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THE IMPACT OF ETHANOL ON CORN MARKET
RELATIONSHIPS AND CORN PRICE BASIS LEVELS

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THE IMPACT OF ETHANOL ON CORN MARKET RELATIONSHIPS AND CORN PRICE BASIS LEVELS

By

Karen Elizabeth Lewis

A THESIS

Submitted to
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ABSTRACT

THE IMPACT OF ETHANOL ON CORN MARKET RELATIONSHIPS AND CORN PRICE BASIS LEVELS

By

Karen Elizabeth Lewis

Corn market relationships were examined in Michigan, Kansas, Iowa and Indiana to determine if the increase in the percentage of corn used in ethanol production or the increase in the number of ethanol plants affected the annual degree of cointegration of corn prices at different grain markets in these states from September 1998 through June 2008. It was determined that corn price relationships at grain markets in the studied states were not affected by the increase in the percentage of corn used in ethanol production or the increase in the number of ethanol plants. Therefore, farmers and commodity traders were correct if they assumed the relationships between corn prices at different grain markets remained the same from September 1998 through June 2008.

Corn price basis levels were examined to determine if ethanol plant openings affected corn price basis levels at grain markets located at the site of an ethanol plant opening. On average, grain markets located at the site of an ethanol plant opening in Michigan and Kansas felt the largest corn price basis level increase at the time of an ethanol plant opening while grain markets located at the site of an ethanol plant opening in Iowa and Indiana did not experience substantial corn price basis level increases. Therefore, increased ethanol production increased corn price basis levels in Michigan and Kansas while corn price basis levels in Iowa and Indiana were relatively unaffected.

Dedicated to My Family

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CHAPTER 1: GENERAL INTRODUCTION

The production of corn-based-ethanol in the United States has been steadily increasing in the past few decades. The creation of laws at the federal level of government is a central reason for the growth of the ethanol industry. Beginning in 1978 the federal government began passing legislation geared towards increasing domestic energy production in an attempt to create energy independence from foreign countries. Congress passed the Energy Tax Act (ETA) of 1978 which created an exemption on the federal gasoline tax for gasoline that was blended with at least ten percent ethanol. Since 1978, the ETA monetary incentive for ethanol to be blended into gasoline has been adjusted several times. Currently, the Federal Highway Bill of 1998 set the exemption at fifty-one cents for every gallon of pure ethanol blended into gasoline.

Besides the ETA, several other laws motivating ethanol production have been passed by Congress such as the Crude Oil Windfall Profit Tax Act of 1980 and the Energy Security Act of 1980. Additionally, the Ethanol Import Tariff Act which establishes a tax on foreign-produced ethanol that is imported into the United States was passed in 1980. In 1988, the Alternative Motor Fuels Act passed which created incentive for vehicles to be produced that were able to run on E85, which is eighty-five percent ethanol blended fuel. The Budget Reconciliation Act of 1990 issued an income tax break to entrepreneurs who pursued the creation of new ethanol plants. The law issued a ten cent per gallon income tax credit on the first fifteen million gallons of ethanol produced at ethanol plants which had production capacity of less than sixty million gallons of ethanol per year. Finally, the Energy Policy Act of 1992 set a standard of domestic alternative energy fuels accounting for ten percent of the total United States fuel consumption by 2000 and thirty percent by 2010.

Environmental policy laws have also created increased demand for ethanol. The Clean Air Act Amendments in 1990 required the current composition of gasoline to be changed in an attempt to reduce carbon monoxide exhaust emissions. The new composition required gasoline to be reformulated with either ethanol or methyl tertiary butyl ether (MTBE). However, MTBE was found to contaminate ground and surface water; therefore, ethanol production increased greatly after the Clean Air Act Amendments in 1990.

Besides the passage of several laws at the federal level, many state and local laws have also created favorable incentives for ethanol production. Together, this stream of legislation created an opportunity for ethanol plant owners to gain profits by producing a larger quantity of ethanol. Accordingly, the number of ethanol plants in the United States rose from fifty to 189 from January 1999 through January 2010 with another eleven ethanol plants under construction or expanding (Renewable Fuels Association).

Several aspects of agriculture have been impacted by the rapid increase of the ethanol industry. In an attempt to assess some of the changes that may have occurred as a result of increased ethanol production, this paper will analyze changes in corn production from September 1998 through June 2008. During this time interval, ethanol production increased from 1.4 billion gallons per year to 9 billion gallons per year (Renewable Fuels Association). While ethanol production increased nearly 650% in this time interval, corn production increased by approximately 24% (USDA).

This discussion is aimed at discovering the impact increased ethanol production had on corn price relationships at different grain markets in the Midwestern United States and determining the impact ethanol plant openings had on corn price basis levels at grain markets in the Midwestern United States. Chapter 2 will examine the impact increased ethanol production had on the annual degree of cointegration of corn prices at different grain markets in Michigan, Kansas, Indiana, Iowa and the Midwestern Region of the United States in general. It is likely that increased ethanol production affected existing corn price relationships at different grain markets by increasing the annual degree of cointegration of corn prices that existed between different grain markets before the escalation of ethanol production. Ethanol plant openings have created new demand centers for corn which increases competition for corn. Increased competition for corn is expected to increase the annual degree of cointegration of corn prices at different grain markets and ensure that corn prices in different regions differ only by transaction costs (Brester and Goodwin 1993). Chapter 3 will observe the impact ethanol plant openings had on corn price basis levels located at the site of an ethanol plant opening over the average time period after an ethanol plant opened and each month after an ethanol plant opened. Corn price basis levels likely strengthened because ethanol plant openings created a new local demand center for corn.

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CHAPTER 2: THE IMPACT OF ETHANOL PRODUCTION ON SPATIAL GRAIN MARKET RELATIONSHIPS

2.1 Introduction

In recent years the trend witnessed in the United States concerning corn-based-ethanol can be summarized by the rapidly increasing percentage of corn used in the production of ethanol (Table 2.a). The growth of this statistic is largely attributed to the increase in corn-based-ethanol production. In 1998 the annual production of ethanol was 1.4 billion gallons and by 2008 annual ethanol production was 9 billion gallons, an increase of 7.6 billion gallons (Renewable Fuels Association). The percentage of corn used in the production of ethanol within the particular states of Michigan, Kansas, Indiana and Iowa also increased from 1998 through 2008 and is also found in Table 2.a.

Table 2.a Percent of Corn Used in the Production of Ethanol

Year	Michigan %	Kansas %	Iowa %	Indiana %	U.S. %
1998	0.00%	1.51%	14.15%	4.84%	5.18%
1999	0.00%	1.50%	14.24%	4.92%	5.62%
2000	0.00%	1.53%	14.39%	4.51%	5.93%
2001	0.00%	6.29%	16.24%	4.16%	6.72%
2002	7.71%	11.52%	17.15%	5.83%	8.54%
2003	6.95%	11.13%	19.63%	4.68%	10.02%
2004	7.02%	11.49%	22.62%	3.96%	10.40%
2005	6.28%	13.37%	28.24%	4.14%	12.68%
2006	19.42%	22.24%	37.80%	4.36%	16.64%
2007	32.46%	30.75%	35.79%	16.63%	18.00%
2008	32.03%	36.92%	50.20%	36.94%	26.85%

The characteristics of ethanol production in Michigan, Kansas, Iowa and Indiana are reflected in the percentage of corn used in the production of ethanol statistic. For example, during the time period of 1998 through 2008 the number of ethanol plants operating in Michigan improved from zero to five. Table 2.b highlights details of ethanol production in the state of Michigan.

Table 2.b Michigan Ethanol Plants and Production

Location	Started Production	Owner	Annual Ethanol Production (gallons)
Caro	Nov. 2002	Poet Biorefinery	50 million
Albion	Aug. 2006	Andersons Albion Ethanol LLC	55 million
Lake Odessa	Sept. 2006	VeraSun Woodbury LLC*	50 million
Riga	Feb. 2007	Midwest Grain Processors LLC	57 million
Marysville	Oct. 2007	Marysville Ethanol LLC	50 million
		Total Production	**262 million**

*VeraSun declared bankruptcy in the Fall of 2008

The trends of Michigan's ethanol industry are comparable to the trends found throughout the ethanol industries in Kansas, Iowa and Indiana. From 1998 to 2008 the number of ethanol plants in Kansas increased from three to thirteen, in Iowa the number of ethanol plants ascended from four to thirty-nine and in Indiana the number of ethanol plants increased from one to twelve (Ethanol Producer Magazine). Accordingly, from 1998 to 2008 annual ethanol production in the state of Kansas increased from 17.5 million gallons to 497.5 million gallons, in Iowa ethanol production escalated from 693 million gallons to 3.04 billion gallons and in Indiana ethanol production grew from 102 million gallons to 894 million gallons (Ethanol Producer Magazine).

Evidenced by the increase in the percentage of corn used in the production of ethanol, the annual amount of corn harvested in the United States and in the individual states of Michigan, Kansas, Iowa and Indiana did not increase at the same pace as ethanol production. In the United States, corn production increased from 9.76 billion bushels in 1998 to 12.1 billion bushels in 2008, an increase of approximately twenty-four percent (USDA 1). In Michigan corn production increased thirty percent, in Kansas corn production expanded sixteen percent, in Iowa corn production grew twenty-four percent and in Indiana corn production increased fifteen percent (USDA 1).

From 1998 to 2008, many economic consequences transpired as the percent of corn used in the production of ethanol increased as a result of the expansion in the number of ethanol plants in the United States. Most predominantly, nominal corn prices increased steadily. In 1998 the national average price for a bushel of corn was $2.21 per bushel (USDA 2). By June 2008, the average price for a bushel of corn was $5.47 (USDA 3). As the price of corn increased, another notable outcome occurred. VeraSun Energy Corporation, owner of twelve ethanol plants, declared bankruptcy in the Fall of 2008.

As increased ethanol production created higher corn prices, some critics also blamed ethanol production and ethanol production subsidizes for higher food prices. Because corn is an input for raising several types of livestock, increased corn prices also increased livestock production costs. Somewhat offsetting the negative effect of ethanol production, increased ethanol production also increased the supply of ethanol co-products. The most prominent co-product of ethanol is distillers dried grains with solubles (DDGS) (Baker and Zahniser 2006). DDGS are useful in feeding livestock and many livestock farmers have begun to feed their livestock DDGS instead of corn to lower production costs (Baker and Zahinser 2006). As ethanol production increases, DDGS exports have also been rapidly increasing (Baker and Zahinser 2006).

Considering all of the effects of increased ethanol production, from 1998 through 2008, it is possible that the increase in the percent of corn used in the production of ethanol caused changes in market price relationships. Market price relationships regarding increased corn demand in response to ethanol have recently been studied. Harri et al. (2009) discuss changes in the relationships between crude oil and corn prices in risk management strategies for corn producers because of the growing use of corn for ethanol. They found clear evidence that the relationship between corn and oil has strengthened over time as a result of the growing use of corn for ethanol. Additionally, Harri et al. cite Anderson and Coble (2009) as determining that the strengthening in the relationship between crude oil and corn prices occurred when the corn ethanol production mandates were raised in the Energy Policy Act of 2005.

Recent research has determined that market relationships between corn and oil have strengthened as a result of increased ethanol production. However, investigating whether increased ethanol production has altered the existing relationships among corn prices at different grain markets has not been previously studied. If increased ethanol production has altered existing corn price relationships at grain markets, it is important for farmers and grain merchandisers to have this information. When grain merchandisers purchase corn from farmers, knowledge regarding relationships among local grain markets is utilized to make a contract. If increased ethanol production has altered corn price relationships at different grain markets, it is useful for both grain merchandisers and farmers to know how corn price relationships at different grain markets have changed.

To determine how the percentage of corn used in the production of ethanol has altered corn price relationships at different grain markets, the concept of cointegration will be used. Cointegration is a technique used to study market price relationships. The ensuing discussion is aimed at first discovering if corn prices at different grain markets throughout the Midwestern United States were cointegrated from 1998 through 2008. Next, whether the percentage of corn used in the production of ethanol altered the annual degree of cointegration of corn prices at different grain markets throughout the Midwestern United States will be determined. In addition, the question of whether the increase in the number of ethanol plants in the Midwestern United States altered the annual degree of cointegration of corn prices at different grain markets throughout the Midwestern United States will be established.

Investigating whether different grain markets throughout the Midwestern United States were cointegrated from 1998 through 2008 is important because farmers and commodity traders rely on information regarding corn price relationships at different grain markets to predict corn price movements. From 1998 through 2008, increased ethanol production influenced several sections of the agriculture industry; therefore, it is possible that corn price relationships at different grain markets were altered during this time period. Particularly, it is possible that increased ethanol production has strengthened the annual degree of cointegration of corn prices at different grain markets. Increased competition for a commodity helps to ensure grain markets are cointegrated and spatial price discrimination in particular regions does not exist (Brester and Goodwin 1993).

2.2 Materials and Methods

Cointegration theory has been utilized to study many economic situations. Economically speaking, two variables are cointegrated if they have a long-term, or equilibrium, price relationship between them (Gujarati and Porter 2009). Cointegration testing can be used to determine long-run price relationships across different markets (Schroeder 1997). For our purposes, we will be investigating cointegration trends of corn prices at different grain markets. Grain markets with cointegrated corn prices maintain a stable spatial price relationship equilibrium which indicates the grain markets are in the same geographic corn procurement market. Conversely, if corn prices at different grain markets are not cointegrated, corn prices diverge from each other; therefore, the grain markets do not operate in a stable spatial price relationship equilibrium which suggests the grain markets are not in the same spatial market. Therefore, if it is discovered that corn prices at different grain markets throughout particular states are cointegrated, the grain markets are operating in a stable, long-run spatial price relationship equilibrium (Pendell and Schroeder 2006). It is worth noting that grain market's corn price series cointegration has no direct implication on corn price levels. Instead, if corn prices at different grain markets are cointegrated, it is only concluded that there is a long-term, or equilibrium, price relationship found between the corn price series at the different grain markets. Otherwise stated, at any time period, the cointegrated corn price series at different grain markets may deviate from their equilibrium price relationship, but this deviation will be temporary: there are economic forces that drive the corn price series at different grain markets back toward their long-term equilibrium price relationship (Wooldridge 2006).

To test if the percentage of corn used in the production of ethanol has affected the annual degree of the cointegration of corn prices at different grain markets, the methodology of Brester and Goodwin (1993) will be followed. They utilized a multivariate cointegration test following the technique created by Johansen and Juselius (1990) to determine if the increased four-firm (Conagra, Archer Daniels Midland, Peavey/Cargill and Pillsbury/General Mills) concentration in the U.S. wheat milling industry affected the annual cointegration of wheat prices at different wheat markets. They investigated if the increased four-firm concentration in the U.S. wheat milling industry created noncompetitive pricing behavior (i.e. spatial price discrimination and thus weakened annual cointegration statistics) . However, Brester and Goodwin (1993, 513) determined that "one cannot conclude that the increase in market concentration in the wheat milling industry caused spatial prices at the four markets considered in their analysis to diverge from a long-run equilibrium" (i.e. the increase in market concentration in the wheat milling industry did not affect the annual cointegration of wheat markets).

To begin the cointegration analysis, daily corn price observations were purchased from Cash Grain Bids Data Service. The purchased data included daily corn prices collected from every grain market Cash Grain Bids Data Service had data on within 300 miles of Omaha, Nebraska and within 300 miles of Indianapolis, Indiana. For this study, weekly corn price averages were used and were created from the daily corn price observations recorded by Cash Grain Bids Data Service. Additionally, only weekly corn price averages at grain markets located in Michigan, Kansas, Iowa and Indiana were compiled. The summary statistics for the weekly corn price average series at grain markets in Michigan, Kansas, Iowa and Indiana are found Appendix 1. McNew and Griffith (2005) also used local corn price data collected from Cash Grain Bids Data Service in their analysis of measuring the impact of ethanol plants on local grain prices.

Michigan, Kansas, Iowa and Indiana were the states chosen to represent the Midwestern United States in this study. These four states geographically are representative of both the Eastern and Western Corn Belt Region. Additionally, from 1998 through 2008 Iowa annually produced the most corn in the nation (USDA 1). Michigan, Kansas, Iowa and Indiana account for approximately fifty-two percent of the national annual production of ethanol (Ethanol Producer Magazine). Michigan, Kansas, Iowa and Indiana account for approximately thirty-two percent of the total corn produced in the United States (USDA 1).

A state by state approach was utilized to determine if the percentage of corn used in ethanol production affected the annual degree of cointegration of corn prices at different grain markets. Exemplifying the state by state approach, in Michigan the weekly corn price averages recorded at fifty-seven grain markets from September 1998 through June 2008 were complied. Next, two criterions were used to narrow the grain markets to be examined to four grain markets per state. Only four grain markets were examined in each state because of degrees of freedom constraints on annual multivariate cointegration testing. The two criterions were (1) completeness of corn price observations in the weekly average corn price series and (2) geographical dispersion between the locations of the different grain markets chosen. A third criterion would have been utilized regarding volume of trading at each market; however, this information was not accessible. This same process was used to select four grain markets to examine in Kansas, Iowa and Indiana. Table 2.c illustrates which four grain markets were studied in each state along with the characteristics of each weekly average corn price series recorded at each grain market.

Table 2.c Weekly Average Corn Price Statistics (cents/bu)

Grain Market	# of Obs.	Mean	Std. Dev.	Minimum	Maximum
Blissfield, MI	512	238	85	145	588
Lake Odessa, MI	512	226	86	137	576
Marlette, MI	512	229	83	136	571
Middleton, MI	512	226	84	136	571
Chapman, KS	512	233	89	144	627
Hillsboro, KS	512	235	87	143	580
Larned, KS	512	241	85	155	576
Osborne, KS	512	230	85	142	555
Algona, IA	512	218	86	129	567
Audubon, IA	512	218	87	127	603
Cedar Rapids, IA	512	242	81	155	583
Chariton, IA	512	225	80	130	557
Columbus, IN	512	235	86	137	586
Delphi, IN	512	242	86	147	592
Greensburg, IN	512	239	83	143	571
Hamlet, IN	512	237	85	143	589

Criterion one noted completeness of corn price observations in the weekly average corn price series as being one way of selecting the proper grain market to study. However, no grain market contained 100% of their weekly corn price observations. Therefore, missing observations were predicted by regressing the Chicago corn price time series with each individual grain market's corn price time series. The weekly average Chicago corn price time series from September 1998 through June 2008 was recorded by the Livestock Market Information Center. All grain markets used in the study were missing less than nine percent of their total weekly corn price observations.

The first item to investigate when conducting a multivariate cointegration test is to determine if the individual corn market price series are nonstationary and integrated to the same order (Pendell and Schroeder 2006). To test if the individual corn price series were nonstationary, the Augmented Dickey-Fuller (ADF) unit root test was used. The ADF test utilizes the following OLS regression:

$$(1)\ \Delta y_t = \alpha + \rho y_{t-1} + \sum_{i=1}^{j} \theta \Delta y_{t-i} + \epsilon_t$$

where y is the particular corn price series, Δ indicates the first difference and j is the lag length that ensures the residual ϵ_t is white noise. The Akaike Information Criteria (AIC) was used to determined proper lag length. The corresponding ADF test statistic is defined as ρ divided by its standard error. Table 2.d reports the ADF test results for the corn price series used in our study. The AIC lag lengths that were used in the tests also appear on Table 2.d.

The test statistics of the individual corn price series at all of the grain markets were greater than the required critical value at the one percent level of significance. Therefore, the null hypothesis that the corn price series contain a unit root was not rejected, implying that the individual corn price series were all nonstationary. Therefore, the corn prices were stochastic and followed a random walk (Gujarati and Porter 2009). The next step in our analysis is to determine whether the first differenced corn price series are stationary. After first differencing the corn price series, all of the test statistics were less than the one percent critical value level of significance. Thus, the null hypothesis that the series contains a unit root was rejected, implying that the first differencing of the individual price series were stationary. Together these results suggest each corn price series was integrated of order one [I(1)] and a multivariate cointegration analysis could be conducted.

Table 2.d ADF Test Results

Grain Market	Price Series Test Statistic	Lag Length	First-Differenced Test Statistic	Lag Length
Blissfield, MI	1.755	2	-7.948*	4
Lake Odessa, MI	1.674	3	-7.851*	4
Marlette, MI	1.199	4	-8.066*	4
Middleton, MI	1.113	4	-7.771*	4
Chapman, KS	2.756	3	-7.747*	4
Hillsboro, KS	1.187	4	-8.462*	4
Larned, KS	1.776	1	-22.561*	0
Osborne, KS	1.578	3	-8.396*	4
Algona, IA	1.023	4	-7.535*	4
Audubon, IA	1.835	4	-7.371*	4
Cedar Rapids, IA	1.242	4	-9.63*	3
Chariton, IA	1.773	1	-8.243*	4
Columbus, IN	1.694	2	-8.816*	4
Delphi, IN	1.663	2	-8.531*	4
Greensburg, IN	0.752	4	-9.422*	3
Hamlet, IN	1.368	4	-7.648*	4

* Indicates rejection of the null hypothesis at 1% significance

Multivariate cointegration testing was used to determine whether corn prices series at different grain markets throughout particular states were cointegrated over the time frame of 1998 through 2008. The annual cointegration test statistics were also recorded. The first state explored was Michigan. To determine if the corn price series at the grain markets in Blissfield, Lake Odessa, Marlette and Middleton were cointegrated, maximum likelihood cointegration estimates were taken. Because four markets were used in the cointegration analysis, three independent cointegrating vectors were necessary to determine if one grain market's corn price series was representative of the all of the grain market's corn price series.

Johansen and Juselius (1990) suggest a methodology for both testing for the number of cointegrating vectors and for obtaining maximum likelihood estimates of those vectors (Brester and Goodwin 1993). This methodology involves estimating the following vector autoregressive model:

$$(2)\ \Delta Y_t = \sum_{i=1}^{k-1} \tau_{0i} \Delta Y_{t-i} + v_{0t}$$

$$Y_{t-k} = \sum_{i=1}^{k-1} \tau_{1i} \Delta Y_{t-i} + v_{1t}$$

where Y represents a matrix of each of the corn price series (y) used for the state of Michigan analysis. There are two test statistics used to test the null hypothesis that there are at most r cointegrating vectors in the system Y_t. The following equations represent the maximal eigenvalue test statistic and the trace test statistic:

$$(3)\ \tau_{MAX} = -T \ln (1 - \lambda_{r+1})$$

$$\tau_{TRACE} = -T \sum_{i=r+1}^{t} \ln (1 - \lambda_i)$$

where T represents the total number of observations in the price series and $\lambda_{r+1}, \ldots, \lambda_p$ represents the p-r smallest possible correlations of residual $v_{0t}$with respect to residual v_{1t}.

2.3 Results and Implications

State Models

Michigan was the first state subject to the multivariate cointegration testing. Table 2.e illustrates the results of multivariate cointegration testing on the corn price series at Blissfield, Lake Odessa, Marlette and Middleton grain markets from September 1998 through June 2008. Table 2.e shows both the maximal eigenvalue test statistic and the trace test statistic resulting from the multivariate cointegration procedure. Lag length of two was selected because Akaike's Final Prediction Error (FPE) was minimized at this amount.

Table 2.e Michigan Grain Markets Multivariate Cointegration Testing Results

Null Hypothesis	Alternative Hypothesis	Cointegration Test Stat	5% Critical Value
Trace Test			
Ho: r=0	H1: r>0	157.36*	47.21
Ho: r=1	H1: r>1	82.55*	29.38
Ho: r=2	H1: r>2	27.49*	15.34
Ho: r=3	H1: r>3	2.21	3.84
Max Test			
Ho: r=0	H1: r=1	74.81*	27.07
Ho: r=1	H1: r=2	55.06*	20.97
Ho: r=2	H1: r=3	25.27*	14.07
Ho: r=3	H1: r=4	2.21	3.76

*Indicates rejection of the null hypothesis at 5% significance

Table 2.e displays three cointegrating vectors for the four corn price series using both the maximal eigenvalue test statistic and the trace test statistic. Therefore, from 1998 through 2008, corn prices at Blissfield, Lake Odessa, Marlette and Middleton grain markets were cointegrated. Thus, there was a long-term, or equilibrium, price relationship found between the corn price series at the different grain markets.

Next, we examined if the percentage of corn used in the production of ethanol in Michigan affected the annual cointegration of the corn price series at the different grain markets. To determine this, the Brester and Goodwin procedure was followed. They began their methodology by determining the annual multivariate cointegration test statistics for wheat prices at different grain markets. Accordingly, for our analysis, annual multivariate cointegration tests were used to determine the annual cointegration statistics for the corn price series at Blissfield, Lake Odessa, Marlette and Middleton grain markets. Table 2.f displays the annual cointegration maximal eigenvalue test statistics as well as the proper lag lengths determined by the minimum value of the FPE. The annual test statistic for the null hypothesis r=3 has been excluded from Table 2.f to save space. Additionally, the annual cointegration trace statistics for the Michigan grain markets were recorded but excluded from Table 2.f to save space.

Table 2.f Michigan Markets Annual Cointegration Tests

FPE Lag Length Selection	Time Period	Null Hypothesis Ho:	Maximal Eigenvalue Test Statistic	5% Critical Value
1	Sept. 1998-1999	r=0	26.78	27.07
		r=1	17.77	20.97
		r=2	6.57	14.07
2	1999-2000	r=0	34.29*	27.07
		r=1	19.32	20.97
		r=2	16.22	14.07
7	2000-2001	r=0	75.55*	27.07
		r=1	13.47	20.97
		r=2	11.28	14.07
1	2001-2002	r=0	30.12*	27.07
		r=1	21.54*	20.97
		r=2	5.28	14.07
7	2002-2003	r=0	51.14*	27.07
		r=1	37.35*	20.97
		r=2	25.42	14.07
2	2003-2004	r=0	22.02	27.07
		r=1	11.50	20.97
		r=2	4.64	14.07
1	2004-2005	r=0	25.20	27.07
		r=1	10.69	20.97
		r=2	9.36	14.07
7	2005-2006	r=0	64.51*	27.07
		r=1	30.35*	20.97
		r=2	12.28	14.07
1	2006-2007	r=0	32.49*	27.07
		r=1	11.08	20.97
		r=2	8.13	14.07
1	2007-2008	r=0	24.63	27.07
		r=1	19.69	20.97
		r=2	7.82	14.07
1	2008-June 2008	r=0	22.74	27.07
		r=1	14.46	20.97
		r=2	9.29	14.07

*Indicates rejection of the null hypothesis at 5% significance

Table 2.f indicates the existence of at least one cointegrating vector in six of the eleven years. The annual cointegration test statistics can be thought of as a measure of the degree of cointegration over time with larger statistics indicating a stronger degree of cointegration (Brester and Goodwin 1993). There are no clear trends quickly revealed in Table 2.f; however, the goal of this model is to determine if the increased Michigan percentage of corn in used in the production of ethanol had an effect on the annual degree of cointegration of corn prices at the Blissfield, Lake Odessa, Marlette and Middleton grain markets.

To discover the answer to the posed question, the maximal eigenvalue test statistics for the years 1998 through 2008 were regressed on the percentage of Michigan's corn production which was used in the production of ethanol. Similarly, Brester and Goodwin regressed their maximal eigenvalue test statistics on the four-firm concentration ratio of the U.S. wheat milling industry to determine if the increased four-firm concentration ratio in the U.S. wheat milling industry affected the annual cointegration of wheat prices at different wheat markets. To run this regression, an ordinary least squares approach would not be sufficient because our regression contains a non normal distribution. A non normal distribution results because the dependent variable in this model is the maximal eigenvalue test statistics. Therefore, Efron's bootstrapping technique was used to solve the problem of a nonnormal distribution. Brester and Goodwin also utilized Efron's bootstrapping technique in their analysis. Efron's bootstrapping technique regurgitates a given sample over and over again and then obtains the sampling distributions of the parameters of interest to fix the problem of non normal distribution (Gujarati and Porter 2009).

Using Efron's bootstrapping technique with 1,000 replications, the result of regressing the annual cointegration maximal eigenvalue test statistic (MAXE) on the Michigan percent of corn used in the production of ethanol (PCEM) is the following:

$$(4)\quad MAXE = \underset{(0.00)}{43.10} - \underset{(0.22)}{57.81} * PCEM$$

where the numbers in parentheses are the p-values for the respective parameter estimates. As evidenced by its p-value, the Michigan percent of corn used in the production of ethanol is not significantly different from zero. Therefore, the percentage of Michigan's corn production used in the production of ethanol is not significantly correlated with the annual cointegration maximal eigenvalue test statistic. This process was also performed by using Efron's bootstrapping technique with 1,000 replications to regress the annual trace test statistics on the percent of Michigan's corn production used in the production of ethanol in Michigan. The results were the same as the above test (i.e. the Michigan percentage of corn used in the production of ethanol was not significantly different from zero). Therefore, the Michigan percentage of corn used in the production of ethanol is not significantly related to the annual degree of cointegration of grain markets in the state of Michigan. Otherwise stated, one cannot conclude that the increase in the percent of corn used in the production of ethanol has caused corn price relationships at the Blissfield, Lake Odessa, Marlette and Middleton grain markets to diverge from a long-run spatial price relationship equilibrium.

Besides testing to establish whether the increased Michigan percentage of corn in used in the production of ethanol had an effect on the annual degree of cointegration of corn prices at the Blissfield, Lake Odessa, Marlette and Middleton grain markets, also tested was whether the increase in the number of ethanol plants in Michigan altered the annual degree of cointegration of corn prices at the Blissfield, Lake Odessa, Marlette and Middleton grain markets. The following equation uses Efron's bootstrapping technique with 1,000 replications to regress the annual cointegration maximal eigenvalue test statistic (MAXE) on the using number of ethanol plants in Michigan (EPM):

$$(5)\ \ MAXE = \underset{(0.00)}{42.93} - \underset{(0.191)}{3.69} * EPM$$

where the numbers in parentheses are the p-values for the respective parameter estimates. The coefficient for the number of ethanol plants in Michigan is not significantly different from zero. Therefore, the number of ethanol plants in Michigan is not significantly correlated with the annual cointegration maximal eigenvalue test statistic. When the annual trace test statistics were regressed with the number of ethanol plants in Michigan using Efron's bootstrapping technique with 1,000 replications the results also suggested that the coefficient for the number of ethanol plants in Michigan was not significantly different from zero. Therefore, one cannot conclude that the increase in the number of ethanol plants in Michigan has caused corn price relationships at the Blissfield, Lake Odessa, Marlette and Middleton grain markets to diverge from a long-run spatial price relationship equilibrium.

The same procedure was also completed for Kansas, Iowa and Indiana to determine if the percentage of corn used in the production of ethanol in each state or the number of ethanol plants in each state altered the annual degree of cointegration of corn prices at grain markets in the selected states. To save space, the results and implications are found in Appendix 2. In summary, the results for Kansas, Iowa and Indiana were the same as the results witnessed in Michigan.

In Kansas, the grain markets studied were Chapman, Hillsboro, Larned and Osborne. The corn prices at these markets were cointegrated from September 1998 through June 2008. Therefore, the corn prices at Chapman, Hillsboro, Larned and Osborne grain markets had a long-term, or equilibrium, price relationship found between them from September 1998 through June 2008. However, the increase in the percent of corn used in the production of ethanol or the escalation in the number of ethanol plants in Kansas did not conclusively cause corn price relationships at Chapman, Hillsboro, Larned and Osborne to diverge from a long-run price relationship equilibrium.

In Iowa, the grain markets studied were Algona, Aubudon, Cedar Rapids and Chariton. The corn prices at these grain markets were cointegrated from September 1998 through June 2008 and contained an equilibrium price relationship. However, we were unable to conclude that the increase in the percent of corn used in the production of ethanol or the escalation in the number of ethanol plants in Iowa caused corn price relationships at Algona, Aubudon, Cedar Rapids and Chariton grain markets to diverge from a long-run price relationship equilibrium.

The Indiana grain markets studied were located in Columbus, Delphi, Greensburg and Hamlet. From September 1998 through June 2008 the corn prices at these grain markets were cointegrated. Therefore, the corn prices operated in a long-run price relationship equilibrium. However, there was not enough evidence to conclude that the increase in the percentage of corn used in the production of ethanol or the increase in the number of ethanol plants in Indiana caused corn price relationships at Columbus, Delphi, Greensburg and Hamlet grain markets to diverge from a long-run spatial price relationship equilibrium.

National Model

Now that the state by state approach to discovering whether the percent of corn used in the production of ethanol influenced the annual degree of cointegration of corn prices throughout certain grain markets is completed, it is of interest to investigate other techniques to test this study's hypothesis. The following approach utilizes a Midwestern U.S. Regional model similar to the state specific models. The Midwestern U.S. Regional model investigates the cointegration of corn prices at four grain markets, one grain market from each of the above investigated states. The grain markets in Marlette, MI; Hillsboro, KS; Chariton, IA; and Greensburg, IN were chosen for the Midwestern U.S. Regional model. Staying consistent with the previous methodology, the first item to discover is whether the corn prices at the Midwestern U.S. Regional grain markets were cointegrated from September 1998 through June 2008. Table 2.g details the multivariate cointegration testing of the corn prices in Marlette, Hillsboro, Chariton and Greensburg grain markets. Lag length of three was used in the testing because this was the amount that minimized the FPE.

Table 2.g Midwestern Region Multivariate Cointegration Testing Results

Null Hypothesis	Alternative Hypothesis	Cointegration Test Stat	5% Critical Value
Trace Test			
Ho: r=0	H1: r>0	106.43*	47.21
Ho: r=1	H1: r>1	55.25*	29.38
Ho: r=2	H1: r>2	19.87*	15.34
Ho: r=3	H1: r>3	1.05	3.84
Max Test			
Ho: r=0	H1: r=1	51.17*	27.07
Ho: r=1	H1: r=2	35.39*	20.97
Ho: r=2	H1: r=3	18.82*	14.07
Ho: r=3	H1: r=4	1.05	3.76

*Indicates rejection of the null hypothesis at 5% significance

Table 2.g displays three cointegrating vectors for the four corn price series using both the maximal eigenvalue test statistic and the trace test statistic. Therefore, the corn prices at Marlette, Hillsboro, Chariton, and Greensburg are cointegrated. Therefore, there is a long-term, or equilibrium, price relationship found between the corn price series at the different grain markets. To determine if the Midwestern U.S. Region percentage of corn used in the production of ethanol affected the annual cointegration of corn prices at Marlette, MI; Hillsboro, KS; Chariton, IN; and Greensburg, IN we first discovered the annual cointegration statistics for the corn prices at the given grain markets. Table 2.h displays the annual cointegration maximal eigenvalue test statistics as well as the proper lag lengths determined by the minimum value of the FPE. The annual test statistic for the null hypothesis r=3 and the corresponding trace statistics have been excluded from Table 2.h to save space.

Table 2.h Midwestern U.S. Region Markets Annual Cointegration Tests

Lag Length (using FPE)	Time Period	Null Hypothesis Ho:	Maximal Eigenvalue Test Statistic	5% Critical Value
2	Sept. 1998-1999	r=0	49.11*	27.07
		r=1	15.51	20.97
		r=2	9.37	14.07
2	1999-2000	r=0	23.65	27.07
		r=1	12.58	20.97
		r=2	5.76	14.07
4	2000-2001	r=0	31.72*	27.07
		r=1	14.79	20.97
		r=2	11.58	14.07
2	2001-2002	r=0	25.25	27.07
		r=1	18.36	20.97
		r=2	10.51	14.07
1	2002-2003	r=0	26.17	27.07
		r=1	19.26	20.97
		r=2	3.16	14.07
1	2003-2004	r=0	30.9*	27.07
		r=1	10.7	20.97
		r=2	8.53	14.07
1	2004-2005	r=0	31.24*	27.07
		r=1	8.17	20.97
		r=2	4.76	14.07
6	2005-2006	r=0	51.75*	27.07
		r=1	29.92*	20.97
		r=2	17.19*	14.07
2	2006-2007	r=0	21.98	27.07
		r=1	16.70	20.97
		r=2	4.59	14.07
2	2007-2008	r=0	22.01	27.07
		r=1	11.27	20.97
		r=2	5.74	14.07
2	2008-June 2008	r=0	56.40*	27.07
		r=1	14.95	20.97
		r=2	11.57	14.07

*Indicates rejection of the null hypothesis at 5% significance

Table 2.h indicates the existence of at least one cointegrating vector in six of the eleven years. There are no clear trends illustrated by Table 2.h. To discover if the Midwestern U.S. Region percent of corn used in the production of ethanol affected the annual degree of cointegration, Efron's bootstrapping technique with 1,000 replications to regress the annual cointegration maximal eigenvalue test statistic (MAXE) on the U.S. percentage of corn used in the production of ethanol in (US) was employed. The following equation illustrates the results of this procedure:

$$(6)\quad MAXE = \underset{(0.00)}{26.54} + \underset{(0.49)}{61.81} * US$$

where the numbers in the parentheses are the p-values for the respective parameter estimates. The coefficient for the U.S. percent of corn used in the production of ethanol is not significantly different from zero. Therefore, the U.S. percentage of corn used in the production of ethanol is not significantly related to the annual degree of cointegration of grain markets in the Midwestern U.S. Region. Therefore, we are unable to conclude that the increase in the U.S. percent of corn used in the production of ethanol has caused corn price relationships at the Marlette, MI, Hillsboro, KS, Chariton, IA, Greensburg, IN grain markets to diverge from a long-run price relationship equilibrium. This process was also performed by using Efron's bootstrapping technique with 1,000 replications to regress the annual trace test statistics on the percent of ethanol used in the production of ethanol. The results were the same as the above test (i.e. the U.S. percentage of corn used in the production of ethanol was not significantly different from zero).

