IMPACT OF ETHANOL PLANTS ON KANSAS LAND VALUES

by

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ABSTRACT

Land values have a fascinating history after the first settlers started moving west in the 19th century. Much research has been done in agricultural economics with regards to land values and this subject will continue to be watched closely as we move further into the 21st century.

The goal of this thesis is to understand the effect that ethanol plants have on the price of land around the ethanol plant. More specifically, the thesis addresses the question of "What impact do ethanol plants have on Kansas Land values?" The thesis also answers the question of "Are land values directly correlated to the proximity of an ethanol plant and if they are directly correlated, to what extent or how much more valuable is a parcel of land that is 30 miles to an ethanol plant compared to a parcel of land that is 70 miles?"

As we move into the 21st century, the nation continues to look for alternative fuel sources. Ethanol produced from corn has played a key role in that search for an alternative fuel. In 2007, the state of Kansas proposed to have 29 ethanol plants built and/or operational in the near future. The majority of the ethanol plants were built in 2006 and 2007 with only 16 of those plants becoming operational. This thesis uses those 16 ethanol plants as the basis of this study. The study determines if land sale values from 2010 to 2013 were directly impacted based on the proximity to the closest ethanol plant.

Corn is the main crop used in this study with regards to the production of ethanol. While other crops can be used to produce ethanol, the study only focused on the corn crops from 2010 to 2013.

The trend in cash corn prices and basis data reflects the advent of the development of ethanol plants with a cash corn high of $8.05 in 2012 and a basis high of $1.84 above futures prices in 2013. In addition to cash corn prices and basis data, the study also collected land parcel sales from the years 2010 to 2013 with 9,279 total observations.

Utilizing regression, an equation was estimated taking into account land price, size of land parcel sold in acres, quarter of year for sale, a year binary variable, the minimum distance of an ethanol plant to each parcel sale, the percent pasture acres, percent irrigation acres, rainfall, cropland productivity, and population density. Results indicated that land closer to an ethanol plant is priced at a premium compared to land further away.

Land values will continue to be closely studied as we move into the 21st century. This study was able to provide a price point per mile of how much more valuable a land parcel is the closer it is located to an ethanol plant. While this study only factored in the closest ethanol plant to that land parcel sale, other factors such as including multiple ethanol plants located in the same town or ethanol plants that are close in proximity to each other could be further analyzed to continue research on this topic.

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I would like to thank Leah Tsoodle, Paul Antonio Leiva Lanza and Richard Llewelyn for their help in gathering and converting the latitude and longitude points for each elevator and ethanol plant as well as obtaining the information on cash corn prices for the elevators throughout Kansas.

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CHAPTER I: INTRODUCTION

Land values have a fascinating history after the first settlers started moving west in the 19th century. Much research has been done in agricultural economics with regards to land values and they will continue to be watched closely as we move further into the 21st century.

The goal of this thesis is to understand the effect that ethanol plants have on the price of land around the plant. Specifically, are land values directly correlated to the proximity of an ethanol plant?

My objective for this thesis is to use regression to test the effect of ethanol plants on the value of land. The hypothesis is that the closer the land parcel is to an ethanol plant, the higher the value of that land parcel will be.

1.1 Ethanol Plants

While some Ethanol Plants were built in the 1970s and 1980s, the industry didn't expand rapidly until midway through the first decade of the 21st century. In the state of Kansas, there were very few ethanol plants running and operating in the year 2003. For this study, 16 plants were studied. Of those 16 plants, there were only three that were operational in 2003:

- Abengoa Bioenergy in Sedgwick County that started production in 2000
- E.S.E. Alcohol, Inc in Wichita county that started production in 1980, and
- US Energy Partners in Russell county that started production in 2002

By 2007, the industry expanded rapidly and there were 29 total plants proposed to be built in Kansas (Kansas Energy Information Network 2014).

For this study, the 16 ethanol plants that are currently operating in Kansas are analyzed. The plant locations are displayed in Figure 1.1 while the plant names and county locations are shown in Table 1.1.

Figure 1.1: Approximate Location of Kansas Ethanol Plants

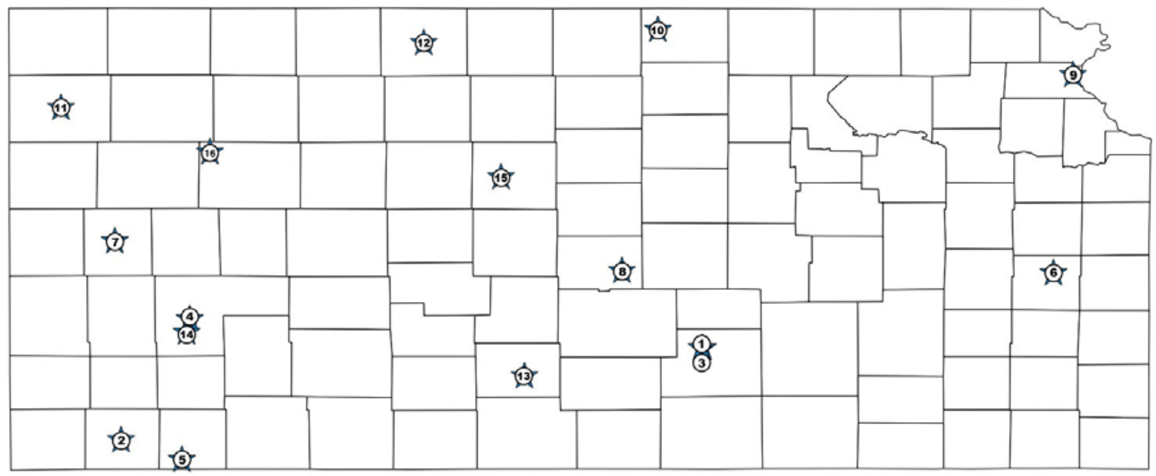


Table 1.1: Kansas Ethanol Plants Operating in 2015

Plant ID Number	Plant Name	Plant County	Year Proposed	Start Date of Ethanol Production
1	Abengoa Bioenergy #2	Sedgwick	2000	2000
2	Abengoa Bioenergy Biomass of KS	Stevens	2011	2014
3	Colwich Ethanol Plant	Sedgwick	Unknown	Unknown
4	Conestoga/Bonanza Bioenergy	Finney	2006	2007
5	Conestoga Arkalon Ethanol	Seward	2006	2007
6	East Kansas Agri-Energy, LLC	Anderson	2001	2005
7	E.S.E. Alcohol, Inc	Wichita	1980	1980
8	Kansas Ethanol	Rice	2007	2007
9	MGP Ingredients	Atchison	Unknown	Unknown
10	Nesika Energy	Republic	2006	2008
11	New Goodland Energy Center	Sherman	Unknown	Unknown
12	Prairie Horizon Agri-Energy	Phillips	2005	2006
13	Pratt Energy LLC	Pratt	2006	2007
14	Reeve Agri-Energy	Finney	Unknown	Unknown
15	US Energy Partners	Russell	2001	2002
16	Western Plains Energy	Borders Gove Logan and Thomas	Unknown	Unknown

The ethanol plant in Colwich, Kansas (Sedgwick County) was purchased by Abengoa Energy in 2014 and started producing corn ethanol later that year. Prior to Abengoa purchasing this location, the plant produced ethanol using milo (sorghum). The plant produces around 25 million gallons of ethanol (Kansas Energy Information Network 2014).

Abengoa Bioenergy Biomass located in Stevens County produces 25 million gallons of ethanol. This plant uses the corn stover as opposed to the actual corn kernels to produce fuel (Kansas Energy Information Network 2014).

Bonanza Bioenergy located in Finney County produces 55 million gallons per year. This plant came online in 2007 (Kansas Energy Information Network 2014).

Conestoga Arkalon Ethanol located in Seward county started producing 110 million gallons in 2007 (Kansas Energy Information Network 2014).

The East Kansas Agri-Energy plant produces more than 40 million gallons of ethanol annually using 16 million bushels of corn. This plant started producing ethanol in 2005 (Kansas Energy Information Network 2014).

ESE Alcohol located in Wichita County produces 1.5 million gallons of ethanol from 0.5 million bushels of corn (Kansas Energy Information Network 2014).

Kansas Ethanol LLC located in Rice County uses milo and corn for their 55 million gallon ethanol plant. This plant started producing in 2007 (Kansas Energy Information Network 2014).

Midwest Grain Products in Atchison was closed in 2002 and started producing again in December 2003 after an explosion at the plant. This plant produces around 9 million gallons of ethanol (Kansas Energy Information Network 2014).

Nesika Energy produces 21 million gallons of ethanol in Republic county and started production in 2008 (Kansas Energy Information Network 2014).

New Goodland Energy Center, located in Sherman County was brought online in 2012 and projected to produce 20 million gallons of ethanol annually (Kansas Energy Information Network 2014).

The plant in Phillips County, Prairie-Horizon Agri-Energy began producing ethanol in 2006 and requires 15 million bushels of grain producing 415,000 tons (Kansas Energy Information Network 2014).

Pratt Energy LLC started production in 2006 producing 50 million gallons of ethanol annually (Kansas Energy Information Network 2014).

Reeve Agri-Energy located in Finney County produces 15 million gallons of ethanol from 5.4 million bushels of corn (Kansas Energy Information Network 2014).

