scotland	Bon Homme	Southeast	9**	1988
Heartland Grain Fuels, LP*	Aberdeen	Brown	North Central	9	1993
Heartland Grain Fuels, LP*	Huron	Beadle	Central	12	1999
Dakota Ethanol, LLC*	Wentworth	Lake	East Central	50	2001
North Country Ethanol, LLC*	Rosholt	Roberts	Northeast	20	2002
Glacial Lakes Energy, LLC*	Watertown	Codington	Northeast	50	2002
Northern Lights Ethanol, LLC*	Big Stone City	Grant	Northeast	50	2002
Great Plains Ethanol, LLC*	Chancellor	Turner	Southeast	50	2003
James Valley Ethanol, LLC	Groton	Brown	North Central	50	2003
Sioux River Ethanol, LLC*	Hudson	Lincoln	Southeast	55**	2004
Vera Sun Energy Corporation	Aurora	Brookings	East Central	120	2004
Prairie Ethanol, LLC	Loomis	Davison	East Central	60	2006
Total				535	

** Farmer owned* *Source: Renewable Fuels Association, June 2006*

***Numbers in table used in analysis; February 2007 lists Scotland at 11 MGY and Hudson at 50 MGY*

Table 1.2 South Dakota Ethanol Plants under Construction/Expansion

Million Gallons per Year (MPY)

Company Name	Location	County	District	Capacity (MGY)	Projected Date
Aberdeen Energy*	Mina	Edmunds	North Central	100	N/A
Glacial Lakes Energy, LLC*	Watertown	Codington	Northeast	50	N/A
Heartland Grain Fuels, LP*	Huron	Beadle	Central	18	N/A
Millennium Ethanol	Marion	Turner	Southeast	100	N/A
Missouri Valley Renewable Energy, LLC*	Meckling	Clay	Southeast	60	N/A
Redfield Energy, LLC	Redfield	Spink	North Central	50	N/A
Total				378	

** Farmer owned* *Source: Renewable Fuels Association, February 2007*

Theory and Methods of Analysis

Basis is the difference between the local cash price and the futures price of a commodity. Local corn basis in South Dakota has been affected by the production of ethanol within the state. As the nation's fourth largest ethanol producer, it is important to analyze the impacts that increased ethanol production has on the South Dakota corn basis.

Formally, a basis (B_t) is defined as a futures price (F_t) minus a cash price (P_t): $B_t = F_t$ - P_t . If the futures price is above the cash price, the basis is positive, while if the futures price is below the cash price, the basis is negative. These definitions follow a convention in the academic literature, whereas commercial practice defines basis as cash minus futures, and thus reverses the sign (Tomek & Robinson, 2003). The cash minus futures definition is used within this study. The futures price is the Chicago price for grain, which is determined by the Chicago Board of Trade (CBOT) and is used for corn, soybeans, and sorghum futures prices (Lutgen & Wasser, 2005).

An ordinary least squares (OLS) regression model was used to estimate the impacts of ethanol production on the South Dakota corn basis. It was also used to project future impacts that increased ethanol production may have on the corn basis. The model was estimated using monthly data from January 1997 through December 2005 for each major corn producing district in South Dakota as well as the "State" as represented by the five east river districts. The major corn producing districts evaluated were the Northeast, East Central, Southeast, North Central, and Central districts since almost all corn produced in South Dakota comes from those districts. In 2005, 97.28% of all corn produced in South Dakota came from the five east river districts (USDA NASS). To determine a "State" impact on the corn basis, the model was run using the sum of the five east river districts. Data used was provided by Alan May, Extension Grain and

Marketing Specialist at South Dakota State University Economics Department and by the USDA NASS.

Factors that can have an impact on the corn basis include but are not limited to futures price, local supply and demand, local storage availability, and transportation costs.

The OLS regression model was used to estimate the impacts of futures prices, corn production from grain, corn usage by ethanol, corn usage by cattle, storage availability, Midwest No. 2 Diesel retail sales prices, and unit train transportation on the South Dakota corn basis. Corn production from grain represents local supply; corn usage by ethanol and corn usage by cattle represent local demand, and the Midwest No. 2. Diesel retail sales prices and unit train transportation represent transportation costs.

The following regression equation is the basis model used for this analysis:

$$\textit{Basis} = \alpha + \beta_1 \text{(Futures Price)} + \beta_2 \text{(Corn Production for Grain)} + \beta_3 \text{(Corn Usage by Ethanol)} + \beta_4 \text{(Corn Usage by Cattle)} + \beta_5 \text{(Midwest No. 2 Diesel Retail Sales Prices)} + \beta_6 \text{(Storage Availability)} + \beta_7 \text{(Unit Train Transportation)} + \mu_i$$

where futures price is in dollars per bushel, corn production for grain is in bushels, corn usage by ethanol is in bushels, corn usage by cattle is in bushels, Midwest No. 2 Diesel retail sales prices is in dollars per gallon, storage availability is in bushels, and unit train transportation is in dollars per unit train car multiplied by the number of unit train cars.

Regression Results

The regression equations for basis for each of the five east river districts and the "State" were run using Microsoft Excel. The results are found below and analyzed in more detail. The following table summarizes the regression results. See Appendix A for summary statistics. Data charts are in Appendix B. Refer to Appendix D for regression statistics.

Table 5.1
Summary of Regression Results

	Northeast	***East Central***	***Southeast***
Futures Prices	0.1205***	0.1337***	0.1420***
Corn Production for Grain	-4.4968E-11	-2.5022E-09***	-2.2735E-09***
Corn Usage by Ethanol	4.9291E-09***	4.2993E-09***	5.4373E-09***
Corn Usage by Cattle	4.7454E-08	6.5480E-08**	4.0335E-08
Midwest No. 2 Diesel Retail Sales Prices	-0.1245***	-0.1859***	-0.1739***
Storage Availability	6.5874E-10*	3.6221E-10	2.6893E-10
Unit Train Transportation	3.1994E-08	2.9385E-07*	8.2445E-08*

	North Central	***Central***	***"State"***
Futures Prices	0.1572***	0.0823**	0.0751**
Corn Production for Grain	-5.3568E-09***	-8.3572E-09***	-9.3822E-10***
Corn Usage by Ethanol	1.0856E-08***	9.0829E-09	2.2418E-09***
Corn Usage by Cattle	1.8144E-07**	-1.4104E-07**	1.3757E-08**
Midwest No. 2 Diesel Retail Sales Prices	-0.1209**	-0.0856**	-0.1833***
Storage Availability	9.0322E-10*	3.3938E-10	3.2796E-11
Unit Train Transportation	1.3905E-07	4.4619E-07***	4.6385E-09

Significance at the 0.99 level is denoted by (***), significance at the 0.95 level is denoted by (**), and significance at the 0.90 level is denoted by (*).

<u>Northeast: Clark, Codington, Day, Deuel, Grant, Hamlin, Marshall, Roberts</u>

The estimated ordinary least squares regression equation for corn basis in the Northeast is

$$Basis_{Northeast} = -0.9656 + 0.1205^{***} \text{ (Futures Price)} - 4.4968E\text{-}11 \text{ (Corn}$$

$$\text{Production for Grain)} + 4.9291E-09^{***} \text{ (Corn Usage by Ethanol)} +$$

4.7454E-08 (Corn Usage by Cattle) - 0.1245^{***} (Midwest No. 2 Diesel Retail Sales Prices) + $6.5875E\text{-}10^{*}$ (Storage Availability) + 3.1994E-08 (Unit Train Transportation) + μ_i

Each coefficient was tested for significance using their *t*-statistic values given in Appendix A. Significance at the 0.99 level is denoted by $\left({}^{***}\right)$, significance at the 0.95 level is denoted by $\left({}^{**}\right)$, and significance at the 0.90 level is denoted by $\left({}^{*}\right)$.

The model is significant with an *F* value of 31.39. The measure of the "goodness of fit" is R^2. The closer R^2 is to 1.0 the better the model is at explaining variation in the dependent variable. The R^2 value for this model is 0.6873, meaning that approximately 69% of the variation in the Northeast corn basis is explained by the independent variables included in the model. However, it also indicates that other factors may exist that are unaccounted for which also have an effect on the local corn basis, such as weather and individual producer decisions to store and sell.

All coefficients in the Northeast basis regression model have the expected sign. The futures prices coefficient for the Northeast is positive. Similar results are shown for the future prices coefficients for the rest of the districts. This result is acceptable even though theoretically we would expect a negative futures prices coefficient. As futures prices increase, elevator management has to compete with other elevators to draw corn in, which should narrow the basis. However, if futures prices decrease, the corn basis falls out and elevators do not have to bid against one another to draw corn in. As we see in the Northeast district, and in the rest of the districts, the positive futures prices coefficient indicates that the elevators in these districts are in a position in which they have to compete against each other.

The unit train transportation coefficient for the Northeast is positive, but is statistically insignificant. The expected sign on this coefficient is indeterminate. As explained earlier, unit train transportation is determined by multiplying the number of cars on the unit train times the expense rate per car depending on the size or number of cars on the unit train. Unit train car capacity alone suggests a positive impact on corn basis, meaning basis would narrow, or become positive as the number of unit train facilities within a district increase. As we see in the Northeast district, and in the other districts, the capacity factor outweighs the cost factor for the unit trains transportation coefficient, giving a positive coefficient value.

The Northeast district is the only district where the corn production coefficient is not significant. The coefficient for corn usage by cattle is not significant in this district, where the other districts, excluding the Southeast district, show significance. The storage availability coefficient is significant for this district, where the other districts, excluding the North Central district, show no significance. Also, unit train transportation is not significant in the Northeast district.

East Central: Brookings, Davison, Hanson, Kingsbury, Lake,
McCook, Miner, Moody, Minnehaha, Sanborn

The estimated ordinary least squares regression equation for corn basis in the East Central is

$$Basis_{EastCentral} = -1.1113 + 0.1337^{***} \text{ (Futures Price)} - 2.5022E-09^{***} \text{(Corn Production for Grain)} + 4.2993E-09^{***} \text{(Corn Usage by Ethanol)} + 6.5480E-08^{**} \text{(Corn Usage by Cattle)} - 0.1859^{***} \text{(Midwest No. 2 Diesel Retail Sales Prices)} + 3.6221E-10 \text{ (Storage Availability)} + 2.9385E-07^{*} \text{ (Unit Train Transportation)} + \mu_i$$

Significance at the 0.99 level is denoted by $\left({}^{***}\right)$, significance at the 0.95 level is denoted by $\left({}^{**}\right)$, and significance at the 0.90 level is denoted by $\left({}^{*}\right)$.