Besides testing to establish whether the increased U.S. percentage of corn in used in the production of ethanol had an effect on the annual degree of cointegration of corn prices at the Marlette, MI, Hillsboro, KS, Chariton, IA, and Greensburg, IN grain markets, also tested was whether the increase in the number of ethanol plants in the U.S. altered the annual degree of cointegration of corn prices at the Marlette, Hillsboro, Chariton and Greensburg grain markets. Using Efron's bootstrapping technique with 1,000 replications and regressing the annual cointegration maximal eigenvalue test statistic (MAXE) on the using number of ethanol plants in the U.S. (EPUS), the following results were found:

$$(7)\quad MAXE = \underset{(0.029)}{25.53} + \underset{(0.549)}{0.093} * EPUS$$

where the p-values for the respective parameter estimates are the numbers in parentheses. As shown by its p-value, the number of ethanol plants in the U.S. is not significantly correlated with the annual cointegration maximal eigenvalue test statistic. When the annual trace test statistics were regressed on the number of ethanol plants in the United States using Efron's bootstrapping technique with 1,000 replications, the results suggested that the coefficient for the number of ethanol plants in the U.S. variable was not significantly different from zero. Thus, one cannot conclude that the increase in the number of ethanol plants in the U.S. has caused corn price relationships at the Marlette, Hillsboro, Chariton and Greensburg grain markets to diverge from a long-run spatial price relationship equilibrium.

2.4 Summary

The percentage of corn used in the production of ethanol in Michigan, Kansas, Iowa and Indiana did not significantly alter the annual degree of cointegration of corn prices at grain markets in Michigan, Kansas, Iowa and Indiana. Similarly, the increase in the number of ethanol plants in Michigan, Kansas, Iowa and Indiana did not significantly alter the annual degree of cointegration of corn prices at grain markets in Michigan, Kansas, Iowa and Indiana. Moreover, the percentage of corn used in the production of ethanol in the U.S. (and the number of ethanol plants in the U.S.) did not significantly alter the annual degree of cointegration of corn prices at grain markets throughout the Midwestern U.S. Region (Michigan, Kansas, Iowa and Indiana). Therefore, one is unable to conclude that the increase in the number of ethanol plants or the escalation in the percent of corn used in the production of ethanol in Michigan, Kansas, Iowa and Indiana caused corn price relationships at the grain markets considered in our study to diverge from a long-term, or equilibrium, price relationship. Additionally, there was not enough evidence to say that the expansion of the number of ethanol plants in the U.S or the increase in the percent of corn used in the production of ethanol in the U.S. caused corn price relationships at different grain markets throughout the Midwestern U.S. to diverge from a long-term price relationship equilibrium.

Once again, it is worth noting that if grain market's corn price series are cointegrated, this has no implication on corn price levels. Instead, if corn prices at different grain markets are cointegrated, it is only concluded that there is a long-term price relationship found between the corn price series at different grain markets. Additionally, if corn price series at the different grain markets are cointegrated, the corn price series relationships may deviate from their equilibrium price relationship, but this deviation is temporary because there are economic forces that drive the relationship between corn price series at different grain markets back toward their long-term equilibrium price relationship.

These findings have many implications. For instance, despite the increase in the percentage of corn used in the production of ethanol, spatial price relationships at grain markets in the Midwestern U.S. Region and in Michigan, Kansas, Iowa and Indiana have not changed. Therefore, from 1998 through 2008, farmers and commodity traders that utilized knowledge regarding the relationships between corn prices at different grain markets in order to make managerial decisions (e.g. initiating hedging positions or timing of sales) were correct if they assumed the relationships between corn prices at different grain markets remained the same. For example, in Michigan, the relationship between corn prices at Blissfield, Lake Odessa, Marlette and Middleton grain markets did not change, so Michigan farmers selling corn to either grain market were correct to assume the corn price relationships between the four markets remained the same from September 1998 through June 2008. From September 1998 through June 2008, the increase in the percentage of corn used in the production of ethanol escalated, but the relationship between corn prices at different grain markets was not altered. Therefore, from September 1998 through June 2008, it was correct if farmers, hedgers, and merchandisers operated their businesses under the assumption that corn price relationships at different grain markets was constant. Despite the fact this analysis only used a subset of grain markets from each state, the grain markets that were analyzed are a good indication of corn price relationships at all the grain markets located throughout Michigan, Kansas, Iowa and Indiana. The existing corn price relationships at grain markets in Michigan, Kansas, Iowa and Indiana did not change when ethanol production expanded. Therefore, the corn price relationships at grain markets in Michigan, Kansas, Iowa and Indiana are the same as they were before the expansion of the ethanol industry.

APPENDIX 2.1: SUMMARY STATISTICS FOR DATA SET RECEIVED FROM CASH GRAIN BIDS DATA SERVICE

Table 2.i Michigan Weekly Corn Price Summary Statistics

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
1	Akron	250	51.17%	267.41	96.51	150.25	564.00
2	Albion	240	53.13%	261.17	106.81	141.00	596.50
3	Auburn	282	44.92%	247.68	103.85	139.00	571.00
4	Blissfield	470	8.20%	241.21	88.16	145.20	588.00
5	Breckenridge	455	11.13%	229.96	88.42	134.00	571.00
6	Britton	95	81.45%	225.12	65.71	144.00	394.75
7	Brown City	413	19.34%	237.93	89.07	136.00	571.00
8	Buchanan	443	13.48%	224.29	83.94	136.00	581.00
9	Caledonia	486	5.08%	231.59	86.85	137.00	585.00
10	Capac	56	89.06%	412.87	91.60	300.00	570.00
11	Caro	158	69.14%	286.57	120.37	149.00	573.00
12	Clarksville	85	83.40%	167.56	19.10	135.00	204.60
13	Coleman	33	93.55%	457.74	80.98	313.50	565.50
14	Constantine	413	19.34%	217.96	76.06	140.00	600.00
15	Croswell	102	80.08%	342.30	104.48	174.00	564.00
16	Elkton	250	51.17%	267.42	96.51	150.25	564.00
17	Emmett	80	84.38%	388.83	88.79	293.80	569.50
18	Fremont	362	29.30%	241.28	96.10	143.00	582.00
19	Grand Ledge	383	25.20%	245.82	95.93	147.20	587.00
20	Hamilton	464	9.38%	240.13	88.11	148.00	598.00
21	Hemlock	421	17.77%	210.66	74.33	134.00	574.00
22	Henderson	103	79.88%	347.82	104.72	182.33	565.00
23	Holland	448	12.50%	246.21	87.11	154.00	606.00
24	Howard City	55	89.26%	411.49	91.83	286.33	561.00
25	Hudsonville	366	28.52%	211.19	41.43	152.00	393.67
26	Imlay City	457	10.74%	231.56	84.98	144.00	570.00
27	Jasper	470	8.20%	236.31	87.26	138.20	583.00
28	Jeddo	56	89.06%	406.94	96.02	285.00	570.00
29	Jonesville	219	57.23%	279.31	108.87	144.80	578.00
30	LakeOdessa	486	5.08%	228.35	86.79	137.00	576.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 2.i (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
31	Lennon	102	80.08%	344.58	105.97	174.00	565.00
32	Marlette	469	8.40%	231.05	85.77	136.00	571.00
33	Marshall	430	16.02%	213.77	81.61	133.00	582.00
34	Middleton	469	8.40%	228.35	87.02	136.00	571.00
35	Millington	97	81.05%	215.60	65.50	140.80	386.50
36	Newaygo	469	8.40%	232.31	87.18	136.00	579.00
37	North Star	189	63.09%	196.63	50.76	133.20	386.25
38	Oakley	141	72.46%	199.78	41.30	141.00	311.75
39	Ottawa Lake	453	11.52%	246.55	89.68	150.60	591.00
40	Palms	56	89.06%	409.65	94.46	291.00	570.00
41	Pigeon	285	44.34%	258.09	94.54	150.25	562.00
42	Ravenna	55	89.26%	411.28	91.75	286.33	561.00
43	Reading	85	83.40%	281.01	122.40	162.60	582.50
44	Richmond	103	79.88%	344.37	106.28	173.50	566.00
45	Riga	56	89.06%	427.69	90.57	314.80	586.60
46	Saginaw	312	39.06%	202.39	33.16	141.00	307.33
47	Saline	119	76.76%	273.77	127.16	138.00	579.00
48	Saranac	204	60.16%	245.07	97.59	160.00	591.00
49	Six Lakes	264	48.44%	253.55	95.24	148.00	551.00
50	Snover	319	37.70%	249.51	92.32	139.00	561.00
51	St. Johns	167	67.38%	173.94	16.58	135.00	204.60
52	Vriesland	52	89.84%	203.36	30.83	147.33	271.50
53	Webberville	481	6.05%	236.04	88.31	145.00	587.00
54	WhitePigeon	322	37.11%	261.18	97.22	144.00	592.00
55	Yale	473	7.62%	233.06	85.77	136.00	571.50
56	Zeeland	461	9.96%	235.36	87.66	147.00	591.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 2.j Kansas Weekly Corn Price Summary Statistics

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
1	Abbyville	352	31.25%	242.27	89.66	156.40	577.67
2	Abilene	153	70.12%	272.30	125.28	152.00	569.50
3	Agenda	423	17.38%	238.09	92.07	140.60	580.00
4	Albert	281	45.12%	270.84	98.99	163.67	583.00
5	Americus	110	78.52%	171.18	17.02	131.80	207.80
6	Andale	461	9.96%	233.92	87.55	149.00	575.50
7	Anthony	111	78.32%	199.09	15.00	163.60	227.25
8	Argonia	87	83.01%	187.43	16.03	167.50	290.00
9	Arkansas City	361	29.49%	223.34	79.40	150.00	572.00
10	Arlington	234	54.30%	294.36	106.11	171.00	587.00
11	Arnold	239	53.32%	291.07	105.06	170.20	585.00
12	Asherville	242	52.73%	265.25	103.95	150.50	566.67
13	Atchison	427	16.60%	217.42	49.12	150.80	411.00
14	Athol	431	15.82%	227.02	90.02	137.25	548.20
15	Barnes	423	17.38%	238.03	92.23	139.80	580.00
16	Bartlett	407	20.51%	232.91	73.89	146.00	561.20
17	Bavaria	308	39.84%	263.07	95.75	158.00	578.33
18	Baxter Springs	231	54.88%	280.16	105.83	164.60	582.50
19	Beattie	478	6.64%	225.35	86.48	135.75	550.20
20	Beloit	442	13.67%	233.23	87.92	139.60	568.67
21	Bennington	133	74.02%	303.88	107.79	145.00	534.50
22	Benton	308	39.84%	265.79	96.64	159.00	582.33
23	Bern	302	41.02%	255.97	99.53	134.00	566.00
24	Bison	400	21.88%	227.42	76.25	151.00	577.00
25	Bogue	253	50.59%	274.44	103.38	151.67	571.50
26	Boyd	260	49.22%	268.17	98.15	163.67	583.00
27	Bremen	342	33.20%	248.45	98.42	137.00	580.00
28	Breton	244	52.34%	260.95	92.40	172.00	574.50
29	Bridgeport	217	57.62%	278.92	110.55	159.00	580.33
30	Brownell	107	79.10%	322.29	84.23	176.25	519.60

Table 2.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
31	Bucklin	348	32.03%	258.07	99.40	167.00	586.00
32	Buhler	308	39.84%	264.77	97.02	159.00	579.50
33	Burlingame	69	86.52%	404.67	87.75	295.25	576.50
34	Burlington	69	86.52%	404.66	87.76	294.60	576.50
35	Burns	343	33.01%	256.02	94.21	156.00	580.33
36	Burrton	163	68.16%	319.12	107.41	160.50	579.00
37	Cairo	234	54.30%	294.08	105.60	171.00	585.00
38	Caldwell	440	14.06%	230.88	83.26	158.20	570.50
39	Calista	234	54.30%	294.23	105.86	171.00	586.00
40	Canada	218	57.42%	277.63	111.40	156.00	580.33
41	Canton	0	100.00%	0.00	0.00	0.00	0.00
42	Chanute	435	15.04%	229.22	83.91	143.00	587.00
43	Chapman	496	3.13%	233.28	88.65	144.00	579.50
44	Cheney	314	38.67%	265.20	96.23	157.60	572.00
45	Clay Center	299	41.60%	237.86	98.61	139.00	566.50
46	Clayton	69	86.52%	413.93	81.31	312.60	573.00
47	Clifton	416	18.75%	224.77	91.36	140.00	580.00
48	Clyde	430	16.02%	227.85	90.48	140.60	580.00
49	Colby	406	20.70%	221.75	65.06	151.00	473.00
50	Coldwater	68	86.72%	429.96	84.74	337.40	594.25
51	Collyer	253	50.59%	276.23	103.75	151.67	576.50
52	Columbus	477	6.84%	242.46	86.57	146.00	580.50
53	Colwich	53	89.65%	345.79	80.41	236.33	555.00
54	Concordia	451	11.91%	232.17	86.41	143.60	567.67
55	Conway	304	40.63%	264.83	96.61	159.00	580.33
56	Conway Springs	226	55.86%	197.56	29.11	143.00	283.00
57	Courtland	416	18.75%	215.09	72.01	142.60	567.00
58	Cunningham	187	63.48%	246.73	97.46	161.80	575.60
59	Danville	205	59.96%	267.73	111.60	161.00	570.25
60	Delphos	57	88.87%	238.76	27.33	197.50	308.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 2.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
61	Dighton	486	5.08%	248.12	87.84	140.00	585.00
62	Dillwyn	242	52.73%	290.68	107.57	173.80	589.00
63	Dodge City	143	72.07%	262.18	59.99	183.00	427.50
64	Dresden	220	57.03%	252.49	69.19	167.60	419.00
65	Durham	107	79.10%	190.92	15.46	150.00	218.75
66	Edgerton	457	10.74%	233.06	89.22	149.00	576.50
67	Effingham	68	86.72%	406.60	90.52	294.80	580.00
68	Ellinwood	348	32.03%	254.44	95.23	162.60	583.00
69	Ellis	40	92.19%	182.16	13.08	152.80	202.20
70	Ellsworth	366	28.52%	248.21	95.83	143.00	560.80
71	Emporia	251	50.98%	221.50	47.86	148.80	381.80
72	Fairview	44	91.41%	428.22	95.65	300.33	566.00
73	Florence	338	33.98%	256.72	94.73	156.00	580.33
74	Ford	342	33.20%	258.35	94.65	161.50	586.00
75	Fredonia	246	51.95%	212.39	82.23	137.60	571.75
76	Galatia	347	32.23%	256.47	93.12	158.00	580.33
77	Galva	308	39.84%	264.03	96.27	158.00	580.33
78	Garden City	430	16.02%	236.50	55.42	167.40	400.00
79	Garden Plain	417	18.55%	246.09	90.97	148.00	572.00
80	Garfield	470	8.20%	243.31	87.73	155.00	576.00
81	Girard	482	5.86%	239.52	84.55	146.00	586.00
82	Glade	65	87.30%	175.39	14.31	142.80	198.00
83	Glen Elder	382	25.39%	242.41	92.02	139.00	565.50
84	Goodland	2	99.61%	217.50	43.13	187.00	248.00
85	Gorham	467	8.79%	241.50	86.30	152.50	583.00
86	Grainfield	253	50.59%	276.49	103.97	151.67	576.50
87	Gray	91	82.23%	351.83	115.12	220.20	582.00
88	Great Bend	467	8.79%	238.06	86.10	155.00	583.00
89	Greenleaf	409	20.12%	200.88	48.05	141.60	407.00
90	Greensburg	184	64.06%	219.86	34.17	164.20	325.50

Table 2.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
91	Gridley	147	71.29%	310.27	117.51	157.33	575.00
92	Haddam	260	49.22%	266.68	105.38	143.80	580.00
93	Halstead	452	11.72%	238.77	90.86	144.00	579.00
94	Hanover	381	25.59%	193.88	33.04	136.00	301.00
95	Hanston	167	67.38%	308.04	110.35	179.00	582.00
96	Hartford	103	79.88%	162.33	17.01	121.75	196.80
97	Haven	447	12.70%	238.55	90.59	149.00	586.33
98	Haviland	417	18.55%	252.29	93.35	150.00	585.50
99	Hepler	52	89.84%	183.38	23.88	125.00	219.00
100	Hiawatha	402	21.48%	193.01	32.71	130.60	302.67
101	Hill City	98	80.86%	376.29	91.72	199.00	571.50
102	Hillsboro	477	6.84%	235.37	86.82	150.00	580.33
103	Hilton	221	56.84%	277.96	110.41	159.00	581.33
104	Hoisington	153	70.12%	315.74	110.62	173.33	582.00
105	Holton	400	21.88%	227.53	92.37	136.00	576.00
106	Home	192	62.50%	219.74	91.58	136.25	558.00
107	Hope	472	7.81%	241.84	89.49	150.00	570.00
108	Hoxie	437	14.65%	236.37	90.17	150.00	570.00
109	Hudson	428	16.41%	228.96	75.96	159.00	588.00
110	Hunter	391	23.63%	242.18	93.16	139.00	569.50
111	Hutchinson	217	57.62%	219.07	36.13	163.00	318.50
112	Inman	217	57.62%	279.51	110.87	159.00	581.33
113	Isabel	428	16.41%	229.38	75.40	160.00	588.00
114	luka	354	30.86%	261.53	99.09	162.40	589.00
115	Jamestown	207	59.57%	210.53	35.51	140.00	303.75
116	Jetmore	167	67.38%	308.08	110.32	179.00	582.00
117	Jewell	25	95.12%	223.91	12.58	198.20	244.33
118	Junction City	423	17.38%	212.48	75.63	144.40	564.67
119	Kackley	242	52.73%	265.24	103.95	150.50	566.67
120	Kalvesta	175	65.82%	225.72	36.20	167.60	333.50

Note: Highlighting indicates the grain market was chosen for analysis

Table 2.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
121	Kansas City	67	86.91%	280.50	158.97	148.00	599.00
122	Kensington	420	17.97%	207.30	73.34	136.00	546.75
123	Kingsdown	249	51.37%	288.68	102.64	182.75	586.00
124	Kiowa	149	70.90%	321.06	117.03	163.20	594.00
125	LaCrosse	40	92.19%	195.36	5.07	185.00	207.00
126	Laird	141	72.46%	222.94	40.18	170.20	328.50
127	Lancaster	368	28.13%	239.71	93.07	143.00	578.00
128	Larned	493	3.71%	241.20	85.83	155.00	576.00
129	Lawrence	126	75.39%	332.54	104.58	202.00	576.50
130	Lehigh	308	39.84%	263.23	96.84	156.00	580.33
131	Lenora	232	54.69%	267.77	94.69	166.20	567.25
132	Leonardville	61	88.09%	408.21	89.07	302.00	566.50
133	LeRoy	476	7.03%	229.68	87.72	136.00	575.00
134	Lewis	349	31.84%	209.89	33.23	155.00	322.50
135	Lindsborg	308	39.84%	263.93	96.37	159.00	577.50
136	Linn	259	49.41%	267.25	105.40	143.80	580.00
137	Logan	380	25.78%	200.78	48.13	131.00	403.25
138	Longford	110	78.52%	344.29	110.87	185.60	565.00
139	Ludell	151	70.51%	309.35	114.54	161.33	566.00
140	Macksville	467	8.79%	245.65	87.51	156.00	576.00
141	Manhattan	436	14.84%	230.43	88.48	136.00	557.50
142	Marion	308	39.84%	263.23	96.84	156.00	580.33
143	Marquette	215	58.01%	191.12	25.98	148.00	287.00
144	Marysville	432	15.63%	233.40	92.96	137.00	580.00
145	McCracken	40	92.19%	195.36	5.07	185.00	207.00
146	McCune	460	10.16%	231.92	84.60	159.40	585.00
147	McPherson	481	6.05%	235.77	86.59	148.00	581.33
148	Melvern	310	39.45%	256.90	99.16	154.00	576.50
149	Menlo	401	21.68%	228.49	81.87	151.00	574.50
150	Meriden	313	38.87%	234.91	100.32	137.00	571.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 2.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
151	Milton	76	85.16%	249.66	62.90	161.50	478.33
152	Miltonvale	61	88.09%	408.20	89.05	302.00	566.50
153	Mingo	402	21.48%	230.34	81.63	154.00	576.50
154	Minneapolis	441	13.87%	222.25	82.96	149.00	568.00
155	Morganville	360	29.69%	214.28	74.14	140.40	566.25
156	Morland	249	51.37%	275.91	103.78	151.67	571.50
157	Morrill	465	9.18%	226.20	87.31	134.25	562.00
158	Moundridge	491	4.10%	235.25	86.67	149.00	580.50
159	Mount Hope	259	49.41%	275.13	103.45	161.00	581.50
160	Mullinville	386	24.61%	233.75	84.16	163.00	590.00
161	Mulvane	386	24.61%	249.18	93.74	131.00	573.00
162	Murdock	307	40.04%	251.96	73.48	157.60	497.00
163	Muscotah	57	88.87%	230.91	32.35	184.80	299.50
164	Narka	184	64.06%	278.50	122.29	141.80	583.00
165	Natoma	40	92.19%	195.33	5.13	184.50	207.00
166	Ness City	142	72.27%	222.71	40.13	170.20	328.50
167	New Cambria	228	55.47%	283.73	110.26	159.00	579.00
168	Newton	343	33.01%	257.28	92.47	159.00	576.33
169	Nickerson	498	2.73%	237.22	86.09	148.00	584.33
170	Norton	419	18.16%	231.79	92.07	143.00	571.00
171	Oakley	450	12.11%	244.89	89.18	154.00	578.00
172	Oberlin	427	16.60%	239.58	90.87	148.00	566.00
173	Offerle	473	7.62%	252.92	87.97	167.00	586.00
174	Osborne	484	5.47%	231.22	87.16	142.00	555.00
175	Ottawa	462	9.77%	227.00	87.98	147.40	576.50
176	Overbrook	457	10.74%	232.71	89.67	144.00	576.50
177	Palmer	168	67.19%	301.71	105.26	165.00	575.00
178	Paola	402	21.48%	197.80	44.25	133.80	405.00
179	Park	188	63.28%	304.22	107.00	151.67	576.50
180	Partridge	308	39.84%	268.65	96.54	165.00	586.33

Note: Highlighting indicates the grain market was chosen for analysis

Table 2.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
181	Pawnee Rock	437	14.65%	239.33	88.70	155.00	582.00
182	Peabody	340	33.59%	256.77	94.30	157.00	580.33
183	Penalosa	234	54.30%	294.36	106.11	171.00	587.00
184	Penokee	253	50.59%	274.51	103.56	151.67	571.50
185	Phillipsburg	460	10.16%	228.45	87.22	133.20	548.00
186	Pittsburg	427	16.60%	221.54	74.50	142.25	590.00
187	Pratt	206	59.77%	199.21	23.76	162.00	290.00
188	Preston	234	54.30%	294.49	106.36	171.00	588.00
189	Protection	288	43.75%	284.02	102.48	166.00	594.25
190	Quinter	261	49.02%	273.70	103.15	151.67	576.50
191	Rago	195	61.91%	278.37	77.60	177.00	497.00
192	Randall	465	9.18%	228.76	86.11	139.00	465.00
193	Ransom	143	72.07%	257.21	127.76	159.60	585.00
194	Republic	300	41.41%	260.57	98.78	147.50	574.00
195	Rexford	253	50.59%	202.69	36.61	150.00	316.50
196	Roxbury	308	39.84%	263.58	96.48	158.00	580.33
197	Rush Center	210	58.98%	218.58	36.78	152.80	320.50
198	Russell	163	68.16%	220.92	34.73	170.75	317.00
199	Sabetha	398	22.27%	229.88	91.12	132.00	556.00
200	Salina	89	82.62%	307.20	121.04	188.00	580.00
201	Scandia	32	93.75%	198.14	4.93	189.00	208.50
202	Scott City	432	15.63%	235.32	56.35	158.40	399.00
203	Scranton	25	95.12%	507.98	52.07	405.00	576.50
204	Sedgwick	251	50.98%	233.45	65.33	160.60	418.50
205	Seguin	405	20.90%	228.02	81.57	151.00	574.50
206	Selden	233	54.49%	269.18	95.08	167.50	571.25
207	Seneca	35	93.16%	425.96	95.94	300.33	561.40
208	Smith Center	393	23.24%	220.93	88.04	140.00	548.20
209	Solomon	110	78.52%	346.27	113.17	185.60	572.00
210	Spearville	210	58.98%	236.65	50.23	182.75	408.50

Table 2.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
211	St Marys	376	26.56%	234.53	91.35	139.00	556.00
212	Stafford	278	45.70%	213.20	52.25	158.00	428.50
213	Sterling	484	5.47%	237.72	88.26	149.20	575.00
214	Stockton	439	14.26%	221.00	82.00	142.00	547.75
215	Studley	258	49.61%	272.80	103.16	151.67	571.50
216	Sublette	429	16.21%	239.30	54.78	169.00	400.00
217	Talmage	110	78.52%	344.86	111.52	185.60	567.00
218	Tampa	430	16.02%	231.23	85.51	150.00	575.00
219	Tipton	392	23.44%	242.05	93.06	139.00	569.50
220	Topeka	45	91.21%	239.56	30.13	202.00	316.00
221	Turon	234	54.30%	294.35	106.11	171.00	587.00
222	Utica	81	84.18%	412.88	79.57	313.40	585.00
223	Valley Center	40	92.19%	195.34	4.57	185.75	209.00
224	Wakeeney	250	51.17%	277.22	103.97	151.67	576.50
225	Wakefield	248	51.56%	198.14	78.31	140.00	541.75
226	Waldeck	234	54.30%	294.35	106.11	171.00	587.00
227	Walker	40	92.19%	198.02	5.14	189.00	208.50
228	Walton	485	5.27%	235.09	86.03	148.00	580.33
229	Wamego	420	17.97%	210.83	74.43	138.75	556.00
230	Washington	261	49.02%	267.33	104.85	144.60	580.00
231	Waterville	368	28.13%	222.68	88.38	135.75	568.00
232	Waverly	69	86.52%	404.66	87.76	294.60	576.50
233	Wellington	385	24.80%	238.84	86.59	160.00	571.00
234	Wellsville	69	86.52%	407.05	86.10	300.25	576.50
235	Westphalia	147	71.29%	310.27	117.51	157.33	575.00
236	White Cloud	108	78.91%	346.22	105.92	180.00	566.00
237	Whitewater	343	33.01%	259.05	94.94	160.00	584.33
238	Whiting	69	86.52%	397.66	89.81	285.80	571.00
239	Wilmore	179	65.04%	219.14	35.30	163.60	322.50
240	Wilroads	238	53.52%	294.25	104.00	182.75	591.00

Table 2.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
241	Windom	308	39.84%	264.21	96.13	159.00	580.33
242	Winfield	474	7.42%	230.26	83.40	134.00	560.00
243	Wright	457	10.74%	252.48	88.58	167.00	590.00
244	Yates Center	236	53.91%	240.35	88.60	154.50	557.50
245	Zenda	64	87.50%	203.04	8.68	178.75	215.00
246	Zurich	40	92.19%	195.32	5.14	184.50	207.00

Table 2.k Iowa Weekly Corn Price Summary Statistics

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
1	Ackley	383	25.20%	231.92	92.34	131.60	571.00
2	Adair	473	7.62%	225.21	88.22	131.00	571.00
3	Ainsworth	282	44.92%	258.49	93.13	149.75	556.00
4	Akron	283	44.73%	253.60	103.58	134.40	570.00
5	Albert City	346	32.42%	243.78	96.03	136.80	572.00
6	Albia	92	82.03%	234.71	32.36	194.50	308.67
7	Albion	280	45.31%	253.79	98.32	140.60	562.00
8	Alden	474	7.42%	223.06	86.76	133.00	569.00
9	Alexander	403	21.29%	230.75	93.06	126.75	572.00
10	Algona	486	5.08%	220.82	88.56	129.00	567.00
11	Alleman	482	5.86%	225.27	87.10	129.00	568.00
12	Allendorf	309	39.65%	253.49	100.93	143.20	584.00
13	Allison	226	55.86%	260.08	102.78	139.00	553.00
14	Alta	500	2.34%	222.29	88.11	131.20	573.00
15	Alton	463	9.57%	230.93	92.77	136.40	589.00
16	Altoona	378	26.17%	237.39	90.36	134.00	570.00
17	Alvord	230	55.08%	262.91	111.35	146.80	586.00
18	Ames	120	76.56%	240.14	120.81	154.00	569.00
19	Anthon	111	78.32%	165.22	17.61	126.60	205.00
20	Arcadia	161	68.55%	284.92	120.37	133.00	560.50
21	Archer	159	68.95%	295.31	125.61	146.80	587.00
22	Aredale	254	50.39%	250.87	100.51	144.20	553.00
23	Arlington	124	75.78%	314.79	111.07	163.25	547.60
24	Armstrong	476	7.03%	217.82	87.73	125.00	562.00
25	Ashton	484	5.47%	225.76	90.82	134.00	584.00
26	Atlantic	279	45.51%	254.30	99.61	135.20	561.00
27	Auburn	133	74.02%	224.00	61.23	136.25	398.25
28	Audubon	471	8.01%	222.51	88.48	127.00	568.00
29	Aurelia	495	3.32%	222.35	89.06	130.20	576.00
30	Avoca	162	68.36%	272.03	121.06	130.80	562.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
31	Avon	354	30.86%	250.91	92.91	145.40	575.00
32	Ayrshire	285	44.34%	249.38	101.78	134.80	565.00
33	Badger	260	49.22%	259.89	103.39	139.40	568.00
34	Bagley	269	47.46%	192.33	34.91	128.00	298.67
35	Bancroft	193	62.30%	192.80	35.58	131.00	319.00
36	Barnes City	203	60.35%	280.76	105.02	146.00	556.60
37	Barnum	258	49.61%	260.61	103.46	139.40	568.00
38	Battle Creek	149	70.90%	297.35	121.26	133.50	572.00
39	Bayard	441	13.87%	224.79	89.04	132.00	572.00
40	Beaman	488	4.69%	224.07	84.76	131.50	562.00
41	Beaver	396	22.66%	232.52	92.98	132.00	570.00
42	Belmond	237	53.71%	266.17	107.22	150.00	568.00
43	Bettendorf	355	30.66%	255.96	91.78	152.50	569.00
44	Blairsburg	393	23.24%	232.20	94.31	132.00	573.00
45	Blairstown	191	62.70%	264.21	114.05	136.00	559.50
46	Blakesburg	264	48.44%	190.70	24.69	137.20	362.00
47	Blencoe	482	5.86%	224.11	88.78	134.40	572.00
48	Bloomfield	200	60.94%	202.15	35.60	133.00	303.33
49	Bode	260	49.22%	259.90	103.39	139.40	568.00
50	Bondurant	366	28.52%	236.71	91.65	134.00	570.00
51	Boone	471	8.01%	227.40	88.43	133.00	573.00
52	Booneville	437	14.65%	231.38	90.54	129.00	568.00
53	Boxholm	319	37.70%	246.18	97.80	133.40	569.00
54	Boyden	302	41.02%	262.23	103.05	149.00	590.00
55	Bradford	405	20.90%	228.58	90.87	131.60	571.00
56	Bradgate	210	58.98%	260.64	112.30	139.20	573.00
57	Bristow	91	82.23%	218.55	79.45	141.50	470.00
58	Britt	334	34.77%	239.50	98.99	134.80	573.00
59	Brooklyn	155	69.73%	292.28	114.78	146.60	556.00
60	Brunsville	260	49.22%	221.22	93.28	136.00	590.00

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
61	Buckeye	424	17.19%	226.64	91.56	133.20	575.00
62	Buckingham	399	22.07%	234.04	88.95	135.20	558.00
63	Buffalo Center	313	38.87%	243.40	96.77	131.00	562.00
64	Burlington	254	50.39%	277.10	97.31	173.60	565.00
65	Burt	416	18.75%	229.48	91.77	131.00	570.00
66	Callender	190	62.89%	197.18	35.55	133.40	295.67
67	Cambridge	329	35.74%	248.92	95.29	136.60	568.00
68	Carlisle	133	74.02%	231.09	60.44	145.40	397.50
69	Carnes	223	56.45%	283.33	105.10	175.00	586.00
70	Carpenter	310	39.45%	244.81	94.54	133.50	555.00
71	Carroll	65	87.30%	306.48	168.72	139.67	568.00
72	Casey	300	41.41%	249.79	98.26	132.40	568.00
73	Cedar Falls	255	50.20%	261.21	99.04	147.25	557.40
74	Cedar Rapids	494	3.52%	244.48	82.91	155.00	583.00
75	Center Point	177	65.43%	214.30	31.22	152.00	306.50
76	Centerville	71	86.13%	225.58	36.90	181.50	299.50
77	Central City	169	66.99%	285.06	112.59	148.60	561.50
78	Chapin	417	18.55%	231.30	92.79	127.00	576.00
79	Chariton	493	3.71%	227.61	81.70	130.00	556.75
80	Charles City	166	67.58%	278.51	121.62	139.25	564.00
81	Chelsea	79	84.57%	378.43	91.97	273.00	559.50
82	Cherokee	473	7.62%	222.78	90.81	129.20	575.00
83	Chillicothe	409	20.12%	207.14	46.35	136.00	396.00
84	Churdan	168	67.19%	271.58	121.69	136.60	572.00
85	Clare	260	49.22%	259.90	103.39	139.40	568.00
86	Clarence	493	3.71%	231.52	82.94	137.50	556.60
87	Clarinda	262	48.83%	257.85	99.47	130.33	555.00
88	Clarion	462	9.77%	222.29	90.66	130.00	573.00
89	Clarksville	251	50.98%	220.76	88.07	129.20	559.00
90	Clayton	442	13.67%	237.97	81.60	133.60	549.25

Note: Highlighting indicates the grain market was chosen for analysis

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
91	Clear Lake	438	14.45%	210.99	83.49	126.00	558.00
92	Cleghorn	494	3.52%	222.87	91.29	127.40	584.00
93	Clemons	241	52.93%	259.39	103.34	139.25	567.00
94	Clermont	124	75.78%	314.37	112.00	160.75	548.00
95	Clinton	441	13.87%	251.08	89.50	148.80	584.00
96	Clutier	236	53.91%	263.89	102.38	151.20	560.00
97	Collins	387	24.41%	237.06	92.52	131.00	568.00
98	Colo	490	4.30%	225.59	86.62	133.00	568.00
99	Colwell	152	70.31%	286.64	123.38	139.25	564.00
100	Conrad	447	12.70%	228.40	86.71	133.00	562.00
101	Conroy	504	1.56%	225.81	83.09	134.20	559.25
102	Coon Rapids	455	11.13%	222.06	87.61	132.00	567.00
103	Corning	216	57.81%	183.52	25.51	130.00	263.00
104	Correctionville	292	42.97%	253.71	99.93	138.00	572.00
105	Corwith	488	4.69%	222.52	88.28	131.00	576.00
106	Corydon	164	67.97%	253.49	109.66	141.50	547.00
107	Coulter	488	4.69%	222.01	87.96	127.50	572.00
108	Council Bluffs	314	38.67%	202.31	33.36	142.00	310.50
109	Craig	359	29.88%	199.19	48.12	136.60	394.00
110	Crawfordsville	126	75.39%	311.28	108.12	158.50	546.40
111	Cresco	476	7.03%	219.42	84.93	125.00	553.75
112	Creston	497	2.93%	230.30	87.63	129.00	572.00
113	Cylinder	342	33.20%	228.32	100.37	127.80	570.00
114	Dallas Center	406	20.70%	232.48	92.19	129.00	569.00
115	Dana	319	37.70%	248.60	97.22	136.00	572.00
116	Davenport	476	7.03%	245.56	83.29	151.00	569.00
117	Dawson	395	22.85%	232.85	93.42	129.00	571.00
118	Dayton	168	67.19%	271.58	121.69	136.60	572.00
119	Decatur	92	82.03%	229.20	30.97	188.00	301.67
120	Decorah	258	49.61%	252.20	99.53	129.25	542.33