US Energy Partners located in Russell County produces 51 million gallons per year. In 2006, this plant was purchased by White Energy (Kansas Energy Information Network 2014).

The plant that borders Gove, Logan and Thomas counties started operating in 2004. By September 2011, Western Plains Energy was producing 50 million gallons per year (Kansas Energy Information Network 2014).

For this study, corn is the predominant crop that is used for the production of ethanol in the state of Kansas. While ethanol can be produced from a variety of sources including sorghum, sugarcane, etc, corn is used to produce ethanol in Kansas. Because corn is the main commodity to produce ethanol, cash corn prices and corn basis figures plays a role in the profitability of corn production near an ethanol plant.

CHAPTER II: LITERATURE REVEIW

Land values have been a popular research topic in agricultural economics. In recent years, states have seen a dramatic increase in land values, especially after 2005. Many economists have researched land values trying to identify the root cause of the recent spike agricultural land values.

One of the key factors producers consider in purchasing land is location. Land that is located close to the end destination for use for the crop can be very beneficial, because of savings on transportation costs.

Von Thünen discusses the theory that distance to the market place is a factor affecting land values (Von Thunen 1826). The closer the land parcel is to an end use such as an ethanol plant, the higher the land value should be.

Wohlenberg expanded on Von Thünen's concept in his thesis "Brazil Farmland Price Volatility in Distinct Production Regions". Wohlenberg concluded, "Land rent decreases as the distance to the market increases" and "areas far from the markets are exposed to greater changes in land prices" (Wohlenberg 2014).

For this study, we expand on these ideas by Von Thünen and Wohlenberg to examine the impact an ethanol plant close to a land parcel has on value. First we need to understand the history and importance that the ethanol has played at the beginning of the 21st century.

During the decade of the seventies, ethanol was still in its infancy. The nation encountered a gasoline crisis during this time frame and the search for alternative fuels took root. Oil production was on the decline while Americans were increasing their consumption of gasoline. When OPEC imposed an Oil Embargo in 1973, this led to high gas prices and fuel shortages and resulted in an increase in the price of oil from $3 a barrel to $12 a barrel (Staff, History.com 2010). “That crisis set up the first wave for the ethanol industry.” “ (Hart, Otto and Hudak 2012, 1).”

According to Henderson and Gloy’s study on The Impact of Ethanol Plants on Cropland Values in the Great Plains, “Changes in US energy policy in 2005 bolstered the demand for ethanol (Henderson and Gloy 2008, 2).” The raise in corn prices during the past decade also contributed to the increased demand for ethanol as the nation looked for alternative fuel sources. According to Hart, Otto, and Hudak, “ethanol contributed between $0.47 and $0.85 per bushel to the corn price increase (Hart, Otto and Hudak 2012, 6).”

Given the impact of ethanol on corn prices in the past decade, the idea of land values being influenced by distance to the marketplace is the focus of this thesis.

Tsoodle, Featherstone and Golden estimated “the market value of agricultural parcels in Kansas, taking into account the influence of urban location on the market price of agricultural land,” (2005). While Kansas is predominantly agricultural, there are two large metropolitan areas, Kansas City and Wichita that are accounted for in their model.

Tsoodle, Featherstone and Golden’s research is key for this study as ethanol plant locations are modeled similarly to Kansas City and Wichita. The model for this study uses the double log hedonic model developed in their research. Rather than use the explanatory variables of Wichita and Kansas City and the distance to cities with population more than 10,000, we substitute the minimum distance to an ethanol plant for each parcel of land.

CHAPTER III: THEORY

In this chapter, the theory for this thesis is discussed. The time period being studied is 2010 through 2013.

3.1 Supply and Demand

Supply and demand are key factors affecting land values. Changes in demand for corn from ethanol occurred in the past decade as the nation looked for alternative fuel sources. Because of the increase in demand for ethanol, this increased the price of corn over the past decade.

Baye discusses the effects on price curves when demand increases or decreases. Baye uses the analogy of gasoline and rental cars (Baye 2010).

We can expand on Baye's example of shifting demand curves to show what happened to the demand for corn and the cash corn price in the nation with the expansion of ethanol in the first decade of the 21st century. In 2002, the United States produced 227,767,000 metric tons of corn while the average corn price was about $2.00 per bushel (Table 3.1). By 2011, production increased to 312,789,000 metric tons while prices rose to $6.30 per bushel (United States Department of Agriculture 2014).

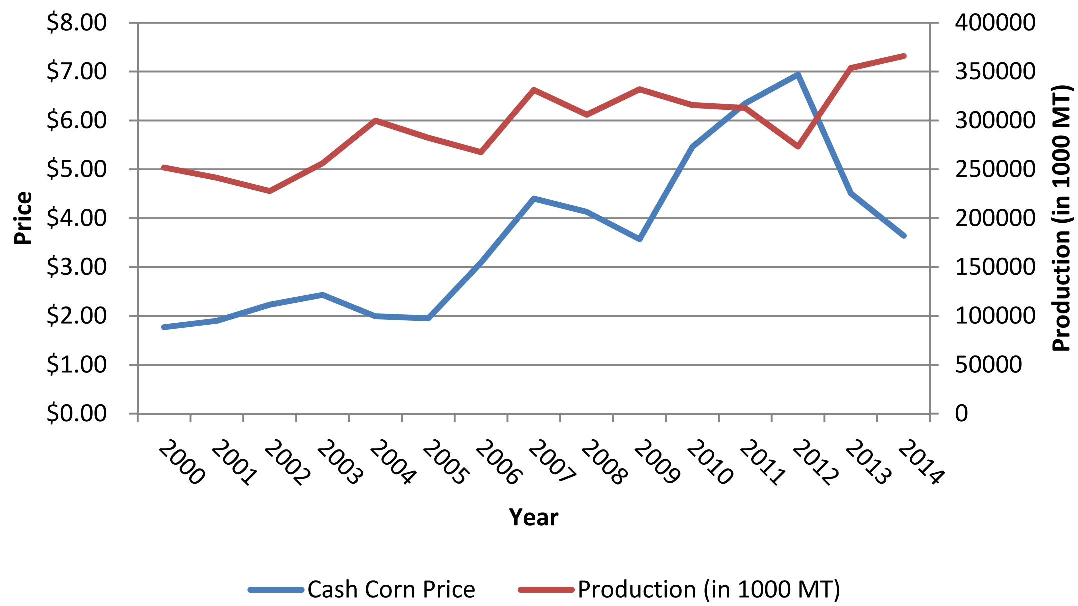
In Figure 3.1 cash corn prices hovered around the $2 a bushel range from 2000 until 2005. Once ethanol started being looked at as an alternative fuel source in 2005, there was an uptick in cash corn prices doubling the price to about $4 a bushel range in 2007 and climbing to as high as $7 a bushel in 2012.

Table 3.1: Cash Corn Price and Corn Production in United States from 2000 to 2014

Market Year	Cash Corn Price	Production (in 1000 MT)
2000	$1.77	251,854
2001	$1.90	241,377
2002	$2.23	227,767
2003	$2.43	256,229
2004	$1.99	299,876
2005	$1.95	282,263
2006	$3.09	267,503
2007	$4.40	331,177
2008	$4.13	305,911
2009	$3.57	331,921
2010	$5.46	315,618
2011	$6.35	312,789
2012	$6.94	273,192
2013	$4.51	353,715
2014	$3.64	365,965

SOURCE: (United States Department of Agriculture 2014)

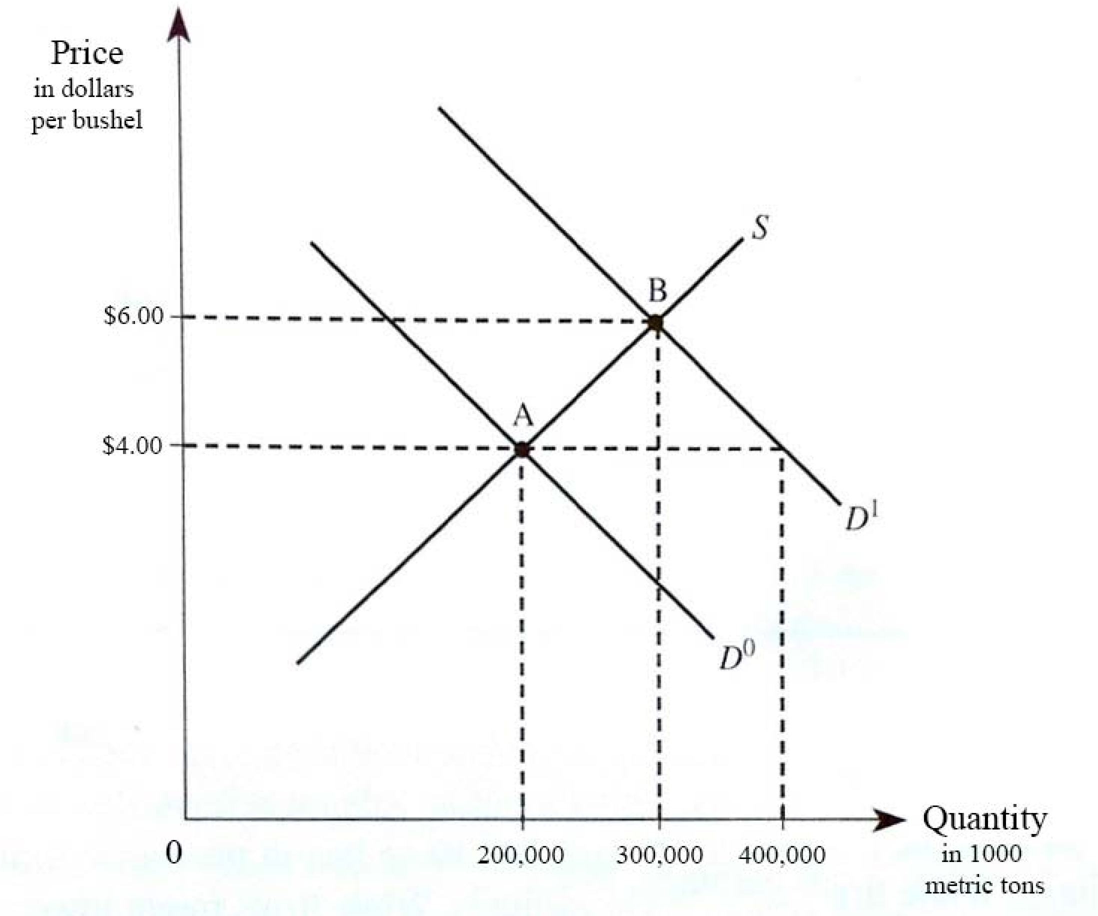
Figure 3.1: Effect of a change in Demand for Corn due to Ethanol Production