The model is significant with an F value of 24.78. The R^2 value for this model is 0.6344, meaning that approximately 63% of the variation in the East Central corn basis is explained by the independent variables included in the model.

All coefficients in the East Central basis regression model have the expected sign. As explained earlier, the positive futures prices coefficient indicates that the elevators in the East Central district are in a position in which they need to compete against each other to draw corn in. The unit train transportation coefficient shows that the unit train capacity factor outweighs the cost factor for the East Central district, giving a positive coefficient value.

The coefficients for the East Central are fairly consistent in significance with the other districts, deviating with a 0.90 significance level for the unit train transportation coefficient where other districts, excluding the Southeast and Central districts, show no significance.

Southeast: Bon Homme, Charles Mix, Clay, Douglas, Hutchinson, Lincoln, Turner, Union, Yankton

The estimated ordinary least squares regression equation for corn basis in the Southeast is

$$Basis_{Southeast} = -0.8225 + 0.1420^{***}(\text{Futures Price}) - 2.2735\text{E}-09^{***}(\text{Corn Production for Grain}) + 5.4373\text{E}-09^{***}(\text{Corn Usage by Ethanol}) + 4.0335\text{E}-08\,(\text{Corn Usage by Cattle}) - 0.1739^{***}(\text{Midwest No. 2 Diesel Retail Sales Prices}) + 2.6893\text{E}-10\,(\text{Storage Availability}) + 8.2445\text{E}-08^{*}(\text{Unit Train Transportation}) + \mu_i$$

Significance at the 0.99 level is denoted by $\left({}^{***}\right)$, significance at the 0.95 level is denoted by $\left({}^{**}\right)$, and significance at the 0.90 level is denoted by $\left({}^{*}\right)$.

The model is significant with an F value of 21.01. The R^2 value for this model is 0.5952, meaning that approximately 60% of the variation in the Southeast corn basis is explained by the independent variables included in the model.

All coefficients in the Southeast basis regression model have the expected sign. The positive futures prices coefficient indicates that the elevators in the Southeast district are in a position in which they need to compete against each other to draw corn in. The unit train transportation coefficient shows that the unit train capacity factor outweighs the cost factor for the Southeast district.

The coefficient for corn usage by cattle is not significant in this district; a similar result is found for this coefficient in the Northeast district, while the other districts show significance. The Southeast district also shows a 0.90 significance level for the unit train transportation coefficient; a similar result is found for this coefficient in the East Central district, while the other districts show no significance. All remaining coefficients for the Southeast are fairly consistent in significance with the other districts tested.

<u>North Central: Brown, Campbell, Edmunds, Faulk, McPherson, Potter, Spink, Walworth</u>

The estimated ordinary least squares regression equation for corn basis in the North Central is

$$Basis_{NorthCentral} = -1.6066 + 0.1572^{***}(\text{Futures Price}) - 5.3568\text{E}-09^{***}(\text{Corn}$$

Production for Grain) + 1.0856E - 08 *** (Corn Usage by Ethanol) + 1.8144E - 07** (Corn Usage by Cattle) - 0.1209 **(Midwest No. 2 Diesel Retail Sales Prices) + 9.0322E -10 *(Storage Availability) + 1.3905E - 07 (Unit Train Transportation) + μ_i

Significance at the 0.99 level is denoted by $\left(^{***}\right)$, significance at the 0.95 level is denoted by $\left(^{**}\right)$, and significance at the 0.90 level is denoted by $\left(^{*}\right)$.

The model is significant with an F value of 14.31. The R^2 value for this model is 0.5004, meaning that approximately 50% of the variation in the North Central corn basis is explained by the independent variables included in the model.

All coefficients in the North Central basis regression model have the expected sign. The positive futures prices coefficient indicates that the elevators in the North Central district are in a position in which they need to compete against each other to draw corn in. The unit train transportation coefficient shows that the unit train capacity factor outweighs the cost factor for the North Central district.

The coefficients for the North Central are fairly consistent in significance with the other districts, deviating with a 0.90 significance level for the storage availability coefficient; a similar result is found for this coefficient in the Northeast district, while the other districts show no significance.

Central: Aurora, Beadle, Brule, Buffalo, Hand, Hughes, Hyde, Jerauld, Sully

The estimated ordinary least squares regression equation for corn basis in the Central is

$Basis_{Central}$ = - 0.2881 + 0.0823 **(Futures Price) – 8.3572E - 09 ***(Corn

Production for Grain) + 9.0829E-09 (Corn Usage by Ethanol) –

$1.4104E-07^{**}$ (Corn Usage by Cattle) - 0.0856^{**} (Midwest No. 2 Diesel

Retail Sales Prices) + 3.3938E-10 (Storage Availability) +

$4.4619E-07^{***}$ (Unit Train Transportation) + μ_i

Significance at the 0.99 level is denoted by $\left(^{***}\right)$, significance at the 0.95 level is denoted by $\left(^{**}\right)$, and significance at the 0.90 level is denoted by $\left(^{*}\right)$.

The model is significant with an *F* value of 30.42. The R^2 value for this model is 0.6804, meaning that approximately 68% of the variation in the Central corn basis is explained by the independent variables included in the model.

All coefficients in the Central basis regression model have the expected sign except corn usage by cattle. The positive futures prices coefficient indicates that the elevators in the Central district are in a position in which they need to compete against each other to draw corn in. The unit train transportation coefficient shows that the unit train capacity factor outweighs the cost factor for the Central district.

The Central district is the only district with a negative coefficient for corn usage by cattle. The corn usage by cattle coefficient is not only negative in the Central district, but it is the lowest corn usage by cattle coefficient value out of all of the districts tested. This could be due to several contributing factors. First, having the lowest corn production for grain coefficient value could be because the Central district produces the least amount of corn for grain compared to the other east river districts. Also, the Central district has the highest corn usage by ethanol coefficient value compared to the other districts. This could be because the Central district produces the least amount of ethanol than the other districts, and as a result the Central district has the largest ratio of corn usage by ethanol to corn production for grain than the other districts. It is also important to note that the Central district has the largest amount of cattle in the state, but has the lowest number of cattle on feed (COF) of the five east river districts. The negative coefficient value for corn usage by cattle for the Central district could be picking up on that difference. All of these factors combined could potentially mean that the small number of COF is less intensive in this district compared to the other districts, and that such a small market for COF could explain the unexpected sign for the corn usage by cattle coefficient.

The Central district is the only district whose futures prices coefficient is not significant at the 0.99 level. It is also the only district whose corn usage by ethanol coefficient is not significant. This may be due to the fact that the Central district produces the least amount of corn out of all the districts and has only one ethanol plant. The central district is also the only district with a 0.99 significance level for the unit train transportation coefficient while the other districts have lower significance levels or show no significance.

<u>East River as "State"</u>

The estimated ordinary least squares regression equation for corn basis in the "State" is

$$Basis_{"State"} = -0.5780 + 0.0751^{**}\text{(Futures Price)} - 9.3822\text{E-}10^{***}\text{(Corn Production for Grain)} + 2.2418\text{E-}09^{***}\text{(Corn Usage by Ethanol)} + 1.3757\text{E-}08^{**}\text{(Corn Usage by Cattle)} - 0.1833^{***}\text{(Midwest No. 2 Diesel Retail Sales Prices)} + 3.2796\text{E-}11\text{(Storage Availability)} + 4.6385\text{E-}09\text{(Unit Train Transportation)} + \mu_i$$

Significance at the 0.99 level is denoted by $\left(^{***}\right)$, significance at the 0.95 level is denoted by $\left(^{**}\right)$, and significance at the 0.90 level is denoted by $\left(^{*}\right)$.

The model is significant with an F value of 36.68. The R^2 value for this model is 0.7197, meaning that approximately 72% of the variation in the "State" corn basis is explained by the independent variables included in the model.

All coefficients in the "State" basis regression model have the expected sign. The positive futures prices coefficient indicates that the elevators in the "State" are in a position in which they need to compete against each other to draw corn in. The unit train transportation coefficient shows that the unit train capacity factor outweighs the cost factor for the "State".

The significance levels of the coefficients for the "State" are consistent with expectations, given the significance of the coefficients for each of the five east river districts.

Impacts of Ethanol Production on Corn Basis

The regression coefficient for corn usage by ethanol is significant for four of the five east river districts and for the "State". Isolating this coefficient, all other variables held constant, the impact of ethanol production on the corn basis can be found. This is done by multiplying the regression coefficient with the corn usage by ethanol value. In Table 5.2, the regression coefficient values are multiplied with the 2005 corn usage by ethanol values found for each district. This shows the total impact that ethanol usage has had on the corn basis within each district as of December 2005. The "State" 2005 corn usage by ethanol values are the sum of the five east river districts corn usage for ethanol values. The "State" impact of ethanol usage on the corn basis was calculated by using a weighted average of the 2005 corn usage by ethanol values for each district and their corresponding impacts on the corn basis to show an overall impact on the corn basis for the "State" as $0.24 in 2005. This impact on the corn basis is consistent with the average basis improvement industry experts have estimated for South Dakota, which is just over 20 cents per bushel on average, while one industry expert, Dr. Kevin McNew from Montana State University, estimates that local basis for corn in South Dakota has been narrowed from 10 to 30 cents per bushel (Steufen, 2005). There is consistency with the basis impacts estimated by industry experts and with those found using econometrics with this model.

Table 5.2 shows that ethanol production until the end of 2005 has had an impact on the corn basis ranging from $0.04 to $0.27, clearly showing that each district has had an impact on the total "State" corn basis, and that the independent variables used in the regression model can be more substantial in certain districts and thus have significant impacts on the corn basis in those districts, such as the number of ethanol plants found within a district, how many bushels of corn for grain are produced within a district, as well as the other independent variables used in the regression analysis.