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
121	Dedham	361	29.49%	228.11	100.35	130.75	570.00
122	Denison	356	30.47%	232.36	101.22	135.00	574.00
123	Des Moines	354	30.86%	250.99	92.89	140.00	575.00
124	DeSoto	91	82.23%	169.92	20.41	128.60	206.80
125	Dewar	194	62.11%	271.00	113.99	148.20	564.00
126	Dewitt	259	49.41%	269.93	98.55	156.40	564.20
127	Dickens	485	5.27%	221.13	89.38	129.00	574.00
128	Dike	483	5.66%	226.05	84.60	133.80	555.00
129	Dixon	282	44.92%	265.33	94.30	156.40	560.20
130	Dolliver	241	52.93%	268.41	116.73	134.75	662.67
131	Donnellson	111	78.32%	185.35	19.07	143.20	224.00
132	Doon	240	53.13%	257.23	110.06	145.80	583.00
133	Dougherty	319	37.70%	247.46	96.16	136.20	568.00
134	Dow City	48	90.63%	343.71	139.12	194.00	565.00
135	Dows	489	4.49%	222.02	88.38	130.80	573.00
136	Dubuque	199	61.13%	226.34	53.51	142.60	388.67
137	Dumont	337	34.18%	235.87	93.79	140.20	562.00
138	Duncombe	260	49.22%	259.89	103.40	139.40	568.00
139	Dunkerton	497	2.93%	228.18	84.92	136.25	564.00
140	Dunlap	365	28.71%	233.26	95.89	131.00	570.25
141	Dysart	490	4.30%	226.04	83.10	136.00	562.00
142	Eagle Grove	488	4.69%	222.98	87.53	131.00	576.00
143	Earlham	168	67.19%	274.80	120.50	139.40	574.00
144	Early	168	67.19%	270.50	122.38	136.60	572.00
145	Eddyville	474	7.42%	238.41	80.99	147.00	565.75
146	Edgewood	419	18.16%	235.43	85.93	136.00	553.00
147	Elberon	79	84.57%	378.43	91.97	273.00	559.50
148	Eldon	384	25.00%	210.16	45.55	134.00	396.00
149	Eldora	98	80.86%	194.35	26.28	154.00	248.20
150	Eldridge	254	50.39%	273.05	96.03	156.40	565.25

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
151	Elgin	124	75.78%	314.39	112.00	160.75	548.00
152	Elk Horn	162	68.36%	271.04	121.00	129.80	560.00
153	Elkader	166	67.58%	279.41	110.78	138.00	533.00
154	Elkhart	492	3.91%	227.47	86.58	131.80	569.00
155	Elliott	162	68.36%	273.43	121.70	131.80	563.00
156	Ellsworth	457	10.74%	220.20	89.52	131.00	569.00
157	Elma	231	54.88%	260.33	106.47	140.00	559.50
158	Emerson	290	43.36%	191.30	31.97	131.00	295.50
159	Emmetsburg	345	32.62%	243.37	96.36	135.80	572.00
160	Estherville	87	83.01%	377.74	100.07	192.00	577.00
161	Everly	216	57.81%	267.48	115.34	135.67	581.00
162	Exira	472	7.81%	222.22	88.45	127.00	568.00
163	Fairbank	414	19.14%	213.44	72.20	137.00	558.00
164	Fairfax	231	54.88%	263.74	100.62	161.00	583.00
165	Fairfield	348	32.03%	241.85	91.61	138.80	550.20
166	Farley	169	66.99%	283.35	111.75	145.40	553.50
167	Farnhamville	168	67.19%	271.61	121.66	136.60	572.00
168	Farragut	170	66.80%	285.80	120.08	145.33	576.00
169	Faulkner	50	90.23%	411.97	109.54	294.67	569.00
170	Fayette	193	62.30%	283.22	97.54	137.33	553.00
171	Fenton	317	38.09%	242.91	97.09	131.00	564.00
172	Fernald	225	56.05%	199.02	34.57	132.00	299.00
173	Fonda	344	32.81%	244.14	96.22	136.80	572.00
174	Fontanelle	403	21.29%	212.25	86.81	130.00	554.25
175	Fort Atkinson	92	82.03%	223.00	32.17	185.50	297.50
176	Fort Dodge	493	3.71%	223.62	90.28	131.40	573.00
177	Fostoria	265	48.24%	254.68	105.84	134.40	574.00
178	Fredericksburg	352	31.25%	229.56	92.53	127.40	543.00
179	Frederika	259	49.41%	251.77	98.28	133.50	544.00
180	Galva	199	61.13%	266.11	109.97	147.00	580.00

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
181	Garden City	485	5.27%	221.67	86.27	133.00	569.00
182	Garner	395	22.85%	187.55	32.12	128.00	294.75
183	Garrison	77	84.96%	174.34	21.66	135.60	207.20
184	Garwin	297	41.99%	249.48	98.15	133.20	562.00
185	Geneva	85	83.40%	206.39	63.91	138.00	368.00
186	George	310	39.45%	257.01	102.14	148.40	589.00
187	Gilbert	406	20.70%	233.26	92.26	132.00	568.00
188	Gilman	240	53.13%	253.39	99.41	146.20	557.75
189	Gilmore City	475	7.23%	223.05	89.50	130.00	572.00
190	Gladbrook	284	44.53%	253.95	97.80	141.00	562.00
191	Glidden	464	9.38%	225.70	89.71	135.00	568.00
192	Goldfield	489	4.49%	224.00	87.97	131.00	576.00
193	Gowrie	480	6.25%	224.92	88.81	132.00	573.00
194	Graettinger	256	50.00%	260.97	103.29	135.00	570.00
195	Grafton	340	33.59%	239.24	92.29	133.33	555.00
196	Grant	484	5.47%	220.36	86.83	129.60	563.00
197	Green Mountain	253	50.59%	262.61	99.62	142.00	562.00
198	Greene	355	30.66%	236.89	91.05	140.00	558.67
199	Greenfield	406	20.70%	212.03	86.42	130.00	554.25
200	Greenville	215	58.01%	266.80	113.33	136.00	576.00
201	Grinnell	100	80.47%	258.53	63.88	159.20	394.00
202	Griswold	162	68.36%	273.41	121.63	131.80	563.00
203	Grundy Center	247	51.76%	254.60	96.92	141.50	561.00
204	Gruver	215	58.01%	266.80	113.33	136.00	576.00
205	Guthrie Center	448	12.50%	225.06	89.54	117.50	577.50
206	Halbur	471	8.01%	224.41	89.01	129.00	571.00
207	Hamburg	158	69.14%	270.91	119.32	148.75	571.00
208	Hampton	244	52.34%	194.04	34.03	127.00	294.50
209	Hancock	162	68.36%	272.99	121.04	131.80	563.00
210	Hanlontown	491	4.10%	219.63	87.37	124.00	568.00

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
211	Hardy	291	43.16%	252.95	101.27	141.00	576.00
212	Harlan	162	68.36%	272.02	121.09	130.80	562.00
213	Harris	272	46.88%	251.85	104.68	145.25	578.00
214	Hartley	503	1.76%	223.40	90.21	127.75	585.00
215	Hartwick	79	84.57%	377.52	91.84	272.00	557.00
216	Hastings	116	77.34%	318.07	119.46	167.67	566.00
217	Haverhill	473	7.62%	226.26	86.08	133.00	566.00
218	Hawarden	452	11.72%	223.53	95.34	129.00	586.00
219	Hawkeye	489	4.49%	221.53	81.81	132.00	545.00
220	Henderson	240	53.13%	259.59	108.52	131.80	572.00
221	Hinton	490	4.30%	226.44	89.29	138.00	576.00
222	Holland	119	76.76%	214.66	35.27	158.60	302.00
223	Holstein	254	50.39%	262.05	107.34	137.75	577.00
224	Hopkinton	70	86.33%	292.42	152.52	149.00	566.25
225	Hornick	471	8.01%	225.00	89.41	134.40	573.00
226	Hospers	262	48.83%	274.25	102.08	163.00	589.00
227	Hubbard	484	5.47%	220.16	85.41	133.00	567.00
228	Hudson	457	10.74%	225.52	85.53	134.00	553.40
229	Hull	229	55.27%	255.91	108.37	153.00	592.00
230	Humboldt	260	49.22%	259.91	103.43	139.40	573.00
231	Humeston	164	67.97%	251.46	109.43	141.50	545.00
232	Ida Grove	169	66.99%	272.72	121.52	136.60	572.00
233	Independence	169	66.99%	281.75	112.27	145.60	557.50
234	Indianola	491	4.10%	224.76	86.19	131.00	566.00
235	Inwood	177	65.43%	281.01	119.94	146.80	586.00
236	Ionia	319	37.70%	247.30	96.34	135.25	564.00
237	Iowa City	262	48.83%	264.87	94.50	170.20	555.50
238	Iowa Falls	44	91.41%	373.43	162.07	145.20	571.00
239	Ireton	359	29.88%	241.48	101.71	136.40	589.00
240	Irwin	409	20.12%	226.88	93.07	131.00	563.50

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
241	Jefferson	472	7.81%	226.21	88.76	132.00	573.00
242	Jesup	474	7.42%	223.25	84.61	133.25	557.00
243	Jewell	450	12.11%	213.89	87.17	129.40	571.00
244	Joice	453	11.52%	212.02	84.27	125.00	568.00
245	Kalona	246	51.95%	264.14	97.18	154.80	555.00
246	Kanawha	458	10.55%	221.92	91.08	129.75	573.00
247	Kelley	400	21.88%	233.94	92.18	134.00	568.00
248	Kellogg	249	51.37%	230.36	58.99	146.20	392.50
249	Keokuk	474	7.42%	250.59	83.12	153.00	577.00
250	Keosauqua	131	74.41%	226.61	44.61	155.20	369.00
251	Keota	61	88.09%	384.92	96.57	276.50	559.00
252	Keystone	42	91.80%	280.48	170.13	137.75	566.50
253	Kingsley	320	37.50%	230.41	104.13	128.50	571.00
254	Klemme	426	16.80%	209.18	82.96	130.00	566.00
255	Knierim	260	49.22%	259.91	103.43	139.40	573.00
256	Knoxville	338	33.98%	247.23	89.22	141.60	556.75
257	La Porte City	301	41.21%	258.00	93.23	148.60	562.40
258	Lacona	170	66.80%	277.78	113.33	140.25	556.75
259	Lake City	433	15.43%	223.72	89.84	132.00	572.00
260	Lake Mills	190	62.89%	200.17	35.13	124.00	296.00
261	Lake Park	330	35.55%	238.45	103.39	124.00	574.00
262	Lake View	168	67.19%	270.51	122.41	136.60	572.00
263	Lakota	466	8.98%	220.35	88.25	128.00	564.00
264	Lamoni	484	5.47%	222.90	84.43	125.00	556.75
265	Lamont	124	75.78%	316.35	111.52	165.75	551.00
266	Lanesboro	29	94.34%	472.33	107.70	351.25	568.00
267	Larchwood	241	52.93%	255.77	110.01	143.60	582.00
268	Larrabee	473	7.62%	226.63	92.80	130.20	587.00
269	Latimer	168	67.19%	269.65	120.95	140.20	568.00
270	Laurel	301	41.21%	216.63	60.70	133.60	392.50

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
271	Laurens	478	6.64%	222.06	89.97	127.60	573.00
272	Lawler	319	37.70%	248.13	95.66	139.25	564.00
273	Le Mars	293	42.77%	187.94	46.74	134.00	393.00
274	Ledyard	474	7.42%	218.58	88.30	125.00	564.00
275	Leland	354	30.86%	231.85	94.93	135.60	571.00
276	Lenox	259	49.41%	259.31	106.14	137.75	572.00
277	Lester	311	39.26%	242.76	100.85	143.20	582.00
278	Libertyville	171	66.60%	256.50	114.80	135.50	543.00
279	Lidderdale	139	72.85%	237.08	132.69	135.00	568.00
280	Lime Springs	414	19.14%	191.41	43.90	127.00	376.50
281	Lincoln	240	53.13%	257.32	97.04	143.80	561.00
282	Lineville	164	67.97%	253.55	110.13	141.50	547.00
283	Linn Grove	469	8.40%	221.77	91.68	126.60	575.00
284	Liscomb	284	44.53%	254.31	99.52	140.20	567.00
285	Little Rock	501	2.15%	223.16	91.07	129.50	585.00
286	Little Sioux	276	46.09%	256.43	100.97	137.00	572.25
287	Livermore	402	21.48%	230.85	94.19	130.40	576.00
288	Lohrville	260	49.22%	259.90	103.39	139.40	568.00
289	Lone Rock	297	41.99%	252.34	99.49	136.40	575.00
290	Lost Nation	237	53.71%	270.12	93.96	152.40	569.00
291	Luther	369	27.93%	238.97	94.19	136.20	570.00
292	Luverne	261	49.02%	260.12	103.25	139.40	568.00
293	Luzerne	78	84.77%	381.00	91.50	275.00	559.50
294	Lytton	168	67.19%	271.58	121.69	136.60	572.00
295	Madrid	336	34.38%	244.64	96.10	134.00	569.00
296	Malcom	319	37.70%	253.25	92.33	146.80	558.00
297	Mallard	485	5.27%	221.24	88.90	129.00	568.00
298	Manchester	214	58.20%	236.38	86.82	144.20	555.00
299	Manly	482	5.86%	222.88	85.77	126.20	562.00
300	Manning	256	50.00%	245.72	110.14	134.00	566.00

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
301	Manson	223	56.45%	270.38	108.48	139.40	573.00
302	Mapleton	293	42.77%	254.10	99.42	138.00	572.00
303	Marathon	501	2.15%	221.49	88.45	127.60	573.00
304	Marble Rock	464	9.38%	220.41	83.85	130.00	557.00
305	Marcus	473	7.62%	225.34	92.08	129.40	584.00
306	Marengo	79	84.57%	378.20	91.44	273.00	557.25
307	Marshalltown	92	82.03%	226.91	31.81	185.60	300.67
308	Martelle	282	44.92%	261.88	94.65	150.40	557.40
309	Mason City	427	16.60%	214.10	83.60	130.00	557.00
310	Massena	455	11.13%	210.25	82.51	130.80	557.75
311	Matlock	296	42.19%	263.27	101.17	149.00	589.00
312	Maurice	451	11.91%	232.46	93.88	135.00	589.00
313	Maxwell	361	29.49%	235.43	91.94	131.00	568.00
314	Maynard	235	54.10%	250.02	107.30	130.80	549.00
315	McCallsburg	406	20.70%	233.14	92.22	132.00	568.00
316	McGregor	182	64.45%	243.92	93.55	150.80	554.00
317	Melbourne	487	4.88%	225.21	85.65	134.00	563.00
318	Melvin	248	51.56%	267.78	110.12	143.00	582.00
319	Meriden	429	16.21%	222.24	95.96	127.40	584.00
320	Meservey	235	54.10%	236.19	100.99	132.80	566.00
321	Milford	215	58.01%	266.80	113.33	136.00	576.00
322	Minburn	491	4.10%	223.02	87.38	129.00	569.00
323	Mingo	351	31.45%	245.48	92.17	139.60	565.00
324	Missouri Valley	329	35.74%	243.44	98.65	131.00	574.25
325	Mitchellville	370	27.73%	243.60	92.15	139.40	570.00
326	Modale	486	5.08%	225.26	87.49	133.00	574.25
327	Mondamin	458	10.55%	227.39	88.58	132.00	573.25
328	Monona	162	68.36%	279.33	111.20	137.00	532.00
329	Monroe	109	78.71%	266.40	126.60	154.25	562.00
330	Montezuma	319	37.70%	253.15	92.24	146.80	557.00

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
331	Monticello	169	66.99%	284.61	111.90	146.20	557.50
332	Moorland	260	49.22%	259.89	103.39	139.40	568.00
333	Morning Sun	318	37.89%	255.46	91.94	142.00	552.00
334	Moulton	0	100.00%	0.00	0.00	0.00	0.00
335	Mount Union	498	2.73%	231.45	80.70	138.20	557.00
336	Mt Auburn	110	78.52%	178.75	18.00	132.00	206.50
337	Mt Ayr	411	19.73%	217.06	86.64	135.00	561.00
338	Muscatine	227	55.66%	276.87	89.31	175.40	560.00
339	Nashua	491	4.10%	221.88	86.82	128.00	564.00
340	Nemaha	252	50.78%	263.30	108.13	135.33	580.00
341	Neola	162	68.36%	274.04	121.08	132.80	564.00
342	Nevada	406	20.70%	237.44	91.35	137.00	570.00
343	New Hampton	488	4.69%	223.85	86.43	128.00	564.00
344	New Hartford	295	42.38%	238.27	102.65	133.80	558.00
345	New London	236	53.91%	194.40	23.07	137.60	264.00
346	New Providence	477	6.84%	221.03	85.73	131.00	567.00
347	New Sharon	243	52.54%	267.85	101.68	147.00	556.60
348	Newell	278	45.70%	233.40	106.46	133.40	572.00
349	Newton	249	51.37%	264.81	100.91	145.20	560.00
350	Nora Springs	107	79.10%	171.37	18.36	128.60	206.00
351	North Washington	254	50.39%	260.60	102.38	135.25	564.67
352	Northwood	455	11.13%	222.58	85.99	127.00	554.00
353	Oakland	162	68.36%	272.97	121.09	131.80	563.00
354	Oakville	390	23.83%	246.53	88.20	144.00	557.00
355	Ocheyedan	407	20.51%	231.12	98.85	130.00	580.00
356	Odebolt	168	67.19%	272.32	121.58	136.60	572.00
357	Olds	329	35.74%	254.12	89.68	137.00	554.00
358	Olin	240	53.13%	273.62	98.37	152.40	562.00
359	Onawa	487	4.88%	224.24	88.31	130.00	572.00
360	Orange City	455	11.13%	231.96	93.65	135.00	589.00

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
361	Osage	477	6.84%	223.42	85.81	128.40	554.00
362	Osceola	111	78.32%	171.77	19.46	125.25	210.00
363	Oskaloosa	472	7.81%	231.48	83.38	137.20	562.75
364	Ossian	108	78.91%	173.92	18.59	131.20	208.80
365	Otho	260	49.22%	259.90	103.44	139.40	573.00
366	Otley	109	78.71%	266.47	126.73	154.25	562.00
367	Ottosen	497	2.93%	220.64	87.38	129.00	571.00
368	Ottumwa	409	20.12%	212.92	71.83	135.00	561.50
369	Owasa	331	35.35%	232.25	98.03	131.00	567.00
370	Oyens	486	5.08%	225.81	91.00	134.00	576.00
371	Pacific Junction	328	35.94%	209.19	86.06	131.00	572.00
372	Palmer	260	49.22%	259.91	103.43	139.40	573.00
373	Panama	48	90.63%	343.71	139.12	194.00	565.00
374	Panora	440	14.06%	227.23	90.23	128.00	568.00
375	Parkersburg	299	41.60%	234.55	102.29	132.00	555.00
376	Paton	318	37.89%	246.71	97.68	134.40	570.00
377	Pella	427	16.60%	218.69	77.11	136.00	560.00
378	Persia	162	68.36%	274.04	121.08	132.80	564.00
379	Peterson	474	7.42%	221.46	91.29	126.60	575.00
380	Pickering	216	57.81%	263.68	103.16	146.75	569.00
381	Pierson	390	23.83%	233.36	94.23	130.00	572.00
382	Plainfield	355	30.66%	234.43	91.15	140.20	554.50
383	Pleasant Hill	257	49.80%	210.49	47.29	139.00	383.00
384	Plymouth	403	21.29%	215.60	85.07	130.00	558.00
385	Pocahontas	423	17.38%	227.93	92.98	130.00	573.00
386	Pomeroy	260	49.22%	259.89	103.39	139.40	568.00
387	Portsmouth	172	66.41%	267.16	120.65	131.80	564.00
388	Prairie City	497	2.93%	227.83	84.32	136.20	565.00
389	Protivin	354	30.86%	208.66	74.70	127.00	545.00
390	Radcliffe	157	69.34%	250.77	105.73	139.00	569.00

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
391	Rake	354	30.86%	233.40	94.28	135.60	571.00
392	Ralston	472	7.81%	226.19	88.85	131.00	573.00
393	Randall	406	20.70%	205.00	78.78	131.00	570.00
394	Readlyn	92	82.03%	174.12	20.37	131.00	208.80
395	Red Oak	470	8.20%	228.90	89.84	134.00	572.00
396	Redfield	368	28.13%	239.12	93.53	136.00	568.00
397	Reinbeck	386	24.61%	227.79	86.97	133.00	561.00
398	Rembrandt	111	78.32%	186.05	27.16	148.50	368.00
399	Remsen	476	7.03%	223.70	91.39	135.20	582.00
400	Renwick	291	43.16%	252.43	101.45	141.08	576.00
401	Richland	368	28.13%	243.63	88.17	136.00	550.00
402	Ridgeway	258	49.61%	251.70	100.00	128.25	543.33
403	Rinard	168	67.19%	272.21	121.17	136.60	572.00
404	Ringsted	365	28.71%	221.28	97.89	125.00	563.00
405	Rippey	423	17.38%	229.59	91.70	129.00	570.00
406	Ritter	227	55.66%	275.35	111.39	143.00	582.00
407	Rock Rapids	459	10.35%	217.72	92.40	128.20	583.00
408	Rock Valley	461	9.96%	220.72	91.75	138.20	586.00
409	Rockford	483	5.66%	218.08	83.00	128.00	557.00
410	Rockwell	449	12.30%	226.74	88.92	130.00	568.00
411	Rockwell City	458	10.55%	225.99	89.54	132.00	573.00
412	Roland	402	21.48%	233.66	92.51	132.00	568.00
413	Rowan	344	32.81%	231.57	100.28	131.00	573.00
414	Royal	323	36.91%	248.56	98.91	133.80	582.00
415	Rudd	458	10.55%	220.23	84.75	130.00	556.60
416	Runnells	476	7.03%	230.55	84.45	135.80	560.00
417	Ruthven	495	3.32%	220.53	88.15	127.80	571.00
418	Rutland	330	35.55%	234.38	96.15	130.40	580.00
419	Ryan	490	4.30%	229.95	81.58	138.25	562.25
420	Sac City	429	16.21%	224.78	91.28	130.00	575.00

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
421	Saint Ansgar	252	50.78%	256.58	102.14	142.50	552.00
422	Sanborn	465	9.18%	227.44	94.98	128.00	585.00
423	Schaller	472	7.81%	221.86	91.02	128.20	573.00
424	Schleswig	89	82.62%	335.71	126.89	165.20	554.00
425	Scranton	464	9.38%	225.18	89.37	129.00	571.00
426	Seymour	124	75.78%	212.90	102.35	132.00	533.00
427	Sheffield	412	19.53%	231.79	92.26	127.00	572.00
428	Shelby	162	68.36%	273.03	121.08	131.80	563.00
429	Sheldon	449	12.30%	233.09	93.86	135.00	589.00
430	Shell Rock	110	78.52%	176.42	18.46	130.60	207.40
431	Shellsburg	200	60.94%	273.78	108.06	148.00	562.25
432	Shenandoah	263	48.63%	267.02	101.14	145.80	576.00
433	Sibley	180	64.84%	260.89	129.85	130.00	580.00
434	Sidney	160	68.75%	280.17	121.37	132.00	572.00
435	Sigourney	137	73.24%	271.59	107.78	153.80	550.25
436	Silver City	114	77.73%	282.59	119.95	182.50	572.00
437	Sioux Center	302	41.02%	264.16	102.92	156.00	596.00
438	Sioux City	467	8.79%	228.47	90.35	139.00	577.00
439	Sioux Rapids	82	83.98%	164.13	21.11	126.60	201.50
440	Slater	370	27.73%	239.89	93.43	135.00	568.00
441	Sloan	464	9.38%	229.73	89.82	137.00	579.00
442	Somers	168	67.19%	271.58	121.69	136.60	572.00
443	Spencer	215	58.01%	266.80	113.33	136.00	576.00
444	Sperry	480	6.25%	239.15	77.45	149.00	563.00
445	Stacyville	491	4.10%	221.08	84.89	127.60	552.00
446	Stanhope	174	66.02%	253.61	115.30	137.25	572.00
447	Stanton	467	8.79%	225.14	87.80	134.00	564.00
448	Stanwood	237	53.71%	270.12	93.96	152.40	569.00
449	Steamboat Rock	127	75.20%	309.58	122.17	151.40	567.00
450	Stockport	485	5.27%	237.31	81.35	141.00	553.00

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
451	Storm Lake	64	87.50%	230.77	41.06	185.00	306.50
452	Story City	403	21.29%	235.06	91.78	134.00	568.00
453	Sully	243	52.54%	266.03	101.63	145.00	554.60
454	Sumner	259	49.41%	252.62	98.15	134.50	545.00
455	Sunbury	251	50.98%	269.64	91.44	156.40	570.00
456	Superior	216	57.81%	266.06	113.55	136.00	576.00
457	Sutherland	445	13.09%	230.78	92.35	133.00	586.00
458	Swea City	397	22.46%	220.19	94.33	125.00	564.00
459	Taintor	74	85.55%	384.87	92.02	284.60	554.60
460	Templeton	467	8.79%	226.41	89.08	131.00	573.00
461	Terril	295	42.38%	251.23	100.09	132.00	571.00
462	Thor	291	43.16%	252.98	101.27	141.00	576.00
463	Thornton	440	14.06%	211.69	83.38	127.00	558.00
464	Titonka	470	8.20%	222.04	89.86	126.00	576.00
465	Toeterville	275	46.29%	251.18	99.93	128.25	552.00
466	Tracy	108	78.91%	266.94	127.15	154.25	562.00
467	Traer	275	46.29%	249.03	93.75	146.20	560.00
468	Troy Mills	92	82.03%	231.64	31.95	193.50	306.50
469	Truesdale	82	83.98%	164.19	20.94	128.00	201.50
470	Union	482	5.86%	222.10	85.96	133.00	569.00
471	Varina	229	55.27%	195.77	33.09	132.80	295.25
472	Ventura	471	8.01%	222.60	88.06	127.00	568.00
473	Vincent	260	49.22%	259.90	103.39	139.40	568.00
474	Vinton	478	6.64%	230.38	85.14	136.00	562.00
475	Voorhies	198	61.33%	205.51	34.46	135.00	301.33
476	Walcott	251	50.98%	269.64	91.44	156.40	570.00
477	Wallingford	290	43.36%	248.40	95.62	132.00	579.00
478	Walnut	162	68.36%	272.05	121.07	130.80	562.00
479	Wapello	373	27.15%	237.96	68.53	150.00	549.00
480	Washburn	417	18.55%	231.36	83.36	134.00	560.50

Table 2.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
481	Washta	291	43.16%	253.99	99.94	137.75	572.00
482	Watkins	161	68.55%	288.56	114.55	148.50	566.00
483	Waucoma	230	55.08%	258.90	101.38	121.67	545.00
484	Waukee	485	5.27%	224.50	87.58	127.00	569.00
485	Waukon	79	84.57%	306.74	131.94	140.00	531.00
486	Waverly	466	8.98%	221.18	84.12	128.00	547.00
487	Wayland	133	74.02%	240.66	121.71	141.25	564.00
488	Webb	478	6.64%	222.09	89.93	127.60	573.00
489	Webster City	475	7.23%	223.36	87.71	130.00	566.20
490	Wellsburg	94	81.64%	174.88	18.22	143.00	214.00
491	Wesley	476	7.03%	222.38	89.14	128.00	576.00
492	West Bend	495	3.32%	220.59	88.29	128.80	568.00
493	West Burlington	182	64.45%	292.51	110.50	174.20	571.00
494	West Union	249	51.37%	261.02	101.59	135.40	553.00
495	Westgate	111	78.32%	174.33	17.87	131.60	215.75
496	Wever	252	50.78%	279.05	96.23	154.67	564.00
497	Whiting	292	42.97%	255.52	99.75	138.00	573.00
498	Whittemore	489	4.49%	221.26	88.64	129.00	568.00
499	Whitten	272	46.88%	250.20	99.90	139.20	562.00
500	Williams	484	5.47%	219.64	86.19	131.00	567.00
501	Williamsburg	291	43.16%	200.26	32.07	137.00	302.00
502	Winfield	499	2.54%	231.31	80.68	138.20	557.00
503	Winterset	416	18.75%	231.27	90.23	131.25	564.00
504	Winthrop	169	66.99%	281.87	112.18	145.60	557.50
505	Woden	459	10.35%	219.61	91.80	125.60	573.00
506	Woodbine	422	17.58%	230.38	90.54	131.60	571.25
507	Woodward	396	22.66%	232.76	93.06	129.00	570.00
508	Woolstock	450	12.11%	224.87	90.96	128.00	573.00
509	Yale	458	10.55%	220.88	87.20	132.00	567.00
510	Yetter	168	67.19%	272.21	121.17	136.60	572.00
512	Zearing	405	20.90%	233.55	92.38	132.00	568.00

Table 2.1 Indiana Weekly Corn Price Summary Statistics

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
1	Amboy	484	5.47%	243.25	88.50	147.00	599.00
2	Ambia	187	63.48%	244.65	67.47	155.75	401.25
3	Anderson	255	50.20%	268.45	103.52	152.75	598.00
4	Argos	117	77.15%	275.13	138.13	145.50	577.25
5	Attica	224	56.25%	288.12	108.00	158.20	590.50
6	Aurora	474	7.42%	250.20	85.36	151.00	578.00
7	Bluffon	188	63.28%	286.23	117.53	158.00	588.00
8	Boston	266	48.05%	278.22	101.96	152.80	591.00
9	Brazil	469	8.40%	232.71	85.18	141.00	585.00
10	Bremen	446	12.89%	241.47	88.50	145.00	579.00
11	Brook	274	46.48%	227.95	94.04	135.00	590.00
12	Brookston	215	58.01%	282.99	107.35	158.20	581.33
13	Burlington	177	65.43%	312.70	121.17	170.00	614.00
14	Cambria	94	81.64%	224.04	20.34	177.00	276.00
15	Carlisle	434	15.23%	236.09	83.67	150.00	589.00
16	Clay City	259	49.41%	263.54	101.51	147.00	586.00
17	Clymers	61	88.09%	421.54	99.52	306.80	603.40
18	Colfax	94	81.64%	224.08	20.40	177.00	276.00
19	Columbus	491	4.10%	236.79	86.85	137.00	586.00
20	Connersville	405	20.90%	249.38	91.48	146.00	586.00
21	Cortland	308	39.84%	245.28	94.01	139.00	600.00
22	Crawforrdsville	385	24.80%	251.70	93.40	146.00	589.75
23	Dana	475	7.23%	241.62	86.16	147.00	581.00
24	Dacatur	466	8.98%	231.21	96.29	0.00	590.00
25	Delphi	478	6.64%	244.76	87.62	147.20	592.00
26	Dubois	416	18.75%	234.38	74.28	153.00	591.00
27	Dunkirk	486	5.08%	238.83	88.02	145.00	591.00
28	Eaton	181	64.65%	292.98	119.80	154.40	596.00
29	Edinburgh	460	10.16%	243.48	88.68	148.00	592.00
30	Elizabethtown	367	28.32%	232.03	85.91	136.20	596.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 2.1 (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
31	Elwood	223	56.45%	277.32	106.86	152.00	598.00
32	Evansville	480	6.25%	256.69	86.35	156.00	590.20
33	Fowler	314	38.67%	262.73	96.37	158.60	578.00
34	Francesville	330	35.55%	241.73	95.65	140.00	599.80
35	Francisco	136	73.44%	333.79	114.04	168.50	590.00
36	Frankfort	472	7.81%	232.82	85.68	147.00	592.00
37	Franklin	108	78.91%	240.16	25.17	183.60	306.25
38	Geneva	295	42.38%	254.44	83.80	149.00	564.00
39	Glenwood	452	11.72%	243.14	89.02	146.00	596.00
40	Goodland	304	40.63%	259.97	95.86	154.20	583.00
41	Goshen	386	24.61%	223.59	74.40	145.00	589.00
42	Greensburg	510	0.39%	238.70	83.24	143.20	570.60
43	Greentown	464	9.38%	239.69	88.31	143.00	589.00
44	Hagerstown	306	40.23%	271.38	97.86	157.20	597.00
45	Hamlet	496	3.13%	238.21	85.31	143.00	589.00
46	Hammond	397	22.46%	262.93	91.73	165.00	604.00
47	Hebron	88	82.81%	276.40	119.09	142.50	550.00
48	Hope	460	10.16%	239.40	88.22	137.00	586.00
49	Hortonville	138	73.05%	206.62	39.72	145.00	303.50
50	Huntingburg	463	9.57%	248.50	84.48	148.00	584.00
51	Idaville	294	42.58%	305.22	123.88	147.20	631.00
52	Jasonville	104	79.69%	183.60	17.21	144.60	224.80
53	Jasper	436	14.84%	252.15	87.37	148.00	584.00
54	Jeffersonville	479	6.45%	248.61	85.30	151.00	576.80
55	Kentland	271	47.07%	267.97	99.93	154.67	573.50
56	Kersey	292	42.97%	198.01	32.37	139.00	306.50
57	Kwanna	233	54.49%	285.15	97.16	150.00	578.00
58	Kingman	280	45.31%	201.51	30.20	136.00	305.67
59	Knightstown	69	86.52%	403.70	89.10	302.60	579.00
60	Knox	285	44.34%	268.24	98.33	158.00	590.50

Note: Highlighting indicates the grain market was chosen for analysis

Table 2.l (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
61	Kokomo	461	9.96%	245.84	89.73	148.00	599.00
62	Kouts	321	37.30%	198.52	30.62	146.00	307.50
63	L Crosse	431	15.82%	230.31	87.06	144.00	591.00
64	La Fontaine	230	55.08%	251.82	91.22	153.67	599.00
65	Ladoga	175	65.82%	309.91	110.69	160.60	594.00
66	Lafayette	497	2.93%	250.13	85.71	157.00	598.20
67	Lapaz	449	12.30%	241.26	88.26	145.00	579.00
68	Letts	435	15.04%	239.00	92.70	137.00	586.40
69	Linden	471	8.01%	243.55	91.30	146.00	611.00
70	Logansport	474	7.42%	242.96	88.52	147.00	592.00
71	Loogootee	91	82.23%	395.35	82.24	222.00	576.00
72	Lucerne	111	78.32%	174.82	16.38	132.40	210.80
73	Madison	459	10.35%	246.01	84.65	149.00	571.80
74	Marion	381	25.59%	238.34	90.59	150.00	602.00
75	Markle	267	47.85%	248.60	107.69	137.75	574.60
76	Markleville	140	72.66%	329.02	111.33	158.00	596.00
77	Medaryville	426	16.80%	247.45	90.86	142.00	592.00
78	Mellott	288	43.75%	221.53	58.85	138.00	398.00
79	Mexico	111	78.32%	179.41	17.99	134.00	217.80
80	Milroy	125	75.59%	335.10	108.18	189.00	574.67
81	Monon	378	26.17%	246.83	93.93	133.00	601.75
82	Monroe	110	78.52%	237.08	29.25	181.50	305.33
83	Monroeville	65	87.30%	408.45	92.47	305.00	587.00
84	Monticello	245	52.15%	270.87	102.28	151.75	590.00
85	Montpelier	437	14.65%	233.02	85.08	150.00	596.00
86	Morristown	297	41.99%	235.58	86.90	145.60	589.50
87	Mount Vernon	192	62.50%	316.39	105.83	158.33	585.20
88	Nappanee	463	9.57%	237.13	83.75	141.00	585.00
89	New Carlisle	370	27.73%	246.26	88.98	150.60	591.50
90	New Castle	99	80.66%	372.96	104.58	195.33	598.00