SOURCE: (United States Department of Agriculture 2014)

As ethanol demand increased during the early part of the 21st century, the quantity of corn demanded increased as well (Figure 3.2). As more corn was demanded for the ethanol market, supply increased as a result of rising prices. Thus using Bayes' model, we can see what happened to the demand curve when the quantity of corn increased. The initial demand curve was D^0 before ethanol was in demand. Once ethanol entered the marketplace, the demand curve shifted to the right to the new demand curve D^1 resulting in the new equilibrium at point B with a higher price and more corn demanded.

Figure 3.2: Effect of a change in Demand for Corn due to Ethanol



3.2 Basis

Basis is a key factor for understanding commodity markets. The Commodity Trading Manual by the Chicago Board of Trade defines basis as "the difference between the cash price at a specific location and the price of a particular futures contract" (Chicago Board of Trade 1980).

Several factors can cause the cash basis price at a local elevator or ethanol plant to change. According to the Commodity Trading Manual by the Chicago Board of Trade, some of these factors include:

- The availability and cost of transportation,
- Supply and demand conditions at the location of the cash commodity relative to the terminal market where deliveries are permitted,
- Variations in quality factors between the cash commodity and the contract grade of the commodity in the futures market,
- The availability of storage space at the location of the cash commodity relative to that at the futures market, and
- Relative supply and demand and price levels of substitutable commodities.

3.3 Year 2010

Figure 3.3 and Table 3.2 show the cash corn price and basis for the year 2010. During this year, there were 2,944 land parcel sales data available.

The highest cash corn price paid at an elevator in 2010 was in Jefferson County at $5.69 a bushel. The highest statewide average cash corn price was $5.29 a bushel in December 2010.

The lowest cash corn price paid at an elevator in 2010 was $2.83 a bushel in Cheyenne County. The lowest statewide average cash corn price was seen in June 2010 at $3.12 a bushel.

The highest basis price seen at a single location was -$0.04 below futures while the highest average basis for the entire state was -$0.28 below futures in August 2010.

The lowest basis price seen at a single location was -$0.93 below futures while the lowest average basis for the entire state was -$0.65 below futures in September 2010.

Figure 3.3: Statewide Corn Price and Corn Basis Average for Kansas 2010

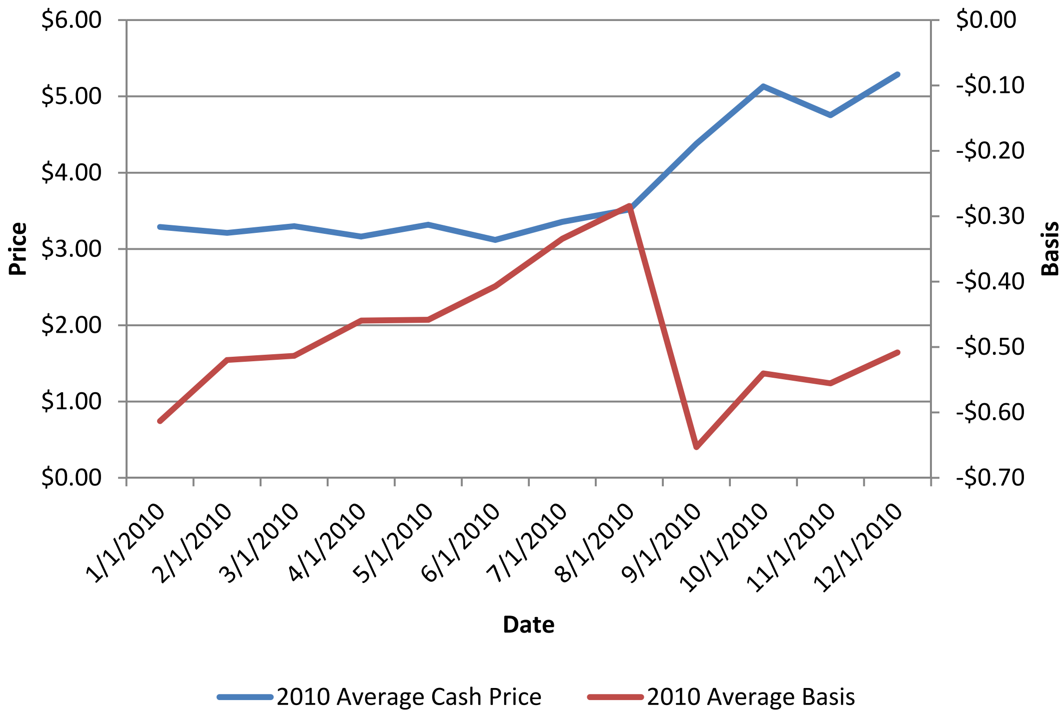


Table 3.2: Statewide Corn Price and Corn Basis Average for Kansas 2010

Month	Average Cash Price	Average Basis	Number of Elevators Reporting
1/1/2010	$3.29	-$0.61	618
2/1/2010	$3.21	-$0.52	700
3/1/2010	$3.30	-$0.51	710
4/1/2010	$3.16	-$0.46	711
5/1/2010	$3.32	-$0.46	738
6/1/2010	$3.12	-$0.46	738
7/1/2010	$3.36	-$0.33	711
8/1/2010	$3.52	-$0.28	747
9/1/2010	$4.38	-$0.65	700
10/1/2010	$5.13	-$0.54	774
11/1/2010	$4.75	-$0.56	766
12/1/2010	$5.29	-$0.51	760

3.4 Year 2011

Figure 3.4 and Table 3.3 show the cash corn price and basis for the year 2011. During this year, there were 2,213 land parcel sales data available.

The highest cash corn price paid at an elevator in 2011 was in Meade County at $7.67 a bushel. The highest statewide average cash corn price was $7.19 a bushel in August 2011.

The lowest cash corn price paid at an elevator in 2011 was $5.20 a bushel in Cheyenne County. The lowest statewide average cash corn price was seen in March 2011 at $5.58 a bushel.

The highest basis price seen at a single location was $0.56 above futures while the highest average basis for the entire state was $0.07 above futures in August 2011.

The lowest basis price seen at a single location was -$0.97 below futures while the lowest average basis for the entire state was -$0.58 below futures in March 2011.