Table 5.2

Impact of Ethanol Usage on Corn Basis in South Dakota as of December 2005

	Regression Coefficient	*2005 Corn Usage by Ethanol*	*Product of Coefficient and Production*	*Impact on Corn Basis*
		(bushels)		*($/bushels)*
Northeast	4.93E-09	44,444,444	0.2191	$0.22
East Central	4.30E-09	62,962,963	0.2707	$0.27
Southeast	5.44E-09	42,222,222	0.2296	$0.23
North Central	1.09E-08	21,851,852	0.2372	$0.24
Central	9.08E-09	4,444,444	0.0404	$0.04
"State"	2.24E-09	175,925,926	0.3944	$0.24*

1 bushel corn = 2.7 gallons ethanol

** weighted average of districts by percentage of 2005 corn usage by ethanol and impact on corn basis*

Tables 5.3 and 5.4 go into further detail with the regression results and project the impacts that additional 40 and 100 million gallons per year (MGY) ethanol plants will have on the corn basis. This is done by first determining the number of additional bushels needed for use in 40 and 100 MGY ethanol plants. Using the conversion ratio that 1 bushel of corn produces 2.7 gallons of ethanol, 40 million gallons divided by 2.7 equals 14.8 million additional bushels of corn needed to sustain an additional 40 MGY ethanol plant. Doing the same for a 100 MGY ethanol plant, 37 million additional bushels of corn are needed to sustain an additional 100 MGY ethanol plant.

The additional bushels of corn needed to sustain an additional 40 MGY or 100 MGY ethanol plant are then multiplied by the regression coefficients for each district, showing the impact on the corn basis if either a 40 MGY or a 100 MGY ethanol plant were added to any district. The "State" impact on the corn basis shows how the corn basis for the "State" as a whole would be impacted with an additional 40 or 100 MGY ethanol plant, regardless of which district it is in.

Table 5.3

Impact of an Additional 40 MGY Ethanol Plant on Corn Basis in South Dakota

	Regression Coefficient	*2005 Corn Usage by Ethanol*	*Product of Coefficient and Production*	*Impact on Corn Basis*
		(bushels)		*($/bushels)*
Northeast	4.93E-09	14,800,000	0.0730	$0.07
East Central	4.30E-09	14,800,000	0.0636	$0.06
Southeast	5.44E-09	14,800,000	0.0805	$0.08
North Central	1.09E-08	14,800,000	0.1607	$0.16
Central	9.08E-09	14,800,000	0.1344	$0.13
"State"	2.24E-09	14,800,000	0.0332	$0.03

Additional 14.8 million bushels used for ethanol production
1 bushel corn = 2.7 gallons ethanol

An additional 40 MGY ethanol plant has an impact on the corn basis that ranges from $0.06 to $0.16, with a total “State” impact of $0.03. An additional 100 MGY ethanol plant has an impact on the corn basis that ranges from $0.16 to $0.40, with a total “State” impact of $0.08.

Table 5.4

Impact of an Additional 100 MGY Ethanol Plant on Corn Basis in South Dakota

	Regression Coefficient	*2005 Corn Usage by Ethanol*	*Product of Coefficient and Production*	*Impact on Corn Basis*
		(bushels)		*($/bushels)*
Northeast	4.93E-09	37,000,000	0.1824	$0.18
East Central	4.30E-09	37,000,000	0.1591	$0.16
Southeast	5.44E-09	37,000,000	0.2012	$0.20
North Central	1.09E-08	37,000,000	0.4017	$0.40
Central	9.08E-09	37,000,000	0.3361	$0.34
"State"	2.24E-09	37,000,000	0.0829	$0.08

Additional 37 million bushels used for ethanol production
1 bushel corn = 2.7 gallons ethanol

Results of the model show futures prices, corn production from grain, corn usage by ethanol, corn usage by cattle, storage availability, Midwest No. 2 Diesel retail sales prices, and unit train transportation have significant effects on the corn basis in South Dakota.

Ultimately, this research shows that ethanol production does have an impact on the South Dakota corn basis. It also shows that ethanol production impacts the corn basis differently in each district. Ethanol production has impacted the corn basis from $0.04 to $0.27 for different districts in 2005, with an overall impact of $0.24 on the “State” corn basis. This clearly shows that each district has had an impact on the total “State” corn basis, and that the independent variables used in the regression model can be more substantial in certain districts and thus have significant impacts on the corn basis in those districts, such as the number of ethanol plants found within a district.

This research also estimates the impacts that additional 40 and 100 million gallons per year (MGY) ethanol plants will have on the corn basis. An additional 40 MGY ethanol plant can impact the corn basis from $0.06 to $0.16 in the various districts, having a total “State” impact of $0.03, and that an additional 100 MGY ethanol plant can impact the corn basis from $0.16 to $0.40, having a total “State” impact of $0.08.

Limitations

Some limitations to this model are that it only uses South Dakota corn production for grain values. Supply characteristics of ethanol plants show that most corn typically comes from within a fifty mile radius of the plant (Urbanchuk & Kapell, 2002). Some of the South Dakota ethanol plants are near the Minnesota and Iowa boarders and whose fifty mile radiuses extend into Minnesota and Iowa. Also, this is a straight linear estimation model. It is not a complete system. It holds all other variables as constants to determine direct impacts on state corn basis as increased ethanol production occurs.

Recommendations

Future research in this area could build on this model to further examine how increased ethanol production impacts the South Dakota corn basis. Data used in the model could be continually updated to see the ongoing impact that ethanol production has on the corn basis at the district and “State” levels. This will be particularly relevant with the significant changes that have occurred in the corn market during the winter of 2006-2007, which is after the period of analysis in this thesis. With the increased demand for ethanol pushing corn prices above the $4 mark, it would be interesting to see if the results are robust with the rapidly changing corn/ethanol markets. Further research could also try to determine how county level corn basis is impacted.

The model could also be used to see the impacts that any new mandates for increased ethanol production would have on the district and "State" corn basis, and to see if any future mandates for increased ethanol production actually increase the price of corn. Such future mandates could be similar to President George W. Bush's Advanced Energy Initiative, in which a national goal is set to replace more than 75% of U.S. oil imports from the Middle East by 2025.

It might also be interesting to apply this model to other states to determine how their corn basis has been impacted by ethanol production and make comparisons. The model could possibly be extended to include multiple states to determine how regional corn basis has been impacted by ethanol production.

Future research could also determine if this model could be applied to the bio-diesel industry to determine the impacts of increased bio-diesel production on the soybean basis.

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APPENDIX A - SUMMARY STATISTICS

A.1 Northeast: Clark, Codington, Day, Deuel, Grant, Hamlin, Marshall, Roberts

	Futures Prices	Corn Production for Grain	Northeast Corn Usage by Ethanol	Northeast Corn Usage by Cattle	Midwest No. 2 Diesel Prices	Northeast Storage Availability	Northeast Unit Train Expenses	Northeast Corn Basis
	$/Bushel	*Bushels*	*Bushels*	*Bushels*	*$/Gallon*	*Bushels*	*$/car*cars*	*$/Bushel*
Mean	2.3041	61,794,625.00	19,753,086.42	5,213,471.73	1.4552	58,004,272.8	1,311,052.00	-0.4469
Standard Error	0.0283	1,058,302.31	2,135,000.99	40,520.23	0.0397	2,389,258.2	10,308.55	0.0134
Median	2.2000	58,976,000.00	0.00	5,284,889.15	1.4090	60,233,618.7	1,252,800.00	-0.4750
Standard Deviation	0.2939	10,998,200.27	22,187,581.17	421,098.55	0.4128	24,829,899.8	107,129.59	0.1391
Sample Variance	0.0864	1.2096E+14	4.9229E+14	1.7732E+11	0.1704	6.1652E+14	1.1477E+10	0.0193
Minimum	1.8200	47,080,500.00	0.00	4,427,880.10	0.9390	10,077,475.1	1,166,400.00	-0.7400
Maximum	3.1200	84,977,000.00	44,444,444.44	5,713,393.68	3.0980	115,703,563.7	1,607,040.00	-0.1075
Count	108	108	108	108	108	108	108	108

1997-2005 monthly data

A.2 East Central: Brookings, Davison, Hanson, Kingsbury, Lake, McCook, Miner, Moody, Minnehaha, Sanborn

	Futures Prices	Corn Production for Grain	East Central Corn Usage by Ethanol	East Central Corn Usage by Cattle	Midwest No. 2 Diesel Prices	East Central Storage Availability	East Central Unit Train Expenses	East Central Corn Basis
	$/Bushel	*Bushels*	*Bushels*	*Bushels*	*$/Gallon*	*Bushels*	*$/car*cars*	*$/Bushel*
Mean	2.3041	108,277,166.67	20,164,609.05	7,199,760.36	1.4552	100,775,163.7	1,081,698.19	-0.4321
Standard Error	0.0283	1,958,221.44	2,345,533.94	55,958.09	0.0397	3,888,260.2	13,127.06	0.0131
Median	2.2000	98,436,000.00	18,518,518.52	7,298,387.22	1.4090	106,320,974.1	1,113,600.00	-0.4480
Standard Deviation	0.2939	20,350,434.17	24,375,503.72	581,533.53	0.4128	40,407,984.8	136,420.44	0.1363
Sample Variance	0.0864	4.1414E+14	5.9417E+14	3.3818E+11	0.1704	1.6328E+15	1.8611E+10	0.0186
Minimum	1.8200	82,001,500.00	0.00	6,114,864.96	0.9390	19,278,906.4	918,400.00	-0.7180
Maximum	3.1200	147,947,000.00	62,962,962.96	7,890,148.34	3.0980	172,274,110.5	1,339,380.00	-0.0800
Count	108	108	108	108	108	108	108	108

1997-2005 monthly data

A.3 Southeast: Bon Homme, Charles Mix, Clay, Douglas, Hutchinson, Lincoln, Turner, Union, Yankton

	Futures Prices	*Corn Production for Grain*	*Southeast Corn Usage by Ethanol*	*Southeast Corn Usage by Cattle*	*Midwest No. 2 Diesel Prices*	*Southeast Storage Availability*	*Southeast Unit Train Expenses*	*Southeast Corn Basis*
	$/Bushel	*Bushels*	*Bushels*	*Bushels*	*$/Gallon*	*Bushels*	*$/car*cars*	*$/Bushel*
Mean	2.3041	111,376,791.67	14,032,921.81	7,946,787.82	1.4552	104,222,635.2	2,078,750.69	-0.4054
Standard Error	0.0283	1,869,048.73	1,557,914.89	61,764.15	0.0397	3,994,864.1	43,260.51	0.0117
Median	2.2000	109,670,000.00	3,333,333.33	8,055,647.92	1.4090	110,221,883.5	2,227,200.00	-0.4210
Standard Deviation	0.2939	19,423,724.21	16,190,326.44	641,871.86	0.4128	41,515,845.6	449,576.45	0.1213
Sample Variance	0.0864	3.7728E+14	2.6213E+14	4.1200E+11	0.1704	1.7236E+15	2.0212E+11	0.0147
Minimum	1.8200	81,568,000.00	3,333,333.33	6,749,326.64	0.9390	17,303,454.9	1,242,600.00	-0.6920
Maximum	3.1200	147,217,000.00	42,222,222.22	8,708,808.57	3.0980	167,890,077.9	2,678,760.00	-0.1300
Count	108	108	108	108	108	108	108	108