Table 2.1 (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
91	New Paris	214	58.20%	230.84	62.14	161.00	525.00
92	Newburgh	459	10.35%	257.23	87.85	155.00	589.20
93	Newtown	37	92.77%	212.23	23.15	185.20	273.00
94	Noblesville	143	72.07%	206.21	38.97	150.40	303.50
95	North Vernon	337	34.18%	239.91	89.57	137.00	585.00
96	Oakville	473	7.62%	236.99	88.50	148.40	591.00
97	Owensville	371	27.54%	216.77	42.30	148.00	382.33
98	Pershing	305	40.43%	268.20	97.66	154.40	587.00
99	Pierceton	257	49.80%	190.45	29.48	134.60	326.00
100	Plymouth	99	80.66%	240.74	25.03	195.75	306.50
101	Poneto	72	85.94%	168.86	18.08	130.50	194.40
102	Portage	456	10.94%	244.35	84.15	152.00	577.00
103	Portland	42	91.80%	459.96	97.39	326.50	608.00
104	Princeton	474	7.42%	248.32	86.34	152.20	590.00
105	Ramsey	233	54.49%	236.16	56.43	167.00	419.20
106	Redkey	61	88.09%	213.04	45.07	136.67	310.00
107	Remington	472	7.81%	234.34	84.93	144.00	583.00
108	Rensselaer	217	57.62%	269.59	101.86	155.50	596.00
109	Reynolds	287	43.95%	265.03	99.18	155.00	590.00
110	Richmond	356	30.47%	220.31	47.27	142.00	557.00
111	Roachdale	253	50.59%	198.53	22.42	148.00	282.00
112	Rochester	381	25.59%	224.98	76.49	145.60	578.25
113	Rockport	171	66.60%	316.38	114.38	158.20	588.20
114	Rolling Prairie	377	26.37%	228.34	90.73	141.80	571.00
115	Romney	177	65.43%	295.43	118.94	154.80	595.00
116	Roselawn	293	42.77%	197.73	32.62	139.00	306.50
117	Rushville	451	11.91%	243.69	84.44	146.40	572.67
118	Russiaville	251	50.98%	205.89	33.37	143.00	311.50
119	Schneider	268	47.66%	204.92	32.52	139.00	307.50
120	Seymour	111	78.32%	175.72	17.97	133.00	208.67

Table 2.l (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
121	Sharpsville	75	85.35%	222.40	21.02	177.00	290.00
122	Shelburn	434	15.23%	247.99	88.88	150.00	589.00
123	Shelbyville	69	86.52%	181.15	20.99	140.00	217.00
124	Sheridan	393	23.24%	216.57	75.03	140.00	591.00
125	Sims	179	65.04%	299.61	118.90	158.00	600.00
126	South Bend	467	8.79%	246.78	86.59	153.00	596.60
127	South Milford	270	47.27%	254.82	109.19	147.00	593.00
128	South Whitley	71	86.13%	181.69	19.04	144.00	218.80
129	Star City	150	70.70%	296.59	119.58	146.00	581.40
130	State Line	205	59.96%	278.93	108.80	159.75	582.00
131	Sullivan	489	4.49%	245.89	85.93	152.00	591.00
132	Summitville	459	10.35%	239.06	89.98	142.00	596.00
133	Swayzee	133	74.02%	275.15	128.54	145.60	599.00
134	Syracuse	105	79.49%	351.27	99.02	181.75	562.20
135	Tefft	296	42.19%	196.87	32.31	138.00	305.50
136	Terre Haute	395	22.85%	237.30	87.31	147.80	593.00
137	Tipton	379	25.98%	248.43	92.25	151.00	592.00
138	Trafalgar	295	42.38%	266.87	101.63	143.00	597.00
139	Union Mills	462	9.77%	233.37	87.30	141.00	591.00
140	Valparaiso	265	48.24%	209.93	50.80	146.00	404.25
141	Vincennes	463	9.57%	243.63	84.59	151.00	586.00
142	Wabash	82	83.98%	180.22	19.15	141.00	217.40
143	Waldron	312	39.06%	236.80	91.59	138.00	586.00
144	Walton	110	78.52%	183.46	16.21	143.00	216.00
145	Wanatah	413	19.34%	204.58	43.74	142.20	398.25
146	Warsaw	438	14.45%	224.02	82.69	140.00	580.00
147	Washington	427	16.60%	231.22	72.36	148.00	580.00
148	Waterloo	463	9.57%	241.47	87.74	149.00	588.00
149	Waveland	362	29.30%	244.01	94.42	134.00	584.75
150	Westfield	91	82.23%	180.95	19.12	139.60	219.80

Table 2.1 (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
151	Whitesville	193	62.30%	249.61	62.67	160.00	409.67
152	Williamsport	264	48.44%	270.61	99.80	156.00	583.67
153	Winamac	316	38.28%	202.20	31.17	138.60	306.00
154	Winchester	295	42.38%	265.54	99.33	153.80	593.00
155	Windfall	82	83.98%	186.47	18.42	147.25	222.00
156	Wingate	342	33.20%	231.99	86.45	138.00	589.50
157	Winslow	250	51.17%	274.34	106.31	157.80	582.00
158	Wolcott	256	50.00%	271.15	104.17	154.00	584.00
159	Woodburn	340	33.59%	251.45	96.14	147.60	591.00
160	Wyatt	448	12.50%	236.72	89.07	144.00	588.00
161	Yoder	151	70.51%	209.51	95.94	141.40	553.50

APPENDIX 2.2: COINTEGRATION RESULTS FOR KANSAS, IOWA AND INDIANA

To discover if the Kansas percentage of corn used in the production of ethanol altered the degree of annual cointegration of corn prices at grain markets in Kansas, a procedure similar to the one used for Michigan was utilized. However, before beginning that procedure it was useful to determine whether the corn prices at different grain markets in Kansas were cointegrated from September 1998 through June 2008. Table 2.m details the statistics relating to the Kansas multivariate cointegration testing of corn prices in Chapman, Hillsboro, Larned and Osborne grain markets from September 1998 through June 2008. Lag length of four was used in the testing because the FPE was minimized at this amount.

Table 2.m Kansas Grain Markets Multivariate Cointegration Testing Results

Null Hypothesis	Alternative Hypothesis	Cointegration Test Stat	5% Critical Value
Trace Test			
Ho: r=0	H1: r>0	121.75*	47.21
Ho: r=1	H1: r>1	58.06*	29.38
Ho: r=2	H1: r>2	23.50*	15.34
Ho: r=3	H1: r>3	3.68	3.84
Max Test			
Ho: r=0	H1: r=1	63.69*	27.07
Ho: r=1	H1: r=2	34.56*	20.97
Ho: r=2	H1: r=3	19.82*	14.07
Ho: r=3	H1: r=4	3.68	3.76

*Indicates rejection of the null hypothesis at 5% significance

Table 2.m presents three cointegrating vectors for the four corn price series using both the maximal eigenvalue test statistic and the trace test statistic. Therefore, the corn

prices at Chapman, Hillsboro, Larned and Osborne grain markets are cointegrated. Thus, the corn prices operate in a stable long-run spatial price equilibrium.

To determine if the Kansas percentage of corn used in the production of ethanol affected the annual cointegration of corn prices at Chapman, Hillsboro, Larned and Osborne we first must determine the annual cointegration statistics for the corn prices at the given grain markets. Table 2.n displays the annual cointegration maximal eigenvalue test statistics as well as the proper lag lengths determined by the minimum value of the FPE. The annual test statistic for the null hypothesis r=3 and the corresponding trace statistics have been excluded from Table 2.n to save space.

Table 2.n Kansas Markets Annual Cointegration Tests

FPE Lag Length Selection	Time Period	Null Hypothesis Ho:	Maximal Eigenvalue Test Statistic	5% Critical Value
2	Sept. 1998-1999	r=0	19.59	27.07
		r=1	10.84	20.97
		r=2	8.14	14.07
1	1999-2000	r=0	34.02*	27.07
		r=1	19.96	20.97
		r=2	12.48	14.07
2	2000-2001	r=0	35.85*	27.07
		r=1	17.13	20.97
		r=2	15.05	14.07
1	2001-2002	r=0	32.49*	27.07
		r=1	21.93	20.97
		r=2	18.88	14.07
1	2002-2003	r=0	42.68*	27.07
		r=1	20.69	20.97
		r=2	1.70	14.07
7	2003-2004	r=0	54.49*	27.07
		r=1	25.05*	20.97
		r=2	12.77	14.07
7	2004-2005	r=0	51.31*	27.07
		r=1	28.2*	20.97
		r=2	19.47*	14.07
5	2005-2006	r=0	31.52*	27.07
		r=1	18.43	20.97
		r=2	7.94	14.07
1	2006-2007	r=0	34.30*	27.07
		r=1	18.21	20.97
		r=2	9.91	14.07
4	2007-2008	r=0	29.08*	27.07
		r=1	25.94*	20.97
		r=2	5.69	14.07
3	2008-June 2008	r=0	93.42*	27.07
		r=1	35.24*	20.97
		r=2	15.06*	14.07

*Indicates rejection of the null hypothesis at 5% significance

Table 2.n indicates the existence of at least one cointegrating vector in ten of the eleven years. To discover if the Kansas percent of corn used in the production of ethanol affected the annual degree of cointegration Efron's bootstrapping technique with 1,000 replications to regress the annual cointegration maximal eigenvalue test statistic (MAXE) on the Kansas percentage of corn used in the production of ethanol in (KS) was employed. The following equation illustrates the results of this procedure:

$$(8)\quad MAXE = \underset{(0.00)}{28.67} + \underset{(0.13)}{96.74} * KS$$

where the numbers in the parentheses are the p-values for the respective parameter estimates. The coefficient for the Kansas percentage of corn used in the production of ethanol variable is not significantly related to the annual degree of cointegration of grain markets in the state of Kansas. The increase in the Kansas percent of corn used in the production of ethanol has not conclusively caused spatial corn price relationships at the Chapman, Hillsboro, Larned and Osborne grain markets to diverge from a long-run equilibrium. This process was also performed by using Efron's bootstrapping technique with 1,000 replications to regress the annual trace test statistics on the percent of ethanol used in the production of ethanol. The results were the same as the above test (i.e. the Kansas percentage of corn used in the production of ethanol was not significantly different from zero).

Besides testing to establish whether the increased percentage of corn in used in the production of ethanol had an effect on the annual degree of cointegration of corn prices at the Chapman, Hillsboro, Larned and Osborne grain markets, also tested was whether the increase in the number of ethanol plants in Kansas altered the annual degree of cointegration of corn prices at the Chapman, Hillsboro, Larned and Osborne grain markets. Using Efron's bootstrapping technique with 1,000 replications and regressing the annual cointegration maximal eigenvalue test statistic (MAXE) on the using number of ethanol plants in Kansas (EPK), the following results were found:

$$(9)\quad MAXE = \underset{(0.079)}{20.36} + \underset{(0.149)}{3.45} * EPK$$

where the numbers in parentheses are the p-values for the respective parameter estimates. The coefficient of the number of ethanol plants in Kansas is not significantly correlated with the annual cointegration maximal eigenvalue test statistic. When this process was performed using Efron's bootstrapping technique with 1,000 replications to regress the annual trace test statistics on the number of ethanol plants in Kansas the estimates from this process indicated that the coefficient for the number of ethanol plants in Kansas variable was not significantly different from zero. Therefore, one cannot conclude that the increase in the number of ethanol plants in the Kansas has caused corn price relationships at the Chapman, Hillsboro, Larned and Osborne grain markets to diverge from a long-run spatial price relationship equilibrium.

Next, the same procedure was utilized to determine if the Iowa percentage of corn used in the production of ethanol altered the annual degree of cointegration of corn prices at the Iowa grain markets of Algona, Aubudon, Cedar Rapids and Chariton. Following past methodology, examined first was whether the corn prices at the Iowa grain markets were cointegrated from September 1998 through June 2008. Table 2.o details the multivariate cointegration testing of the corn prices in Algona, Audubon, Cedar Rapids and Chariton grain markets. Lag length of six was used in the testing because this was the amount that minimized the FPE.

Table 2.o Iowa Grain Markets Multivariate Cointegration Testing Results

Null Hypothesis	Alternative Hypothesis	Cointegration Test Stat	5% Critical Value
Trace Test			
Ho: r=0	H1: r>0	142.45*	47.21
Ho: r=1	H1: r>1	74.75*	29.38
Ho: r=2	H1: r>2	32.67*	15.34
Ho: r=3	H1: r>3	1.36	3.84
Max Test			
Ho: r=0	H1: r=1	67.70*	27.07
Ho: r=1	H1: r=2	42.08*	20.97
Ho: r=2	H1: r=3	31.32*	14.07
Ho: r=3	H1: r=4	1.36	3.76

*Indicates rejection of the null hypothesis at 5% significance

Table 2.o displays three cointegrating vectors for the four corn price series using both the maximal eigenvalue test statistic and the trace test statistic. Therefore, the corn prices at Algona, Audubon, Cedar Rapids and Chariton are cointegrated. Thus, the corn prices operate in a stable long-run spatial price equilibrium.

To determine if the Iowa percentage of corn used in the production of ethanol affected the annual cointegration of corn prices at Algona, Audubon, Cedar Rapids and Chariton the annual cointegration statistics for the corn prices at the given grain markets must be determined. Table 2.p displays the annual cointegration maximal eigenvalue test statistics as well as the proper lag lengths determined by the minimum value of the FPE. The annual test statistic for the null hypothesis r=3 and the corresponding trace statistics have been excluded from Table 2.p to save space.

Table 2.p Iowa Markets Annual Cointegration Tests

Lag Length (using FPE)	Time Period	Null Hypothesis Ho:	Maximal Eigenvalue Test Statistic	5% Critical Value
2	Sept. 1998-1999	r=0	25.68	27.07
		r=1	16.70	20.97
		r=2	12.66	14.07
1	1999-2000	r=0	56.25*	27.07
		r=1	25.38*	20.97
		r=2	9.90	14.07
7	2000-2001	r=0	41.41*	27.07
		r=1	25.80*	20.97
		r=2	16.19	14.07
1	2001-2002	r=0	91.75*	27.07
		r=1	33.73*	20.97
		r=2	20.73*	14.07
4	2002-2003	r=0	34.41*	27.07
		r=1	21.59*	20.97
		r=2	15.87*	14.07
3	2003-2004	r=0	24.58	27.07
		r=1	12.52	20.97
		r=2	7.43	14.07
2	2004-2005	r=0	22.47	27.07
		r=1	12.15	20.97
		r=2	8.42	14.07
4	2005-2006	r=0	49.46*	27.07
		r=1	26.32*	20.97
		r=2	8.73	14.07
5	2006-2007	r=0	36.36*	27.07
		r=1	15.12	20.97
		r=2	9.07	14.07
2	2007-2008	r=0	19.94	27.07
		r=1	10.59	20.97
		r=2	7.09	14.07
2	2008-June 2008	r=0	45.63*	27.07
		r=1	14.15	20.97
		r=2	6.25	14.07

*Indicates rejection of the null hypothesis at 5% significance

Table 2.p indicates the existence of at least one cointegrating vector in seven of the eleven years. To discover if the Iowa percent of corn used in the production of ethanol affected the annual degree of cointegration we employed Efron's bootstrapping technique with 1,000 replications to regress the annual cointegration maximal eigenvalue test statistic (MAXE) on the Iowa percentage of corn used in the production of ethanol in (IA). The following equation illustrates the results of this procedure:

$$(10)\quad MAXE = \underset{(0.01)}{47.69} - \underset{(0.66)}{28.35} * IA$$

where the numbers in the parentheses are the p-values for the respective parameter estimates. As illustrated by its corresponding p-value, the coefficient for the Iowa percent of corn used in the production of ethanol is not significantly different from zero. Therefore, the Iowa percentage of corn used in the production of ethanol is not significantly related to the annual degree of cointegration of grain markets in the state of Iowa. Alternatively stated, one cannot conclude that the increase in the Iowa percent of corn used in the production of ethanol has caused spatial corn price relationships at the Algona, Audubon, Cedar Rapids and Chariton grain markets to diverge from a long-run equilibrium. This process was also performed by using Efron's bootstrapping technique with 1,000 replications to regress the annual trace test statistics on the percent of ethanol used in the production of ethanol. The results were the same as the above test (i.e. the Iowa percentage of corn used in the production of ethanol was not significantly different from zero.)

Besides testing to establish whether the increased percentage of corn in used in the production of ethanol had an effect on the annual degree of cointegration of corn prices at the Algona, Audubon, Cedar Rapids and Chariton grain markets, also tested was whether the increase in the number of ethanol plants in Iowa altered the annual degree of cointegration of corn prices at the Algona, Audubon, Cedar Rapids and Chariton grain markets. Using Efron's bootstrapping technique with 1,000 replications and regressing the annual cointegration maximal eigenvalue test statistic (MAXE) on the using number of ethanol plants in Iowa (EPIA), the following results were found:

$$(11)\quad MAXE = \underset{(0.000)}{46.87} - \underset{(0.505)}{0.43} * EPIA$$

where the numbers in parentheses are the p-values for the respective parameter estimates. Therefore, the coefficient for the number of ethanol plants in Iowa is not significantly correlated with the annual cointegration maximal eigenvalue test statistic. This process was also performed by using Efron's bootstrapping technique with 1,000 replications to regress the annual trace test statistics on the number of ethanol plants in Iowa The results found that the number of ethanol plants in Iowa variable was not significantly different from zero. The increase in the number of ethanol plants in the Iowa did not conclusively cause corn price relationships at the Algona, Audubon, Cedar Rapids and Chariton grain markets to diverge from a long-run spatial price relationship equilibrium.

Next, the same procedure was used to determine if the Indiana percentage of corn used in the production of ethanol altered the annual degree of cointegration of corn prices at the Indiana grain markets of Columbus, Delphi, Greensburg and Hamlet. Staying consistent with past methodology, whether the corn prices at the Indiana grain markets were cointegrated from September 1998 through June 2008 was determined. Table 2.q details the multivariate cointegration testing of the corn prices in Columbus, Delphi, Greensburg and Hamlet markets. Lag length of four was used in the testing because this was the amount that minimized the FPE.

Table 2.q Indiana Grain Markets Multivariate Cointegration Testing Results

Null Hypothesis	Alternative Hypothesis	Cointegration Test Stat	5% Critical Value
Trace Test			
Ho: r=0	H1: r>0	206.22*	47.21
Ho: r=1	H1: r>1	121.48*	29.38
Ho: r=2	H1: r>2	42.57*	15.34
Ho: r=3	H1: r>3	1.60	3.84
Max Test			
Ho: r=0	H1: r=1	84.74*	27.07
Ho: r=1	H1: r=2	78.90*	20.97
Ho: r=2	H1: r=3	40.97*	14.07
Ho: r=3	H1: r=4	1.60	3.76

*Indicates rejection of the null hypothesis at 5% significance

Table 2.q displays three cointegrating vectors for the four corn price series using both the maximal eigenvalue test statistic and the trace test statistic. Therefore, the corn price series at Columbus, Delphi, Greensburg and Hamlet contain are cointegrated. Therefore, the corn prices operate in a stable long-run spatial price equilibrium.

To determine if the Indiana percentage of corn used in the production of ethanol affected the annual cointegration of corn prices at Columbus, Delphi, Greensburg and Hamlet we must determine the annual cointegration statistics for the corn prices at the given grain markets. Table 2.r displays the annual cointegration maximal eigenvalue test statistics as well as the proper lag lengths determined by the minimum value of the FPE. The annual test statistic for the null hypothesis r=3 and the corresponding trace statistics have been excluded from Table 2.r to save space.

Table 2.r Indiana Markets Annual Cointegration Tests

Lag Length (using FPE)	Time Period	Null Hypothesis Ho:	Maximal Eigenvalue Test Statistic	5% Critical Value
2	Sept. 1998-1999	r=0	27.73*	27.07
		r=1	11.79	20.97
		r=2	6.95	14.07
7	1999-2000	r=0	35.96*	27.07
		r=1	29.14*	20.97
		r=2	6.23	14.07
1	2000-2001	r=0	32.29*	27.07
		r=1	26.22*	20.97
		r=2	9.74	14.07
6	2001-2002	r=0	42.87*	27.07
		r=1	26.63*	20.97
		r=2	5.29	14.07
1	2002-2003	r=0	52.87*	27.07
		r=1	16.76	20.97
		r=2	5.81	14.07
7	2003-2004	r=0	69.66*	27.07
		r=1	15.10	20.97
		r=2	9.07	14.07
1	2004-2005	r=0	15.97	27.07
		r=1	14.94	20.97
		r=2	5.83	14.07
1	2005-2006	r=0	22.38	27.07
		r=1	11.83	20.97
		r=2	6.17	14.07
5	2006-2007	r=0	30.48*	27.07
		r=1	19.77	20.97
		r=2	8.88	14.07
6	2007-2008	r=0	72.97*	27.07
		r=1	25.77*	20.97
		r=2	10.03	14.07
2	2008-June 2008	r=0	28.82*	27.07
		r=1	17.31	20.97
		r=2	10.79	14.07

*Indicates rejection of the null hypothesis at 5% significance

Table 2.r indicates the existence of at least one cointegrating vector in nine of the eleven years. To discover if the Indiana percent of corn used in the production of ethanol affected the annual degree of cointegration we employed Efron's bootstrapping technique with 1,000 replications to regress the annual cointegration maximal eigenvalue test statistic (MAXE) on the Indiana percentage of corn used in the production of ethanol in (IN). The following equation illustrates the results of this procedure:

$$(12)\quad MAXE = \underset{(0.21)}{38.37} + \underset{(0.99)}{10.51} * IN$$

where the numbers in the parentheses are the p-values for the respective parameter estimates. As evidenced by its corresponding p-value, the coefficient for the Indiana percent of corn used in the production of ethanol is not significantly different from zero. Thus, the Indiana percentage of corn used in the production of ethanol is not significantly related to the annual degree of cointegration of grain markets in the state of Indiana. Te increase in the Indiana percent of corn used in the production of ethanol did not conclusively cause spatial corn price relationships at the Columbus, Delphi, Greensburg and Hamlet grain markets to diverge from a long-run equilibrium. This process was also performed by using Efron's bootstrapping technique with 1,000 replications to regress the annual trace test statistics on the percent of ethanol used in the production of ethanol. The results were the same as the above test (i.e. the Indiana percentage of corn used in the production of ethanol was not significantly different from zero).

Besides testing to establish whether the increased percentage of corn in used in the production of ethanol had an effect on the annual degree of cointegration of corn prices at the Columbus, Delphi, Greensburg and Hamlet grain markets, also tested was whether the increase in the number of ethanol plants in Indiana altered the annual degree of cointegration of corn prices at the Columbus, Delphi, Greensburg and Hamlet grain markets. Using Efron's bootstrapping technique with 1,000 replications and regressing the annual cointegration maximal eigenvalue test statistic (MAXE) on the using number of ethanol plants in Indiana (EPIN), the following results were found:

$$\text{(13)}\quad MAXE = \underset{(7.10)}{38.44} + \underset{(0.849)}{0.51} * EPIN$$

where the numbers in parentheses are the p-values for the respective parameter estimates. The coefficient for the number of ethanol plants in Indiana is not significantly correlated with the annual cointegration maximal eigenvalue test statistic. When this process was performed using Efron's bootstrapping technique with 1,000 replications to regress the annual trace test statistics on the number of ethanol plants in Indiana the estimated results found that the coefficient for the number of ethanol plants in Indiana variable was not significantly different from zero. Therefore it was not concluded that the increase in the number of ethanol plants in the Indiana caused corn price relationships at the Columbus, Delphi, Greensburg and Hamlet grain markets to diverge from a long-run spatial price relationship equilibrium.

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CHAPTER 3: THE IMPACT OF ETHANOL PLANT OPENINGS ON CORN PRICE BASIS LEVELS

3.1 Introduction

In recent years there has been a rapid increase in the number of ethanol plants in the United States. In the previous chapter it was determined that corn price *relationships* at different grain markets were not affected by the increase in the percent of corn that went into the production of ethanol from September 1998 through June 2008. However, it is possible that corn price *levels* at particular grain markets were affected when new ethanol plants were built within the same region of an existing grain market. From September 1998 through June 2008 several ethanol plants were built that used corn as their primary input. This likely affected corn price levels at grain markets close to the newly constructed ethanol plants. When the ethanol plants began purchasing corn to produce ethanol, the local demand for corn at grain markets near the ethanol plant increased. Therefore, it is expected that the appearance of new ethanol plants caused increases in corn price levels at nearby grain markets.

The idea that newly introduced ethanol plants affect different aspects of agriculture in the region of the ethanol plant opening has previously been studied by Henderson and Gloy (2009). They determined that land price changes were consistent with previous estimates of basis change associated with ethanol plant location. Henderson and Gloy cite McNew and Griffith (2005) as studying the impact ethanol plant openings had on local grain prices. McNew and Griffith estimated the impact of twelve corn-based ethanol plants that opened between March 2000 and March 2003 on local corn price levels. They discovered the average impact on corn price basis levels after an ethanol plant opened was positive 12.5 cents at grain markets located at the site of an ethanol plant opening. The 12.5 cent increase was the average corn price basis impact over the entire time period after an ethanol plant opened. Corn price basis levels are defined as the corn price at a local grain market less the futures contract corn price at the Chicago Board of Trade. If corn price basis levels increase at a local grain market, this indicates that the corn price at the local grain market has increased relative to the futures contract corn price at the Chicago Board of Trade.

Other studies suggest ethanol plant openings have not increased corn price basis levels. Katchova (2009) used USDA's ARMS data to discover that farmers located close to ethanol plants did not received significantly higher corn prices compared to farmers who live further away from ethanol plants. Katchova found farmers located in the same zip code of an ethanol plant contracted their corn for an average of 10.9 cents lower than farmers who did not live in the same zip code of an ethanol plant.

Basis values are influenced by local supply and demand conditions, transportation costs, and local storage costs for corn. Variation in the location of the final demand center for the contracted corn creates differences in transportation costs which also contribute to the discrepancies in local corn price levels at different grain markets. For example, if the final demand center for the contracted corn is farther away from the grain market where the corn was contracted, this causes transportation costs to increase which leads to declining local corn prices. If a farmer contracts his or her corn to a grain market in Marlette, MI and the corn is to be delivered to an ethanol plant in Marysville, MI, the transportation cost is lower than if the corn is to be delivered to a feedlot in Indiana.

Otherwise stated, if the corn has to be shipped a shorter distance, the corn's basis level increases. The local corn price recorded at the Marlette, MI, grain market would be higher if the corn was delivered to Marysville, MI, than if the corn was delivered to the feedlot in Indiana. Consequently, the ethanol plant opening in Marysville created a new demand center in the state of Michigan, which is expected to increase local corn price levels at grain markets located nearby (Marlette) because the ethanol plant opening lowered transportation costs for the closest demand center as well as increased the local demand for corn.

Following this logic, McNew and Griffith examined how ethanol plant openings changed local corn price levels at different grain markets. They argued the introduction of a new demand source for grain could induce shifts in trade patterns and adjust the spatial characteristics of grain prices around an ethanol plant opening. To conceptualize the introduction of a new demand center (ethanol plant), McNew and Griffith began their framework by assuming initially that only one demand center for the grain's final demand destination existed. They referred to this final demand center as "terminal market," and described it as being located at the end of a line segment measured in distance $d \in [0,1]$. Therefore, "terminal market" was located at $d=1$. Next, McNew and Griffith assumed the price producers received for their corn that was shipped to "terminal market" was adjusted for transportation costs; therefore, the price at any location along d could be expressed in terms of the terminal market price, P^T, and the per unit cost of shipping, r:

(1) $$P(d) = P^T - r\,(1-d).$$

Using this equation, McNew and Griffith explain that the price for corn continuously increases as one moves closer to the terminal market (as d approaches 1). Similarly, as a result of an ethanol plant opening, it is probable that corn price levels increased at the site of an ethanol plant opening. Additionally, the price impact of the ethanol plant openings is most likely spatially varied across the line segment.

To empirically determine if corn price basis levels increased at the site of an ethanol plant opening, the following section will expand upon modeling techniques similar to the empirical models used by McNew and Griffith. They used a spatial econometric model to examine how corn price basis levels adjusted to changes in national and local corn production, seasonality, transportation rates and the distance grain markets were away from ethanol plant openings.

Our modeling of the impact ethanol plant openings had on local corn price basis levels aims to improve the work completed by McNew and Griffith. Our data set examines ethanol plant openings from September 1998 through June 2008 compared to McNew and Griffith who examined ethanol plant openings from March 2000 through March 2003. Examining the impact ethanol plant openings have on corn price basis levels over an eleven year time frame rather than three years will provide a more complete analysis of the impact increased ethanol production had on corn price basis levels. It is worth noting that between September 1998 and June 2008 forty-two ethanol plants opened in Michigan, Kansas, Iowa and Indiana (the states studied in the upcoming analysis) while only twelve ethanol plant openings occurred between March 2000 and March 2003.

McNew and Griffith estimated the effect ethanol plant openings had on corn price basis levels over the average of the entire time period after the ethanol plant opened. They did not include any time effect variables in their models. Our analysis will also study the impact ethanol plant openings had on corn price basis levels over the average of the entire time period after the ethanol plant opened. However, our analysis will also add time component variables that estimate the impact ethanol plant openings had on corn price basis levels each month after the ethanol plant opened. By studying the impact ethanol plant openings had on corn price basis levels each month after an ethanol plant opened we will be able to determine how quickly the corn market adjusted to increased demand created by increased ethanol production. Together, a longer time frame and the addition of a time component will enhance the work completed by McNew and Griffith to create a more comprehensive analysis of the impact ethanol plant openings had on corn price basis levels.

3.2 Materials and Methods

To determine if corn price basis levels at different grain markets were affected by ethanol plants openings, corn price basis levels at different grain markets in Michigan, Kansas, Iowa and Indiana were identified. As previously mentioned, corn price basis levels are determined by local supply and demand, transportation costs, and local storage costs for corn. Local market conditions, rather than national market circumstances, are reflected by corn price basis levels. Therefore, we are able to establish what effect ethanol plant openings had on local grain markets by examining corn price basis levels.

Corn price basis levels from September 1998 through June 2008 were purchased from Cash Grain Bids Data Service. McNew and Griffith (2005) also acquired corn price data from Cash Grain Bids Data Service. For this study, daily corn basis levels were collected from every grain market Cash Grain Bids Data Service had data on within 300 miles of Omaha, Nebraska and within 300 miles of Indianapolis, Indiana. Monthly corn basis level averages were created from the daily basis level observations recorded by Cash Grain Bids Data Service. Additionally, only monthly corn price basis level averages at grain markets located in Michigan, Kansas, Iowa and Indiana were compiled.

Michigan, Kansas, Iowa and Indiana account for approximately fifty-two percent of the national annual production of ethanol (Ethanol Producer Magazine). These four states also account for approximately thirty-two percent of the total corn produced in the United States (USDA 1). Iowa, from 1998 through 2008, annually produced the most corn in the nation (USDA 1). Together, these states provide insight into how increased ethanol production has affected corn price basis levels in the Midwestern United States.

The summary statistics for the monthly corn basis levels at grain markets in Michigan, Kansas, Iowa and Indiana are found Appendix 1. Highlighted in Appendix 1 are the grain markets that were used in each state for this study. As shown in Appendix1, not all grain markets contained 100% of their monthly corn price basis level observations. To determine which grain markets to study in each state, a criterion was established that each grain market had to be missing less than five percent of their monthly corn price basis level observations. In Michigan, sixteen grain markets were missing less than five percent of their monthly observations. Kansas contained thirty-three grain markets that were missing less than five percent of their monthly observations. Out of the thirty-three grain markets in Kansas, seven were not missing any monthly basis observations. In Iowa, 121 grain markets were missing less than five percent of their monthly basis observations and fifty-seven of these grain markets were not missing any monthly basis observations. In Indiana, thirty-four markets were missing less than five percent of their monthly basis observations and four of these grain markets contained 100% of their monthly basis observations.

Missing monthly observations for the grain markets used in this analysis were predicted by examining the grain market's weekly corn price observations which were also compiled from the daily corn price observations recorded by Cash Grain Bids Data Service. The weekly corn price observations also included missing observations. Therefore, missing weekly corn price observations were predicted by regressing the Chicago corn price time series with each individual grain market's corn price time series. The weekly average Chicago corn price time series from September 1998 through June 2008 was recorded by the Livestock Market Information Center. To create the weekly corn price basis levels, once the weekly corn price observations were predicted, the weekly corn price observations less the Chicago corn price observations were calculated. The weekly grain market corn price basis levels were then compiled into monthly corn price basis levels which were used in the ensuing analysis.

Ethanol plant information was also required to determine the impact ethanol plant openings had on corn price basis levels at grain markets located nearby. Ethanol plant construction information was compiled from the Renewable Fuels Association and Ethanol Producer Magazine. For this study, all ethanol plant openings that occurred between September 1998 and June 2008 in the states of Michigan, Kansas, Iowa and

Indiana were identified. However, ethanol plants that produced less than twenty million gallons of ethanol a year were omitted from analysis. Ethanol plants with annual production capacity of less than twenty million gallons were not thought to impact corn price basis levels the same as ethanol plants with annual production capacity of more than fifty million gallons (which is the production capacity of many ethanol plants in this analysis). Therefore, ethanol plants in Steamboat Rock, IA, Atchison, KS, Garden City, KS, Leoti, KS, and Scandia, KS, were omitted from this analysis because they produced less than twenty million gallons of ethanol a year.

In Iowa, ethanol plants in Corning, IA, Gowrie, IA, and Nevada, IA, all opened in May 2006. This is the only instance where more than one ethanol plant opened in a single month for a given state. To properly examine the monthly effect of ethanol plant openings on corn price basis levels, only the ethanol plant opening at Corning, IA, was examined. Therefore, the ethanol plant openings at Gowrie, IA, and Nevada, IA, were also excluded from analysis.

Table 3.a displays ethanol plant data used for analysis in Michigan. Table 3.a illustrates the number of grain markets with recorded basis observations located within 150 miles of an ethanol plant opening. McNew and Griffith also determined the effect ethanol plant openings had on grain market's corn price basis levels that were located within 150 miles of an ethanol plant opening. They considered grain markets only within 150 miles of an ethanol plant opening in their study because this process allowed them to consider a definite market impact for each ethanol plant opening. For this analysis, a 150 mile radius approach was used for similar reasons. Smaller radius approaches were

considered, but were not feasible given the lack of grain observations around several ethanol plants.

Table 3.a Michigan Ethanol Plants Opening and Grain Markets Nearby

Michigan Plant Location	Start-up Date	Plant Capacity (Million Gallons Per Year)	Number of Grain Markets in 150-m square area
Caro	November, 2002	50	15
Albion	August, 2006	55	16
Lake Odessa*	September, 2006	50	16
Riga	February, 2007	57	15
Marysville	October, 2007	50	10

*Owned by VeraSun which declared bankruptcy in the Fall of 2008

The ethanol plant in Lake Odessa, MI, was owned by VeraSun Energy Corporation and went bankrupt in the Fall of 2008. This information is irrelevant to our analysis because our data set ends in June of 2008.

Table 3.b illustrates the Kansas ethanol plant information used in the ensuing analysis. Table 3.b displays ethanol plant opening dates in the state of Kansas as well as the number of grain markets with recorded basis observations located within 150 miles of an ethanol plant opening.

Table 3.b Kansas Ethanol Plant Openings and Grain Markets Nearby

Kansas Plant Location	Start-up Date	Plant Capacity (Million Gallons Per Year)	Number of Grain Markets in 150-m square area
Russell	October 2001	50	23
Colwich	December 2002	25	25
Oakley	January 2004	45	10
Garnett	January 2005	35	20
Phillipsburg	January 2006	40	19
Pratt*	June 2007	55	22
Garden City	October 2007	55	10
Liberal	December 2007	110	7
Lyons	May 2008	55	26

*Declared bankruptcy in February 2008

The ethanol plant in Pratt, KS went bankrupt in February 2008 and this information is incorporated into the Kansas model which is explained in the upcoming section.