Figure 3.4: Statewide Corn Price and Corn Basis Average for Kansas 2011

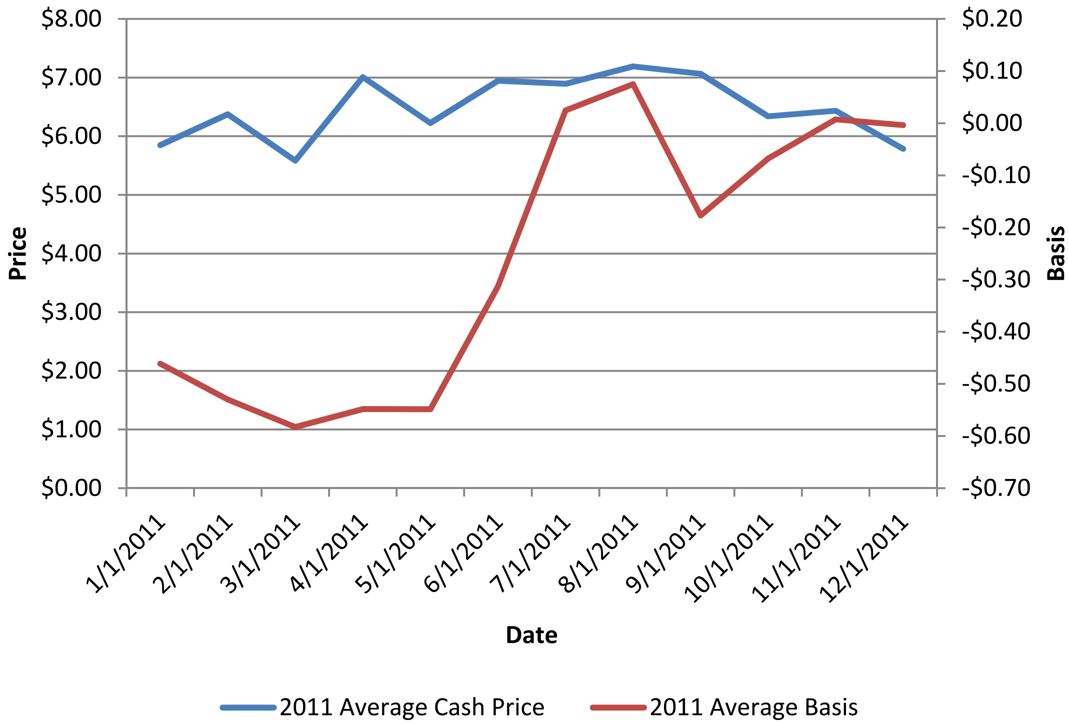


Table 3.3: Statewide Corn Price and Corn Basis Average for Kansas 2011

Month	Average Cash Price	Average Basis	Number of Elevators Reporting
1/1/2011	$5.85	-$0.46	765
2/1/2011	$6.38	-$0.53	762
3/1/2011	$5.58	-$0.58	756
4/1/2011	$7.01	-$0.55	749
5/1/2011	$6.22	-$0.55	751
6/1/2011	$6.94	-$0.31	673
7/1/2011	$6.89	$0.02	678
8/1/2011	$7.19	$0.07	486
9/1/2011	$7.07	-$0.18	517
10/1/2011	$6.34	-$0.07	471
11/1/2011	$6.43	$0.01	549
12/1/2011	$5.79	$0.00	493

3.5 Year 2012

Figure 3.5 and Table 3.4 show the cash corn price and basis for the year 2012. During this year, there were 2,172 land parcel sales data available.

The highest cash corn price paid at an elevator in 2012 was in Stevens County at $8.55 a bushel. The highest statewide average cash corn price was $8.07 a bushel in July 2012.

The lowest cash corn price paid at an elevator in 2012 was $4.81 a bushel in Edwards County. The lowest statewide average cash corn price was seen in April 2012 at $5.91 a bushel.

The highest basis price seen at a single location was $0.60 above futures while the highest average basis for the entire state was $0.12 above futures in July 2012.

The lowest basis price seen at a single location was -$1.12 below futures while the lowest average basis for the entire state was -$0.11 below futures that occurred in both April and October 2012.

Figure 3.5: Statewide Corn Price and Corn Basis Average for Kansas 2012

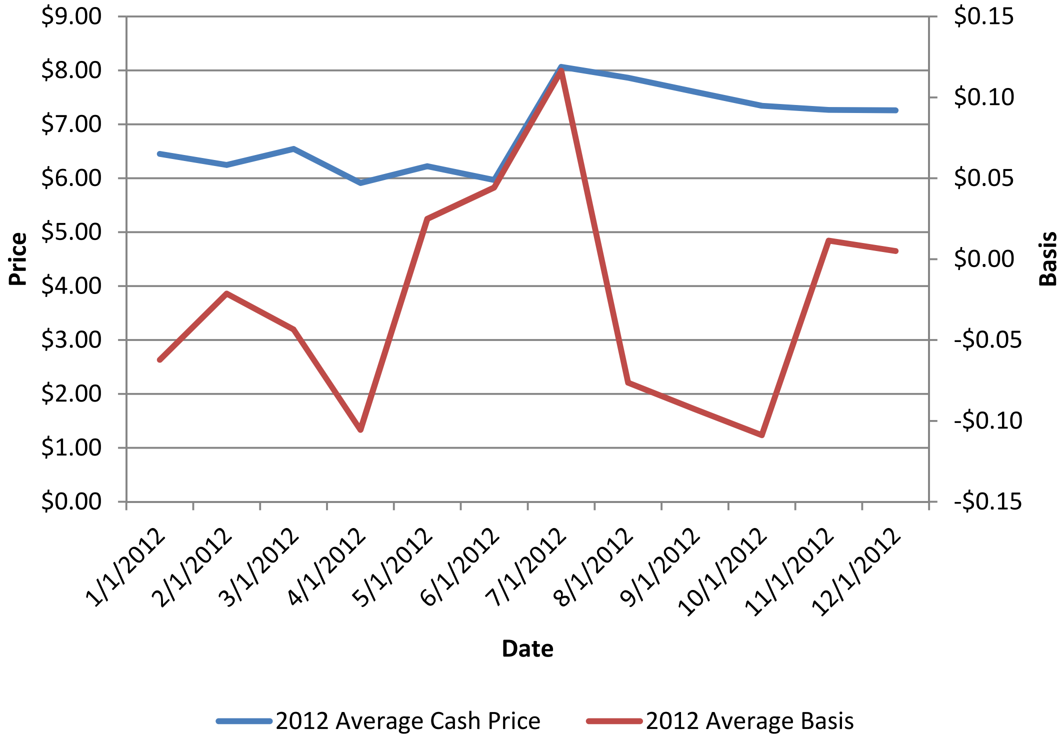


Table 3.4: Statewide Corn Price and Corn Basis Average for Kansas 2012

Month	Average Cash Price	Average Basis	Number of Elevators Reporting
1/1/2012	$6.45	-$0.06	468
2/1/2012	$6.25	-$0.02	660
3/1/2012	$6.54	-$0.04	567
4/1/2012	$5.91	-$0.11	616
5/1/2012	$6.22	$0.02	564
6/1/2012	$5.97	$0.04	655
7/1/2012	$8.07	$0.12	575
8/1/2012	$7.86	-$0.08	585
9/1/2012	$7.60	-$0.09	712
10/1/2012	$7.35	-$0.11	592
11/1/2012	$7.27	$0.01	643
12/1/2012	$7.26	$0.00	610

3.6 Year 2013

Figure 3.6 and Table 3.5 show the cash corn price and basis for the year 2013. During this year, there were 1,961 land parcel sales data collected for the study.

The highest cash corn price paid at an elevator in 2013 was in Meade County at $7.68 a bushel. The highest statewide average cash corn price was $7.38 a bushel in January 2013.

The lowest cash corn price paid at an elevator in 2013 was $3.81 a bushel in Pottawatomie, Nemaha and Marshall Counties. The lowest statewide average cash corn price was seen in December 2013 at $4.12 a bushel.

The highest basis price at a single location was $1.85 above futures while the highest average basis for the entire state was $1.36 above futures in July 2013.

The lowest basis price seen at a single location was -$0.47 below futures while the lowest average basis for the entire state was -$0.17 below futures in October 2013.

Figure 3.6: Statewide Corn Price and Corn Basis Average for Kansas 2013

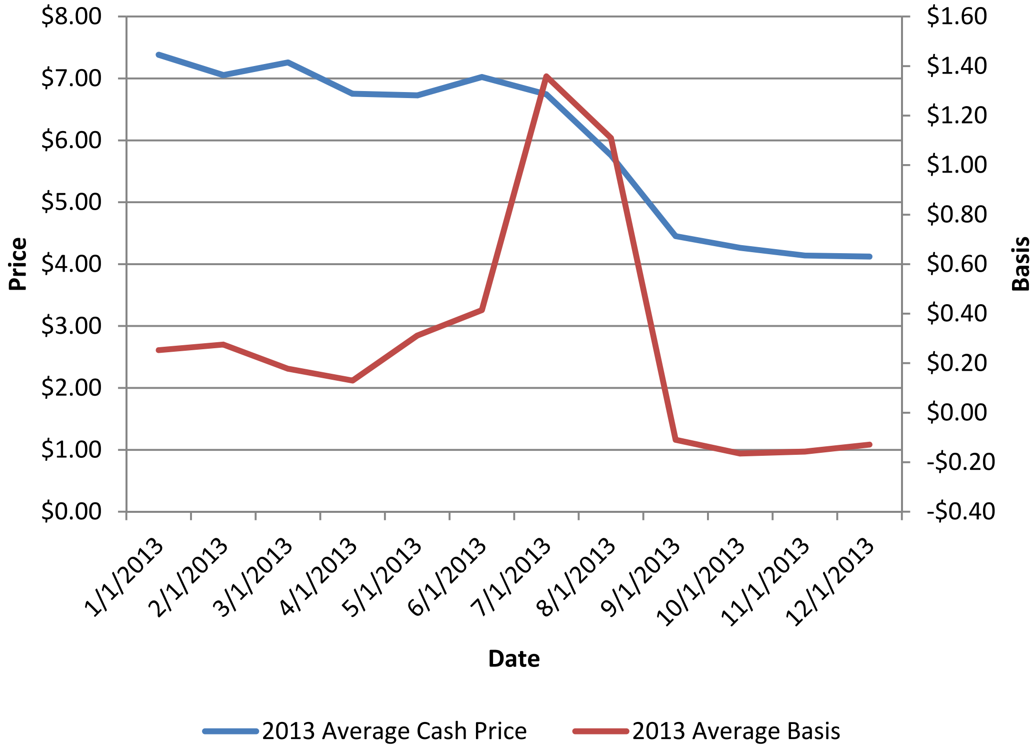


Table 3.5: Statewide Corn Price and Corn Basis Average for Kansas 2013

Month	Average Cash Price	Average Basis	Number of Elevators Reporting
1/1/2013	$7.38	$0.25	583
2/1/2013	$7.05	$0.28	641
3/1/2013	$7.26	$0.18	546
4/1/2013	$6.75	$0.13	621
5/1/2013	$6.73	$0.31	622
6/1/2013	$7.02	$0.41	665
7/1/2013	$6.74	$1.36	606
8/1/2013	$5.76	$1.11	672
9/1/2013	$4.45	-$0.11	711
10/1/2013	$4.26	-$0.17	632
11/1/2013	$4.14	-$0.16	642
12/1/2013	$4.12	-$0.13	615