1997-2005 monthly data

A.4 North Central: Brown, Campbell, Edmunds, Faulk, McPherson, Potter, Spink, Walworth

	Futures Prices	*Corn Production for Grain*	*North Central Corn Usage by Ethanol*	*North Central Corn Usage by Cattle*	*Midwest No. 2 Diesel Prices*	*North Central Storage Availability*	*North Central Unit Train Expenses*	*North Central Corn Basis*
	$/Bushel	*Bushels*	*Bushels*	*Bushels*	*$/Gallon*	*Bushels*	*$/car*cars*	*$/Bushel*
Mean	2.3041	61,485,591.67	7,448,559.67	4,858,026.31	1.4552	56,657,573.6	1,852,766.24	-0.4785
Standard Error	0.0283	1,682,017.13	744,279.16	37,757.63	0.0397	2,427,701.8	37,967.93	0.0141
Median	2.2000	56,019,000.00	3,333,333.33	4,924,574.62	1.4090	53,684,962.6	1,896,600.00	-0.5068
Standard Deviation	0.2939	17,480,034.80	7,734,775.94	392,388.78	0.4128	25,229,417.4	394,574.33	0.1461
Sample Variance	0.0864	3.0555E+14	5.9827E+13	1.5397E+11	0.1704	6.3652E+14	1.5569E+11	0.0214
Minimum	1.8200	36,908,100.00	3,333,333.33	4,125,994.95	0.9390	9,242,071.3	1,231,200.00	-0.7780
Maximum	3.1200	95,617,000.00	21,851,851.85	5,323,864.45	3.0980	103,305,567.8	2,522,400.00	-0.1075
Count	108	108	108	108	108	108	108	108

1997-2005 monthly data

A.5 Central: Aurora, Beadle, Brule, Buffalo, Hand, Hughes, Hyde, Jerauld, Sully

	Futures Prices	*Corn Production for Grain*	*Central Corn Usage by Ethanol*	*Central Corn Usage by Cattle*	*Midwest No. 2 Diesel Prices*	*Central Storage Availability*	*Central Unit Train Expenses*	*Central Corn Basis*
	$/Bushel	*Bushels*	*Bushels*	*Bushels*	*$/Gallon*	*Bushels*	*$/car*cars*	*$/Bushel*
Mean	2.3041	40,721,666.67	2,962,962.96	3,583,649.33	1.4552	37,108,455.2	1,282,067.98	-0.4574
Standard Error	0.0283	1,133,583.27	202,543.98	27,852.90	0.0397	1,617,826.2	23,785.75	0.0139
Median	2.2000	43,812,000.00	4,444,444.44	3,632,740.42	1.4090	37,459,058.9	1,258,600.00	-0.4755
Standard Deviation	0.2939	11,780,542.90	2,104,898.77	289,455.78	0.4128	16,812,943.0	247,188.81	0.1448
Sample Variance	0.0864	1.3878E+14	4.4306E+12	8.3785E+10	0.1704	2.8268E+14	6.1102E+10	0.0210
Minimum	1.8200	13,696,000.00	0.00	3,043,647.38	0.9390	6,350,530.2	923,400.00	-0.7900
Maximum	3.1200	56,748,000.00	4,444,444.44	3,927,286.94	3.0980	67,688,300.8	1,763,400.00	-0.1375
Count	108	108	108	108	108	108	108	108

1997-2005 monthly data

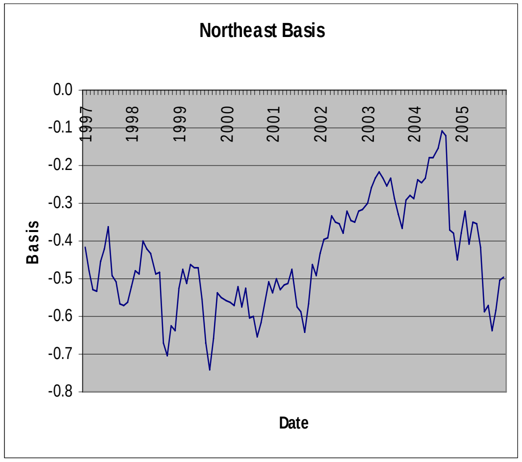
A.6 East River as whole "State"

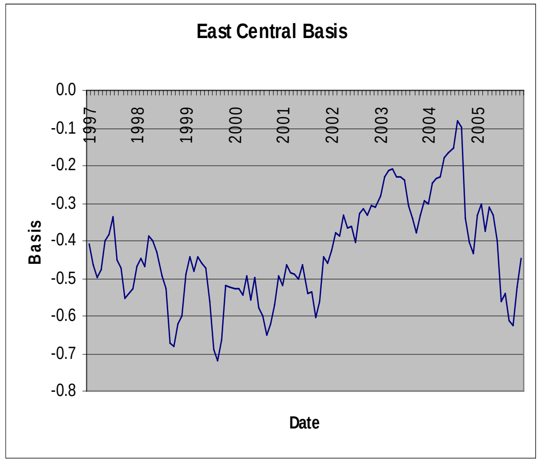
	Futures Prices	*Corn Production for Grain*	*East River Corn Usage by Ethanol*	*East River Corn Usage by Cattle*	*Midwest No. 2 Diesel Prices*	*East River Storage Availability*	*East River Unit Train Expenses*	*East River Corn Basis*
	$/Bushel	*Bushels*	*Bushels*	*Bushels*	*$/Gallon*	*Bushels*	*$/car*cars*	*$/Bushel*
Mean	2.3041	383,655,841.67	64,362,139.92	28,801,695.55	1.4552	356,768,100.4	7,606,335.09	-0.4440
Standard Error	0.0283	6,519,651.13	6,429,791.70	223,852.99	0.0397	13,406,784.5	123,525.89	0.0131
Median	2.2000	351,071,000.00	29,629,629.63	29,196,239.32	1.4090	379,737,720.4	7,748,800.00	-0.4658
Standard Deviation	0.2939	67,754,201.98	66,820,355.39	2,326,348.51	0.4128	139,327,391.8	1,283,718.67	0.1360
Sample Variance	0.0864	4.5906E+15	4.4650E+15	5.4119E+12	0.1704	1.9412E+16	1.6479E+12	0.0185
Minimum	1.8200	304,813,000.00	6,666,666.67	24,461,714.03	0.9390	69,001,841.8	5,563,200.00	-0.7436
Maximum	3.1200	530,661,000.00	175,925,925.93	31,563,501.97	3.0980	571,995,614.5	9,910,980.00	-0.1125
Count	108	108	108	108	108	108	108	108