Table 3.c displays ethanol plant opening dates in the state of Iowa as well as the number of grain markets with recorded basis observations located within 150 miles of an ethanol plant opening. Table 3.c illustrates the information used for the ensuing analysis.

Table 3.c Iowa Ethanol Plant Openings and Grain Markets Nearby

Iowa Plant Location	Start-up Date	Plant Capacity (Million Gallons Per Year)	Number of Grain Markets in 150-m square area
Sioux Center	November 2001	55	69
Galva	February 2002	30	98
Coon Rapids	August 2002	54	109
Lakota	November 2002	100	99
Marcus	April 2003	92	86
Hanlontown	February 2004	55	97
Ashton	March 2004	55	76
West Burlington	April 2004	92	35
Iowa Falls	November 2004	100	111
Mason City	December 2004	80	100
Emmetsburg	April 2005	50	105
Denison	September 2005	55	97
Fort Dodge*	October 2005	110	113
Goldfield	December 2005	50	113
Jewell	March 2006	60	116
Corning	May 2006	60	80
Fairbank	June 2006	115	86
Albert City*	November 2006	100	113
Charles City*	April 2007	110	105
Shenandoah	June 2007	50	92
Superior	November 2007	50	58
St. Ansgar	February 2008	100	92

*Owned by VeraSun which declared bankruptcy in the Fall of 2008

Ethanol plants in Fort Dodge, IA, Albert City, IA, and Charles City, IA were all owned by VeraSun Energy Corporation which declared bankruptcy in the Fall of 2008. June 2008 is the end of this model's data set, so this information is not incorporated in the upcoming model.

Table 3.d displays ethanol plant opening dates in the state of Indiana as well as the number of grain markets with recorded basis observations located within 150 miles of

an ethanol plant opening. The information contained in Table 3.d is used in the upcoming analysis.

Table 3.d Indiana Ethanol Plants Opening and Grain Markets Nearby

Indiana Plant Location	Start-up Date	Plant Capacity (Million Gallons Per Year)	Number of Grain Markets in 150-m square area
Rensselaer	January 2007	40	26
Marion	March 2007	40	29
Clymers	May 2007	110	29
Linden*	August 2007	100	31
Portland	September 2007	60	28
Alexandria	April 2008	65	30

*Owned by VeraSun which declared bankruptcy in the Fall of 2008

The ethanol plant in Linden, IN, was owned by VeraSun Energy Corporation and went bankrupt in the the Fall of 2008. This model's data set ends in June 2008, so this information is not contained in the approaching model.

To determine the effect of an ethanol plant opening on corn price basis levels from September 1998 through June 2008, a state by state approach was utilized. The first state examined was Michigan. The following model was utilized to examine the impact ethanol plant openings had on corn price basis levels in Michigan over the average time period after an ethanol plant opened:

$$(2)\ B_{it} = \alpha_0 USC_t + \alpha_1 MC_t + \Sigma_k^{11} \alpha_{2k} MO_k + \Sigma_i^{15} \alpha_{3i} MK_i$$
$$+ \Sigma_{e=1}^{5} R_{ie} E_{et} [\delta_e + \beta_{e1} DIST_{ei} + \beta_{e2} (DIST_{ei})^2 + \beta_{e3} r_t DIST_{ei}$$
$$+ \beta_{e4} r_t (DIST_{ei})^2] + e_{it}$$

where B_{it} is the basis for grain market i in time period t, USC_t is U.S. corn production at time t and MC_t is corn production in the state of Michigan at time t. Both U.S. and

Michigan corn production are in millions of bushels and are the same values from October through September because corn is harvested in October. The variable MO_k is a dummy variable indicating the month of the year which is used to estimate seasonality in basis levels. The variables MK_i are dummy variables equal to one if the corn price basis observations are from grain market i. The variable R_{ie} is a dummy variable indentifying whether grain market i is within 150 miles of ethanol plant e (in the region of ethanol plant e) where $R_{ie}$is equal to one if grain market i is within 150 miles of an ethanol plant and equal to zero otherwise. The variable E_{et} is a dummy variable indicating whether ethanol plant e is open at time t where E_{et} is equal to one if ethanol plant e is open at time t and equal to zero otherwise. There are five ethanol plant openings in Michigan; therefore, e is indexed from one to five. The variable r_t is U.S. average retail diesel price used to estimate trucking costs. The observations for this variable were compiled from the United States Energy Information Administration. The variable $DIST_{ei}$ is the distance grain market i is from ethanol plant e and $(DIST_{ei})^2$ is the distance grain market i is from ethanol plant e squared.

Equation (2) most likely has spatially correlated errors because many grain markets are located close to each other and operate in overlapping grain production/demand areas. For a given time period, any two grain markets i and j will likely have positive correlation which violates the assumptions of an ordinary least squares regression (McNew and Griffith 2005). To deal with this problem, Anselin (1998) provides a maximum likelihood method for estimating models using cross-sectional spatial data. Following Anselin's methodology, LeSage and Pace (2009) created a regression model that account for spatial autocorrelation. Similarly, the model we estimated is a spatial error model (SEM) that deals with spatial autocorrelation:

(3)
$$y = X\beta + u$$
$$u = \lambda W u + \epsilon$$
$$\epsilon \sim N(0, \sigma^2 I \quad)$$

where y is an nx1 vector of cross-sectional dependent variables and X represents an nxk matrix of explanatory variables. W is an nxn spatial weight matrix which has zeros along the main diagonal and rows that contain zeros in positions associated with non-contiguous observational units and ones in positions reflecting neighboring units that are first-order contiguous (LeSage and Pace 2009). The spatial weight matrix W quantifies the spatial aspect of the data by signifying which observations are correlated. The spatial weight matrix's (W) coefficient λ represents the serial correlation problem in the time-series models (McNew and Griffith 2005). If λ is found to be significant, then observations in the same neighboring area exhibit serial correlation.

To construct the spatial weight matrix (W) the latitude and longitude of all the grain markets in Michigan were used. Following LeSage and Pace, a function in MATLAB named xy2cont, which is part of Pace and Barry's Spatial Statistics Toolbox, was utilized. This function uses triangles connecting the x-y coordinates in space to deduce contiguous entries (LeSage and Pace 2009). If two grain markets are contiguous, the spatial weight matrix (W) places a one in the cells of the matrix which links the two grain markets.

Many journal articles have cited several ways of dealing with spatial autocorrelation problems in models. Overmars et al. (2003) discuss various ways of dealing with spatial autocorrelation in land use models. Overmars et al. also explain the usage of models created by LeSage and Anselin to overcome the problem of spatial autocorrelation. Furthermore, Lambert et al. (2006) discuss using LeSage's MATLAB code to account for spatial autocorrelation when modeling the effect different attributes had on manufacturing investment flows throughout Indiana between 2000 and 2004.

To further examine the impact ethanol plant openings had on corn price basis levels, a second model was built expanding equation (2) that allows the basis effect to adjust as the number of months since an ethanol plant opening increases. Allowing the basis effect to change as the number of months since an ethanol plant opened increases allows Model II to estimate a more practical basis effect. Model I assumes an average basis effect for the entire time period after the ethanol plant opened. Model II allows basis variation to adjust to market conditions as the months since an ethanol plant opening increases. Model II will use equation (3) to account for spatial correlation. Specific for the state of Michigan, Model II is as follows:

$$(4)\ B_{it} = \alpha_0 USC_t + \alpha_1 MC_t + \Sigma_k^{11} \alpha_{2k} MO_k + \Sigma_i^{15} \alpha_{3i} MK_i$$

$$+ \Sigma_{e=1}^{5} R_{ie} E_{et} [\delta_e + \beta_{e1} DIST_{ei} + \beta_{e2} (DIST_{ei})^2 + \beta_{e3} r_t DIST_{ei}$$

$$+ \beta_{e4} r_t (DIST_{ei})^2 + \beta_{e3} MOopen_e + e_{it}$$

where the common variables are defined the same as in equation (2), the variable $MOopen_e$ is the number of months since ethanol plant e opened. The variable $MOopen_e$ is equal to zero prior to the opening of ethanol plant e. After ethanol plant e opens, the variable $MOopen_e$ is equal to the number of months since the ethanol plant opened. For example, after the ethanol plant has been opened for one month, the variable $MOopen_e$ is equal to one.

3.3 Results and Implications

Results for Michigan's Model I, which estimated equation (2) using the maximum likelihood method following equation (3), are found in table 3.e.

Table 3.e Michigan Equation (2) Estimated Results

Variable	Coeff.	Variable	Coeff.	Variable	Coeff.
USC	7.4E-4**	Blissfield	6.9788**	Webberville	1.6156**
MC	-0.1615**	Breckenridge	-4.0738**	Yale	-0.5298
January	3.9103**	Buchanan	-1.4109*		
February	5.3723**	Caledonia	-1.7518**		
March	2.8123**	Hamilton	5.6771**		
April	6.4076**	Holland	11.5830**		
May	5.6843**	Imlay City	0.1388		
June	9.5189**	Jasper	1.2185*		
July	8.5343**	Lake Odessa	-5.0323**		
August	9.8559**	Marlette	-2.9073**		
September	-0.2785	Middleton	-5.1165**		
October	-2.4109**	Newago	-1.0773		
November	1.7605**	Ottawa Lake	10.5695**		
Variable	**Caro**	**Albion**	**Lake Odessa**	**Riga**	**Marysville**
RE(DIST)	0.8883**	-2.3097**	0.6638	-0.2863	-0.4446
RE(DIST)^2	-0.0053**	0.0140**	-0.0018	0.0031	0.0038
REr(DIST)	-0.0046**	0.0069**	-0.0019	7.4E-4	9.7E-5
REr(DIST)^2	2.7E-5**	-4.2E-5**	0.0E-6	-1.2E-5*	-5.0E-6
RE	10.0978**	5.3319**	12.3065**	17.8666**	19.2172**

Note: R^2=0.6826 and the spatial error coefficient λ=0.7960 was significant at the 1% level.
* Indicates significance at the 5% level.
** Indicates significance at the 1% level.

Table 3.e shows that λ was statistically significant. Therefore, using equation (3) and running the Model I to account for spatial autocorrelation in the error terms, rather than conducting an ordinary least squares regression, was important. The variable USC_t is annual corn production in the United States. This variable was significant at the five percent level and positive. To interpret this coefficient, if corn production in the United States were to increase by one billion bushels, corn price basis levels in Michigan would increase by 0.74 cents. This result is unexpected because as corn production in the U.S. increases, local basis levels are expected to fall because of the increase in national supply. The variable MC_t is annual corn production in Michigan, which is significant at the one percent level. If Michigan corn production were to increase by five million bushels, Michigan corn price basis levels would decrease by 0.81 cents. This is consistent with expected results because as corn supply increases, corn price basis levels are expected to decrease.

Table 3.e also shows the month dummy variables were significant, except for September. The monthly dummy variables fluctuate which indicates seasonal patterns were existent in corn basis levels at different grain markets in Michigan. The greatest increase in basis levels was felt in the summer months (i.e. basis levels increased on average 9.8559 cents in August). The greatest weakening of corn price basis levels was felt in October, the month most corn is harvested. The grain market dummy variables were significant at all grain markets. If a grain market was located in Holland relative to Zeeland corn price basis levels were 11.58 cents higher.

The coefficients of the variables $R_{ie}E_{et}DIST_{ei}$ and $R_{ie}E_{et}(DIST_{ei})^2$ and $R_{ie}E_{et}r_tDIST_{ei}$ and $R_{ie}E_{et}r_t(DIST_{ei})^2$ were significant for Caro and Albion ethanol plants. The variable $R_{ie}E_{et}DIST_{ei}$ is the distance grain market i is from ethanol plant e, multiplied by the dummy variable R_{ie} which indicates whether grain market i is within 150-miles of ethanol plant e and multiplied by the dummy variable E_{et} which indicates whether ethanol plant e is open at time t. The variables $R_{ie}E_{et}r_tDIST_{ei}$ and $R_{ie}E_{et}r_t(DIST_{ei})^2$ are the same as the variables $R_{ie}E_{et}DIST_{ei}$ and $R_{ie}E_{et}(DIST_{ei})^2$ except they include the U.S. average retail diesel price,r_t, which allows the corn price basis levels to adjust depending on trucking costs. In Caro, as the distance grain market i was away from ethanol plant e increased, the corn price basis levels increased to 36.62 cents at grain markets located 75 miles from the ethanol plant opening before decreasing to strengthened levels of 13.91 cents 150 miles away from the ethanol plant opening. As the distance grain market i was away from ethanol plant opening e increased, corn price basis levels fluctuated.

The coefficient of the variable $R_{ie}E_{et}$ was significant at the one percent level in all cases. The variable $R_{ie}E_{et}$ represents whether grain market i was within 150-miles of ethanol plant e and whether ethanol plant e was open at time t. The coefficient was positive for all of the ethanol plants. The coefficient (δ_e) for variable $R_{ie}E_{et}$ represents the corn price basis level impact at the site of the ethanol plant opening because this is where the distance away from the ethanol plant is equal to zero. The average corn price basis level effect across the five ethanol plants in Michigan was positive at 12.97 cents. Therefore, the corn price basis level impact at the site of an ethanol plant opening in

Michigan, experienced, on average, a 12.97 cent increase in corn price basis levels over the average time period after the ethanol plant opened.

The results for variations of Model I specific for Kansas, Iowa and Indiana are found in Appendix 2. The summary results indicate that grain markets located at the site of an ethanol plant opening in Kansas experienced, on average, a 9.55 cent increase in corn price basis levels over the entire time period after an ethanol plant opened. In Iowa, grain markets located at the site of an ethanol plant opening experienced an average of 2.41 cent increase in corn price basis levels over the average time period after an ethanol plant opened. In Indiana, grain markets located at the site of an ethanol plant opening experienced an average of 2.21 cent decrease in corn price basis levels over the average time period after an ethanol plant opened. The other coefficient estimates for Model I for Kansas, Iowa and Indiana were similar to that of Michigan and are found in Appendix 2.

McNew and Griffith found an average increase of corn price basis levels of 12.5 cents at the site of an ethanol plant opening over the average time period after an ethanol plant opened. Model I for the state of Michigan and Kansas had the most similar results to McNew and Griffith who studied a total of twelve ethanol plant openings from March 2000 through March 2003 that occurred in Illinois, Iowa, Montana, South Dakota, and Wisconsin. The improvement in corn price basis levels in Iowa and Indiana were smaller than the increases found by McNew and Griffith. Because the increase in corn basis levels is averaged over the entire time period after an ethanol plant opening it is probable that the increase in corn price basis levels was greater in the McNew and Griffith model because they studied a shorter time period. McNew and Griffith results also are different because they studied the first series of ethanol plant openings in the United States.

Model I does not allow the basis effect to change as the number of months since an ethanol plant opened increases. To allow basis variation to adjust to market conditions as the months since an ethanol plant opening increases, Model II was estimated. Results for Michigan's Model II, which estimates the impact ethanol plant openings had on basis levels each month after an ethanol plant opened, are found in Table 3.f. Michigan's Model II estimates equation (4) and uses equation (3) to correct for spatially correlated errors.

Table 3.f Michigan Equation (4) Estimate Results

Variable	Coeff.	Variable	Coeff.	Variable	Coeff.
USC	0.0009**	Blissfield	5.8102**	Webberville	0.7523**
MC	-0.1609**	Breckenridge	-5.3679**	Yale	-2.1119**
January	3.2321**	Buchanan	2.8295*		
February	5.9234**	Caledonia	-2.7354**		
March	3.0389**	Hamilton	4.9581**		
April	6.5391**	Holland	10.7786**		
May	5.6845**	Imlay City	-1.0434**		
June	9.4370**	Jasper	0.2494**		
July	7.8572**	Lake Odessa	-5.9524**		
August	8.4159**	Marlette	-3.9696**		
September	-1.5830**	Middleton	-6.3146**		
October	-3.7523**	Newago	-2.7730**		
November	0.6105	Ottawa Lake	9.2477**		

Variable	Caro	Albion	Lake Odessa	Riga	Marysville
REDIST	0.4179**	-0.3975	0.3516	0.1075	-1.0599**
RE(DIST)^2	-0.0027**	0.0025	-8.6E-4	-0.0016	0.0071**
RErDIST	-0.023**	9.9E-4	-9.81E-4	-4.26E-4	0.0024*
REr(DIST)^2	1.4E-5**	-5.0E-6	-3.0E-6	-3.0E-6	4.0E-6*
MOopen	-0.3954**	-37.3505**	38.6674**	2.1520**	-4.3918**
RE	19.3810**	45.6282**	-1.5457**	-1.1860**	8.2394**

Note: R^2=0.7374 and the spatial error coefficient λ=0.8100 was significant at the 1% level.
* Indicates significance at the 5% level.
** Indicates significance at the 1% level.

Table 3.f shows that λ was statistically significant; therefore, using equation (3) to account for spatial autocorrelation was valuable. The coefficients for the variables USC_t, MC_t and the monthly dummy variables were all significant, except for the November dummy variable, and similar to estimates found in Model I. The grain market dummy variables were all significant. IF a grain market was located in Holland relative to Zeeland, corn price basis levels were 10.78 cents higher. While most of the coefficients for the variables $R_{ie}E_{et}DIST_{ei}$ and $R_{ie}E_{et}(DIST_{ei})^2$ and $R_{ie}E_{et}r_tDIST_{ei}$ and

$R_{ie}E_{et}r_t(DIST_{ei})^2$ were not significant, the values of the coefficients altered corn price basis levels as the distance away from ethanol plant e increased, also similar to Model I results.

The coefficients for the variable $MOopen_e$ were significant at all ethanol plants. The coefficients for $R_{ie}E_{et}$ were positive at all of the ethanol plants except the ethanol plants located at Lake Odessa and Riga. The average corn price basis level impact at the site of an ethanol plant opening in Michigan the month an ethanol plant opened experienced an average increase of 14.10 cents in corn price basis levels. In Model I it was estimated that the corn price basis level impact at the site of an ethanol plant opening in Michigan experienced an average 12.97 cent increase in corn price basis levels over the average time period after an ethanol plant opened. Model II is expected to have a higher corn price basis level average impact than Model I because the basis impact is expected to be the greatest the month an ethanol plant opened and then decrease as the months since an ethanol plant opened increases. The basis impact is expected to diminish over time because market conditions will adjust to the increase in demand created by the ethanol plant opening. Figure 3.a illustrates how the corn price basis level impact at the site of an ethanol plant opening, over the average of the five ethanol plants, changed as the months since an ethanol plant opening increased. Figure 3.a was constructed by using the average coefficient estimates for the variables $MOopen_e$ which was -0.264.

Figure 3.a Michigan Plants: Months Since Opened Time Impact

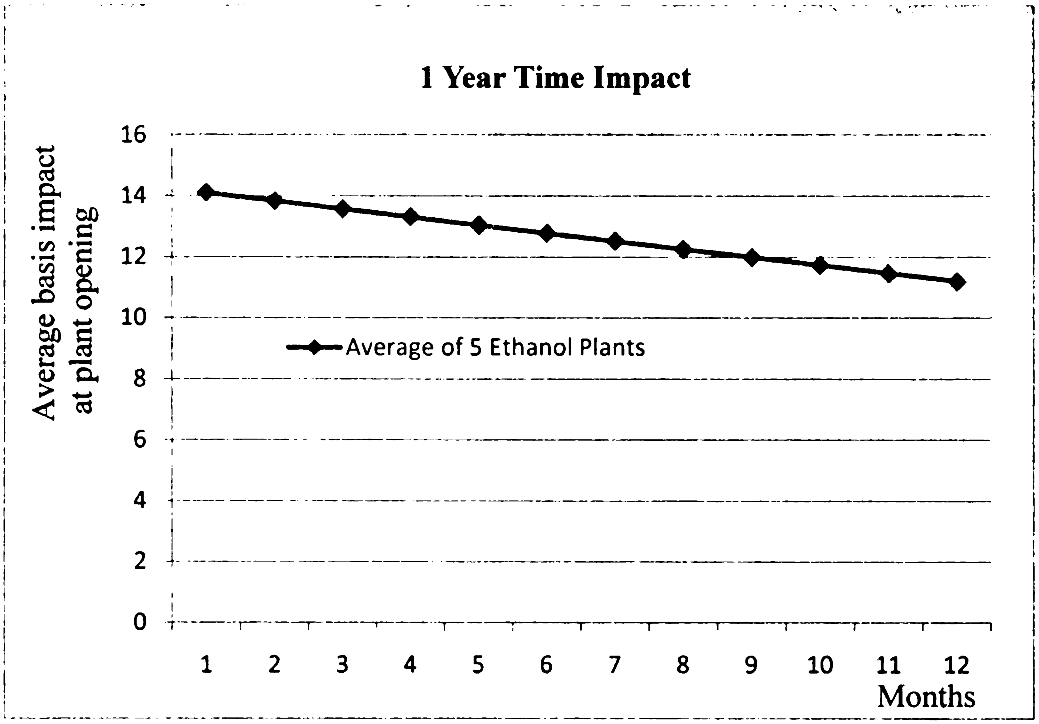


Figure 3.a shows that corn price basis levels decreased during the first year after an ethanol plant opened.

The results for variations of Model II specific for Kansas, Iowa and Indiana are found in Appendix 3. The summary results from these models indicate that grain markets located at the site of an ethanol plant opening in Kansas experienced, on average, an increased corn price basis level of 11.02 cents the month the ethanol plant opened. In Iowa, grain markets located at the site of an ethanol plant opening experienced an average of 2.07 cents increase in corn price basis levels the month the ethanol plant opened. In Indiana, grain markets located at the site of an ethanol plant opening experienced an average decrease of 0.29 cents in corn price basis levels the month the ethanol plant opened. In Kansas, Iowa and Indiana corn price basis levels decreased as the number of months since an ethanol plant opening increased. For an expanded discussion of the other Model II estimated coefficients for the Kansas, Iowa and Indiana see Appendix 3.

A third model was used to examine the possible causes for variation in the coefficients for the variable $R_{ie}E_{et}$ estimated by Model I and Model II for the states of Michigan, Kansas, Iowa and Indiana. The coefficients for the variable $R_{ie}E_{et}$estimated by Model I approximate the impact of an ethanol plant opening on corn price basis levels over the average time period after the ethanol plant opened for grain markets located at the site of the ethanol plant opening. The coefficients for $R_{ie}E_{et}$determined from Model II represent the impact ethanol plant e had on the corn price basis levels at grain markets located at the site of an ethanol plant opening the month the ethanol plant opened. Model III will utilize the following equation to explain variation in the coefficients for the Model I and Model II variable $R_{ie}E_{et}$:

$$(5)\quad 1R_eE_e = \beta_0 + \beta_1 S_e + \beta_2 S_e^2 + \beta_3 MI_e + \beta_4 KS_e + \beta_5 IA_e$$
$$+\beta_6 2003or2004_e + \beta_7 2005or2006_e + \beta_8 2007or2008_e$$
$$+\beta_9 CCR_e + e_e$$

where $1R_eE_e$ are the estimated coefficients from Model I of the variable $R_{ie}E_{et}$. Model III was also estimated using the left hand side variable $2R_eE_e$, where the variable $2R_eE_e$represents the coefficients of the Model II variable $R_{ie}E_{et}$. Therefore, there are a total of forty-two observations. The variable S_e is the production capacity (size) of ethanol plant e measured in million gallons per year. It is likely that the annual capacity of an ethanol plant contributed to the variation in corn price basis level estimates. If an ethanol plant produces 110 million gallons of ethanol a year it is likely the impact on corn price basis levels at the site of the ethanol plant is greater than if an ethanol plant only produces fifty million gallons of ethanol annually. The variables MI_e, KS_e and IA_e are dummy variables that are equal to one if ethanol plant e is located in the corresponding variable state name; otherwise the variables are equal to zero. It is possible that the state location of an ethanol plant contributed to alterations in corn price basis levels. Iowa produces nearly two and a half times more corn per year than Indiana (USDA 1). The variable $2003or2004_e$ is a dummy variable equal to one if ethanol plant e was opened in either 2003 or 2004, otherwise the variable is equal to zero. The values of variables $2005or2006_e$ and $2007or2008_e$ are determined the same as variable$2003or2004_e$. All ethanol plants in this analysis opened after 2001 and it is possible that the basis impact was greatest during a particular year. Finally, the variable CCR_e is the county corn ratio. To determine the value of this variable, the number of bushels of corn used in the annual production of ethanol at ethanol plant e was divided by the annual county corn production for the county where ethanol plant e is located. A higher statistic indicates a larger portion of the corn produced in the county was used for ethanol production and therefore this likely increases corn price basis levels at nearby grain markets. The county corn production estimates were gathered from USDA NASS.

Results for Model III, which explains the variation in the coefficients for the variable $R_{ie}E_{et}$ from both Model I and Model II are found in Table 3.g.

Table 3.g Model III Estimated Results

LHS variable	1RE	2RE
constant	12.9779	10.51
S	-0.75	-0.438
S^2	0.0059	0.0038
MI	21.4962*	15.719
KS	14.3858	10.703
IA	7.2618	-0.547
var1	3.5946	4.2941
Var2	-0.2124	2.3326
Var3	3.5943	-1.738
CCR	0.0903	0.0073

* Indicates significance at the 5% level.

Note: R^2=0.2295 when $1R_eE_e$ was the LHS variable and R^2=0.1889 when $2R_eE_e$ was the LHS variable in equation (5).

Table 3.g illustrates the reported coefficients for the variables when the left hand side variable for equation (5) was $1R_eE_e$ (coefficients from estimated $R_{ie}E_{et}$from Model I) and when the left hand side variable for equation (5) was $2R_eE_e$(coefficients from estimated $R_{ie}E_{et}$from Model II). The coefficient for the variable MI was significant at the five percent level when the estimated Model I coefficients for $R_{ie}E_{et}$ was the left hand side variable in equation (5). Therefore, if ethanol plant e opened in Michigan relative to opening in Indiana, it caused a increase in corn price basis levels of 21.50 cents at grain markets located at the site of the ethanol plant opening. No other variables were significant in Model III.

McNew and Griffith also estimated variation in basis levels at the site of an ethanol plant opening similar to our Model III. They regressed their equivalent coefficients of our Model I $R_{ie}E_{et}$ variable against a county corn ratio equivalent to our CCR_e variable. Their model also had a poor R^2 (R^2=0.209) and found their CCR_e

variable to be insignificant. Neither McNew and Griffith or this study was able to conclude what causes variation in corn price basis levels at the site of an ethanol plant opening. This suggests the variation is due to other factors not considered in eather study. Also, particular states have implemented different ethanol policy incentives that may be effecting the unexplained variation in corn price basis levels at the site of an ethanol plant opening.

3.4 Summary

The highest corn price basis level average improvement between the four states was witnessed in Michigan and Kansas. Over the average time period after an ethanol plant opened, Michigan and Kansas corn price basis levels increased an average of 12.97 cents and 9.55 cents respectively at the site of an ethanol plant opening. The month an ethanol plant opened in Michigan and Kansas, average corn price basis levels increased 14.10 cents and 11.02 cents respectively. In Michigan and Kansas as the number of months since an ethanol opening increased, strengthened corn price basis levels began to decline. Results in Michigan and Kansas were similar to the results estimated by McNew and Griffith who discovered corn price basis levels increased 12.5 cents over the average time period after twelve ethanol plants opened in Illinois, Iowa, Montana, South Dakota, and Wisconsin from March 2000 through March 2003.

Grain markets located at the site of an ethanol plant opening in Iowa and Indiana experienced an average increase of 2.41 cents and an average decrease of 2.21 cents respectively in corn price basis levels over the average time period after an ethanol plant opened. It is possible that the corn market quickly adjusted to the new conditions that resulted as a consequence of the rise of the ethanol industry in Iowa and Indiana. The results witnessed in Iowa and Indiana are similar to results found by Katchova who found farmers located in the same zip code of an ethanol plant contracted their corn for an average of 10.9 cents cheaper than farmers who did not live in the same zip code of an ethanol plant.

Grain markets located at the site of an ethanol plant opening in Iowa and Indiana experienced, on average, a positive 2.07 cent increase and a decrease of 0.29 cents respectively in corn price basis levels the month an ethanol plant opened. In Iowa and Indiana average basis levels decreased steadily as the months since an ethanol plant opening increased. However, in Indiana specifically and also in Iowa, many ethanol plants opened in 2007 and 2008. Additionally, some ethanol plants declared bankruptcy after our time period ended in June 2008. It is likely the corn price basis level effect the months after an ethanol plant opening occurred has changed in these states and studying an expanded time frame would be beneficial.

The variation in the impact ethanol plant openings had on grain markets located at the site of an ethanol plant opening over the average time period after an ethanol plant opened and at the time an ethanol plant opened are still not explained. By expanding this study to estimate the impact ethanol plant openings had on grain markets located in other states, the question of variation in the impact ethanol plant openings had on grain markets may be answered. Also, studying a larger time frame could enhance our results because corn prices began to decrease after they peaked during the summer of 2008, which is when our data set ended (USDA 3).

APPENDIX 3.1: SUMMARY STATISTICS FOR DATA SET RECEIVED FROM CASH GRAIN BIDS DATA SERVICE

Table 3.h Michigan Monthly Corn Price Basis Level Summary Statistics

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
1	Akron	61	48.74%	-33.14	16.58	-57.63	2.95
2	Albion	59	50.42%	-24.27	11.19	-52.90	7.61
3	Auburn	81	31.93%	-30.17	12.81	-53.25	13.00
4	Blissfield	118	0.84%	-18.60	11.35	-49.00	10.27
5	Breckenridge	116	2.52%	-30.87	12.70	-52.29	10.93
6	Britton	23	80.67%	-33.05	7.88	-55.14	-23.05
7	Brown City	104	12.61%	-28.13	13.74	-53.00	7.93
8	Buchanan	110	7.56%	-32.12	11.32	-60.28	-4.48
9	Caledonia	118	0.84%	-27.46	13.59	-56.50	10.28
10	Capac	15	87.39%	-31.82	10.95	-49.53	-10.64
11	Caro	42	64.71%	-35.37	11.22	-56.50	-14.70
12	Clarksville	21	82.35%	-42.83	7.51	-61.00	-35.00
13	Coleman	9	92.44%	-49.02	4.35	-55.00	-44.00
14	Constantine	102	14.29%	-25.34	11.56	-49.59	0.44
15	Croswell	25	78.99%	-44.27	8.74	-55.18	-23.81
16	Elkton	61	48.74%	-33.14	16.57	-57.63	2.95
17	Emmett	20	83.19%	-38.29	13.72	-61.64	-15.50
18	Fremont	92	22.69%	-25.71	12.39	-50.18	12.42
19	Grand Ledge	98	17.65%	-24.48	11.21	-52.05	8.06
20	Hamilton	118	0.84%	-20.57	11.02	-53.89	7.26
21	Hemlock	105	11.76%	-31.96	11.85	-52.21	7.53
22	Henderson	26	78.15%	-41.23	8.25	-53.57	-22.10
23	Holland	117	1.68%	-14.37	11.69	-45.89	12.59
24	Howard City	14	88.24%	-34.14	11.67	-55.00	-19.12
25	Hudsonville	99	16.81%	-21.88	11.44	-49.08	2.43
26	Imlay City	113	5.04%	-26.02	13.25	-50.11	14.79
27	Jasper	118	0.84%	-23.42	12.03	-55.14	9.93
28	Jeddo	15	87.39%	-38.20	6.00	-49.53	-29.82
29	Jonesville	52	56.30%	-25.47	23.38	-51.14	78.86
30	LakeOdessa	118	0.84%	-30.87	12.45	-58.00	3.39

Note: Highlighting indicates the grain market was chosen for analysis

Table3.h (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
31	Lapeer	105	11.76%	-25.55	14.44	-50.11	14.79
32	Lennon	26	78.15%	-45.69	8.90	-57.89	-24.10
33	Marlette	118	0.84%	-28.71	13.12	-52.00	7.93
34	Marshall	106	10.92%	-32.93	10.53	-58.73	-3.32
35	Middleton	118	0.84%	-31.38	11.91	-52.81	6.27
36	Millington	24	79.83%	-41.16	7.16	-53.21	-28.00
37	Newaygo	118	0.84%	-27.79	11.76	-52.00	8.75
38	North Star	49	58.82%	-38.84	12.23	-62.47	-6.14
39	Oakley	33	72.27%	-34.87	10.69	-53.17	-12.00
40	Ottawa Lake	114	4.20%	-15.87	11.37	-46.90	13.10
41	Palms	15	87.39%	-35.48	8.15	-49.53	-20.36
42	Pigeon	68	42.86%	-32.42	16.07	-57.61	2.95
43	Ravenna	14	88.24%	-34.26	11.64	-55.00	-19.12
44	Reading	68	42.86%	-18.23	20.82	-48.48	78.86
45	Richmond	26	78.15%	-44.46	8.83	-55.25	-23.80
46	Riga	15	87.39%	-13.74	10.22	-27.30	8.89
47	Saginaw	80	32.77%	-21.64	11.38	-42.00	12.90
48	Saline	34	71.43%	-28.50	14.07	-53.29	1.50
49	Saranac	48	59.66%	-24.67	14.36	-56.24	10.20
50	Six Lakes	69	42.02%	-30.71	13.74	-65.00	0.05
51	Snover	78	34.45%	-32.65	17.27	-68.50	0.84
52	St. Johns	42	64.71%	-38.30	7.75	-60.00	-24.64
53	Vriesland	14	88.24%	-28.09	14.59	-59.00	-6.94
54	Webberville	116	2.52%	-23.23	11.25	-52.43	8.71
55	WhitePigeon	76	36.13%	-20.15	12.12	-47.14	6.00
56	Yale	118	0.84%	-27.17	15.75	-52.73	15.28
57	Zeeland	115	3.36%	-23.84	10.06	-46.71	4.67

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.i Kansas Monthly Corn Price Basis Level Summary Statistics

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
1	Abbyville	86	27.73%	-16.25	11.75	-43.28	10.50
2	Abilene	43	63.87%	-21.15	15.03	-48.00	36.00
3	Agenda	99	16.81%	-27.50	12.98	-51.20	2.20
4	Albert	71	40.34%	-13.51	11.80	-37.58	10.00
5	Americus	26	78.15%	-38.55	8.43	-60.00	-27.07
6	Andale	114	4.20%	-19.62	13.35	-49.20	9.50
7	Anthony	81	31.93%	-11.63	11.87	-46.00	17.33
8	Argonia	23	80.67%	-20.26	21.62	-43.00	65.00
9	Arkansas City	88	26.05%	-22.49	11.42	-45.33	1.67
10	Arlington	57	52.10%	-11.05	11.57	-31.58	14.70
11	Arnold	58	51.26%	-10.54	13.27	-34.59	14.50
12	Asherville	59	50.42%	-29.27	11.90	-51.00	-7.33
13	Atchison	115	3.36%	-17.61	11.29	-43.20	4.93
14	Athol	107	10.08%	-35.46	13.90	-76.00	-1.00
15	Barnes	99	16.81%	-27.51	13.20	-55.29	2.20
16	Bartlett	105	11.76%	-14.09	12.50	-50.00	13.00
17	Bavaria	76	36.13%	-17.70	15.51	-44.05	45.00
18	Baxter Springs	57	52.10%	-18.23	11.06	-58.00	10.00
19	Beattie	116	2.52%	-34.07	13.26	-78.00	-6.20
20	Beloit	104	12.61%	-26.98	12.56	-57.11	1.75
21	Bennington	33	72.27%	-29.51	19.45	-85.00	0.05
22	Benton	76	36.13%	-14.95	15.75	-43.05	46.00
23	Bern	71	40.34%	-31.85	18.47	-63.57	2.11
24	Bison	104	12.61%	-17.14	13.81	-51.00	8.67
25	Bogue	63	47.06%	-16.53	15.63	-50.00	20.35
26	Boyd	70	41.18%	-12.02	14.18	-37.50	47.00
27	Bremen	87	26.89%	-28.22	12.70	-63.63	-4.33
28	Breton	60	49.58%	-13.24	14.62	-47.00	15.71
29	Bridgeport	54	54.62%	-21.46	13.07	-43.05	5.89
30	Brownell	26	78.15%	-21.63	12.20	-43.00	-3.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.i (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
31	Bucklin	87	26.89%	-10.52	12.73	-35.33	20.25
32	Buhler	76	36.13%	-15.98	15.31	-43.05	45.00
33	Burlingame	17	85.71%	-28.99	8.50	-40.50	-10.25
34	Burlington	17	85.71%	-28.99	8.50	-40.50	-10.25
35	Burns	85	28.57%	-18.14	13.76	-46.05	5.89
36	Burrton	45	62.18%	-15.00	13.62	-40.22	9.89
37	Cairo	57	52.10%	-11.34	11.79	-32.86	14.70
38	Caldwell	107	10.08%	-18.38	10.72	-47.00	5.67
39	Calista	57	52.10%	-11.19	11.68	-31.86	14.70
40	Canada	54	54.62%	-22.81	13.94	-46.05	5.89
41	Canton	75	36.97%	-18.18	14.21	-45.05	5.89
42	Chanute	107	10.08%	-20.21	9.49	-48.33	2.11
43	Chapman	118	0.84%	-24.50	13.61	-51.80	7.80
44	Cheney	78	34.45%	-18.32	10.57	-44.00	7.00
45	Clay Center	76	36.13%	-29.86	12.48	-55.20	-4.05
46	Clayton	17	85.71%	-20.83	18.10	-45.95	14.05
47	Clifton	104	12.61%	-30.55	12.83	-60.60	2.00
48	Clyde	102	14.29%	-28.75	13.70	-60.84	2.20
49	Colby	103	13.45%	-21.22	16.60	-56.80	16.33
50	Coldwater	17	85.71%	-4.08	11.89	-22.05	17.81
51	Collyer	63	47.06%	-14.70	15.33	-45.00	22.35
52	Columbus	116	2.52%	-17.24	10.33	-58.00	9.80
53	Colwich	15	87.39%	7.51	11.99	-21.00	21.57
54	Concordia	107	10.08%	-26.88	12.40	-55.11	1.75
55	Conway	75	36.97%	-16.27	15.27	-43.05	45.00
56	Conway Springs	62	47.90%	-23.31	12.11	-51.67	4.00
57	Courtland	102	14.29%	-26.66	10.32	-54.60	-0.33
58	Cunningham	50	57.98%	-13.40	9.80	-35.50	4.70
59	Danville	58	51.26%	-25.62	10.99	-53.25	2.14
60	Delphos	85	28.57%	-26.16	12.77	-55.11	1.75