CHAPTER IV: METHODS

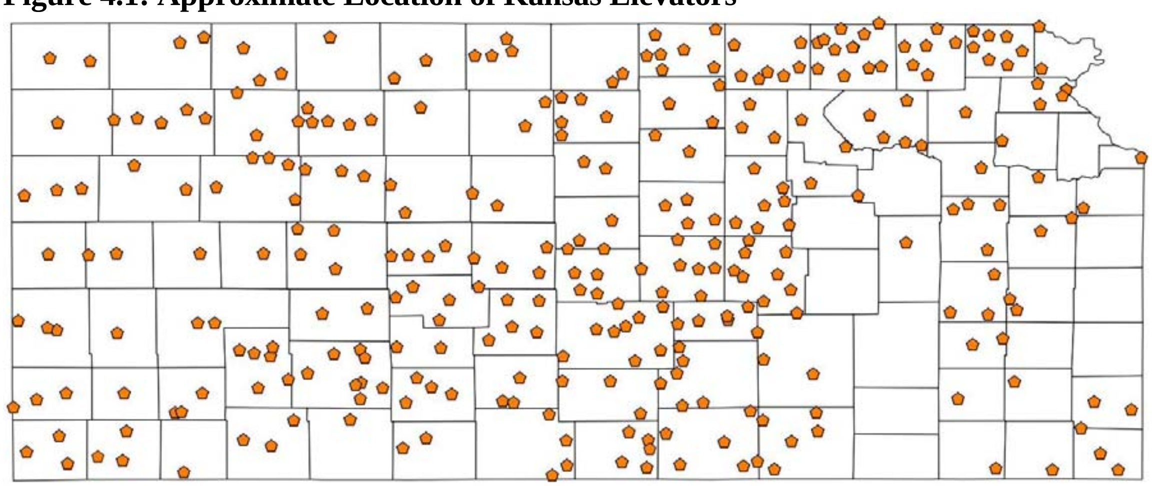
In this chapter, the methods and econometric model used for this research are presented. The objective of this research is to estimate the market value of agricultural land with regards to their location to an ethanol plant. The nonlinear model estimated for this research parallels the model estimated by Tsoodle, Featherstone, and Golden (2005).

The time period for this study will be the four year period from 2010 to 2013. Data collected from Kansas State University as well as Census survey data was gathered to include in the nonlinear model.

4.1 Elevator Locations

This study used elevator data gathered by Kansas State University Department of Agricultural Economics and from DTN for various elevators located throughout the state. Data was obtained from 2010 to 2013 for corn. Some towns had more than one elevator located in the same town/city. Figure 4.1 provides the approximate location of the elevators across the state used in this study.

Figure 4.1: Approximate Location of Kansas Elevators



4.2 Corn Basis

Basis is a key factor in farmer profitability. The Commodity Trading Manual by the Chicago Board of Trade defines basis as “the difference between a cash price at a specific location and the price of a particular futures contract” (Chicago Board of Trade 1980). Basis can either be strong or weak depending on how closely the cash price is to the futures price. “A weak basis (cash far below futures price) reflects an oversupply and/or low demand situation, and a strong basis (cash closer to or over futures price) reflects an undersupply and / or heavy demand situation” (Chicago Board of Trade 1980).

On September 18, 2013, Hi Plains Coop in Colby, Kansas had a basis of $0.69 above the futures price with a cash price of $5.26. The futures price contract was $5.95. This was a strong basis.

On September 15, 2010, the Wakefield Farmers Coop in Wakefield, Kansas had a basis of -$0.79 basis with a cash price of $4.16. The futures price contract was $4.95. This is a weak basis.

Over the four year period being studied in this project, 2013 saw an exceptionally strong demand for corn as the highest basis was $1.84 above the futures price with a cash price of $7.23 on July 17, 2013 at the Cargill plant in Hutchison, Kansas. In contrast, the lowest basis was on January 11, 2012 in Rush Center, Kansas at the Mid State Farmer Cooperative. They had a basis of -$1.18 below the futures price with a cash price of $5.33.

From 2010 to 2013, the statewide average cash corn price for Kansas increased from $3.39 in January 2010 to as high as $8.05 in July 2012. The rest of 2012 saw prices above $7.00 before receding to $4.12 in December 2013. The increase in price at each local area increases the cash returns for farmers that in turn increases the land values.

Figure 4.2 graphs the statewide Kansas average corn from January 2010 to December 2013. This graph constructed from 126,938 data points from the various elevators located throughout Kansas. The average cash price and average basis figures were then calculated from the entire data set to determine one overall average for Kansas.

Figure 4.2: Statewide Corn Price and Basis Average for Kansas 2010 to 2013

4.3 Sales Data by Year

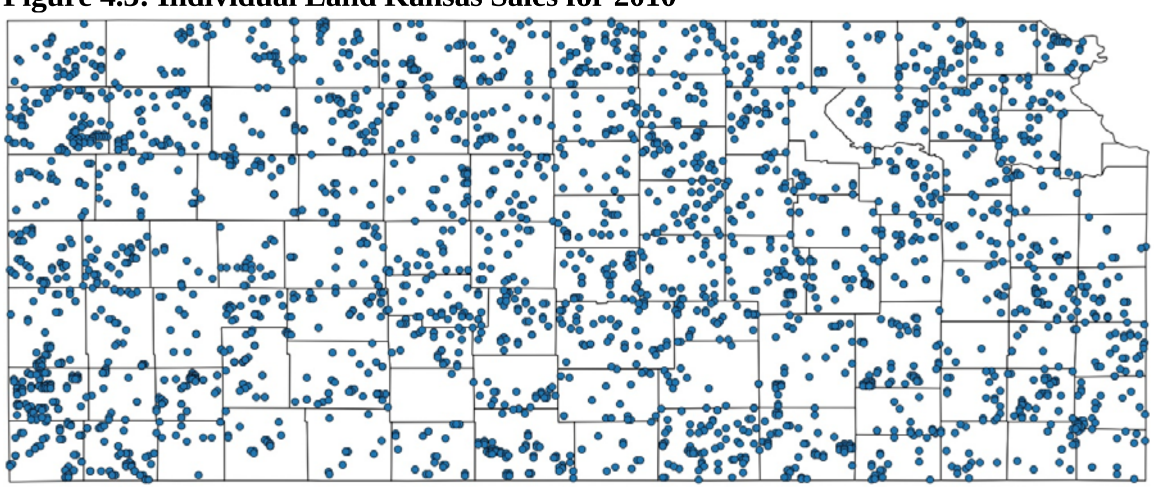
The four year period for this study was from 2010 to 2013. Individual land sales were obtained for each year. In comparison, cash corn prices and basis figures were also collected for each year.

4.3.1 Sales Data for 2010

In 2010, there were 2,944 land parcel sales collected for the state for this research study (Figure 1.4). These sales were for all counties with the exception of two: Johnson and Wyandotte that are close to Kansas City.

In 2010, cash corn prices for the state varied from a low of $2.83 on June 1 to a high of $5.69 on December 29. The average state basis was below futures with a low of -$0.93 on May 1 and a high of $-0.04 on April 2.

Figure 4.3: Individual Land Kansas Sales for 2010

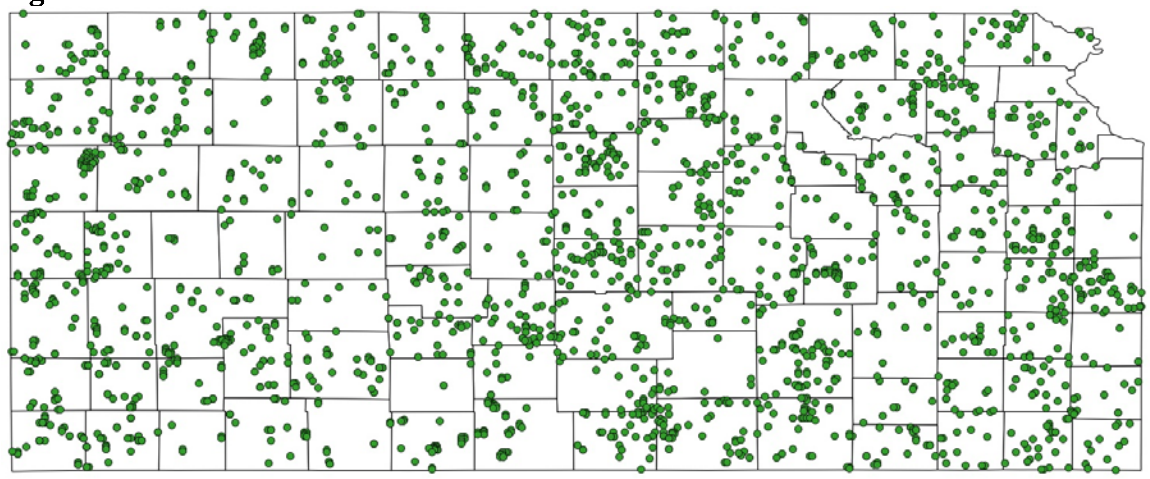


4.3.2 Sales Data for 2011

In 2011, there were 2,213 land parcel sales obtained for the state for this research study (Figure 4.4). These sales were for all counties with the exception of two: Johnson and Wyandotte that are close to Kansas City.