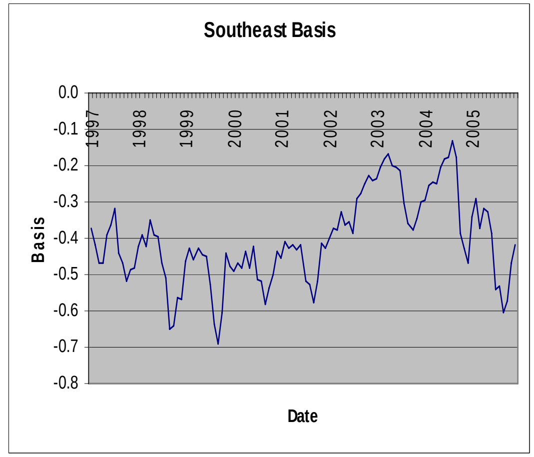
1997-2005 monthly data

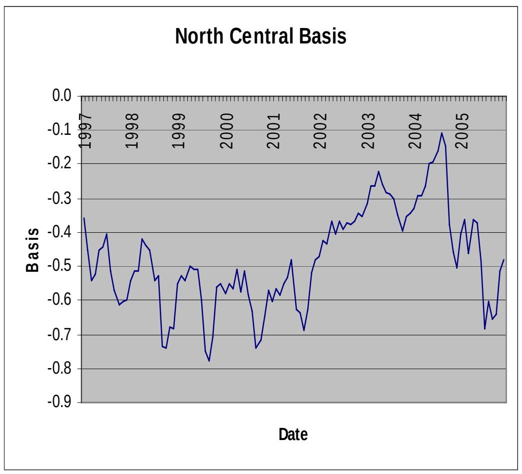
APPENDIX B - DATA CHARTS

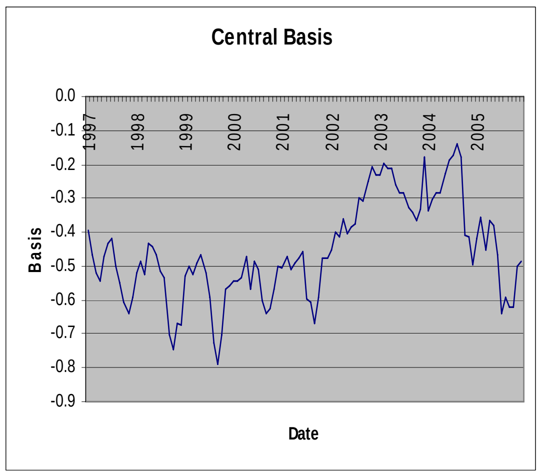
B.1 BASIS

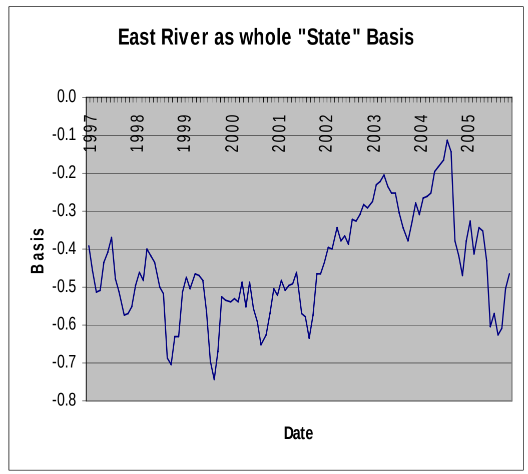




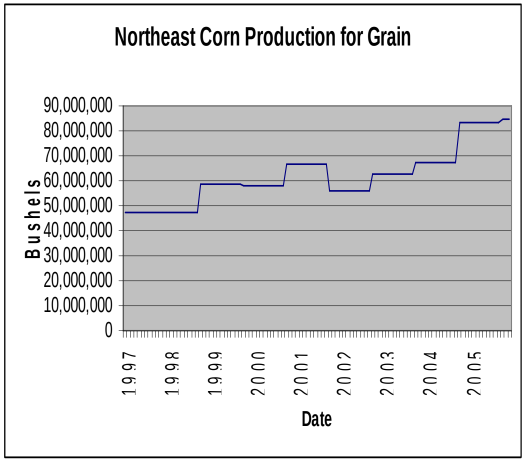


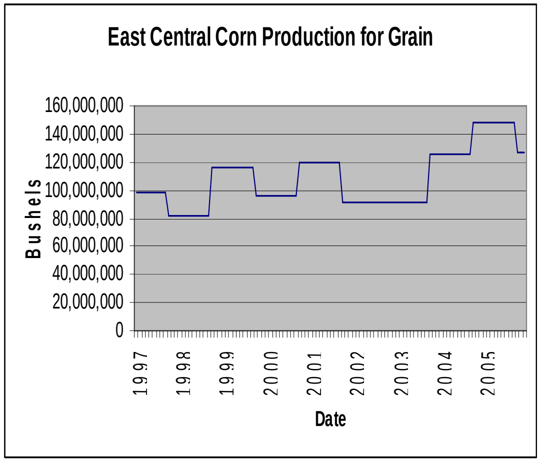


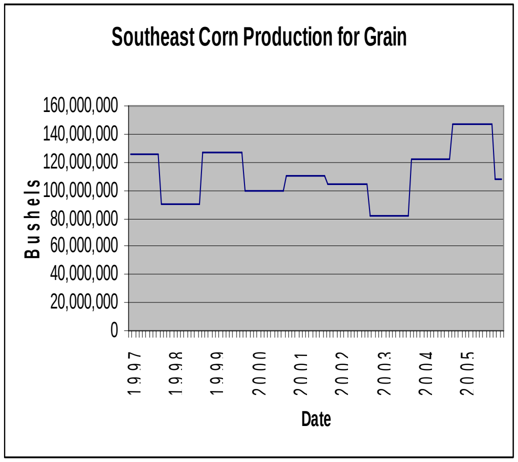


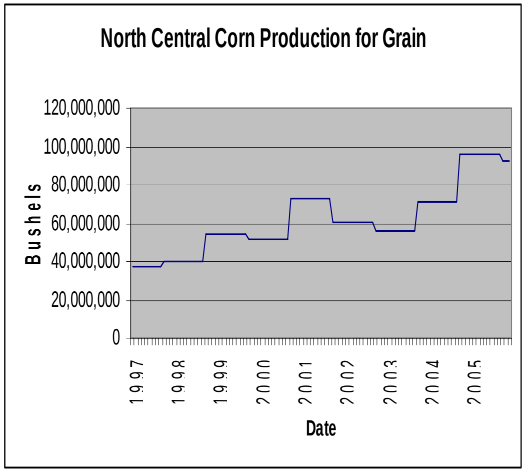


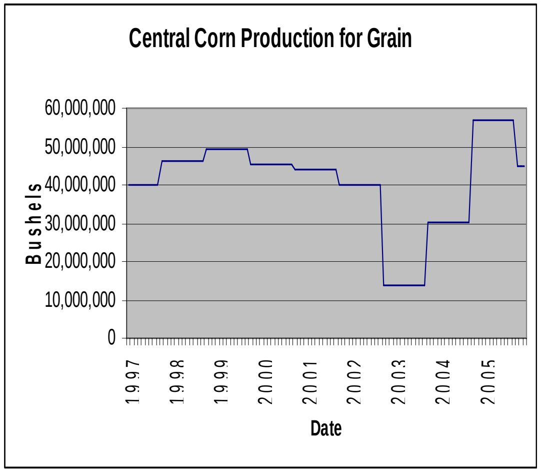
B.2 Corn Production for Grain

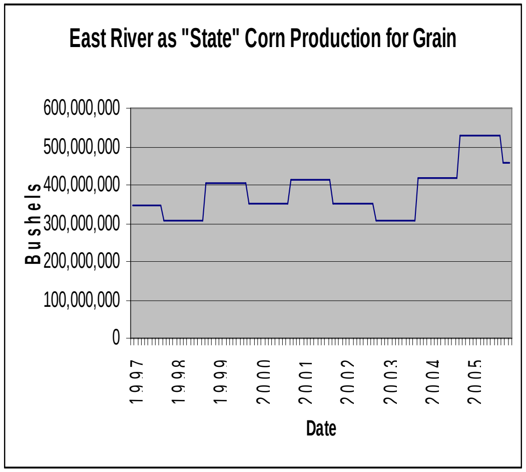












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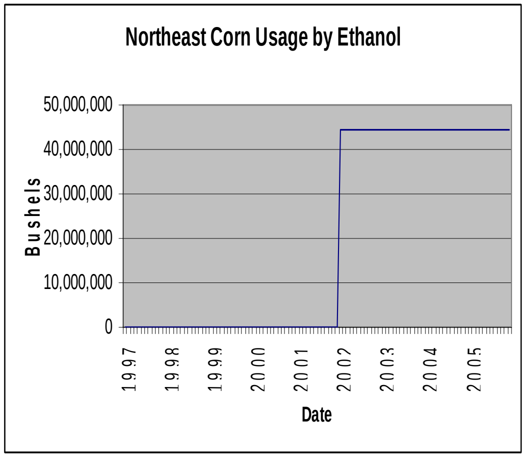

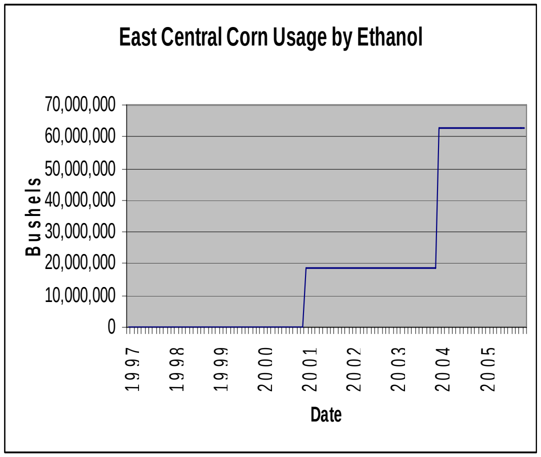

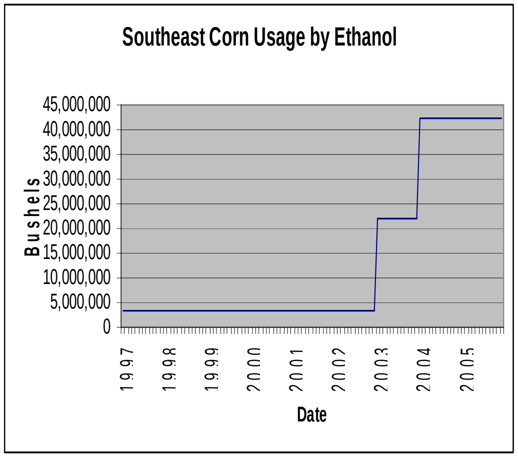

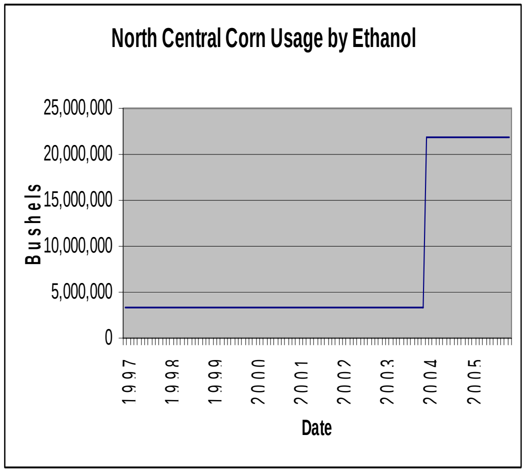

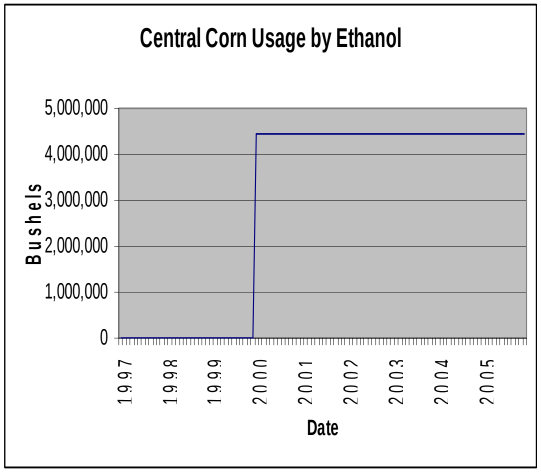

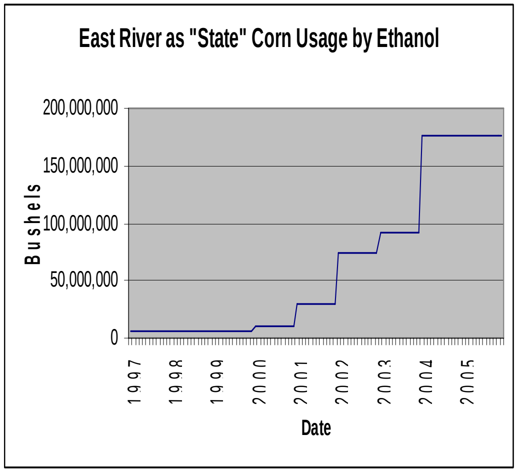

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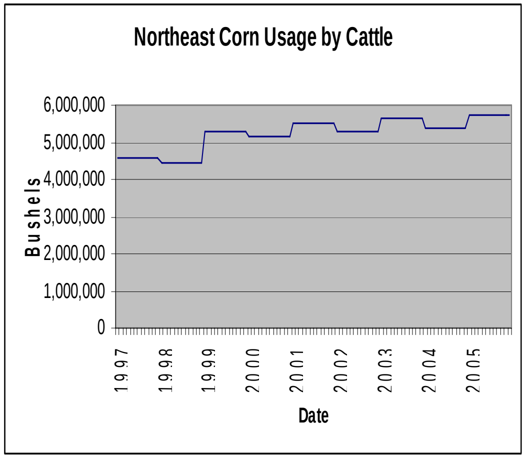