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.i (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
61	Dighton	116	2.52%	-10.72	15.75	-44.75	18.33
62	Dillwyn	58	51.26%	-8.55	10.79	-28.14	15.00
63	Dodge City	93	21.85%	-4.49	13.33	-33.68	17.48
64	Dresden	57	52.10%	-15.46	14.40	-48.83	17.45
65	Durham	26	78.15%	-18.47	10.12	-37.00	-1.45
66	Edgerton	115	3.36%	-28.68	8.00	-48.67	-10.25
67	Effingham	17	85.71%	-27.11	8.62	-43.06	-12.32
68	Ellinwood	86	27.73%	-15.03	11.38	-37.58	10.00
69	Ellis	11	90.76%	-23.52	12.00	-45.73	-8.60
70	Ellsworth	91	23.53%	-23.89	14.11	-74.00	12.77
71	Emporia	59	50.42%	-23.55	10.00	-43.52	-8.21
72	Fairview	11	90.76%	-38.63	8.57	-51.30	-23.43
73	Florence	84	29.41%	-17.90	13.64	-46.05	5.89
74	Ford	83	30.25%	-4.68	11.59	-30.00	17.18
75	Fredonia	59	50.42%	-29.38	9.48	-50.79	-10.50
76	Galatia	10	91.60%	-13.48	4.85	-22.25	-5.36
77	Galva	76	36.13%	-16.72	15.52	-44.05	45.00
78	Garden City	103	13.45%	-3.31	12.86	-38.11	17.36
79	Garden Plain	103	13.45%	-20.39	12.25	-48.80	7.00
80	Garfield	116	2.52%	-16.81	12.48	-45.67	6.67
81	Girard	119	0.00%	-17.67	10.52	-43.35	19.50
82	Glade	17	85.71%	-33.63	9.26	-52.93	-24.00
83	Glen Elder	94	21.01%	-25.92	12.07	-51.00	1.67
84	Goodland	2	98.32%	-5.00	7.07	-10.00	0.00
85	Gorham	116	2.52%	-15.46	14.25	-49.67	23.09
86	Grainfield	63	47.06%	-14.43	15.38	-45.00	22.35
87	Gray	22	81.51%	-6.12	16.24	-34.00	13.27
88	Great Bend	113	5.04%	-16.81	12.72	-46.60	9.40
89	Greenleaf	116	2.52%	-30.40	13.45	-62.40	-0.40
90	Greensburg	78	34.45%	-8.01	11.01	-30.56	14.35

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.i (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
91	Gridley	38	68.07%	-30.33	7.82	-47.50	-12.10
92	Haddam	62	47.90%	-27.61	15.14	-57.89	-0.63
93	Halstead	116	2.52%	-19.67	13.35	-51.20	9.89
94	Hanover	92	22.69%	-29.66	13.13	-60.36	-3.56
95	Hanston	40	66.39%	-8.55	13.95	-34.00	13.27
96	Hartford	24	79.83%	-47.78	6.70	-64.28	-38.00
97	Haven	113	5.04%	-18.83	13.04	-50.80	9.89
98	Haviland	106	10.92%	-13.68	12.64	-41.25	9.81
99	Hepler	15	87.39%	-22.14	15.39	-49.87	0.67
100	Hiawatha	119	0.00%	-31.94	11.61	-62.61	-7.88
101	Hill City	24	79.83%	-24.16	17.46	-50.00	9.36
102	Hillsboro	119	0.00%	-21.32	13.93	-52.33	5.89
103	Hilton	55	53.78%	-21.53	13.35	-43.47	6.89
104	Hoisington	45	62.18%	-13.14	12.52	-37.35	9.40
105	Holton	104	12.61%	-31.84	10.94	-62.00	-7.67
106	Home	50	57.98%	-31.56	14.16	-60.31	-5.48
107	Hope	116	2.52%	-18.10	14.89	-51.00	25.00
108	Hoxie	111	6.72%	-22.77	16.50	-55.00	17.65
109	Hudson	104	12.61%	-13.35	11.91	-43.00	9.00
110	Hunter	96	19.33%	-24.69	11.99	-47.00	1.67
111	Hutchinson	76	36.13%	-13.03	14.45	-39.05	45.00
112	Inman	54	54.62%	-20.85	13.36	-43.05	6.89
113	Isabel	104	12.61%	-12.86	11.64	-43.40	9.00
114	luka	85	28.57%	-9.60	9.94	-28.14	15.00
115	Jamestown	74	37.82%	-25.10	12.76	-56.11	1.67
116	Jetmore	40	66.39%	-8.53	13.92	-34.00	13.27
117	Jewell	7	94.12%	-8.24	4.25	-14.25	-2.11
118	Junction City	104	12.61%	-29.87	13.32	-54.00	3.67
119	Kackley	59	50.42%	-29.28	11.90	-51.00	-7.33
120	Kalvesta	77	35.29%	-5.56	11.23	-28.94	16.36

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.i (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
121	Kansas City	17	85.71%	-17.76	7.93	-37.20	-8.00
122	Kensington	106	10.92%	-35.73	13.81	-70.08	2.33
123	Kingsdown	60	49.58%	-4.19	11.90	-30.00	17.18
124	Kiowa	39	67.23%	-16.33	13.95	-49.00	16.28
125	LaCrosse	10	91.60%	-16.29	3.37	-22.46	-9.75
126	Laird	35	70.59%	-10.72	14.69	-36.50	14.50
127	Lancaster	97	18.49%	-23.81	14.32	-60.67	41.00
128	Larned	118	0.84%	-16.52	12.67	-45.67	6.60
129	Lawrence	31	73.95%	-19.87	13.23	-40.50	3.57
130	Lehigh	76	36.13%	-17.53	16.00	-46.05	44.00
131	Lenora	60	49.58%	-18.55	16.27	-51.38	17.45
132	Leonardville	17	85.71%	-31.46	12.47	-50.00	-7.33
133	LeRoy	118	0.84%	-28.63	9.62	-52.67	-5.33
134	Lewis	89	25.21%	-13.91	12.85	-44.40	10.00
135	Lindsborg	76	36.13%	-16.85	15.15	-43.05	45.00
136	Linn	62	47.90%	-27.57	15.22	-58.83	-0.63
137	Logan	100	15.97%	-32.38	14.19	-62.00	10.00
138	Longford	27	77.31%	-28.07	14.62	-52.05	0.05
139	Ludell	36	69.75%	-28.71	14.69	-60.76	0.76
140	Macksville	116	2.52%	-14.55	12.63	-45.20	11.00
141	Manhattan	109	8.40%	-30.47	15.94	-62.00	10.00
142	Marion	76	36.13%	-17.53	16.00	-46.05	44.00
143	Marquette	109	8.40%	-22.66	13.67	-52.00	6.89
144	Marysville	112	5.88%	-30.75	12.81	-62.25	-4.33
145	McCracken	10	91.60%	-16.29	3.37	-22.46	-9.75
146	McCune	111	6.72%	-20.55	9.55	-43.33	5.00
147	McPherson	119	0.00%	-20.52	13.58	-53.00	6.89
148	Melvern	76	36.13%	-27.36	8.03	-47.81	-10.25
149	Menlo	105	11.76%	-20.35	16.88	-54.00	15.71
150	Meriden	82	31.09%	-34.78	11.09	-58.86	-6.14

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.i (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
151	Milton	23	80.67%	-17.03	12.35	-34.00	3.57
152	Miltonvale	17	85.71%	-31.47	12.48	-50.00	-7.33
153	Mingo	104	12.61%	-18.46	16.73	-51.00	16.82
154	Minneapolis	107	10.08%	-26.63	13.02	-53.79	14.33
155	Morganville	88	26.05%	-29.72	13.09	-55.50	3.00
156	Morland	63	47.06%	-16.48	15.65	-50.00	20.35
157	Morrill	115	3.36%	-33.29	11.55	-64.37	-9.33
158	Moundridge	119	0.00%	-20.08	13.44	-52.20	8.89
159	Mount Hope	66	44.54%	-15.30	15.83	-41.05	46.00
160	Mullinville	99	16.81%	-11.46	13.22	-38.20	27.75
161	Mulvane	96	19.33%	-22.14	11.23	-72.00	1.48
162	Murdock	76	36.13%	-16.20	10.03	-34.00	7.00
163	Muscotah	14	88.24%	-23.06	4.33	-29.55	-14.30
164	Narka	45	62.18%	-34.53	10.41	-53.10	-6.95
165	Natoma	10	91.60%	-16.29	3.37	-22.46	-9.75
166	Ness City	35	70.59%	-10.69	14.65	-36.50	14.50
167	New Cambria	54	54.62%	-21.36	10.93	-41.07	0.48
168	Newton	85	28.57%	-16.98	13.92	-45.77	5.89
169	Nickerson	119	0.00%	-18.67	12.89	-49.20	9.89
170	Norton	105	11.76%	-26.17	16.50	-60.80	10.15
171	Oakley	105	11.76%	-17.14	17.09	-51.00	17.82
172	Oberlin	105	11.76%	-25.50	16.95	-60.76	8.20
173	Offerle	116	2.52%	-7.13	13.52	-36.00	20.25
174	Osborne	119	0.00%	-27.14	17.68	-65.00	22.05
175	Ottawa	115	3.36%	-30.13	8.30	-53.33	-10.25
176	Overbrook	115	3.36%	-29.01	8.85	-52.33	-7.00
177	Palmer	51	57.14%	-21.58	13.72	-51.00	4.00
178	Paola	100	15.97%	-31.31	10.29	-57.29	-8.08
179	Park	48	59.66%	-15.06	17.49	-45.00	22.35
180	Partridge	76	36.13%	-12.04	14.01	-37.05	45.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.i (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
181	Pawnee Rock	111	6.72%	-17.39	12.50	-46.60	9.40
182	Peabody	85	28.57%	-18.01	13.57	-45.05	5.89
183	Penalosa	57	52.10%	-11.05	11.57	-31.58	14.70
184	Penokee	63	47.06%	-16.49	15.58	-50.00	20.35
185	Phillipsburg	118	0.84%	-33.02	15.20	-68.10	10.00
186	Pittsburg	104	12.61%	-20.45	9.51	-44.00	4.29
187	Pratt	107	10.08%	-13.03	12.04	-42.40	15.75
188	Preston	57	52.10%	-10.92	11.46	-31.58	14.70
189	Protection	102	14.29%	-5.70	13.04	-35.79	18.85
190	Quinter	102	14.29%	-15.48	15.81	-45.08	22.35
191	Rago	49	58.82%	-13.65	8.96	-33.71	3.11
192	Randall	116	2.52%	-28.62	12.62	-56.60	1.67
193	Ransom	35	70.59%	-21.24	8.92	-43.94	-8.25
194	Republic	71	40.34%	-27.12	12.94	-50.83	3.83
195	Rexford	93	21.85%	-22.05	17.20	-55.75	11.42
196	Roxbury	76	36.13%	-17.14	15.43	-44.05	45.00
197	Rush Center	54	54.62%	-6.66	19.09	-41.00	81.50
198	Russell	40	66.39%	-11.25	8.80	-32.87	6.67
199	Sabetha	98	17.65%	-33.75	13.35	-62.84	-1.13
200	Salina	24	79.83%	-8.10	13.38	-36.00	9.71
201	Scandia	8	93.28%	-11.72	3.41	-17.64	-5.36
202	Scott City	103	13.45%	-5.35	13.89	-41.37	18.90
203	Scranton	17	85.71%	-28.99	8.50	-40.50	-10.25
204	Sedgwick	62	47.90%	-16.40	12.53	-42.00	9.50
205	Seguin	105	11.76%	-20.42	16.89	-54.00	15.71
206	Selden	60	49.58%	-17.04	15.81	-48.83	17.45
207	Seneca	92	22.69%	-35.48	10.81	-60.52	-5.33
208	Smith Center	102	14.29%	-33.59	16.72	-76.00	0.00
209	Solomon	27	77.31%	-25.75	12.88	-48.55	0.05
210	Spearville	68	42.86%	-4.35	11.48	-25.77	16.36

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.i (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
211	St Marys	97	18.49%	-30.05	13.84	-60.70	-3.39
212	Stafford	71	40.34%	-16.70	12.76	-46.00	9.80
213	Sterling	116	2.52%	-21.21	13.16	-48.40	9.24
214	Stockton	107	10.08%	-28.37	16.68	-69.00	16.71
215	Studley	64	46.22%	-16.98	15.89	-50.00	20.35
216	Sublette	103	13.45%	-0.06	12.48	-30.84	20.18
217	Talmage	27	77.31%	-27.41	14.06	-50.05	0.05
218	Tampa	107	10.08%	-17.31	15.43	-49.00	25.00
219	Tipton	96	19.33%	-24.68	11.98	-47.00	1.67
220	Topeka	42	64.71%	-16.08	9.64	-39.00	1.29
221	Turon	57	52.10%	-11.06	11.56	-31.58	14.70
222	Utica	20	83.19%	-12.80	12.49	-31.00	12.40
223	Valley Center	10	91.60%	-15.89	3.81	-20.83	-10.75
224	Wakeeney	63	47.06%	-14.70	15.35	-45.00	22.35
225	Wakefield	67	43.70%	-38.87	18.80	-82.50	10.50
226	Waldeck	57	52.10%	-11.06	11.56	-31.58	14.70
227	Walton	118	0.84%	-20.95	13.40	-53.33	5.89
228	Wamego	104	12.61%	-31.97	12.81	-61.57	-3.70
229	Washington	62	47.90%	-27.18	14.65	-53.95	-0.63
230	Waterville	97	18.49%	-33.45	13.38	-62.00	-6.20
231	Waverly	17	85.71%	-28.99	8.50	-40.50	-10.25
232	Wellington	92	22.69%	-20.16	11.17	-45.33	5.73
233	Wellsville	17	85.71%	-26.63	10.35	-40.50	-5.25
234	Westphalia	38	68.07%	-30.33	7.82	-47.50	-12.10
235	White Cloud	26	78.15%	-38.47	7.93	-51.73	-21.44
236	Whitewater	85	28.57%	-15.07	13.50	-42.05	11.89
237	Whiting	17	85.71%	-36.05	8.64	-52.06	-21.32
238	Wilmore	44	63.03%	-8.82	9.37	-33.15	6.43
239	Wilroads	58	51.26%	-5.36	11.89	-25.19	16.36
240	Windom	76	36.13%	-16.54	15.34	-43.05	45.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.i (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
241	Winfield	113	5.04%	-22.32	13.57	-61.55	2.86
242	Wright	116	2.52%	-7.49	13.22	-35.80	20.75
243	Yates Center	58	51.26%	-26.28	14.75	-59.79	37.00
244	Zenda	25	78.99%	-11.43	8.94	-29.73	-0.11
245	Zurich	10	91.60%	-16.28	3.39	-22.46	-9.67

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j Iowa Monthly Corn Price Basis Level Summary Statistics

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
1	Ackley	92	22.69%	-34.57	9.31	-57.37	-14.94
2	Adair	119	0.00%	-37.03	9.64	-62.80	-17.83
3	Ainsworth	68	42.86%	-32.41	12.90	-64.70	-11.87
4	Akron	69	42.02%	-36.63	11.69	-64.80	-13.73
5	Albert City	82	31.09%	-35.49	9.23	-61.15	-18.95
6	Albia	22	81.51%	-14.87	4.11	-22.62	-6.43
7	Albion	66	44.54%	-36.66	12.02	-58.32	-14.54
8	Alden	115	3.36%	-33.94	9.09	-57.20	-17.10
9	Alexander	96	19.33%	-38.28	9.05	-65.52	-21.00
10	Algona	119	0.00%	-38.91	9.10	-63.20	-20.14
11	Alleman	119	0.00%	-35.68	10.55	-61.80	-15.82
12	Allendorf	75	36.97%	-31.51	12.05	-59.00	-6.76
13	Allison	57	52.10%	-39.92	12.74	-67.44	-17.36
14	Alta	118	0.84%	-36.53	9.50	-61.61	-18.23
15	Alton	112	5.88%	-30.96	10.49	-59.20	-9.38
16	Altoona	96	19.33%	-31.02	11.67	-59.00	-11.27
17	Alvord	56	52.94%	-30.25	13.48	-57.33	-1.80
18	Ames	32	73.11%	-32.11	8.30	-51.35	-17.80
19	Anthon	26	78.15%	-43.99	6.92	-59.70	-33.31
20	Arcadia	39	67.23%	-38.30	10.28	-60.80	-11.72
21	Archer	38	68.07%	-33.96	12.26	-55.92	-10.53
22	Aredale	61	48.74%	-39.34	12.77	-67.05	-13.95
23	Arlington	30	74.79%	-48.63	11.45	-87.00	-29.00
24	Armstrong	117	1.68%	-43.59	10.44	-72.25	-25.47
25	Ashton	119	0.00%	-31.03	12.17	-64.00	-2.76
26	Atlantic	67	43.70%	-36.43	12.32	-60.80	-14.53
27	Auburn	32	73.11%	-36.81	10.89	-60.29	-20.00
28	Audubon	119	0.00%	-39.98	9.30	-66.80	-21.39
29	Aurelia	119	0.00%	-36.52	9.54	-61.40	-18.00
30	Avoca	40	66.39%	-46.65	9.87	-69.24	-22.05

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
31	Avon	85	28.57%	-26.81	12.29	-53.21	-6.64
32	Ayrshire	68	42.86%	-40.58	9.70	-63.69	-23.14
33	Badger	64	46.22%	-36.28	9.58	-63.60	-19.86
34	Bagley	68	42.86%	-35.77	9.88	-61.85	-19.10
35	Bancroft	46	61.34%	-44.55	12.84	-72.25	-26.47
36	Barnes City	51	57.14%	-33.52	13.15	-61.00	-7.27
37	Barnum	63	47.06%	-36.23	9.65	-63.60	-19.86
38	Battle Creek	37	68.91%	-40.44	10.28	-63.33	-20.48
39	Bayard	114	4.20%	-34.99	9.90	-61.20	-15.28
40	Beaman	119	0.00%	-35.39	10.07	-58.32	-15.44
41	Beaver	95	20.17%	-37.69	9.17	-63.67	-21.10
42	Belmond	61	48.74%	-37.19	9.22	-68.00	-21.11
43	Bettendorf	87	26.89%	-16.21	13.06	-53.61	6.68
44	Blairsburg	94	21.01%	-36.35	8.29	-58.76	-18.78
45	Blairstown	45	62.18%	-36.22	10.23	-58.67	-19.00
46	Blakesburg	68	42.86%	-28.60	9.09	-60.00	-13.14
47	Blencoe	118	0.84%	-36.01	10.60	-62.35	-14.10
48	Bloomfield	48	59.66%	-26.93	9.25	-54.60	-10.78
49	Bode	64	46.22%	-36.28	9.58	-63.60	-19.86
50	Bondurant	94	21.01%	-31.31	11.57	-59.00	-9.14
51	Boone	119	0.00%	-34.82	9.46	-60.65	-16.10
52	Booneville	106	10.92%	-33.78	10.42	-59.00	-13.39
53	Boxholm	75	36.97%	-37.73	9.67	-65.45	-21.10
54	Boyden	71	40.34%	-25.62	12.61	-52.65	1.38
55	Bradford	96	19.33%	-35.20	9.00	-57.42	-17.00
56	Bradgate	52	56.30%	-35.19	8.82	-60.29	-20.80
57	Bristow	26	78.15%	-43.89	8.21	-57.46	-28.00
58	Britt	79	33.61%	-38.46	9.17	-64.44	-22.55
59	Brooklyn	38	68.07%	-41.69	8.35	-60.86	-27.45
60	Brunsville	66	44.54%	-34.12	10.19	-53.00	-3.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
61	Buckeye	107	10.08%	-33.12	9.73	-57.42	-14.89
62	Buckingham	94	21.01%	-33.72	11.51	-59.38	-12.44
63	Buffalo Center	73	38.66%	-43.04	12.11	-71.35	-19.13
64	Burlington	60	49.58%	-18.89	13.86	-57.26	4.71
65	Burt	101	15.13%	-38.36	8.77	-64.70	-22.95
66	Callender	45	62.18%	-35.31	9.81	-64.65	-22.10
67	Cambridge	78	34.45%	-34.47	11.37	-62.35	-16.73
68	Carlisle	32	73.11%	-29.41	14.07	-53.21	-8.30
69	Carnes	53	55.46%	-28.27	10.39	-54.63	-7.00
70	Carpenter	75	36.97%	-39.07	12.27	-66.61	-19.83
71	Carroll	18	84.87%	-41.31	10.03	-63.82	-27.95
72	Casey	70	41.18%	-39.05	10.70	-64.29	-20.83
73	Cedar Falls	60	49.58%	-34.19	13.10	-65.00	-10.59
74	Cedar Rapids	119	0.00%	-15.04	10.30	-40.95	4.74
75	Center Point	42	64.71%	-17.29	5.31	-27.82	-6.56
76	Centerville	18	84.87%	-24.63	3.70	-31.50	-17.40
77	Central City	40	66.39%	-37.73	9.94	-56.31	-18.14
78	Chapin	99	16.81%	-35.79	8.93	-59.30	-17.11
79	Chariton	119	0.00%	-32.20	14.32	-72.65	-4.70
80	Charles City	40	66.39%	-45.74	9.59	-66.00	-26.19
81	Chelsea	19	84.03%	-45.53	8.93	-60.67	-30.32
82	Cherokee	113	5.04%	-37.70	10.06	-63.93	-17.00
83	Chillicothe	104	12.61%	-26.86	11.09	-50.50	-6.84
84	Churdan	42	64.71%	-40.41	8.81	-61.32	-23.33
85	Clare	64	46.22%	-36.28	9.58	-63.60	-19.86
86	Clarence	119	0.00%	-27.12	11.61	-62.00	-6.14
87	Clarinda	62	47.90%	-40.63	13.81	-69.06	-16.15
88	Clarion	111	6.72%	-37.77	9.24	-63.45	-21.14
89	Clarksville	62	47.90%	-35.70	10.57	-58.93	-17.00
90	Clayton	109	8.40%	-24.60	15.84	-70.00	1.78

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
91	Clear Lake	110	7.56%	-38.79	9.74	-60.10	-22.00
92	Cleghorn	119	0.00%	-36.05	10.87	-62.40	-13.00
93	Clemons	58	51.26%	-36.45	11.54	-58.91	-16.59
94	Clermont	30	74.79%	-48.51	9.86	-68.70	-28.00
95	Clinton	114	4.20%	-16.42	11.10	-51.07	5.23
96	Clutier	58	51.26%	-37.68	11.93	-61.62	-16.00
97	Collins	97	18.49%	-34.46	11.25	-63.68	-16.00
98	Colo	119	0.00%	-34.56	10.22	-62.55	-16.00
99	Columbus Junction	8	93.28%	-32.59	7.34	-42.41	-19.60
100	Colwell	39	67.23%	-45.88	10.05	-67.88	-26.19
101	Conrad	114	4.20%	-35.41	10.21	-58.32	-15.44
102	Conroy	119	0.00%	-32.98	10.69	-59.00	-13.14
103	Coon Rapids	115	3.36%	-36.28	11.30	-63.21	-8.50
104	Corning	73	38.66%	-34.34	10.89	-60.80	-9.10
105	Correctionville	70	41.18%	-35.99	10.76	-62.65	-16.86
106	Corwith	119	0.00%	-36.77	9.05	-63.50	-21.06
107	Corydon	39	67.23%	-43.00	12.46	-80.40	-21.11
108	Coulter	118	0.84%	-37.77	9.37	-66.38	-19.95
109	Council Bluffs	118	0.84%	-37.77	9.37	-66.38	-19.95
110	Craig	89	25.21%	-34.57	10.57	-60.80	-4.50
111	Crawfordsville	32	73.11%	-39.26	13.78	-71.25	-8.78
112	Cresco	116	2.52%	-41.24	13.00	-74.00	-18.50
113	Creston	119	0.00%	-29.48	11.65	-55.00	-6.50
114	Cylinder	88	26.05%	-41.96	9.56	-67.07	-22.95
115	Dallas Center	100	15.97%	-36.26	10.34	-61.22	-17.22
116	Dana	75	36.97%	-35.66	9.84	-61.71	-19.00
117	Davenport	118	0.84%	-15.51	12.05	-53.76	6.74
118	Dawson	95	20.17%	-37.62	9.15	-63.67	-21.10
119	Dayton	42	64.71%	-40.41	8.81	-61.32	-23.33
120	Decatur	22	81.51%	-20.31	5.00	-28.65	-9.75

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
121	Decorah	61	48.74%	-43.48	15.30	-76.00	-17.71
122	Dedham	87	26.89%	-39.16	8.10	-62.60	-20.92
123	Denison	89	25.21%	-35.09	9.68	-56.95	-5.15
124	Des Moines	87	26.89%	-25.84	11.42	-48.75	-6.64
125	DeSoto	22	81.51%	-39.17	5.74	-55.25	-31.33
126	Dewar	47	60.50%	-36.48	10.26	-58.75	-9.00
127	Dewitt	61	48.74%	-25.20	12.77	-54.00	-3.23
128	Dickens	119	0.00%	-38.62	9.52	-63.73	-19.29
129	Dike	119	0.00%	-38.62	9.52	-63.73	-19.29
130	Dixon	67	43.70%	-25.25	13.47	-58.00	-5.00
131	Dolliver	56	52.94%	-40.99	10.74	-64.50	-20.90
132	Donnellson	26	78.15%	-23.72	7.38	-44.79	-12.50
133	Doon	58	51.26%	-32.41	13.15	-58.33	-1.75
134	Dougherty	75	36.97%	-36.87	9.97	-60.53	-21.70
135	Dow City	18	84.87%	-35.04	12.23	-50.20	-12.27
136	Dows	116	2.52%	-37.21	8.50	-60.61	-20.94
137	Dubuque	61	48.74%	-26.23	17.36	-67.68	2.55
138	Dumont	85	28.57%	-37.56	9.67	-57.73	-20.90
139	Duncombe	64	46.22%	-36.28	9.58	-63.60	-19.86
140	Dunkerton	119	0.00%	-30.80	10.29	-57.70	-6.05
141	Dunlap	88	26.05%	-37.52	11.60	-64.38	-12.33
142	Dysart	118	0.84%	-33.24	11.13	-59.90	-13.14
143	Eagle Grove	119	0.00%	-36.04	8.78	-62.00	-20.06
144	Earlham	42	64.71%	-37.18	9.25	-58.53	-19.00
145	Early	42	64.71%	-41.38	9.39	-63.00	-23.33
146	Eddyville	116	2.52%	-19.32	11.96	-53.00	2.26
147	Edgewood	107	10.08%	-31.26	12.11	-63.05	-10.21
148	Elberon	19	84.03%	-45.53	8.93	-60.67	-30.32
149	Eldon	105	11.76%	-26.53	9.53	-50.00	-8.55
150	Eldora	24	79.83%	-32.37	7.90	-49.13	-20.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
151	Eldridge	61	48.74%	-25.75	13.53	-55.00	-5.00
152	Elgin	30	74.79%	-48.52	9.85	-68.70	-28.00
153	Elk Horn	40	66.39%	-47.67	9.93	-70.24	-22.95
154	Elkader	41	65.55%	-46.91	14.28	-87.05	-25.95
155	Elkhart	119	0.00%	-32.49	11.40	-59.21	-12.00
156	Elliott	39	67.23%	-45.25	10.05	-68.24	-21.11
157	Ellsworth	111	6.72%	-36.52	8.53	-59.20	-18.90
158	Elma	55	53.78%	-42.54	11.67	-67.40	-22.00
159	Emerson	104	12.61%	-36.84	10.06	-61.80	-18.90
160	Emmetsburg	82	31.09%	-36.11	9.64	-62.37	-19.24
161	Estherville	22	81.51%	-34.33	5.81	-48.36	-24.44
162	Everly	51	57.14%	-37.72	12.02	-65.95	-17.52
163	Exira	119	0.00%	-40.02	9.29	-66.80	-21.39
164	Fairbank	104	12.61%	-30.95	11.05	-60.79	-9.60
165	Fairfax	56	52.94%	-16.01	12.42	-40.63	3.50
166	Fairfield	83	30.25%	-31.33	12.35	-68.00	-9.32
167	Farley	40	66.39%	-39.62	11.14	-65.00	-20.90
168	Farnhamville	42	64.71%	-40.37	8.77	-61.30	-23.33
169	Farragut	40	66.39%	-37.55	9.54	-58.50	-11.25
170	Faulkner	13	89.08%	-36.56	7.70	-50.21	-26.71
171	Fayette	48	59.66%	-32.63	20.09	-70.58	3.15
172	Fenton	75	36.97%	-42.13	10.81	-70.25	-24.47
173	Fernald	59	50.42%	-31.45	7.38	-50.50	-18.11
174	Fonda	82	31.09%	-35.51	9.29	-62.71	-18.95
175	Fontanelle	105	11.76%	-40.54	11.21	-68.62	-16.82
176	Fort Atkinson	67	43.70%	-43.75	15.85	-74.58	-16.33
177	Fort Dodge	115	3.36%	-36.97	8.56	-61.75	-21.82
178	Fostoria	63	47.06%	-38.88	10.75	-63.73	-19.86
179	Fredericksburg	83	30.25%	-42.91	12.60	-76.81	-19.37
180	Frederika	61	48.74%	-43.90	13.72	-76.00	-19.53

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
181	Galva	51	57.14%	-33.45	10.24	-58.11	-16.35
182	Garden City	117	1.68%	-34.14	9.17	-57.20	-16.86
183	Garner	106	10.92%	-38.32	9.91	-64.20	-21.44
184	Garrison	18	84.87%	-34.30	5.35	-43.54	-24.37
185	Garwin	70	41.18%	-35.97	11.75	-57.90	-14.50
186	Geneva	24	79.83%	-42.04	8.38	-56.38	-26.00
187	George	75	36.97%	-28.22	12.45	-56.29	-2.00
188	Gilbert	100	15.97%	-35.75	9.56	-62.00	-18.61
189	Gilman	58	51.26%	-36.08	11.30	-59.00	-13.50
190	Gilmore City	116	2.52%	-37.37	8.49	-62.20	-20.40
191	Gladbrook	67	43.70%	-35.81	12.01	-57.90	-14.50
192	Glidden	114	4.20%	-37.14	9.52	-63.50	-18.39
193	Goldfield	119	0.00%	-35.91	8.63	-62.00	-20.06
194	Gowrie	119	0.00%	-36.29	8.96	-62.00	-19.10
195	Graettinger	61	48.74%	-37.96	10.80	-62.50	-20.10
196	Grafton	81	31.93%	-38.47	12.43	-66.16	-15.00
197	Grant	116	2.52%	-38.85	11.43	-69.90	-17.10
198	Green Mountain	61	48.74%	-36.03	12.31	-57.88	-14.50
199	Greene	86	27.73%	-34.11	10.77	-59.23	-14.15
200	Greenfield	105	11.76%	-40.52	11.18	-68.65	-16.50
201	Greenville	51	57.14%	-38.97	10.90	-61.07	-18.20
202	Grinnell	38	68.07%	-34.90	12.63	-63.00	-13.50
203	Griswold	40	66.39%	-45.31	9.85	-68.24	-21.11
204	Grundy Center	60	49.58%	-36.02	12.23	-58.05	-14.12
205	Gruver	51	57.14%	-38.97	10.90	-61.07	-18.20
206	Guthrie Center	116	2.52%	-34.21	11.19	-65.57	-10.40
207	Halbur	119	0.00%	-37.99	9.64	-64.40	-16.28
208	Hamburg	41	65.55%	-25.78	24.06	-53.25	30.00
209	Hampton	97	18.49%	-37.33	8.78	-58.37	-21.00
210	Hancock	40	66.39%	-45.63	9.88	-68.24	-21.05

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
211	Hanlontown	119	0.00%	-39.99	10.14	-65.60	-18.19
212	Hardy	68	42.86%	-35.82	9.69	-61.55	-20.06
213	Harlan	39	67.23%	-46.59	10.04	-69.24	-22.35
214	Harris	65	45.38%	-32.23	8.41	-59.37	-12.77
215	Hartley	119	0.00%	-35.53	10.76	-65.40	-12.15
216	Hartwick	19	84.03%	-46.50	9.07	-61.67	-31.32
217	Hastings	28	76.47%	-42.06	9.27	-57.50	-19.00
218	Haverhill	119	0.00%	-34.60	9.95	-57.05	-14.50
219	Hawarden	114	4.20%	-35.34	13.03	-67.40	-0.15
220	Hawkeye	119	0.00%	-38.33	12.66	-75.00	-15.18
221	Henderson	57	52.10%	-40.57	10.88	-68.05	-18.27
222	Hinton	119	0.00%	-33.30	10.10	-57.62	-10.50
223	Holland	29	75.63%	-25.43	6.80	-37.45	-14.12
224	Holstein	60	49.58%	-34.79	10.50	-63.75	-16.05
225	Hopkinton	19	84.03%	-42.53	9.82	-57.85	-24.75
226	Hornick	116	2.52%	-36.42	10.30	-62.40	-15.67
227	Hospers	62	47.90%	-25.53	10.27	-52.60	-4.00
228	Hubbard	117	1.68%	-35.62	9.25	-59.19	-18.86
229	Hudson	113	5.04%	-35.72	10.73	-65.00	-12.95
230	Hull	58	51.26%	-26.65	12.30	-51.29	-2.00
231	Humboldt	64	46.22%	-36.21	9.50	-63.60	-19.86
232	Humeston	39	67.23%	-45.13	12.78	-82.40	-21.16
233	Ida Grove	42	64.71%	-39.59	9.16	-61.58	-20.17
234	Independence	40	66.39%	-41.09	10.21	-60.44	-20.14
235	Indianola	119	0.00%	-35.34	10.66	-59.45	-13.58
236	Inwood	45	62.18%	-30.10	14.65	-57.33	-1.80
237	Ionia	75	36.97%	-37.11	11.70	-67.31	-17.12
238	Iowa City	63	47.06%	-32.44	14.35	-81.00	-8.00
239	Iowa Falls	38	68.07%	-34.68	9.92	-53.50	-16.71
240	Ireton	86	27.73%	-30.65	11.80	-55.23	-0.85