In 2011, cash corn prices for the state varied from a low of $5.20 on March 1 to a high of $7.67 on August 11. The average state basis varied from a low of -$0.97 on March 1 to a high of $0.56 on August 11.

Figure 4.4: Individual Land Kansas Sales for 2011

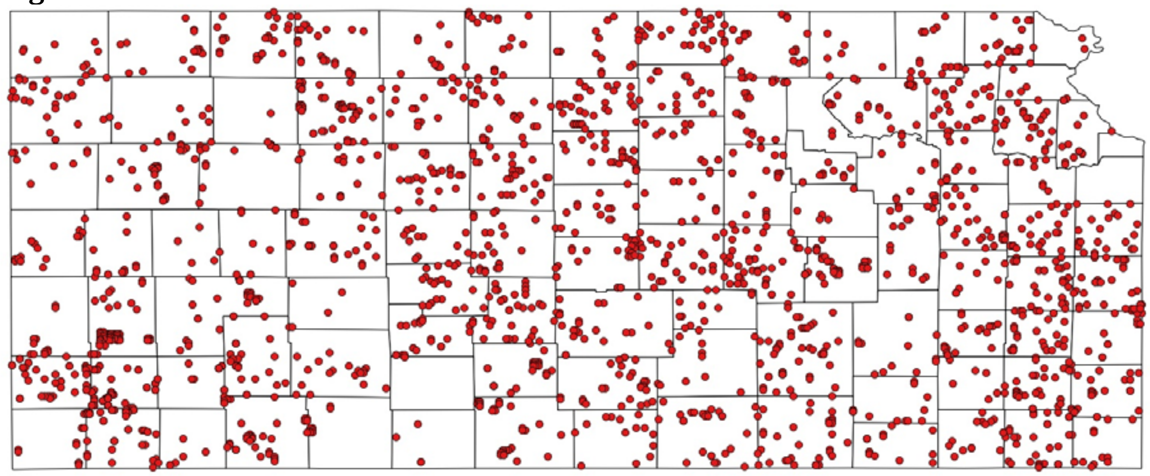


4.3.3 Sales Data for 2012

In 2012, there were 2,172 land parcel sales obtained for the state for this research study (Figure 4.5). These sales were for all counties with the exception of two: Johnson and Wyandotte that are close to Kansas City.

In 2012, cash corn prices for the state varied from a low of $4.81 on June 11 to a high of $8.55 on July 2. The average state basis varied from a low of -$1.12 on June 11 to a high of $0.60 on November 27.

Figure 4.5: Individual Land Kansas Sales for 2012

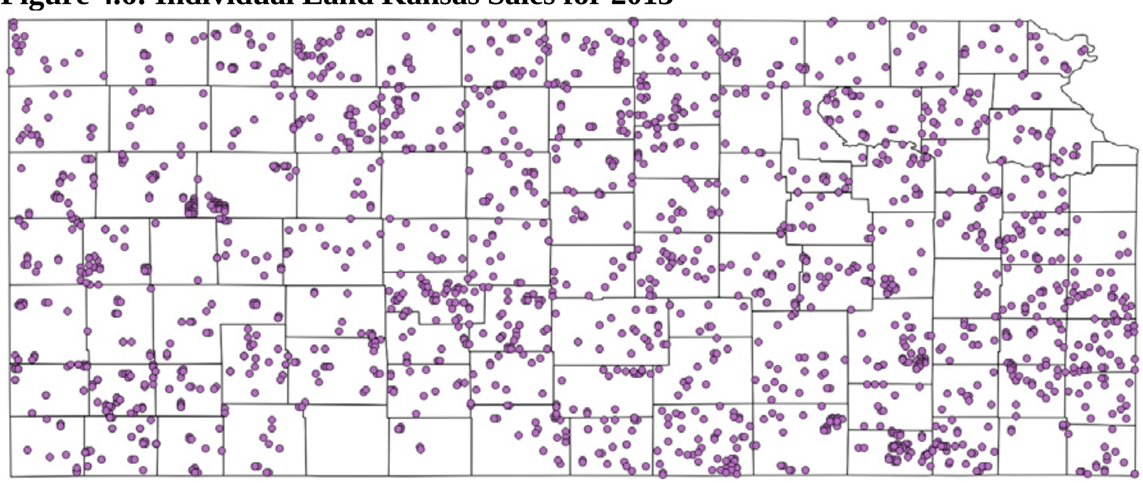


4.3.4 Sales Data for 2013

In 2013, there were 1,961 land parcel sales obtained for the state for this research study (Figure 4.6). These sales were for all counties with the exception of two: Johnson and Wyandotte that are close to Kansas City.

In 2013, cash corn prices for the state varied from a low of \$3.81 on December 12 to a high of \$7.68 on January 25. The average state basis varied from a low of -\$0.47 on September 13 to a high of \$1.85 on July 31.

Figure 4.6: Individual Land Kansas Sales for 2013



4.4 Model

The econometric model estimated for this research is as follows:

$$LSPA = \beta_o + \beta_1*lnsize + \beta_2*q1 + \beta_{2a}*q2 + \beta_{2b}*q3 + \beta_3*y2011 + \beta_{3a}*y2012 + \beta_{3b}*y2013 + exp(\{\beta_4\} - \{\beta_5\}*eth\_dist) + \beta_6*perpasacre + \beta_7*perirracre + \beta_8*lnrain + \beta_9*lnciwave + \beta_{10}*lnpopdes$$

The variables and the means, standard deviations, minimums, and maximums (Table 4.1) are discussed below.

4.5 Data Results

Table 4.1: Mean, Standard Deviation, Minimum and Maximum for Kansas Land Sales

Variable	Mean	Standard Deviation	Min	Max
Price	$1,741.51	$2,168.90	$3.13	$67,948.72
Total Acres	161.8	114.841	26.6	1634.8
Quarter 1	0.2409	0.42763	0	1
Quarter 2	0.2845	0.45121	0	1
Quarter 3	0.2103	0.40752	0	1
Quarter 4	0.2644	0.44102	0	1
y2010	0.3173	0.46544	0	1
y2011	0.2385	0.42619	0	1
y2012	0.2341	0.42344	0	1
y2013	0.2102	0.40744	0	1
Land Productivity (Ciwave)	41.4773	1.4010	0.0297	187.08
Population Density	10.1498	2.9430	1.6	499.6
Perpasacre	0.4147	0.4133	0	1
Perirracre	20.8725	45.2029	0	1
Rain (inches)	28.6378	7.9324	14.6	45.6
eth_dist (miles)	35.8182	18.6196	0.6658	97.6379

4.6 Data and Variables

4.6.1 Land Price

The main variable in the equation is LSPA, the logged price of the sale price per acre of each parcel. There were 9,279 total observations gathered during the four year time period from 2010 to 2013 for Land Price. The average price per acre was $1741.51 with a standard deviation of 2169. The minimum price was $3.13 per acre sold on March 3, 2010 in Rush county while the maximum price was $67,949 sold in Wallace County on January 21, 2011.

4.6.2 Size of Land Parcel Sold in acres

The variable is the logged total number of acres in each land parcel sale. Prior research (Featherstone, et al. 1993) (Roka and Palmquist 1997) (Xu, Mittelhammer and Barkley 1993) has shown the expected sign on this coefficient is negative.

The average size was 161.80 acres while the standard deviation was 114.84 acres. The minimum size sold was 26.6 acres in Hamilton county on August 12, 2011 while the maximum size sold was 1634.8 acres in Cowley county on October 28, 2013.

4.6.3 Quarters 1, 2, 3 and 4

Each land parcel sale listed the month, day and year the sale took place. This was then associated with the quarter that sale took place. Q1 is assigned to January through March, Q2 is assigned to April through June, Q3 is assigned to July through September and Q4 is assigned to October to December.

In the econometric model, Q4 was used as the default. The coefficients for Q1, Q2, and Q3 are expected to be negative to Q4 due to the trend in land prices throughout the period.

4.6.4 Years 2010, 2011, 2012, and 2013

Each land parcel sale listed the month, day and year the sale took place. This was then associated with the year that sale took place.

The year 2010 was used as the default. With the land prices increasing, the coefficients for y2011, y2012 and y2013 are expected to be positive.

4.6.5 Ethanol Plants

The explanatory variable in the model is the minimum distance to an Ethanol Plant. Each land parcel sale was assigned the Latitude and Longitude coordinates for that sale. Calculations were made to determine the nearest ethanol plant to that location. This coefficient is used to determine if land value decreases with increased distance to an ethanol plant. It is expected to be positive and the closer each land parcel is to an ethanol plant, the higher in land value per acre that parcel of land.

In working with the Agricultural Economics Department at Kansas State University, GIS data is used to measure the distance between the parcel of the land sale and the nearest ethanol plant location in Kansas to that land parcel sale. The distance is measured in miles.