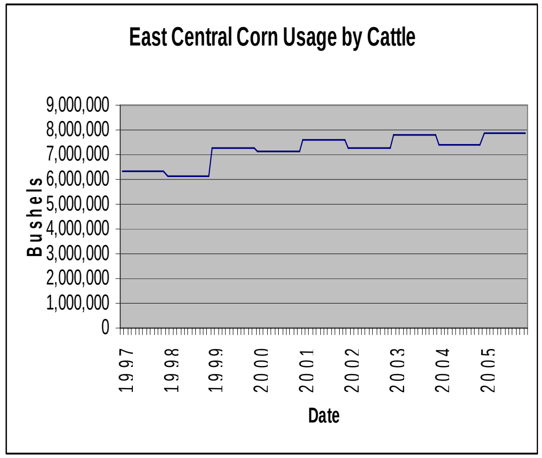

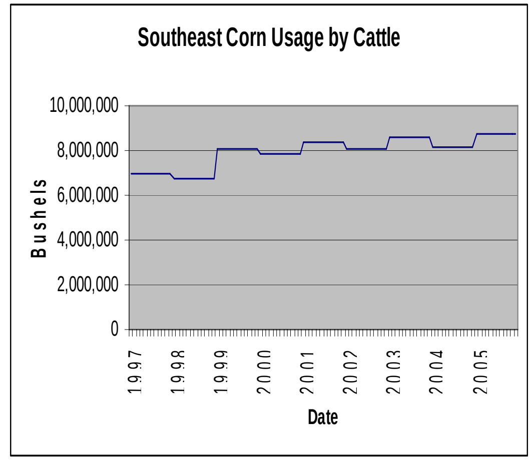

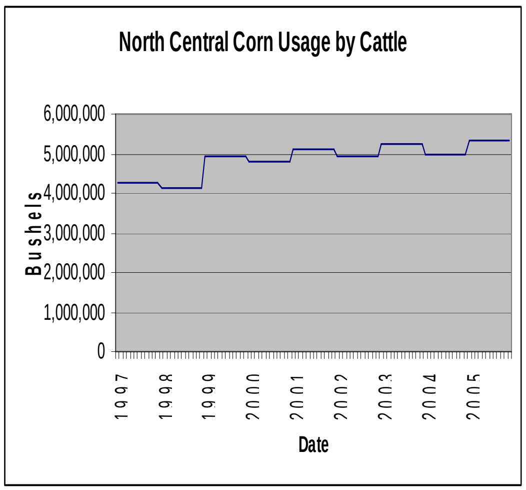

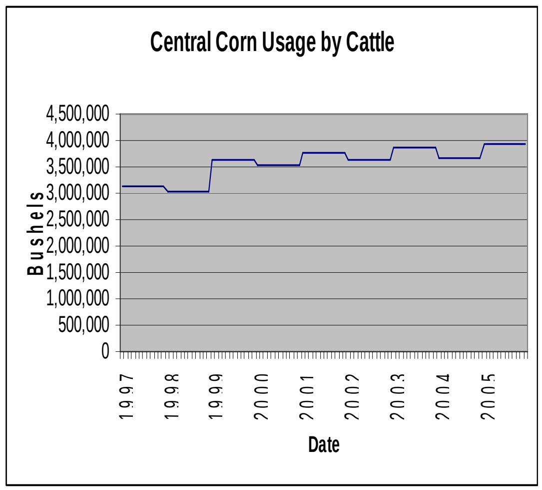

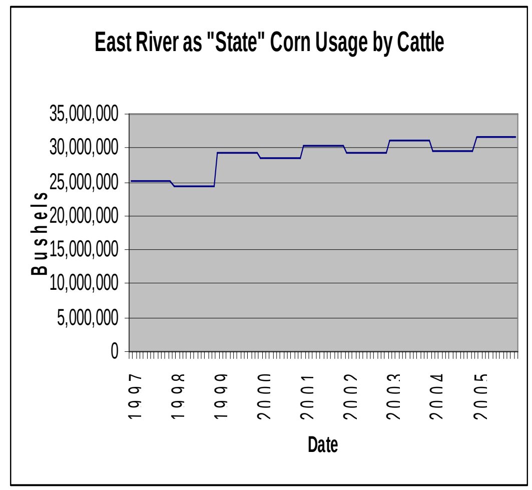

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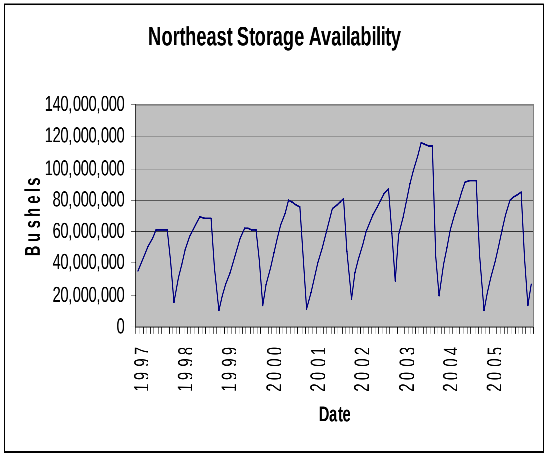