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
241	Irwin	98	17.65%	-39.26	10.41	-63.60	-18.93
242	Jefferson	119	0.00%	-35.91	9.14	-62.00	-18.10
243	Jesup	113	5.04%	-33.28	10.95	-59.00	-9.35
244	Jewell	109	8.40%	-37.34	9.05	-61.40	-19.56
245	Joice	110	7.56%	-37.57	9.84	-62.60	-20.00
246	Kalona	60	49.58%	-30.53	14.49	-66.31	-6.36
247	Kanawha	111	6.72%	-38.27	9.44	-65.20	-22.55
248	Kelley	100	15.97%	-34.89	9.92	-62.00	-16.61
249	Kellogg	66	44.54%	-31.81	13.00	-58.50	-9.57
250	Keokuk	116	2.52%	-10.23	11.36	-46.76	10.50
251	Keosauqua	40	66.39%	-22.25	9.92	-46.67	-5.53
252	Keota	16	86.55%	-42.25	12.94	-62.06	-23.88
253	Keystone	11	90.76%	-43.02	11.84	-59.31	-26.56
254	Kingsley	77	35.29%	-41.06	9.54	-65.00	-19.14
255	Klemme	119	0.00%	-36.68	10.29	-63.13	-14.05
256	Knierim	64	46.22%	-36.21	9.50	-63.60	-19.86
257	Knoxville	81	31.93%	-33.60	15.08	-72.50	-10.00
258	La Porte City	71	40.34%	-29.65	12.79	-56.00	-6.95
259	Lacona	40	66.39%	-45.83	11.30	-72.50	-23.85
260	Lake City	108	9.24%	-36.88	8.75	-61.32	-20.28
261	Lake Mills	46	61.34%	-36.46	11.70	-60.20	-22.71
262	Lake Park	80	32.77%	-39.30	11.27	-66.00	-14.00
263	Lake View	42	64.71%	-41.38	9.39	-63.00	-23.33
264	Lakota	98	17.65%	-35.56	10.56	-63.40	-11.40
265	Lamoni	116	2.52%	-37.17	12.96	-72.50	-10.40
266	Lamont	30	74.79%	-46.48	9.32	-65.90	-28.95
267	Lanesboro	8	93.28%	-37.01	7.09	-48.00	-27.95
268	Larchwood	58	51.26%	-33.59	13.29	-59.33	-2.80
269	Larrabee	113	5.04%	-33.82	11.10	-62.40	-11.76
270	Latimer	42	64.71%	-42.42	8.37	-58.84	-26.33

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
271	Laurel	73	38.66%	-33.74	9.42	-56.27	-13.50
272	Laurens	113	5.04%	-38.43	8.85	-65.00	-21.95
273	Lawler	75	36.97%	-36.21	11.07	-64.50	-17.06
274	Le Mars	72	39.50%	-42.02	8.46	-61.00	-22.25
275	Ledyard	117	1.68%	-43.05	9.81	-70.25	-24.47
276	Leland	86	27.73%	-39.12	8.77	-60.74	-21.14
277	Lenox	61	48.74%	-36.11	11.69	-63.06	-12.00
278	Lester	76	36.13%	-33.02	12.68	-56.45	-2.29
279	Libertyville	42	64.71%	-37.27	13.97	-73.12	-18.00
280	Lidderdale	34	71.43%	-37.66	5.90	-52.50	-27.90
281	Lime Springs	100	15.97%	-41.34	12.37	-76.75	-19.38
282	Lincoln	59	50.42%	-35.52	12.76	-58.05	-13.12
283	Lineville	39	67.23%	-42.85	12.35	-80.40	-20.63
284	Linn Grove	112	5.88%	-39.05	10.07	-68.00	-19.00
285	Liscomb	67	43.70%	-35.40	11.25	-58.32	-14.44
286	Little Rock	119	0.00%	-35.60	12.16	-65.00	-6.10
287	Little Sioux	66	44.54%	-34.85	13.01	-62.38	-10.28
288	Livermore	94	21.01%	-36.43	8.88	-61.55	-20.06
289	Lohrville	64	46.22%	-36.28	9.58	-63.60	-19.86
290	Lone Rock	71	40.34%	-37.42	10.32	-67.70	-22.00
291	Lost Nation	58	51.26%	-27.87	13.48	-61.36	-4.00
292	Luther	89	25.21%	-35.35	10.12	-63.35	-17.80
293	Luverne	64	46.22%	-36.14	9.59	-63.60	-19.86
294	Luzerne	19	84.03%	-44.05	9.31	-58.67	-28.32
295	Lytton	42	64.71%	-40.41	8.81	-61.32	-23.33
296	Madrid	83	30.25%	-35.38	10.36	-63.63	-17.80
297	Malcom	75	36.97%	-31.79	12.86	-58.50	-10.72
298	Mallard	119	0.00%	-38.59	9.00	-63.47	-20.14
299	Manchester	51	57.14%	-31.15	14.82	-67.53	-8.69
300	Manly	116	2.52%	-35.81	10.59	-60.74	-13.50

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
301	Manning	63	47.06%	-39.18	8.01	-58.85	-19.11
302	Manson	55	53.78%	-37.21	8.92	-59.55	-21.00
303	Mapleton	71	40.34%	-35.41	10.78	-60.55	-16.86
304	Marathon	119	0.00%	-37.43	9.25	-65.00	-18.95
305	Marble Rock	115	3.36%	-35.79	9.94	-59.00	-18.05
306	Marcus	113	5.04%	-35.12	10.80	-62.40	-13.00
307	Marengo	19	84.03%	-45.82	9.28	-60.67	-30.32
308	Marshalltown	104	12.61%	-34.72	10.16	-57.91	-14.50
309	Martelle	67	43.70%	-28.74	13.98	-63.00	-7.23
310	Mason City	109	8.40%	-37.26	10.14	-59.75	-19.29
311	Massena	110	7.56%	-39.64	11.95	-68.62	-16.67
312	Matlock	70	41.18%	-26.90	10.70	-52.60	-4.00
313	Maurice	112	5.88%	-31.96	11.55	-61.50	-4.00
314	Maxwell	94	21.01%	-33.55	10.61	-59.75	-9.14
315	Maynard	56	52.94%	-41.39	10.40	-67.85	-24.50
316	McCallsburg	100	15.97%	-35.88	9.51	-62.22	-18.61
317	McGregor	47	60.50%	-30.61	16.64	-69.89	1.41
318	Melbourne	119	0.00%	-35.39	9.99	-58.47	-16.22
319	Melvin	59	50.42%	-30.28	13.77	-57.35	-3.20
320	Meriden	102	14.29%	-37.39	10.34	-62.40	-15.56
321	Meservey	57	52.10%	-37.19	11.05	-63.13	-20.47
322	Milford	51	57.14%	-38.97	10.90	-61.07	-18.20
323	Minburn	119	0.00%	-37.10	9.80	-61.80	-18.22
324	Mingo	83	30.25%	-32.76	12.20	-58.74	-13.94
325	Missouri Valley	79	33.61%	-34.07	12.17	-62.33	-9.33
326	Mitchellville	89	25.21%	-30.98	11.76	-59.21	-12.00
327	Modale	119	0.00%	-34.54	11.26	-62.33	-9.33
328	Mondamin	112	5.88%	-35.02	11.35	-62.86	-10.28
329	Monona	41	65.55%	-48.13	14.38	-88.05	-26.47
330	Monroe	29	75.63%	-41.53	10.54	-59.00	-18.44

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
331	Montezuma	75	36.97%	-31.91	12.90	-59.20	-10.72
332	Monticello	40	66.39%	-38.23	10.45	-60.41	-19.90
333	Moorland	64	46.22%	-36.28	9.58	-63.60	-19.86
334	Morning Sun	88	26.05%	-25.71	13.02	-67.47	-3.64
335	Mount Union	119	0.00%	-26.57	10.82	-65.44	-8.33
336	Mt Auburn	26	78.15%	-30.43	6.35	-42.67	-19.40
337	Mt Ayr	105	11.76%	-35.05	11.69	-61.00	-9.47
338	Muscatine	57	52.10%	-17.55	15.49	-58.67	5.95
339	Nashua	119	0.00%	-37.51	10.58	-67.31	-17.12
340	Nemaha	60	49.58%	-33.37	10.39	-63.65	-14.06
341	Neola	40	66.39%	-44.63	9.89	-67.24	-19.90
342	Nevada	100	15.97%	-31.59	9.91	-57.00	-13.61
343	New Hampton	119	0.00%	-36.22	10.65	-63.29	-17.12
344	New Hartford	70	41.18%	-35.96	8.03	-63.29	-23.13
345	New London	62	47.90%	-25.05	8.72	-46.67	-8.46
346	New Providence	116	2.52%	-35.65	9.44	-59.20	-18.14
347	New Sharon	57	52.10%	-32.67	12.84	-61.00	-7.14
348	Newell	99	16.81%	-34.18	10.05	-61.32	2.20
349	Newton	60	49.58%	-33.41	13.26	-56.52	-8.18
350	Nora Springs	26	78.15%	-36.97	6.37	-51.15	-25.25
351	North Washington	61	48.74%	-38.13	12.41	-67.31	-17.12
352	Northwood	113	5.04%	-39.29	10.70	-68.21	-20.32
353	Oakland	39	67.23%	-45.58	10.06	-68.24	-21.33
354	Oakville	104	12.61%	-22.76	11.90	-63.79	-2.30
355	Ocheyedan	105	11.76%	-36.44	12.16	-68.60	-9.77
356	Odebolt	42	64.71%	-39.57	9.21	-61.58	-20.17
357	Olds	85	28.57%	-27.22	12.45	-67.58	-7.38
358	Olin	59	50.42%	-28.36	13.86	-59.00	-4.00
359	Onawa	118	0.84%	-35.51	10.56	-62.16	-14.33
360	Orange City	112	5.88%	-31.98	11.57	-62.00	-4.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
361	Osage	115	3.36%	-37.51	10.26	-63.20	-16.71
362	Osceola	26	78.15%	-37.32	8.32	-59.10	-24.75
363	Oskaloosa	113	5.04%	-25.66	11.40	-58.00	-1.43
364	Ossian	26	78.15%	-35.08	8.32	-52.10	-20.15
365	Otho	64	46.22%	-36.20	9.50	-63.60	-19.86
366	Otley	29	75.63%	-41.52	10.53	-59.00	-18.44
367	Ottosen	119	0.00%	-38.46	8.86	-63.40	-19.67
368	Ottumwa	104	12.61%	-31.28	11.73	-68.00	-11.63
369	Owasa	80	32.77%	-37.50	9.17	-59.21	-18.95
370	Oyens	119	0.00%	-34.22	11.06	-60.20	-8.23
371	Pacific Junction	95	20.17%	-38.74	10.16	-68.40	-18.00
372	Palmer	64	46.22%	-36.21	9.50	-63.60	-19.86
373	Panama	18	84.87%	-35.04	12.23	-50.20	-12.27
374	Panora	106	10.92%	-37.44	9.82	-62.40	-19.06
375	Parkersburg	72	39.50%	-38.84	8.37	-66.29	-17.33
376	Paton	75	36.97%	-37.50	9.60	-63.65	-21.10
377	Pella	106	10.92%	-29.09	12.74	-59.00	-8.16
378	Persia	40	66.39%	-44.64	9.88	-67.24	-20.05
379	Peterson	113	5.04%	-38.98	10.05	-68.00	-19.68
380	Pickering	54	54.62%	-34.17	9.91	-51.15	-13.50
381	Pierson	99	16.81%	-37.58	9.90	-62.50	-16.95
382	Plainfield	86	27.73%	-36.97	10.25	-62.22	-20.75
383	Pleasant Hill	89	25.21%	-27.69	11.90	-53.27	-7.16
384	Plymouth	102	14.29%	-36.94	10.13	-59.80	-19.24
385	Pocahontas	108	9.24%	-37.60	8.30	-62.20	-21.00
386	Pomeroy	64	46.22%	-36.28	9.58	-63.60	-19.86
387	Portsmouth	41	65.55%	-45.02	10.00	-68.20	-20.05
388	Prairie City	119	0.00%	-31.39	10.72	-55.61	-11.67
389	Protivin	93	21.85%	-40.13	12.91	-76.00	-17.27
390	Radcliffe	40	66.39%	-36.17	10.18	-56.58	-19.05

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
391	Rake	86	27.73%	-37.50	9.41	-60.74	-18.36
392	Ralston	119	0.00%	-36.12	9.17	-62.00	-18.10
393	Randall	101	15.13%	-35.90	9.41	-60.00	-17.70
394	Readlyn	21	82.35%	-35.30	5.86	-47.83	-25.53
395	Red Oak	116	2.52%	-32.05	10.61	-57.20	-11.10
396	Redfield	89	25.21%	-35.95	9.67	-61.55	-18.71
397	Reinbeck	92	22.69%	-34.70	10.76	-58.05	-13.12
398	Rembrandt	28	76.47%	-38.41	9.43	-61.00	-21.00
399	Remsen	114	4.20%	-36.47	8.87	-60.50	-16.20
400	Renwick	68	42.86%	-36.37	9.41	-61.55	-21.06
401	Richland	97	18.49%	-29.04	12.70	-69.47	-9.20
402	Ridgeway	61	48.74%	-43.96	15.16	-75.00	-18.47
403	Rinard	42	64.71%	-39.86	8.24	-61.32	-23.33
404	Ringsted	92	22.69%	-45.81	9.78	-71.25	-29.90
405	Rippey	100	15.97%	-37.21	9.25	-63.71	-19.88
406	Ritter	55	53.78%	-29.97	13.99	-56.67	-3.20
407	Rock Rapids	111	6.72%	-37.70	12.64	-64.80	-2.70
408	Rock Valley	111	6.72%	-34.47	12.14	-62.60	-0.71
409	Rockford	116	2.52%	-36.64	9.94	-59.00	-18.91
410	Rockwell	115	3.36%	-37.50	8.95	-60.43	-21.70
411	Rockwell City	117	1.68%	-36.62	8.58	-63.60	-19.86
412	Roland	100	15.97%	-35.92	9.55	-62.00	-18.61
413	Rowan	87	26.89%	-38.90	8.13	-59.19	-26.05
414	Royal	75	36.97%	-35.50	9.65	-63.28	-20.52
415	Rudd	115	3.36%	-36.44	10.20	-61.00	-18.77
416	Runnells	116	2.52%	-29.67	12.17	-57.00	-6.11
417	Ruthven	118	0.84%	-38.80	9.55	-64.20	-20.10
418	Rutland	81	31.93%	-37.74	8.02	-59.22	-21.00
419	Ryan	119	0.00%	-29.84	12.26	-61.00	-9.12
420	Sac City	108	9.24%	-36.02	9.23	-63.20	-17.47

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
421	Saint Ansgar	61	48.74%	-39.49	12.12	-65.00	-16.28
422	Sanborn	113	5.04%	-33.49	12.59	-65.00	-2.00
423	Schaller	113	5.04%	-38.82	9.83	-63.93	-20.00
424	Schleswig	22	81.51%	-37.76	10.53	-59.89	-14.42
425	Scranton	118	0.84%	-37.89	9.40	-64.00	-19.10
426	Seymour	30	74.79%	-37.17	19.91	-91.00	-13.20
427	Sheffield	98	17.65%	-35.78	11.46	-65.85	-8.14
428	Shelby	40	66.39%	-45.64	9.88	-68.24	-20.95
429	Sheldon	113	5.04%	-31.76	11.57	-62.00	-4.00
430	Shell Rock	26	78.15%	-32.57	6.32	-44.64	-21.00
431	Shellsburg	50	57.98%	-35.03	12.60	-61.00	-12.67
432	Shenandoah	65	45.38%	-30.50	12.18	-58.46	-8.25
433	Sibley	43	63.87%	-34.14	10.25	-53.30	-9.77
434	Sidney	39	67.23%	-43.97	10.18	-68.00	-18.36
435	Sigourney	39	67.23%	-30.11	16.84	-71.00	-9.94
436	Silver City	29	75.63%	-29.74	7.96	-48.90	-20.65
437	Sioux Center	71	40.34%	-23.76	11.45	-49.33	1.38
438	Sioux City	114	4.20%	-33.12	10.38	-59.76	-11.60
439	Sioux Rapids	21	82.35%	-44.50	5.31	-57.56	-37.12
440	Slater	89	25.21%	-34.75	10.69	-62.90	-16.41
441	Sloan	119	0.00%	-32.91	10.33	-59.40	-10.90
442	Somers	42	64.71%	-40.41	8.81	-61.32	-23.33
443	Spencer	51	57.14%	-38.97	10.90	-61.07	-18.20
444	Sperry	119	0.00%	-18.29	13.40	-63.33	4.06
445	Stacyville	119	0.00%	-38.51	10.81	-64.00	-17.90
446	Stanhope	48	59.66%	-37.53	10.24	-60.67	-22.50
447	Stanton	116	2.52%	-35.91	11.31	-66.14	-13.75
448	Stanwood	58	51.26%	-27.87	13.48	-61.36	-4.00
449	Steamboat Rock	33	72.27%	-36.77	8.52	-49.76	-20.52
450	Stockport	119	0.00%	-22.84	12.30	-70.30	-2.75

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
451	Storm Lake	15	87.39%	-21.95	4.40	-28.35	-14.12
452	Story City	100	15.97%	-34.35	9.66	-60.00	-16.61
453	Sully	57	52.10%	-34.48	12.61	-63.00	-9.14
454	Sumner	61	48.74%	-43.05	13.88	-74.25	-18.53
455	Sunbury	60	49.58%	-25.34	13.25	-57.64	-5.00
456	Superior	51	57.14%	-39.17	11.30	-65.68	-18.20
457	Sutherland	109	8.40%	-33.40	10.91	-66.20	-7.00
458	Swea City	101	15.13%	-44.09	10.23	-70.70	-24.47
459	Taintor	18	84.87%	-42.61	10.05	-63.00	-28.68
460	Templeton	119	0.00%	-36.23	9.17	-62.40	-18.10
461	Terril	70	41.18%	-38.72	9.87	-65.50	-23.10
462	Thor	68	42.86%	-35.85	9.66	-61.55	-20.06
463	Thornton	111	6.72%	-39.00	9.76	-61.20	-22.00
464	Titonka	119	0.00%	-38.70	9.98	-68.00	-21.06
465	Toeterville	65	45.38%	-40.55	12.52	-64.43	-18.84
466	Tracy	29	75.63%	-41.60	10.57	-59.00	-18.44
467	Traer	66	44.54%	-34.36	12.25	-58.35	-12.12
468	Troy Mills	22	81.51%	-18.08	5.17	-28.23	-9.72
469	Truesdale	21	82.35%	-44.44	5.33	-58.56	-37.12
470	Union	117	1.68%	-34.04	9.59	-57.20	-15.20
471	Varina	53	55.46%	-38.06	10.72	-65.21	-21.95
472	Ventura	116	2.52%	-38.66	9.83	-63.60	-21.05
473	Vincent	64	46.22%	-36.28	9.58	-63.60	-19.86
474	Vinton	118	0.84%	-30.40	10.85	-55.65	-8.52
475	Voorhies	50	57.98%	-27.24	7.41	-46.00	-13.33
476	Walcott	60	49.58%	-25.34	13.25	-57.64	-5.00
477	Wallingford	69	42.02%	-38.64	9.92	-65.50	-23.00
478	Walnut	39	67.23%	-46.56	10.02	-69.24	-22.35
479	Wapello	89	25.21%	-15.83	13.94	-74.00	4.95
480	Washburn	108	9.24%	-29.75	10.73	-56.00	-10.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.j (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
481	Washta	70	41.18%	-36.06	10.73	-62.65	-16.86
482	Watkins	39	67.23%	-39.42	9.40	-56.41	-18.13
483	Waucoma	56	52.94%	-46.22	15.65	-73.82	-17.35
484	Waukee	119	0.00%	-36.16	10.39	-60.50	-15.76
485	Waukon	22	81.51%	-50.00	19.84	-89.05	-17.63
486	Waverly	116	2.52%	-39.26	11.68	-73.00	-18.33
487	Wayland	79	33.61%	-24.59	11.75	-58.58	-2.24
488	Webb	113	5.04%	-38.46	8.85	-65.00	-21.95
489	Webster City	116	2.52%	-36.96	8.72	-61.40	-19.14
490	Wellsburg	24	79.83%	-40.07	9.84	-56.29	-18.00
491	Wesley	118	0.84%	-37.66	9.85	-66.60	-20.06
492	West Bend	119	0.00%	-38.64	8.96	-63.47	-20.36
493	West Burlington	43	63.87%	-22.39	10.92	-50.76	-1.95
494	West Union	60	49.58%	-37.02	14.57	-69.85	-9.58
495	Westgate	26	78.15%	-34.88	5.82	-47.22	-25.00
496	Wever	61	48.74%	-19.78	14.50	-57.00	3.74
497	Whiting	70	41.18%	-34.21	11.31	-62.90	-15.62
498	Whittemore	119	0.00%	-38.64	8.98	-63.57	-20.36
499	Whitten	64	46.22%	-36.76	11.50	-58.91	-16.59
500	Williams	117	1.68%	-36.17	9.05	-59.20	-19.15
501	Williamsburg	75	36.97%	-27.13	8.30	-48.00	-10.50
502	Winfield	119	0.00%	-26.62	10.93	-65.44	-8.33
503	Winterset	97	18.49%	-35.88	11.12	-62.30	-16.67
504	Winthrop	40	66.39%	-40.97	10.31	-60.41	-18.71
505	Woden	111	6.72%	-40.40	9.49	-66.45	-23.29
506	Woodbine	100	15.97%	-35.40	11.51	-63.38	-11.44
507	Woodward	95	20.17%	-37.50	9.78	-64.65	-18.10
508	Woolstock	112	5.88%	-37.80	8.39	-63.40	-21.40
509	Yale	115	3.36%	-37.72	9.49	-63.05	-15.50
510	Yetter	42	64.71%	-39.86	8.24	-61.32	-23.33
511	Zearing	100	15.97%	-35.67	9.30	-62.00	-18.61

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.k Indiana Monthly Corn Price Basis Level Summary Statistics

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
1	Amboy	116	2.52%	-15.57	9.27	-36.65	12.24
2	Ambia	45	62.18%	-23.67	8.68	-38.87	-6.40
3	Anderson	63	47.06%	-17.18	11.45	-40.55	8.78
4	Argos	36	69.75%	-32.78	11.30	-51.36	2.00
5	Attica	54	54.62%	-18.17	8.22	-35.94	-3.59
6	Aurora	116	2.52%	-9.96	12.24	-45.47	11.24
7	Bluffon	47	60.50%	-23.21	9.26	-39.44	-1.50
8	Boston	63	47.06%	-15.61	12.12	-44.78	14.38
9	Brazil	116	2.52%	-23.73	11.65	-52.95	7.58
10	Bremen	113	5.04%	-20.79	9.99	-45.00	7.06
11	Brook	92	22.69%	-22.02	9.40	-42.00	-0.58
12	Brookston	52	56.30%	-20.05	8.96	-36.89	-1.57
13	Burlington	42	64.71%	-5.85	8.59	-23.95	14.15
14	Cambria	23	80.67%	-15.18	6.13	-25.18	-1.92
15	Carlisle	105	11.76%	-13.90	10.50	-42.82	14.48
16	Clay City	63	47.06%	-24.46	13.63	-52.57	7.58
17	Clymers	15	87.39%	-15.05	11.28	-37.05	3.13
18	Colfax	23	80.67%	-15.18	6.12	-25.18	-1.92
19	Columbus	119	0.00%	-22.17	12.52	-48.48	14.70
20	Connersville	104	12.61%	-17.91	11.87	-45.00	15.90
21	Cortland	83	30.25%	-18.76	15.74	-47.93	21.81
22	Crawforrdsville	97	18.49%	-18.57	10.54	-43.79	8.00
23	Dana	116	2.52%	-16.72	11.56	-41.91	40.00
24	Dacatur	114	4.20%	-19.75	10.50	-44.80	10.67
25	Delphi	119	0.00%	-15.41	9.75	-37.55	10.31
26	Dubois	102	14.29%	-8.16	10.18	-30.35	22.38
27	Dunkirk	116	2.52%	-19.57	9.68	-40.71	7.90
28	Eaton	43	63.87%	-21.77	8.15	-40.32	-2.79
29	Edinburgh	114	4.20%	-16.32	10.12	-39.62	14.95
30	Elizabethtown	88	26.05%	-22.37	15.23	-49.31	24.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
31	Elwood	63	47.06%	-18.48	10.80	-44.00	5.47
32	Evansville	116	2.52%	-2.82	10.81	-34.25	15.40
33	Fowler	74	37.82%	-20.59	8.52	-40.14	1.29
34	Francesville	83	30.25%	-18.78	11.83	-44.55	11.20
35	Francisco	32	73.11%	-17.11	9.22	-37.11	6.81
36	Frankfort	117	1.68%	-23.45	8.31	-44.30	-1.92
37	Franklin	27	77.31%	-11.20	13.43	-32.50	14.70
38	Geneva	70	41.18%	-19.66	15.65	-48.55	16.43
39	Glenwood	113	5.04%	-16.13	11.45	-40.89	16.86
40	Goodland	74	37.82%	-21.62	9.97	-39.35	0.69
41	Goshen	102	14.29%	-20.40	10.90	-41.83	10.22
42	Greensburg	119	0.00%	-18.74	13.24	-53.19	17.69
43	Greentown	116	2.52%	-21.19	9.54	-41.32	6.48
44	Hagerstown	73	38.66%	-15.25	12.25	-41.62	11.25
45	Hamlet	119	0.00%	-20.21	10.50	-41.47	6.81
46	Hammond	103	13.45%	-5.32	8.13	-25.04	14.69
47	Hebron	26	78.15%	-32.71	18.62	-71.00	-4.88
48	Hope	118	0.84%	-21.60	12.74	-49.13	14.70
49	Hortonville	32	73.11%	-24.79	11.45	-46.05	3.14
50	Huntingburg	117	1.68%	-11.01	12.39	-39.22	18.95
51	Idaville	63	47.06%	-22.70	11.03	-46.17	2.67
52	Indianapolis	60	49.58%	-12.02	13.77	-35.21	21.18
53	Jasonville	26	78.15%	-25.13	7.08	-42.11	-16.60
54	Jasper	109	8.40%	-10.67	12.60	-40.00	18.95
55	Jeffersonville	115	3.36%	-10.93	12.24	-49.00	12.19
56	Kentland	64	46.22%	-25.12	10.71	-45.70	1.75
57	Kersey	75	36.97%	-25.20	9.04	-45.50	-0.58
58	Kwanna	56	52.94%	-25.58	13.47	-50.33	-0.32
59	Kingman	72	39.50%	-23.83	8.56	-41.33	-3.72
60	Knightstown	17	85.71%	-30.55	9.14	-41.10	-10.10

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
61	Knox	67	43.70%	-22.36	11.79	-42.72	3.81
62	Kokomo	116	2.52%	-15.55	9.03	-35.50	11.00
63	Kouts	83	30.25%	-25.76	8.07	-44.06	-6.67
64	L Crosse	109	8.40%	-24.42	10.00	-43.65	7.33
65	La Fontaine	61	48.74%	-15.04	11.88	-38.75	9.60
66	Ladoga	45	62.18%	-17.04	11.46	-41.90	9.54
67	Lafayette	59	50.42%	-14.57	9.62	-41.37	6.67
68	Lapaz	113	5.04%	-20.74	10.10	-45.00	8.00
69	Letts	112	5.88%	-22.16	13.30	-50.65	18.50
70	Linden	114	4.20%	-16.23	9.45	-38.06	9.57
71	Logansport	116	2.52%	-16.07	9.41	-36.88	11.29
72	Loogootee	22	81.51%	-17.21	16.49	-45.14	10.33
73	Lucerne	26	78.15%	-35.02	5.72	-51.90	-26.20
74	Madison	115	3.36%	-13.45	12.93	-50.00	8.35
75	Marion	97	18.49%	-15.45	10.24	-34.00	15.40
76	Markle	64	46.22%	-31.53	7.81	-46.07	-12.21
77	Markleville	39	67.23%	-19.65	11.91	-42.30	10.71
78	Medaryville	106	10.92%	-19.43	10.32	-44.00	6.80
79	Mellott	75	36.97%	-26.38	9.32	-43.00	-0.50
80	Mexico	26	78.15%	-30.22	7.41	-51.32	-18.00
81	Milroy	30	74.79%	-29.62	11.20	-52.00	-10.19
82	Monon	101	15.13%	-19.29	11.18	-41.50	13.00
83	Monroe	27	77.31%	-13.24	13.09	-32.93	8.26
84	Monroeville	17	85.71%	-23.23	9.45	-32.88	-3.95
85	Monticello	62	47.90%	-21.20	10.96	-43.17	4.67
86	Montpelier	107	10.08%	-15.95	9.83	-34.94	14.50
87	Morristown	71	40.34%	-16.84	11.45	-41.25	15.95
88	Mount Vernon	47	60.50%	-5.14	12.56	-36.89	14.79
89	Nappanee	116	2.52%	-22.72	11.03	-48.00	11.90
90	New Carlisle	94	21.01%	-22.13	11.11	-43.46	7.31

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
91	New Castle	26	78.15%	-23.36	8.80	-36.00	-3.08
92	New Paris	52	56.30%	-22.99	17.91	-75.00	14.42
93	Newburgh	115	3.36%	-3.88	10.82	-34.40	15.00
94	Newtown	9	92.44%	-27.66	6.19	-35.21	-17.30
95	Noblesville	34	71.43%	-25.33	11.35	-45.48	3.14
96	North Vernon	92	22.69%	-21.14	15.82	-61.80	15.05
97	Oakville	114	4.20%	-20.78	10.09	-44.71	6.00
98	Owensville	98	17.65%	-14.67	10.90	-42.88	10.86
99	Pershing	73	38.66%	-18.65	13.76	-44.62	10.21
100	Pierceton	62	47.90%	-29.87	9.77	-48.20	-3.67
101	Plymouth	24	79.83%	-12.85	8.67	-24.06	2.68
102	Poneto	19	84.03%	-36.15	11.78	-51.57	-16.20
103	Portage	116	2.52%	-17.42	10.68	-44.00	10.65
104	Portland	11	90.76%	-11.87	6.77	-21.79	3.00
105	Princeton	116	2.52%	-11.60	11.68	-46.33	15.86
106	Ramsey	73	38.66%	-4.77	12.13	-36.27	30.00
107	Redkey	19	84.03%	-41.19	15.85	-65.00	-20.00
108	Remington	118	0.84%	-22.14	8.98	-40.00	2.54
109	Rensselaer	53	55.46%	-15.94	10.80	-40.00	8.17
110	Reynolds	71	40.34%	-16.53	10.96	-40.48	8.68
111	Richmond	97	18.49%	-16.20	14.49	-44.00	14.25
112	Roachdale	68	42.86%	-17.35	8.63	-38.38	3.00
113	Rochester	95	20.17%	-20.73	10.72	-42.84	6.05
114	Rockport	41	65.55%	-7.17	11.51	-34.57	13.76
115	Rolling Prairie	96	19.33%	-34.75	10.00	-54.56	-9.38
116	Romney	42	64.71%	-23.16	7.41	-39.00	-5.15
117	Roselawn	75	36.97%	-25.25	9.23	-45.50	-0.58
118	Rushville	109	8.40%	-18.23	13.97	-54.00	17.50
119	Russiaville	65	45.38%	-19.25	8.92	-40.50	6.24
120	Schneider	71	40.34%	-21.72	10.11	-46.00	4.00

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
121	Seymour	26	78.15%	-33.97	9.56	-54.67	-17.00
122	Sharpsville	19	84.03%	-12.90	7.75	-26.27	4.58
123	Shelburn	107	10.08%	-14.14	10.37	-42.88	14.33
124	Shelbyville	18	84.87%	-27.36	8.27	-46.53	-14.25
125	Sheridan	102	14.29%	-25.49	10.25	-54.82	3.00
126	Sims	42	64.71%	-18.12	7.65	-35.80	2.05
127	South Bend	114	4.20%	-13.47	9.99	-37.05	14.81
128	South Milford	64	46.22%	-26.43	7.92	-46.33	-6.89
129	South Whitley	18	84.87%	-27.36	5.85	-41.44	-18.60
130	Star City	38	68.07%	-30.20	9.12	-48.56	-10.81
131	State Line	51	57.14%	-17.96	8.48	-34.33	-1.36
132	Sullivan	116	2.52%	-12.54	10.28	-38.76	16.90
133	Summitville	111	6.72%	-22.00	10.99	-43.67	5.86
134	Swayzee	38	68.07%	-16.65	11.93	-37.85	11.81
135	Syracuse	25	78.99%	-34.41	11.70	-56.18	-5.68
136	Tefft	75	36.97%	-26.04	9.09	-46.50	-0.58
137	Terre Haute	97	18.49%	-16.03	10.45	-43.94	12.52
138	Tipton	92	22.69%	-18.20	11.81	-41.30	10.85
139	Trafalgar	70	41.18%	-18.61	14.94	-51.55	15.30
140	Union Mills	115	3.36%	-23.27	9.07	-43.50	-1.65
141	Valparaiso	63	47.06%	-26.26	9.58	-45.90	-2.40
142	Vincennes	96	19.33%	-11.59	11.62	-41.38	15.82
143	Wabash	20	83.19%	-28.62	7.29	-46.05	-17.00
144	Waldron	87	26.89%	-24.61	12.84	-48.20	10.63
145	Walton	26	78.15%	-26.31	5.42	-42.55	-18.50
146	Wanatah	100	15.97%	-26.94	9.08	-49.41	-3.32
147	Warsaw	106	10.92%	-24.37	10.86	-49.38	8.90
148	Washington	106	10.92%	-12.39	13.00	-41.00	20.70
149	Waterloo	106	10.92%	-19.48	9.95	-40.10	8.15
150	Waveland	92	22.69%	-29.69	10.18	-54.79	-4.61

Note: Highlighting indicates the grain market was chosen for analysis

Table 3.k (cont'd).

#	Grain Market	# of Obs.	% Missing	Mean	Std. Dev.	Min	Max
151	Westfield	22	81.51%	-28.71	7.50	-47.05	-16.25
152	Whitesville	48	59.66%	-15.98	11.97	-39.08	8.00
153	Williamsport	64	46.22%	-18.46	10.93	-39.15	9.15
154	Winamac	79	33.61%	-21.09	9.28	-48.05	2.44
155	Winchester	102	14.29%	-22.96	10.76	-41.20	8.24
156	Windfall	19	84.03%	-24.15	5.28	-37.15	-17.12
157	Wingate	88	26.05%	-26.20	9.19	-43.67	-0.50
158	Winslow	70	41.18%	-15.14	10.21	-37.35	6.33
159	Wolcott	61	48.74%	-23.64	9.77	-43.26	4.26
160	Woodburn	81	31.93%	-21.62	9.73	-43.94	7.33
161	Wyatt	114	4.20%	-23.22	9.79	-48.00	0.50
162	Yoder	37	68.91%	-31.05	10.11	-62.85	-16.00

Note: Highlighting indicates the grain market was chosen for analysis

APPENDIX 3.2: MODEL I RESULTS FOR KANSAS, IOWA AND INDIANA

The following equation was estimated to determine spatial variation in corn price basis levels for Kansas:

$$(6)\ B_{it} = \alpha_0 USC_t + \alpha_1 MC_t + \sum_k^{11} \alpha_{2k} MO_k + \sum_i^{32} \alpha_{3i} MK_i + \sum_{e=1}^{9} R_{ie} E_{et} [\delta_e + \beta_{e1} DIST_{ei} + \beta_{e2} (DIST_{ei})^2 + \beta_{e3} r_t DIST_{ei} + \beta_{e4} r_t (DIST_{ei})^2] + e_{it}$$

where the variables are defined the same as they were defined previously in equation (2). The variables are specific for the state of Kansas and equation (6) includes nine ethanol plant openings. Kansas is the only state where an ethanol plant went bankrupt during our time frame. The ethanol plant located in Pratt went bankrupt in February 2008. To accommodate this information, the variable E_{et} was equal to zero before the ethanol plant was opened, equal to one while the ethanol plant was open and equal to zero after the ethanol plant went bankrupt in February 2008. Equation (6) was estimated with the inclusion of Pratt and Table 3.1 outlines the results. To confirm that the bankruptcy of Pratt did not disrupt our model, equation (6) was also estimated without the inclusion of Pratt and the results remained the same. Equation (6) was estimated using equation (3) to account for spatial correlation.