"To calculate the distance, latitude and longitude are converted from decimal degrees to radian degrees using the following formulas:

(6) $Long\_Rad_1 = Long_1\_Dec * (\pi / 180)$,

(7) $Lat\_Rad_i = Lat_1\_Dec * (\pi / 180)$.

The formulas used to calculate the distance are:

(8) $AA = \sin(Lat\_Rad_1) * \sin(Lat\_Rad_{i+1}) + \cos(Lat\_Rad_i) * \cos(Lat\_Rad_{i+1}) * \cos(Long\_Rad_i - Long\_Rad_{i+1})$,

(9) $CC = \arccos(AA)$,

(10) $Distance = Earthradius * CC$,

where AA is an intermediate calculation to use the "great circle" formula." (Tsoodle, Featherstone and Golden 2005)

4.6.6 Percent Pasture Acre

Pasture Land in Kansas has seen a 15.6 percent increase over the past four years rising from $1,020 an acre in 2010 to $1,684 an acre in 2014 (Taylor 2015). Compared to non-irrigated cropland, the expected coefficient is negative.

4.6.7 Percent Irrigation Acre

Similar to the Pasture Land, Irrigation land has seen a significant increase over the past four years. Irrigated land rose 20.8 percent from 2010 to 2014 going from $3,233 an acre in 2010 to $6,281 an acre in 2014 (Taylor 2015). Compared to non-irrigated cropland, the coefficient is expected to be positive.

4.6.8 Rainfall

Rainfall plays a very important role in crop development so this is a significant variable to include in the estimated model. Rainfall averaged 28.64 inches of rainfall per county for the state of Kansas with a standard deviation of 7.93 inches. The county with the minimum amount of rainfall was Stanton County with 14.6 inches while the county with the maximum amount of rainfall was Crawford County with 45.6 inches.

Appendix A contains the county average rainfall from 1981-2010 (Kansas Statistical Abstract).

Rainfall is measured in inches and the variable is logged in the model. The estimated coefficient is expected to be positive as the higher amount of rainfall received in a county, crop yields will be higher.

4.6.9 Cropland Productivity

The United States Department of Agriculture Natural Resources Conservation Service (NRCS) developed a system to rate cropland productivity based on certain characteristics. For more information on the index, the NRCS has a userguide discussing how the cropland productivity index is calculated (United States Department of Agriculture Natural Resource Conservation Services 2012).

Cropland productivity is a measurement of productivity for each soil for each land parcel. The variable is constructed using a weighted average of soil types found on each parcel of land. This variable was included in the model as each soil varies dependent on where each parcel of land resides in the state.

The soil properties that this variable takes into account are:

- moisture holding capacity,
- slope, and
- texture (Sandy, loamy, clay)

This estimated coefficient is expected to be positive, the more productive the soil, the higher the land value.

4.6.10 Population Density

County Population is measured in units of one for each person. The data was collected by the United States Census Bureau. To obtain population density, the area for each county was obtained and divided by the population per county. The log of that result was then calculated to provide this variable (lnpopdes). Each land parcel sale was assigned the appropriate population density dependent on that county it was located in. See Appendix B for the population for each county.

The sign on this coefficient is expected to be positive. High population counties will be urban centers with development potential, increasing the land value.

CHAPTER V: RESULTS

The STATA program was used to estimate the regression model. There were 9,279 total observations gathered for land parcel sales. A two sided test was run at the 95 percent level. The results proved to be statistically significant with a R-Squared value of 0.1852.

5.1 Model

The econometric model estimated for this research is as follows:

$$LSPA = \beta_o + \beta_1 * lnsize + \beta_2 * q1 + \beta_{2a} * q2 + \beta_{2b} * q3 + \beta_3 * y2011 + \beta_{3a} * y2012 + \beta_{3b} * y2013 + exp(\{\beta_4\} - \{\beta_5\} * ethdist) + \beta_6 * perpasacre + \beta_7 * perirracre + \beta_8 * lnrain + \beta_9 * lnciwave + \beta_{10} * lnpopdes$$

5.2 Data Results

Table 5.1: Estimate Coefficients for Kansas Land Price, 2010 to 2013

				R-Squared	0.1852
Model	1426.8773	13	109.759791	**Adj R-Squared**	0.1841
Residual	6275.9394	9265	0.677381475	**Root MSE**	0.8230319
Total	7702.8167	9278	0.830223826	**Res. Dev.**	22,704.29

lnprice	**Coef**	**Std Err**	**t**	**P>|t|**
Intercept	-10.4564			
Land Size	-0.08138	0.01605	-5.07	0.000
Quarter 1	-0.23288	0.02436	-9.56	0.000
Quarter 2	-0.13635	0.02337	-5.84	0.000
Quarter 3	-0.10419	0.02516	-4.14	0.000
Year 2011	0.24153	0.23497	10.28	0.000
Year 2012	0.35059	0.02357	14.88	0.000
Year 2013	0.47069	0.02429	19.37	0.000
Ethanol Plants	2.68075	0.01266	211.72	0.000
Min Dist Eth Plant	0.00037	0.00004	9.91	0.000
Percent Pasture	-0.46379	0.02456	-18.89	0.000
Percent Irrigated	0.67234	0.04203	16	0.000
Rain	0.99968	0.04845	20.63	0.000
Productivity	0.05116	0.02803	1.83	0.068
Population Density	0.03662	0.01042	3.51	0.000

5.2.1 Land Price

The main variable in the equation is LSPA and is the logged price of the sale price per acre of each parcel. The intercept for this variable is -10.45639 (Table 5.1).

5.2.2 Size of Land Parcel Sold in acres

The coefficient for ln_size was negative as predicted, with a value of -0.0814. The t value was statistically significant at -5.07 (Table 5.1). A doubling of the size of parcel decreases value on a per acre basis by 8.14%.

5.2.3 Quarters 1, 2, 3 and 4

Quarter 4 was used as the base value and quarters 1, 2 and 3 were all negative as predicted. Each value was statistically significant at the 5% level with t values of -9.56 for quarter 1, -5.84 for quarter 2 and -4.14 for quarter 3 (Table 5.1).

The estimates were -0.23288 for quarter 1, -0.13635 for quarter 2 and -0.10419 for quarter 3. The estimated coefficients indicate that the discount for land sold in the 1st quarter was 20.78%, 12.75% for the 2nd quarter and 9.89% for the third quarter using the method in Featherstone, et al. (1993).

5.2.4 Years 2010, 2011, 2012, and 2013

The year 2010 was used as the base the estimated model (Table 5.1). The t values were statistically significant at the 5% level with y2011 having a t value of 10.28, y2012 having a t value of 14.88 and y2013 having a t value of 19.37.

The estimated coefficients for 2011 was 0.2415, was 0.3506 for 2012, and 0.4707 for 2013. The estimated coefficients indicate that land sold in 2011 was 27.32% higher than 2010. Land sold in 2012 was 41.99% higher than 2010, and land sold in 2013 was 60.11% higher than 2013.

5.2.5 Ethanol Plants

The distance variable in the model was the minimum distance to the closest ethanol plant. Each land parcel sale was assigned the Latitude and Longitude coordinates for that sale. Calculations were then made to determine the nearest ethanol plant to each location in miles.

This intercept for distance was statistically significant with a high t value of 211.72. The coefficient was 2.6807. The coefficient (b5 in the estimated equation) for the distance variable was 0.00037 with a t value of 9.91. These coefficients are unable to be interpreted directly but can be graphed. Setting all of the variables but distance at the mean and varying distance from zero to 100 miles results in Figure 5.1. The closer a parcel of land is located to an ethanol plant, the higher the price per acre of that land value. The price of land that is located next to an ethanol plant is worth $1,488 per acre with the other variables at the mean (Figure 5.1). A parcel of land that is located 31 miles from an ethanol plant has a land value of $1,260 per acre. A parcel of land located 82 miles from an ethanol plant has a land value of $962.