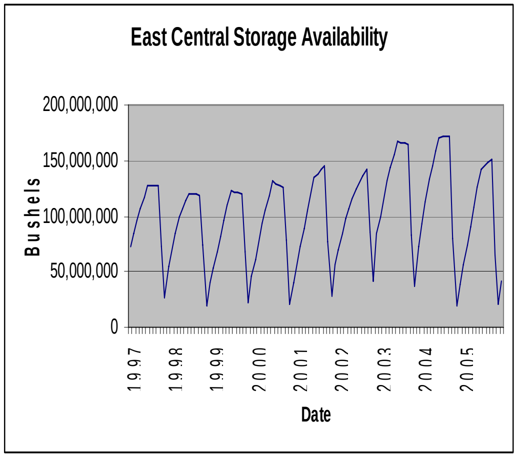

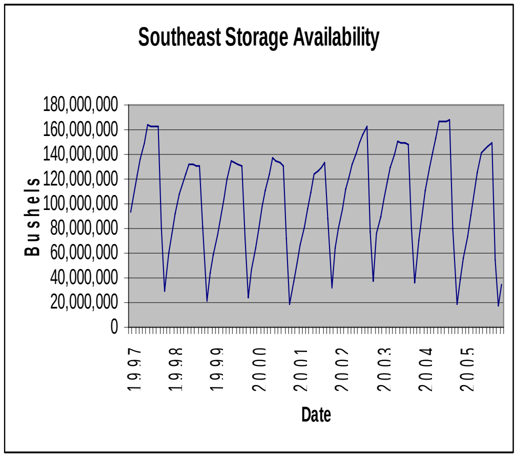

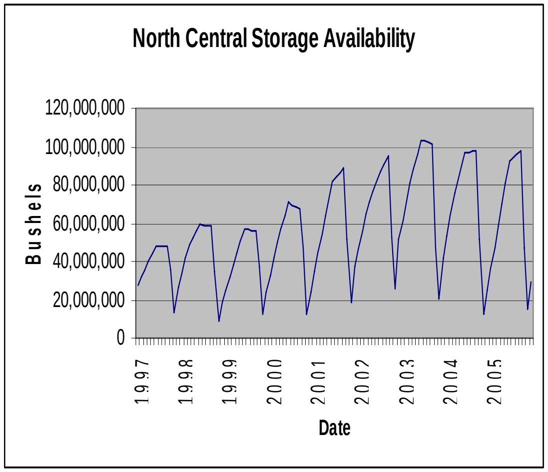

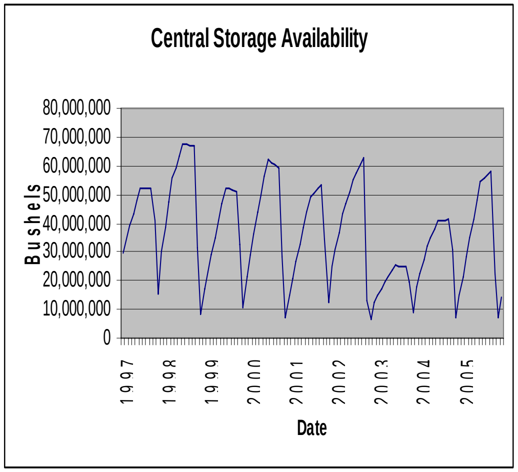

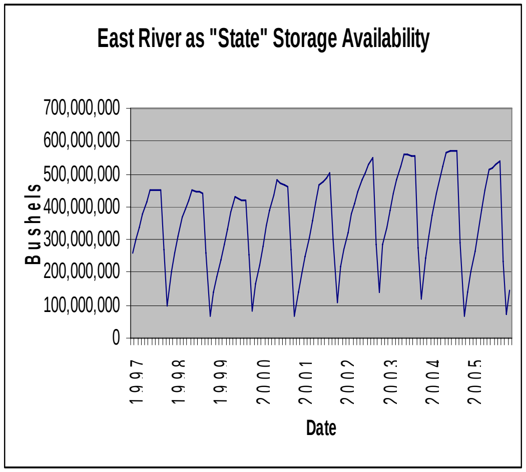

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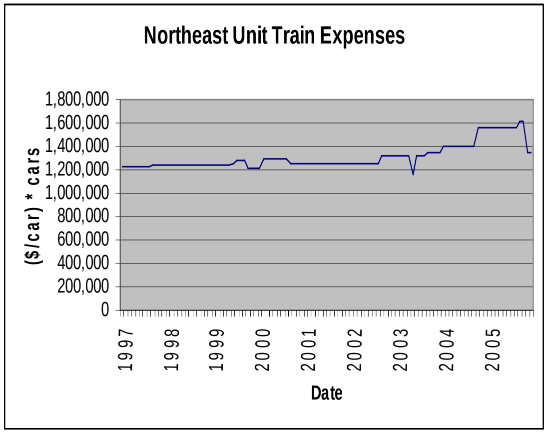
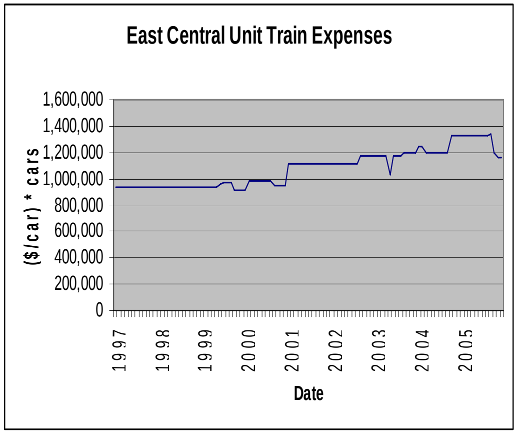
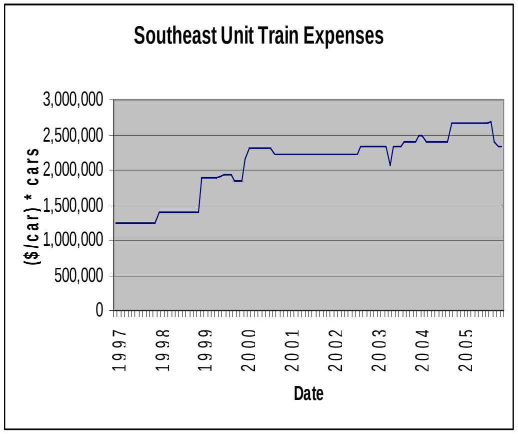
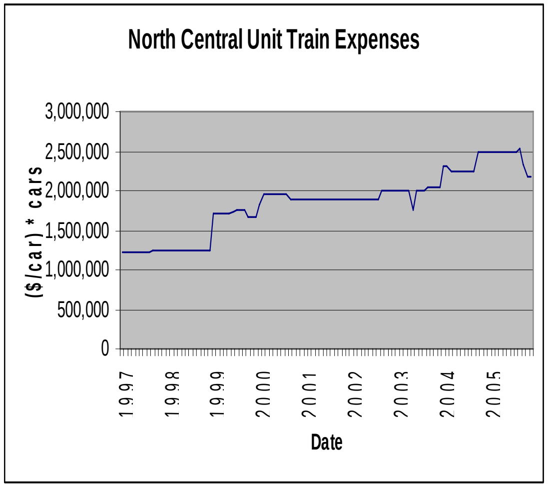
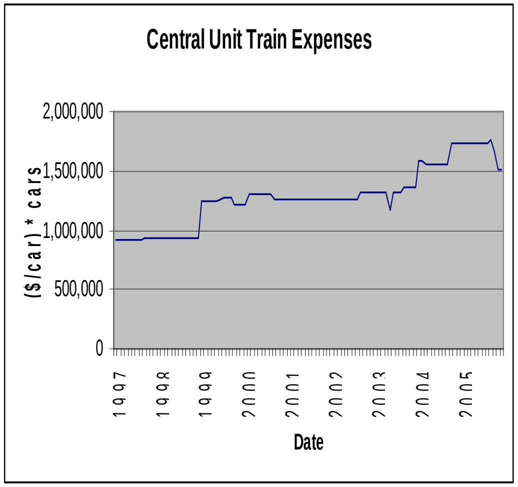
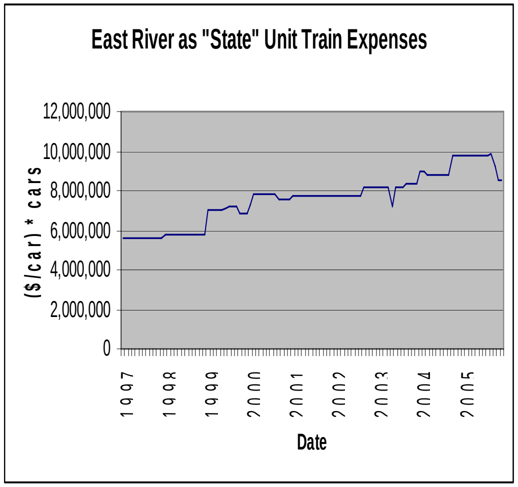












APPENDIX C - TRAIN FACILITIES

C.1 110 Car Capacity Shuttle Train Facilities

Location	County	District	Year	54 Before	27 Before	New
Alpena	Jerauld	Central	2004	x	-	-
Beardsley	Hutchinson	Southeast	2000	-	x	-
Beresford	Union	Southeast	1999	x	-	-
Bowdle	Edmunds	North Central	2006	-	-	x
Canton	Lincoln	Southeast	1997	x	-	-
Craven	Edmunds	North Central	2000	x	-	-
Emery	Hanson	East Central	1997	x	-	-
Grebner	Brown	North Central	1999	x	-	-
Jefferson	Union	Southeast	1997	-	-	x
Madison	Lake	East Central	2001	x	-	-
Marion	Turner	Southeast	1999	-	-	x
Mellette	Spink	North Central	1999	-	-	x
Mitchell	Davison	East Central	1997	x	-	-
Parker	Turner	Southeast	1998	x	-	-
Selby	Walworth	North Central	2004	x	-	-
Wolsey	Beadle	Central	1999	-	-	x

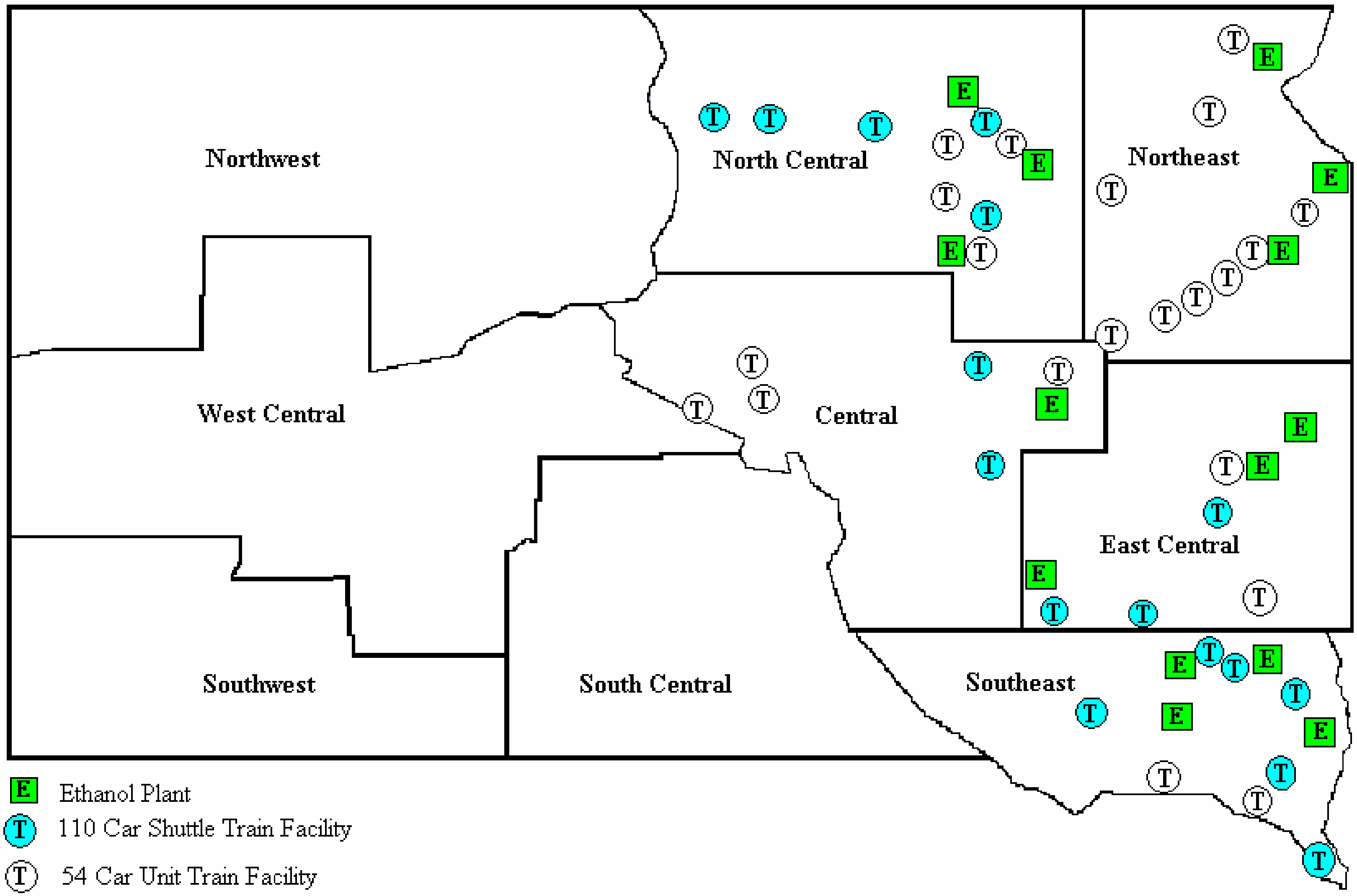
A shuttle train refers to shipments of more than 100 cars.