Table 3.1 Kansas Equation (6) Estimates

Var.	Coeff.	Var.	Coeff.	Var.	Coeff.
USC	0.0018**	Andale	-6.2186**	Hope	-6.9206**
KC	-0.0945**	Atchison	4.9927**	Larned	-5.6646**
Jan.	2.1807**	Beattie	-18.6637**	LeRoy	-9.7599**
Feb.	-1.7129**	Chapman	-12.7895**	Macksville	-3.8444**
March	-0.1834	Columbus	3.1694**	McPherson	-11.5067**
April	-0.9842**	Dighton	-2.4004**	Morrill	-13.4885**
May	2.8241**	Edgerton	-9.8527**	Moundridge	-10.9891**
June	2.4862**	Garfield	-5.8277**	Nickerson	-10.1544**
July	3.1965**	Girard	0.6005**	Offerle	3.0608**
Aug.	-5.6723**	Gorham	-3.7782**	Osborne	-17.2522**
Sept.	-0.7737*	Great Bend	-5.5813**	Ottawa	-12.2953**
Oct.	-0.6162**	Greenleaf	-17.1758**	Overbrook	-9.7146**
Nov.	6.5097**	Halstead	-6.7874**	Phillipsburg	-21.9146**
		Haven	-6.9678**	Randall	-19.5112**
		Hiawatha	-12.5590**	Sterling	-11.6416**
		Hillsboro	-11.0974**	Winfield	-1.0444**
Variable	Russell	Colwich	Oakley	Garnett	Phillipsburg
RE(DIST)	0.3154**	0.2155**	-0.0040	-0.1176	-0.5126**
RE(DIST)^2	-0.0018**	-0.0015**	-6.4E-4	-0.0011*	0.0034**
REr(DIST)	-0.0013**	-0.0012**	-0.0015**	-6.9E-4**	0.0015**
REr(DIST)^2	6.0E-6**	8.0E-6**	9.0E-6**	1.0E-5**	-9.0E-6**
RE	10.4715**	-0.2618**	16.9145**	9.3896**	6.1046**
Variable	Pratt	Garden City	Liberal	Lyons	
RE(DIST)	1.3830**	0.4674*	-1.6664**	-1.1928**	
RE(DIST)^2	-0.0071*	-0.0030	0.0067**	0.0154**	
REr(DIST)	-0.0042**	-3.8E-4	0.0012*	0.0028**	
REr(DIST)^2	2.1E-5*	3.0E-6	-5.0E-6	-3.4E-5**	
RE	4.0657**	-16.1202**	71.6646**	-16.3000**	

Note: R^2=0.7480 and the spatial error coefficient λ=0.5890 was significant at the 1% level.
* Indicates significance at the 5% level.
** Indicates significance at the 1% level.

Table 3.1 shows that λ was statistically significant at the five percent level. Therefore, using equation (3) and running the model to account for spatial autocorrelation in the error terms was important. The variable USC_t was significant at the one percent level and positive. To interpret this coefficient, if corn production in the United States were to increase by one billion bushels, basis levels in Kansas would be expected to increase by 1.8 cents. The variable KC_t is was also significant at the one percent level. If Kansas corn production were to increase by five million bushels, Kansas corn price basis levels would be expected to decrease by 0.47 cents. Table 3.e also shows the month dummy variables were significant, except for March. The month dummy variables vary only slightly which indicates seasonal patterns were somewhat existent in corn basis levels at different grain markets in Kansas. The grain market dummy variables were significant in all cases. If a grain market was located in Beattie relative to Wright, the corn price basis level was 18.66 cents lower.

The coefficients for the variables $R_{ie}E_{et}DIST_{ei}$ and $R_{ie}E_{et}(DIST_{ei})^2$ were significant at all ethanol plants except Oakley, Garnett and Garden City. The coefficients of the variables $R_{ie}E_{et}r_tDIST_{ei}$ and $R_{ie}E_{et}r_t(DIST_{ei})^2$ were significant at all ethanol plants regions except Garden City and Liberal. As the distance a grain market is away from an ethanol plant opening increases, corn price basis levels fluctuated. The coefficient of the variable $R_{ie}E_{et}$ was significant at the one percent level in all cases. The coefficient (δ_e) was positive for five of the nine ethanol plants. The average corn price basis level effect across all nine ethanol plants in Kansas was positive at 9.55 cents. Therefore, the corn price basis level impact at the site of an ethanol plant opening in Kansas was an average increase of 9.55 cents in corn price basis levels over the average time period after the ethanol plant opened.

The following equation was estimated to examine spatial variation in corn price basis levels for Iowa:

$$(7)\ B_{it} = \alpha_0 USC_t + \alpha_1 MC_t + \sum_k^{11} \alpha_{2k} MO_k + \sum_i^{120} \alpha_{3i} MK_i$$

$$+ \sum_{e=1}^{22} R_{ie} E_{et} [\delta_e + \beta_{e1} DIST_{ei} + \beta_{e2} (DIST_{ei})^2 + \beta_{e3} r_t DIST_{ei}$$

$$+ \beta_{e4} r_t (DIST_{ei})^2] + e_{it}$$

where the variables are defined the same as equation (2). The Iowa specific variables include the opening of twenty-two ethanol plants. Equation (7) was estimated using equation (3) to account for spatial correlation. Table 3.m outlines the estimates of the variables in equation (7).

Table 3.m Iowa Equation (7) Estimates

Variable	Coeff.	Variable	Coeff.	Variable	Coeff.
USC	-0.0033**	Conroy	9.3562**	Hubbard	5.3032**
IAC	-0.0059**	Coon Rapids	3.3562**	Hudson	13.7545**
January	1.7919**	Corwith	3.0068**	Indianola	6.4000**
February	5.0485**	Coulter	1.8457**	Jefferson	3.6024**
March	1.5884**	Council Bluffs	18.3835**	Jesup	10.0008**
April	4.1312**	Cresco	8.0281**	Keokuk	34.5184**
May	0.3006**	Creston	12.0720**	Klemme	3.1348**
June	2.6392**	Davenport	28.0785**	Lamoni	7.6793**
July	-2.6764**	Dickens	-1.1715**	Larrabee	3.0487**
August	-9.3276**	Dike	2.6042**	Laurens	0.7652**
September	-3.2968**	Dows	2.5047**	Ledyard	-1.4379**
October	-3.2968**	Dunkerton	12.3250**	Little Rock	-1.9452**
November	3.5402**	Dysart	10.4733**	Mallard	0.2155**
Adair	2.2489**	Eagle Grove	3.2238**	Manly	4.7262**
Alden	6.5371**	Eddyville	25.2848**	Marathon	1.1384**
Algona	0.7753**	Elkhart	8.4886**	Marble Rock	4.4203**
Alleman	5.6895**	Exira	-0.8485**	Marcus	1.1750**
Alta	1.8460**	Fort doge	3.4714**	Melbourne	6.0515**
Armstrong	-3.3682**	Garden City	6.9038**	Minburn	3.3856**
Ashton	3.2483**	Gilmore City	2.2301**	Modale	3.6478**
Audubon	-0.3750**	Glidden	2.9405**	Mt. Union	20.1262**
Aurelia	1.0545**	Goldfield	3.3805**	Nashua	3.9309**
Bayard	5.3423**	Gowrie	3.0766**	New Hamp.	7.2509**
Beaman	6.1078**	Grant	2.2188**	New Prov.	5.6070**
Blencoe	3.2834**	Guthrie Center	6.7765**	Northwood	2.3629**
Boone	5.2826**	Halbur	1.4324**	Onawa	3.5729**
Cedar Rapids	31.6566**	Hanlontown	-0.1859**	Osage	4.0020**
Chariton	9.9738**	Hartley	0.2832**	Okaloosa	17.5735**
Cherokee	-0.3370**	Haverhill	6.5120**	Ottosen	0.8281**
Clarence	19.6235**	Hawarden	-0.3649**	Oyens	0.8665**
Clinton	7.2300**	Hawkeye	10.2533**	Peterson	-1.5686**
Colo	5.9627**	Hinton	1.7795**	Prairie City	10.1142**
Conrad	7.4809**	Hornick	2.5970**	Ralston	3.1127**
				Red Oak	9.0525**

Table 3.m (cont'd).

Variable	Coeff.	Variable	Coeff.	Variable	Coeff.
Remsen	-0.2411**	Sheldon	4.4230**	Vinton	11.7227**
Rockford	3.1674**	Sioux City	5.3868**	Waukee	5.9068**
Rockwell	3.5082**	Sloan	3.5265**	Waverly	5.5108**
Rockwell City	3.9251**	Sperry	26.7341**	Webb	0.1057**
Rudd	3.6035**	Stacyville	2.7045**	Webster City	2.5091**
Runnells	12.5866**	Stanton	5.1148**	Wesley	3.1229**
Ruthven	-0.3977**	Stockport	23.7386**	West Bend	0.4813**
Ryan	16.9481**	Templeton	2.6163**	Whittemore	0.4783**
Sanborn	3.1272**	Titonka	2.1325**	Williams	3.8555**
Schaller	0.2879**	Union	6.9176**	Winfield	19.8733**
Scranton	2.3132**	Ventura	1.7490**	Yale	2.9842**

Variable	Sioux Center	Galva	Coon Rapids	Lakota
RE(DIST)	-0.0955**	0.0761**	0.1165**	-0.0175
RE(DIST)^2	4.3E-4*	-3.6E-4	-6.2E-4**	3.4E-4*
REr(DIST)	5.5E-4**	-3.6E-4*	-9.3E-4**	4.8E-4**
REr(DIST)^2	-3.0E-6**	2.0E-6	6.0E-6**	-3.0E-6**
RE	4.5484**	2.7821**	6.9937**	-3.9111**
Variable	Marcus	Hanlotown	Ashton	W. Burlington
RE(DIST)	-0.0060	-0.5773**	-0.2297**	0.7599**
RE(DIST)^2	1.6E-4	0.0034**	0.0012**	-0.0052**
REr(DIST)	-1.4E-4	0.0025**	4.9E-4**	-0.0024**
REr(DIST)^2	1.0E-6	-1.5E-5**	-3.0E-6**	1.6E-5**
RE	2.1430**	4.7034**	9.4875**	-0.1834**
Variable	Iowa Falls	Mason City	Emmetsburg	Denison
RE(DIST)	0.0948**	0.7519**	0.7756**	-0.0225
RE(DIST)^2	-1.1E-5	-0.0056**	-0.0045**	6.1E-4**
REr(DIST)	-4.3E-4**	-0.0037**	-0.0034**	2.9E-4**
REr(DIST)^2	1.0E-6	2.5E-5**	2.1E-5**	-3.0E-5**
RE	-8.1324**	4.3692**	-6.0361**	-2.3431**

Table 3.m (cont'd).

Variable	Ft. Dodge	Goldfield	Jewell	Corning
RE(DIST)	-0.3336**	-0.4093**	0.0724**	-0.1823**
$RE(DIST)^2$	0.0020**	0.0019**	-1.2E-4	0.0010**
REr(DIST)	8.8E-4**	0.0013**	-6.9E-4**	4.0E-4**
$REr(DIST)^2$	-6.0E-6**	-6.0E-6**	3.0E-5**	-3.0E-5**
RE	-1.2472**	9.2749**	-1.9383**	7.3227**
Variable	Fairbank	Albert City	Charles	Shanedoah
RE(DIST)	-0.3257**	-0.8711**	-0.2162**	0.4504**
$RE(DIST)^2$	0.0024**	0.0050**	0.0015**	-0.0031**
REr(DIST)	0.0011**	0.0033**	5.6E-4**	-0.0020**
$REr(DIST)^2$	-8.0E-6**	-2.1E-5**	-5.0E-6**	1.3E-5**
RE	1.6332**	7.2957**	7.5637**	10.7626**
Variable	Superior	Stangstar		
RE(DIST)	0.3918**	0.8906**		
$RE(DIST)^2$	-0.0019**	-0.0051**		
REr(DIST)	-0.0012**	-0.0020**		
$REr(DIST)^2$	6.0E-6**	1.2E-5**		
RE	8.6053**	-10.5765**		

Note: R^2=0.7644 and the spatial error coefficient λ=0.4270 was significant at the 1% level.
* Indicates significance at the 5% level.
** Indicates significance at the 1% level.

Table 3.m shows that λ was statistically significant at the one percent level. The variable USC_t was significant at the one percent level and positive. If corn production in the United States were to increase by one billion bushels, basis levels in Iowa would be expected to decrease by 3.3 cents. The variable IAC_t is was also significant at the one percent level. If Iowa corn production were to increase by five million bushels, Iowa corn price basis levels would be expected to decrease by 0.3 cents. Table 3.e also shows the month dummy variables were all significant at the one percent level. The values of the coefficients do not greatly alter the corn price basis levels. The grain market dummy

variables were all significant. As the distance a grain market is away from an ethanol plant opening increases, corn price basis levels changed. The coefficients of the variable $R_{ie}E_{et}$ were significant at the one percent level in all cases. The grain markets located at the site of an ethanol plant opening in Iowa experienced, on average, a 2.41 cent increase in corn price basis levels over the average time period after an ethanol plant opened.

The following equation was estimated to determine spatial variation in corn price basis levels for Indiana:

$$(8)\ B_{it} = \alpha_0 USC_t + \alpha_1 MC_t + \sum_k^{11} \alpha_{2k} MO_k + \sum_i^{33} \alpha_{3i} MK_i$$

$$+ \sum_{e=1}^{6} R_{ie}E_{et} [\delta_e + \beta_{e1} DIST_{ei} + \beta_{e2}(DIST_{ei})^2 + \beta_{e3} r_t DIST_{ei}$$

$$+ \beta_{e4} r_t (DIST_{ei})^2] + e_{it}$$

where the variables are defined the same as equation (2) and specific for the state of Indiana. Equation (8) estimates the impact six ethanol plant openings had on corn price basis levels. Equation (8) was estimated using equation (3) to account for spatial correlation. Table 3.n outlines the estimates of the variables in equation (8).

Table 3.n Indiana Equation (8) Estimates

Var.	Coeff.	Var.	Coeff.	Var.	Coeff.
USC	5.0E-4**	Amboy	11.1868**	Hope	5.7812**
KC	-0.0374**	Aurora	18.1923**	Huntingburg	17.0896**
Jan.	2.9132**	Brazil	3.5746**	Jeffersonville	17.0190**
Feb.	-0.7996	Bremen	6.8273**	Kokomo	11.8766**
March	3.0778**	Columbus	4.4424**	Lapaz	6.9589**
April	1.2035**	Decatur	6.2425**	Linden	9.9660**
May	4.1226**	Delphi	10.5540**	Logansport	10.9383**
June	1.1545**	Dana	10.6844**	Madison	15.6453**
July	-0.8850*	Dunkirk	6.9633**	Nappanee	4.8331**
Aug.	-10.3857**	Edinburg	10.7958**	Newburgh	23.6662**
Sept.	-9.4145**	Evansville	24.1532**	Oakville	5.8891**
Oct.	-4.5018**	Frankfort	3.1750**	Portage	11.0177**
Nov.	6.1134**	Glenwood	11.0917**	Princeton	16.0547**
		Greensburg	7.6998**	Remington	4.8889**
		Greentown	5.7683**	South Bend	14.0330**
		Hamlet	6.3115**	Sullivan	14.6232**
				Union Mills	4.2654**

Variable	Rensselear	Marion	Clymers	Linden	Portland
RE(DIST)	-0.8443**	-0.0718	-0.1038	0.5084*	0.8247*
$RE(DIST)^2$	0.0056**	0.0013	-6.4E-4	-0.0027	-0.0050*
REr(DIST)	0.0027**	4.7E-4	5.7E-4	-0.0018**	-0.0017
$REr(DIST)^2$	-1.8E-5**	-7.0E-6	1.0E-6	9.0E-6	1.0E-5
RE	-1.4253**	-1.7957**	11.1396**	4.7404**	-20.4049**

Variable	Alexandria
RE(DIST)	0.0780
$RE(DIST)^2$	0.0014
REr(DIST)	1.4E-4
$REr(DIST)^2$	-6.0E-6
RE	-5.4513**

Note: R^2=0.5398 and the spatial error coefficient λ=0.4290 was significant at the 13% level.

* Indicates significance at the 5% level.

** Indicates significance at the 1% level.

Table 3.n shows that λ was statistically significant at the thirteen percent level. The variable USC_t was significant at the one percent level and positive. The variable INC_t is was also significant at the one percent level. Table 3.e also shows the monthly dummy variables were all significant except for February. The grain market dummy variables were all significant. The coefficient of the variable $R_{ie}E_{et}$ was significant at the one percent level in all cases. The average basis level effect was negative 2.21 cents. Therefore, the grain markets located next to an ethanol plant opening in Indiana experienced, on average, a 2.21cent increase in corn price basis levels over the average time period after an ethanol plant opened.

APPENDIX 3.3: MODEL II RESULTS FOR KANSAS, IOWA AND INDIANA

The following equation estimates Model II for the state of Kansas:

$$(9)\ B_{it} = \alpha_0 USC_t + \alpha_1 MC_t + \Sigma_k^{11} \alpha_{2k} MO_k + \Sigma_i^{32} \alpha_{3i} MK_i$$

$$+ \Sigma_{e=1}^{9} R_{ie} E_{et} [\delta_e + \beta_{e1} DIST_{ei} + \beta_{e2} (DIST_{ei})^2 + \beta_{e3} r_t DIST_{ei}$$

$$+ \beta_{e4} r_t (DIST_{ei})^2 + \beta_{e3} MOopen_e + e_{it}$$

where the variables are the same as equation (4) and explicit for the state of Kansas. Results for equation (9), which estimates the impact ethanol plant openings had on basis levels each month after the ethanol plant was opened, are found in Table 3.o.

Table 3.o Kansas Equation (9) Estimate Results

Var.	Coeff.	Var.	Coeff.	Var.	Coeff.
USC	0.0015**	Andale	-7.5605**	Hope	-9.6096**
KC	-0.0798**	Atchison	0.5288**	Larned	-8.7014**
Jan.	1.3545**	Beattie	-21.1114**	LeRoy	-14.7955**
Feb.	-2.4884**	Chapman	-15.3057**	Macksville	-6.7022**
March	-0.7621*	Columbus	-1.3692**	McPherson	-13.9460**
April	-1.7154**	Dighton	-5.1582**	Morrill	-17.4482**
May	2.3313**	Edgerton	-14.1457**	Moundridge	-13.6597**
June	1.9029**	Garfield	-8.7295**	Nickerson	-11.9727**
July	2.5167**	Girard	-4.5149**	Offerle	0.4930**
Aug.	-6.3490**	Gorham	-7.1998**	Osborne	-20.1717**
Sept.	-1.7194**	Great Bend	-8.8053**	Ottawa	-16.9611**
Oct.	-1.1733**	Greenleaf	-19.0193**	Overbrook	-14.8505**
Nov.	6.0447**	Halstead	-10.6015**	Phillipsburg	-24.2803**
		Haven	-10.2388**	Randall	-20.9066**
		Hiawatha	-16.6859**	Sterling	-13.5046**
		Hillsboro	-13.9046**	Winfield	-6.1972**

Variable	Russell	Colwich	Oakley	Garnett	Phillipsburg
RE(DIST)	0.1261**	0.1061**	-0.0179	-0.1662**	-0.4867**
RE(DIST)^2	-7.0E-4**	-9.4E-4**	-4.0E-4	-5.2E-4	0.0033**
REr(DIST)	-4.9E-4**	-8.9E-4**	-0.0016**	1.7E-4	0.0016**
REr(DIST)^2	1.0E-6	7.0E-6**	9.0E-6**	6.0E-6**	-1.0E-5**
MOopen	0.4239**	-0.9024**	-0.2097	0.7274**	0.3712**
RE	8.3711**	3.8490**	23.9771**	10.8869**	4.8572**

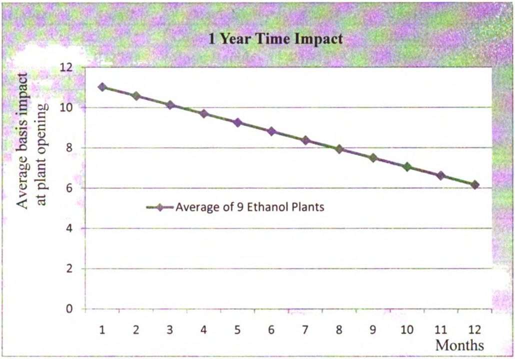
Table 3.o (cont'd).

Variable	Pratt	Garden City	Liberal	Lyons
RE(DIST)	1.9346**	-0.0717	-1.2527**	-2.3328**
$RE(DIST)^2$	-0.0099**	6.1E-4	0.0042*	0.0214**
REr(DIST)	-0.0062**	0.0012	1.3E-5	0.0053**
$REr(DIST)^2$	3.1E-5**	-7.0E-6	2.0E-6	-4.7E-5**
MOopen	-0.5246**	2.5642**	-6.4480**	0.333
RE	2.2919**	-18.5547**	73.6873**	-10.2182**

Note: R^2=0.7792 and the spatial error coefficient λ=0.5840 was significant at the 1% level.
* Indicates significance at the 5% level.
** Indicates significance at the 1% level.

Table 3.o shows that λ and the coefficient for the variable KC_t and USC_t, were statistically significant at the one percent level. Table 3.o also shows the month dummy variables and the grain market dummy variables were all significant. The coefficient for the variable $MOopen_e$ was significant at all ethanol plants except for Lyons and Oakley. The coefficients of the variable $R_{ie}E_{et}$ were significant at the one percent level in all cases. The average corn price basis level effect across the nine ethanol plant in Kansas was positive 11.02 cents. Therefore, the corn price basis level impact at the site of an ethanol plant opening in Kansas experienced an average increase of 11.02 cents in corn price basis levels the month the ethanol plant opened. Figure 3.b illustrates the basis impact at the ethanol plant site opening and how this impact changed as the number of month since an ethanol plant opening increased. Figure 3.b was constructed by using the average coefficient estimates for the variables $MOopen_e$ which was -0.44. Figure 3.a shows that strengthened corn price basis levels decreased as the months since an ethanol plant opened increased in Kansas.

Figure 3.b Kansas Plants: Months Since Opened Time Impact



The following equation estimates Model II for Iowa:

$$(10)\quad B_{it} = \alpha_0 USC_t + \alpha_1 MC_t + \Sigma_k^{11} \alpha_{2k} MO_k + \Sigma_i^{120} \alpha_{3i} MK_i$$

$$+ \Sigma_{e=1}^{22} R_{ie} E_{et} [\delta_e + \beta_{e1} DIST_{ei} + \beta_{e2}(DIST_{ei})^2 + \beta_{e3} r_t DIST_{ei}$$

$$+ \beta_{e4} r_t (DIST_{ei})^2 + \beta_{e3} MOopen_e + e_{it}$$

where the variables are the same as equation (4) and specific for the state of Iowa. Results for equation (10) are found in Table 3.p.

Table 3.p Iowa Equation (10) Estimate Results

Variable	Coeff.	Variable	Coeff.	Variable	Coeff.
USC	-6.2E-4**	Conroy	8.2873**	Hubbard	5.6570**
IAC	-0.0212**	Coon Rapids	4.1942**	Hudson	13.3133**
January	2.1974**	Corwith	3.9749**	Indianola	7.0200**
February	6.4128**	Coulter	3.4982**	Jefferson	4.8797**
March	2.5340**	Council Bluffs	19.4709**	Jesup	9.6563**
April	4.5338**	Cresco	4.9046**	Keokuk	32.6713**
May	0.3694**	Creston	10.0471**	Klemme	4.6077**
June	2.7208**	Davenport	26.3970**	Lamoni	5.3640**
July	-3.2157**	Dickens	0.4763**	Larrabee	3.9998**
August	-2.6907**	Dike	3.8721**	Laurens	1.8907**
September	-10.3705**	Dows	3.8453**	Ledyard	-0.7257**
October	-4.4159**	Dunkerton	12.0478**	Little Rock	-0.1694**
November	3.5544**	Dysart	10.2234**	Mallard	1.5284**
Adair	3.4855**	Eagle Grove	4.3999**	Manly	6.0559**
Alden	7.6501**	Eddyville	23.7132**	Marathon	2.1184**
Algona	1.7979**	Elkhart	9.7070**	Marble Rock	5.5410**
Alleman	6.8220**	Exira	0.2345**	Marcus	1.9112**
Alta	2.4547**	Fort doge	4.8965**	Melbourne	7.1414**
Armstrong	-1.6905**	Garden City	7.0641**	Minburn	4.7353**
Ashton	3.9446**	Gilmore City	3.5847**	Modale	4.4211**
Audubon	0.7922**	Glidden	4.1154**	Mt. Union	16.8962**
Aurelia	1.7484**	Goldfield	4.4769**	Nashua	5.4400**
Bayard	6.2939**	Gowrie	4.5052**	New Hamp.	6.2305**
Beaman	7.0767**	Grant	2.0095**	New Prov.	6.3443**
Blencoe	4.6747**	Guthrie Center	7.8751**	Northwood	3.2720**
Boone	6.9138**	Halbur	2.7776**	Onawa	4.8275**
Cedar Rapids	27.7706**	Hanlontown	0.5571**	Osage	5.2941**
Chariton	10.3945**	Hartley	1.7304**	Okaloosa	16.3785**
Cherokee	0.4662**	Haverhill	7.7598**	Ottosen	2.0262**
Clarence	15.7169**	Hawarden	1.2598**	Oyens	2.4656**
Clinton	5.3547**	Hawkeye	6.5954**	Peterson	-0.5005**
Colo	7.2177**	Hinton	3.2694**	Prairie City	11.1878**
Conrad	8.3548**	Hornick	3.3552**	Ralston	4.2359**
				Red Oak	8.6296**

Table 3.p (cont'd).

Variable	Coeff.	Variable	Coeff.	Variable	Coeff.
Remsen	1.0766**	Sheldon	5.3244**	Vinton	13.7408**
Rockford	4.8908**	Sioux City	7.1306**	Waukee	6.2164**
Rockwell	5.3176**	Sloan	5.5760**	Waverly	5.0798**
Rockwell City	5.1863**	Sperry	25.1120**	Webb	1.2018**
Rudd	5.2945**	Stacyville	4.0209**	Webster City	4.0866**
Runnells	13.5190**	Stanton	4.6390**	Wesley	3.9424**
Ruthven	1.2131**	Stockport	20.1333**	West Bend	1.7766**
Ryan	13.5471**	Templeton	4.3493**	Whittemore	1.8178**
Sanborn	3.6733**	Titonka	2.6962**	Williams	5.1029**
Schaller	0.9260**	Union	7.9017**	Winfield	17.0123**
Scranton	3.4234**	Ventura	3.4601**	Yale	4.1590**

Variable	Sioux Center	Galva	Coon Rapids	Lakota
RE(DIST)	-0.2627**	0.1865**	0.2986**	0.0109
$RE(DIST)^2$	0.0016**	-0.0011**	-0.0022**	1.6E-4
REr(DIST)	0.0014**	-0.0012**	-0.0020**	-1.1E-4
$REr(DIST)^2$	-9.0E-6**	8.0E-6**	1.5E-5**	0.0E-6
MOopen	0.8366**	-0.3735**	1.6536**	-0.6540**
RE	4.6197**	-0.1923**	3.2354**	-3.8904**
Variable	Marcus	Hanlotown	Ashton	W. Burlington
RE(DIST)	0.0190	0.2542 **	-0.0316	-0.0205
$RE(DIST)^2$	-9.2E-5	-0.0018**	-3.7E-5	4.0E-5*
REr(DIST)	-3.8E-4*	-0.0020**	-7.7E-4**	5.8E-4**
$REr(DIST)^2$	2.0E-6*	1.4E-5**	6.0E-6**	-4.0E-6**
MOopen	-2.1297**	-5.0774**	4.9359**	4.0132**
RE	2.7383**	3.1612**	10.0462**	-3.5362**
Variable	Iowa Falls	Mason City	Emmetsburg	Denison
RE(DIST)	0.1440 **	-0.3877 **	0.0296	-0.8506**
$RE(DIST)^2$	-0.0011**	0.0025**	-7.7E-4**	0.0057**
REr(DIST)	-0.0011**	0.0020**	-4.6E-4**	0.0036**
$REr(DIST)^2$	6.0E-6**	1.3E-5**	5.0E-6**	-2.4E-5**
MOopen	-20.3151**	18.3531**	-3.0787**	-2.7891**
RE	9.4713 **	-3.1925 **	5.7144**	3.0240**

Table 3.p (cont'd).

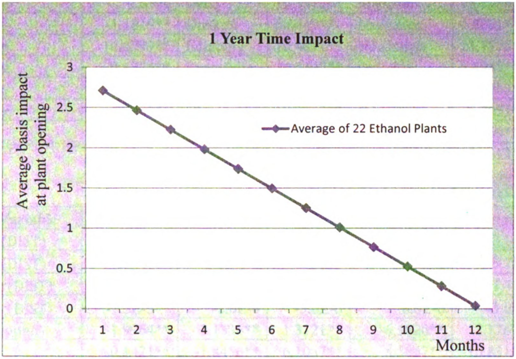
Variable	Ft. Dodge	Goldfield	Jewell	Corning
RE(DIST)	-0.2394**	-0.2874 **	-0.2782 **	0.1300**
$RE(DIST)^2$	0.0024**	2.9E-4	0.0018**	-9.7E-4**
REr(DIST)	5.4E-4**	7.2E-4 **	6.2E-4**	-4.8E-4**
$REr(DIST)^2$	-7.0E-6**	0.0E-6	-4.0E-6**	3.0E-6**
MOopen	8.3017**	-5.8074**	0.2968**	-4.7628**
RE	-7.2141**	15.8989**	2.5313**	2.1707**
Variable	Fairbank	Albert City	Charles	Shanedoah
RE(DIST)	-0.3600 **	-0.2201 **	-0.0365**	0.1006**
$RE(DIST)^2$	0.0025**	0.0011**	-1.1E-4	-5.1E-4**
REr(DIST)	0.0011**	8.9E-4**	-4.0E-4**	-5.7E-4**
$REr(DIST)^2$	-8.0E-6**	-6.0E-6**	3.0E-6**	3.0E-6**
MOopen	9.5526 **	-4.6975**	9.6384**	-9.1911**
RE	-0.5905**	5.7203 **	2.1075 **	2.2770**
Variable	Superior	Stangstar		
RE(DIST)	-0.5245**	0.3253**		
$RE(DIST)^2$	0.0037**	-0.0012**		
REr(DIST)	0.0014**	-4.1E-4**		
$REr(DIST)^2$	-1.1E-5**	1.0E-6		
MOopen	0.2626**	-4.3474		
RE	8.8755**	-3.3894**		

Note: R^2=0.8254 and the spatial error coefficient λ=0.5820 was significant at the 1% level.
* Indicates significance at the 5% level.
** Indicates significance at the 1% level.

Table 3.p shows that λ was statistically significant. The coefficients for the variables USC_t and IAC_t were both significant. Table 3.p also shows the coefficients for the month dummy variables and the grain market dummy variables were all significant. The coefficient of the variable $R_{ie}E_{et}$ was significant at the one percent level in all cases. The average corn price basis level effect across the twenty-two ethanol plants in Iowa was positive 2.71 cents. Therefore, the corn price basis level impact at the site of an ethanol plant opening in Iowa experienced an average increase of 2.71 cents in corn price

basis levels the month an ethanol plant opened. Figure 3.c displays the basis impact at the ethanol plant site opening and how this impact changed as the month since an ethanol plant opening increased. Figure 3.c was constructed by using the average coefficient estimates for the variables $MOopen_e$. Figure 3.c shows that corn price basis levels increased decreased as the number of months since an ethanol plant opening increased.

Figure 3.c Iowa Plants: Months Since Opened Time Impact



The following equation estimates Model 2 for Indiana:

$$(11)\quad B_{it} = \alpha_0 USC_t + \alpha_1 MC_t + \Sigma_k^{11} \alpha_{2k} MO_k + \Sigma_i^{33} \alpha_{3i} MK_i$$

$$+ \Sigma_{e=1}^{6} R_{ie} E_{et} [\delta_e + \beta_{e1} DIST_{ei} + \beta_{e2} (DIST_{ei})^2 + \beta_{e3} r_t DIST_{ei}$$

where the variables are the same as equation (4) and explicit for the state of Indiana. Results for equation (11) are found in Table 3.q.

Table 3.q Indiana Equation (11) Estimate Results

Var.	Coeff.	Var.	Coeff.	Var.	Coeff.
USC	6.3E-4**	Amboy	10.8764**	Hope	5.4475**
KC	-0.0384**	Aurora	17.8384**	Huntingburg	16.8311**
Jan.	3.2424**	Brazil	3.2855**	Jeffersonville	16.7257**
Feb.	-0.7662	Bremen	6.5016**	Kokomo	11.4792**
March	2.9406**	Columbus	4.1137**	Lapaz	6.6318**
April	1.2564**	Decatur	6.2297**	Linden	9.5894**
May	3.9554**	Delphi	10.2167**	Logansport	10.6205**
June	0.6396	Dana	10.3812**	Madison	15.2984**
July	-1.1619**	Dunkirk	6.6449**	Nappanee	4.5061**
Aug.	-10.6799**	Edinburg	10.4811**	Newburgh	23.7775**
Sept.	-9.6774**	Evansville	24.2647**	Oakville	5.4847**
Oct.	-4.6450**	Frankfort	2.8278**	Portage	10.6263**
Nov.	5.8905**	Glenwood	10.7163**	Princeton	15.7951**
		Greensburg	7.3386**	Remington	4.5469**
		Greentown	5.4347**	South Bend	13.6613**
		Hamlet	5.9866**	Sullivan	14.3146**
				Union Mills	3.9175**

Variable	Rensselear	Marion	Clymers	Linden	Portland
RE(DIST)	-0.6802**	-0.1004	-0.2339	0.3567	0.1411
$RE(DIST)^2$	0.0047**	-2.1E-4	0.0013	-0.0023	-5.7E-4
REr(DIST)	0.0021**	6.2E-4	9.3E-4	-0.0015*	1.4E-4
$REr(DIST)^2$	-1.5E-5**	-2.0E-6	-5.0E-6	8.0E-6	-3.0E-6
MOopen	-1.9964**	3.1336**	1.3121**	-6.1820**	2.1767**
RE	-0.1421**	-1.8456**	6.1057**	8.5057**	-10.8316**

Variable	Alexandria
RE(DIST)	0.9068**
$RE(DIST)^2$	-0.0037
REr(DIST)	-0.0022**
$REr(DIST)^2$	8.0E-6
MOopen	1.4822**
RE	-3.5635**

Note: R^2=0.5446 and the spatial error coefficient λ=0.4290 was significant at the 13% level.

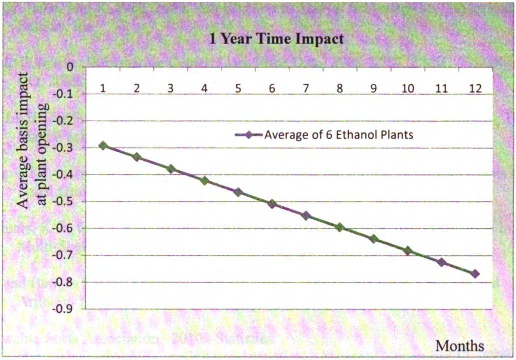
* Indicates significance at the 5% level.

** Indicates significance at the 1% level.

Table 3.q shows that λ was significant at the thirteen percent level. The coefficients for the variables USC_t, INC_t and the grain market dummy variables were significant. The coefficients of the variable $R_{ie}E_{et}$ were significant at the one percent level in all cases. The average basis level impact over the six ethanol plants was a negative .29 cents. Therefore, the corn price basis level impact at the site of an ethanol plant opening in Indiana experienced an average decrease of .29 cents in corn price basis levels the month the ethanol plant opened.

Figure 3.d was constructed by using the average coefficient estimates for the variables $MOopen_e$. Figure 3.d displays that corn price basis levels decreased as the number of months since an ethanol plant opening increased in Indiana.

Figure 3.d Indiana Plants: Months Since Opened Time Impact



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