C.2 54 Car Capacity Unit Train Facilities

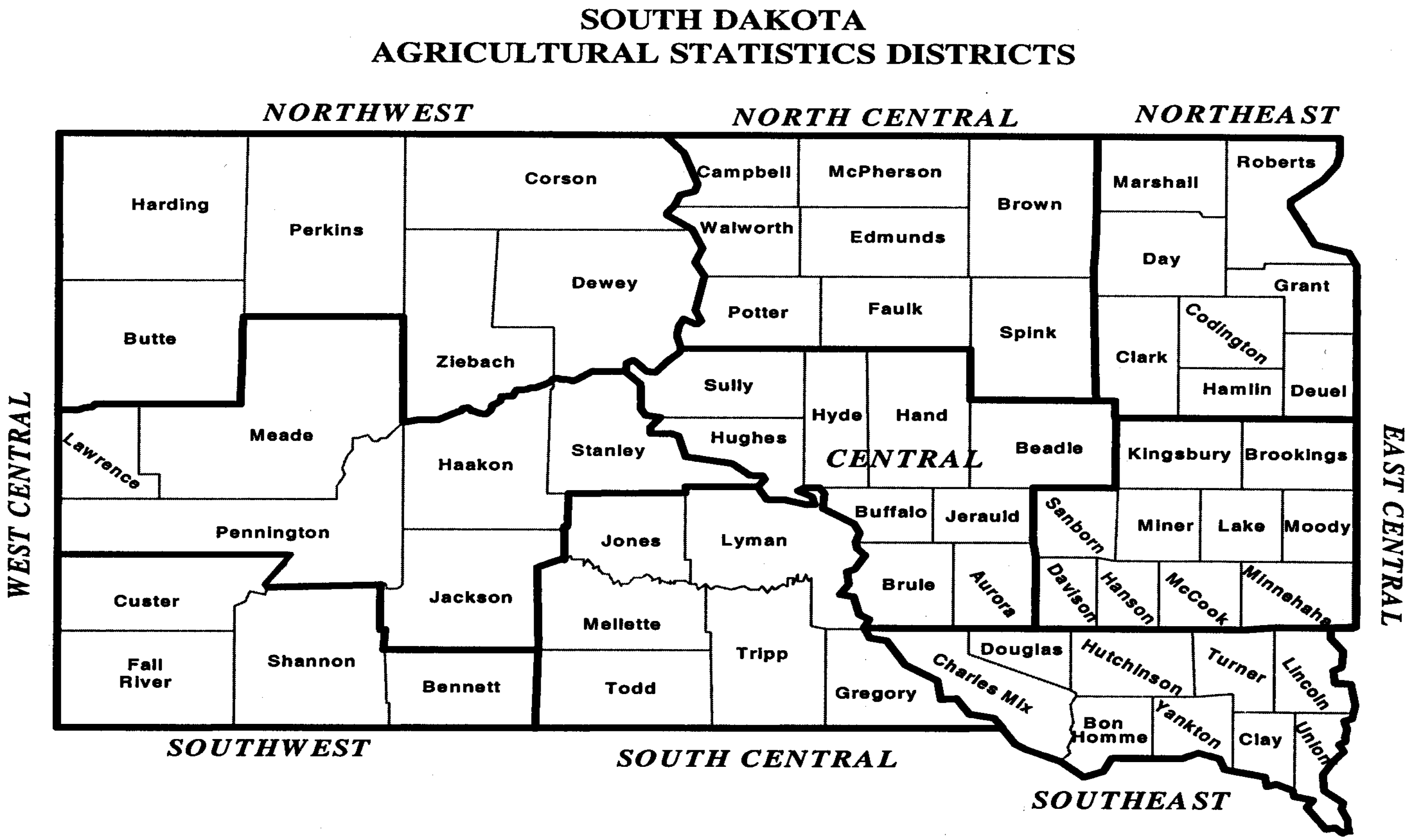
Location	County	District	Year
Aberdeen	Brown	North Central	1993
Bristol	Day	Northeast	87-88
Harrold	Hughes	Central	*
Huron	Beadle	Central	80's
Mansfield	Brown	North Central	*
Milbank	Grant	Northeast	*
Northville	Spink	North Central	*
Onida	Sully	Central	*
Pierre	Hughes	Central	*
Redfield	Spink	North Central	96-97
Rosholt	Roberts	Northeast	*
Sioux Falls	Minnehaha	East Central	*
Sisseton	Roberts	Northeast	*
Vermillion	Clay	Southeast	1995
Vienna	Clark	Northeast	1994
Watertown	Codington	Northeast	1981
Watertown	Codington	Northeast	1993
Wentworth	Lake	East Central	*
Willow Lake	Clark	Northeast	early 90's
Yale	Beadle	Central	1996
Yankton	Yankton	Southeast	early 80's

** Assumed to have been in operation at 54 unit capacity before 1997*
A unit train refers to shipments of a least 52 cars.

C.3 Train Facilities and Ethanol Plants 2006



C.4 State District and County Map



APPENDIX D - REGRESSION STATISTICS

D.1 Northeast: Clark, Codington, Day, Deuel, Grant, Hamlin, Marshall, Roberts

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.829013813
R Square	0.687263903
Adjusted R Square	0.665372376
Standard Error	0.080463858
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	1.422811052	0.203258722	31.39406	1.33207E-22
Residual	100	0.647443251	0.006474433		
Total	107	2.070254303			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-0.965616228	0.279252151	-3.45786496	0.0008012
Futures Prices	0.120545557	0.033034496	3.64908115	0.0004204
Northeast Corn Production for Grain	-4.4968E-11	2.40024E-09	-0.01873482	0.9850900
Northeast Corn Usage by Ethanol	4.92915E-09	5.68912E-10	8.66416069	8.297E-14
Northeast Corn Usage by Cattle	4.74538E-08	3.85561E-08	1.23077115	0.2212955
Midwest No. 2 Diesel Retail Sales Prices	-0.124478196	0.044423547	-2.80207693	0.0060978
Northeast Storage Availability	6.58745E-10	3.76683E-10	1.74880176	0.0833938
Northeast Unit Train Expenses	3.19944E-08	1.81282E-07	0.17648948	0.8602664

1997-2005 monthly data

D.2 East Central: Brookings, Davison, Hanson, Kingsbury, Lake, McCook, Miner, Moody, Minnehaha, Sanborn

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.796463878
R Square	0.634354708
Adjusted R Square	0.608759538
Standard Error	0.085270074
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	1.261436698	0.180205243	24.784156	2.71795E-19
Residual	100	0.727098552	0.007270986		
Total	107	1.98853525			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-1.111320227	0.221665446	-5.01350232	2.317E-06
Futures Prices	0.133748696	0.035038287	3.81721560	0.0002341
East Central Corn Production for Grain	-2.50225E-09	6.40949E-10	-3.90397726	0.0001719
East Central Corn Usage by Ethanol	4.29933E-09	1.00676E-09	4.27044676	4.449E-05
East Central Corn Usage by Cattle	6.54798E-08	2.51348E-08	2.60514188	0.0105843
Midwest No. 2 Diesel Retail Sales Prices	-0.185879846	0.038004651	-4.89097628	3.84E-06
East Central Storage Availability	3.62215E-10	2.20171E-10	1.64515256	0.1030782
East Central Unit Train Expenses	2.93852E-07	1.65201E-07	1.77874747	0.0783199

1997-2005 monthly data

D.3 Southeast: Bon Homme, Charles Mix, Clay, Douglas, Hutchinson, Lincoln, Turner, Union, Yankton

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.771500429
R Square	0.595212911
Adjusted R Square	0.566877815
Standard Error	0.079846684
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	0.937474503	0.133924929	21.006208	3.76394E-17
Residual	100	0.6375493	0.006375493		
Total	107	1.575023803			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-0.822507231	0.209276204	-3.93024728	0.00015643
Futures Prices	0.142023272	0.034237259	4.14820799	7.0420E-05
Southeast Corn Production for Grain	-2.27352E-09	4.62739E-10	-4.91318287	3.5060E-06
Southeast Corn Usage by Ethanol	5.43733E-09	9.79565E-10	5.55076048	2.3428E-07
Southeast Corn Usage by Cattle	4.03345E-08	2.75315E-08	1.46503244	0.14604909
Midwest No. 2 Diesel Retail Sales Prices	-0.173942106	0.036071071	-4.82220525	5.0851E-06
Southeast Storage Availability	2.68931E-10	1.95507E-10	1.37556036	0.17203122
Southeast Unit Train Expenses	8.24452E-08	4.32732E-08	1.90522711	0.05962330

1997-2005 monthly data

D.4 North Central: Brown, Campbell, Edmunds, Faulk, McPherson, Potter, Spink, Walworth

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.707360165
R Square	0.500358403
Adjusted R Square	0.465383491
Standard Error	0.106850373
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	1.14333814	0.16333402	14.306209	9.23819E-13
Residual	100	1.141700212	0.011417002		
Total	107	2.285038352			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-1.606633859	0.249758118	-6.43275931	4.34951E-09
Futures Prices	0.157212916	0.045617476	3.44633086	0.00083233
North Central Corn Production for Grain	-5.35683E-09	1.70297E-09	-3.14557038	0.00218353
North Central Corn Usage by Ethanol	1.08557E-08	3.23846E-09	3.35211927	0.00113309
North Central Corn Usage by Cattle	1.81439E-07	7.12949E-08	2.54490877	0.01245912
Midwest No. 2 Diesel Retail Sales Prices	-0.120858405	0.052097817	-2.31983627	0.02238260
North Central Storage Availability	9.0322E-10	4.83752E-10	1.86711472	0.06481474
North Central Unit Train Expenses	1.39054E-07	9.10668E-08	1.52694873	0.12993060

1997-2005 monthly data

D.5 Central: Aurora, Beadle, Brule, Buffalo, Hand, Hughes, Hyde, Jerauld, Sully

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.824878163
R Square	0.680423985
Adjusted R Square	0.658053663
Standard Error	0.084687815
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	1.527029028	0.218147004	30.416371	3.83519E-22
Residual	100	0.717202602	0.007172026		
Total	107	2.24423163			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-0.288097266	0.25421121	-1.13329883	0.25979856
Futures Prices	0.082283799	0.03700274	2.22372180	0.02841701
Central Corn Production for Grain	-8.35719E-09	1.06485E-09	-7.84824229	4.8112E-12
Central Corn Usage by Ethanol	9.08291E-09	6.92867E-09	1.31091791	0.19288797
Central Corn Usage by Cattle	-1.41045E-07	6.74895E-08	-2.08987625	0.03916610
Midwest No. 2 Diesel Retail Sales Prices	-0.085641598	0.03568172	-2.40015330	0.01823832
Central Storage Availability	3.39376E-10	5.53027E-10	0.61366887	0.54082759
Central Unit Train Expenses	4.46192E-07	8.75401E-08	5.09700422	1.6353E-06

1997-2005 monthly data

D.6 East River as whole "State"

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.848347997
R Square	0.719694325
Adjusted R Square	0.700072927
Standard Error	0.074502657
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	1.425147151	0.20359245	36.679056	6.25001E-25
Residual	100	0.555064589	0.005550646		
Total	107	1.980211741			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-0.578009362	0.194257254	-2.97548405	0.00366800
Futures Prices	0.07512753	0.032753101	2.29375317	0.02389684
East River Corn Production for Grain	-9.38216E-10	1.66144E-10	-5.64699583	1.5357E-07
East River Corn Usage by Ethanol	2.2418E-09	2.72284E-10	8.23329978	7.1391E-13
East River Corn Usage by Cattle	1.37574E-08	6.93862E-09	1.98272501	0.05014136
Midwest No. 2 Diesel Retail Sales Prices	-0.183266048	0.033704126	-5.43749594	3.8344E-07
East River Storage Availability	3.27964E-11	5.55366E-11	0.59053711	0.55616287
East River Unit Train Expenses	4.63852E-09	1.9602E-08	0.23663536	0.81342374

1997-2005 monthly data