Figure 5.1: Approximate Land Value Price per acre vs Distance from Ethanol Plant

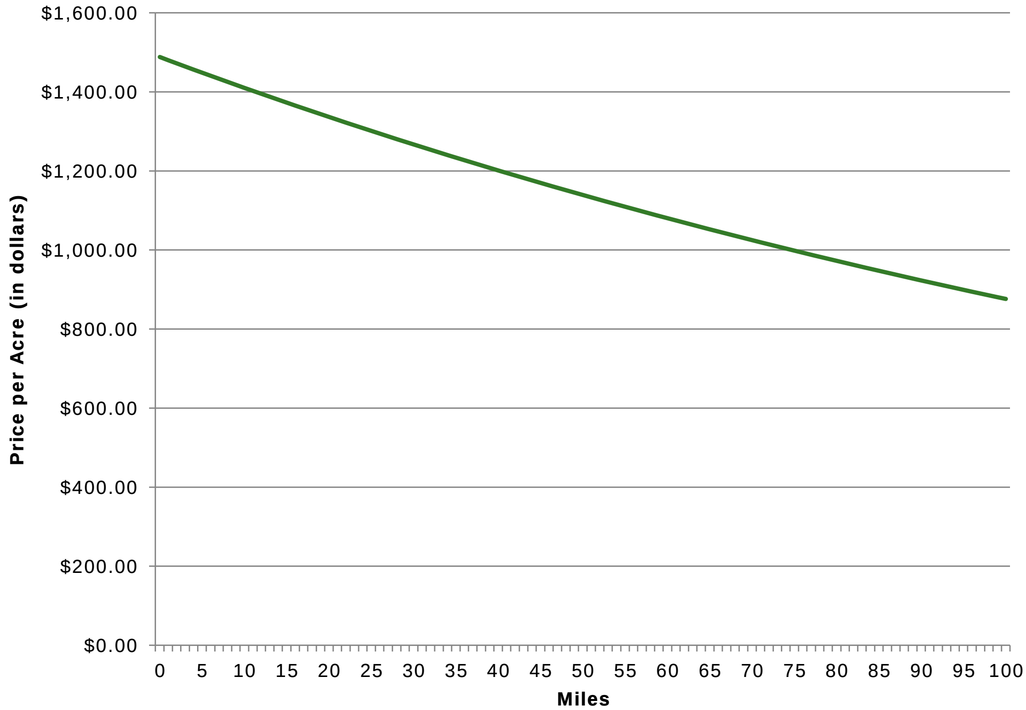
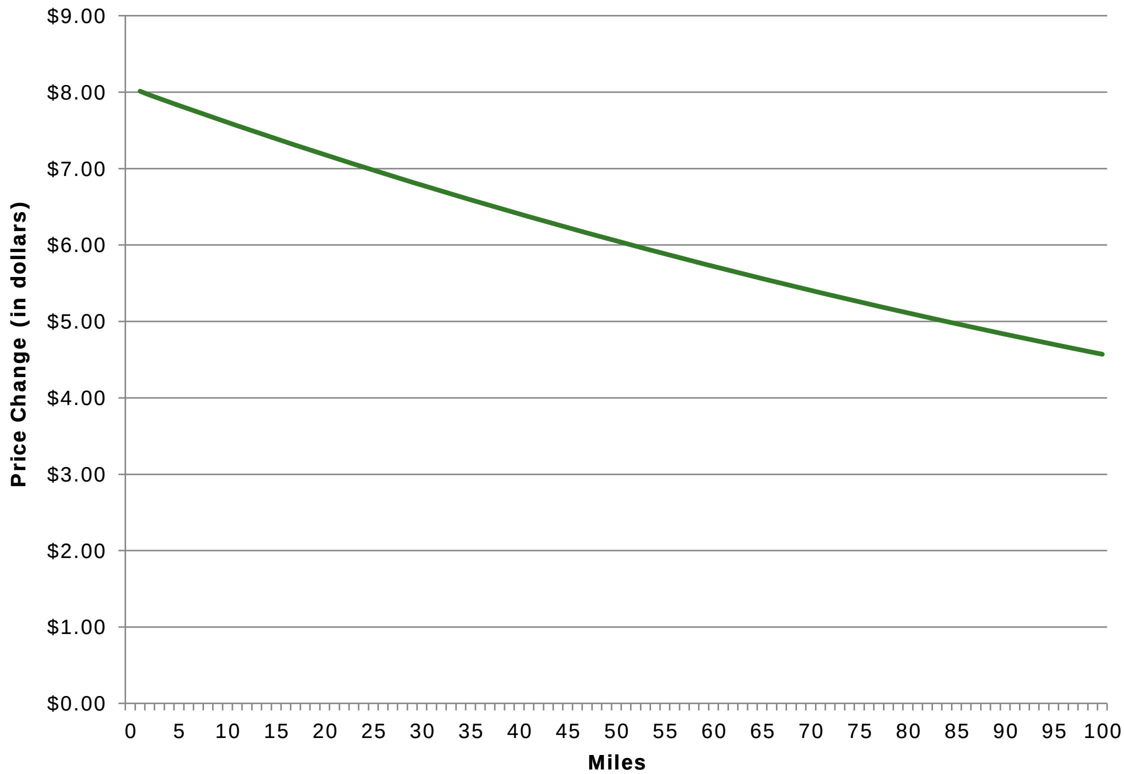


Figure 5.2 graphs the change in value per mile as the distance to the ethanol plant changes by a mile. At the first mile, a one mile change decreases the value by $8.01 per acre. At the 50 mile distance, the change is $6.05 per acre for an additional mile.

Figure 5.2: Price change per acre Versus Distance from Ethanol Plant



See Appendix C for results with regards to Land Prices moving from 0 to 100 miles away from the closest ethanol plant. Appendix C also has the data on price per acre of each land parcel sale based on distance from the nearest ethanol plant measured in miles.

5.2.6 Percent Pasture Acre

Percent Pasture was negative (-0.4638) with a t value of -18.89. Pasture sells for a discount of 37.11% per acre compared to non-irrigated cropland.

5.2.7 Percent Irrigation Acre

Percent Irrigation was positive (0.672338) as expected. The t value for percent irrigation (16.00) was statistically significant at the 5% level. The premium for irrigated cropland is 95.88% compared to non-irrigated cropland.

5.2.8 Rainfall

Rainfall also proved to be statistically significant (0.9997) with a t value of 20.63. A doubling of rainfall doubles the value of land.

5.2.9 Cropland Productivity

Cropland productivity had a t value of 1.83 and an estimated coefficient of 0.0512. A 10% increase in the productivity of land increases value by 0.5% per acre. The value of rainfall is higher than the value of soil quality.

5.2.10 Population Density

Population Density had a t value of 3.51 and an estimated coefficient of 0.036619. A doubling of population density increased land value per acre by 3.66%. It should be noted that the mean of population density is 20.87 and the maximum (499.6) is more than 20 times the mean.

5.3 Summary

As previous research has shown, proximity to a marketplace has an impact on land values. This found that the closer a parcel of land is located to an ethanol plant, the higher that parcel of land is valued at. Figure 5.1 illustrates this point as the further away in miles you travel from an ethanol plant, the less value that parcel has.

The estimated coefficients were statistically significant for Ethanol Plants having a t value of 211.72. Important factors such as rainfall and cropland productivity in each county help determine how much money a parcel of land is worth.

In conclusion, the research found that as one looks at purchasing land parcels in the state of Kansas, ethanol plants positively impact the price of land based on location to the nearest ethanol plant.

CHAPTER VI: CONCLUSIONS AND RECOMMENDATIONS

The goal of this research was to prove that ethanol plants play a key role in regards to land values. The question raised was "What impact do ethanol plants have on land parcel sales in close proximity to that plant in the state of Kansas?"

Using economic theory and regression modeling, a two sided test was run at the 95 percent level. The results proved to be statistically significant with an R-Squared value of 0.1852.

The closer a parcel of land is located to an ethanol plant, the higher the price per acre of that land value. Land parcels located at 0 miles from an ethanol plant has a value of $1,488 while land values located 30 miles from an ethanol plant have a value of $1,267. Land parcels located at 70 miles from an ethanol plant have a value of $1,025 while land parcels located 100 miles from the nearest ethanol plant are valued at $876.

Further research on land prices with regards to ethanol plants could be expanded on as there are other key variables that could be added to the model. This particular research only took into account the producer always going to the closest ethanol plant. Factors such as multiple ethanol plants located closer together or an ethanol plant located 20 miles further offering a higher cash price were not taken into account for this research. This research focused on the minimum distance of an ethanol plant to each parcel of land.

Time is also a key factor in this study as we move into the future to see if alternate fuels take off and if ethanol still plays a key role in the alternative fuel market. Cash corn prices have seen a significant decline in recent years, lowering to around $3.00 to $3.50 a bushel as of November 2015. If the demand for ethanol and corn prices keeps decreasing over the next few years, producers may not be inclined to invest in growing as much corn or investing more in ethanol plants.

Another factor that could be taken into account in future research is to study multiple states in the Corn Belt. Kansas was the only state chosen for this research study and one could add on other states such as Nebraska and Iowa for future studies. One may also want to take into account ethanol plants that are located on the border across state lines if producers choose to transport corn across state lines.

In conclusion, the research found that as one looks at purchasing land parcels in the state of Kansas, ethanol plants positively impact the price of land based on location to the nearest ethanol plant.

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APPENDIX A

Kansas Rainfall by County

County	Rainfall (inches)
Allen	43.38
Anderson	40
Atchison	36.97
Barber	28.51
Bourbon	44.14
Brown	36.92
Barton	26.62
Butler	34.08
Clark	23.18
Cloud	30.03
Coffey	37.91
Cherokee	44.47
Cowley	34.49
Comanche	25.32
Cheyenne	18.35
Chautauqua	38.42
Crawford	45.6
Chase	34.91
Clay	30.29
Decatur	22.12
Douglas	39.33
Dickinson	34.38
Doniphan	37.43
Edwards	26.75
Elk	38.91
Ellis	23.06
Ellsworth	27.99
Finney	19.9
Ford	22.93
Franklin	38.28
Geary	32.54
Graham	21.9
Greeley	17.44
Gove	22.92
Grant	17.39

County	Rainfall (inches)
Greenwood	36.71
Gray	23.05
Hodgeman	21.86
Hamilton	16.62
Harper	31.67
Haskell	19.22
Harvey	31.52
Jackson	36.73
Jefferson	37.79
Jewell	26.87
Kearny	18.58
Kingman	30.33
Kiowa	25.49
Labette	43.99
Lincoln	28.57
Lane	21.47
Logan	18.8
Linn	40.98
Leavenworth	39.51
Lyon	35.96
Mitchell	26.85
Meade	22.19
Montgomery	43.46
Miami	39.64
Marion	32.92
McPherson	31.96
Morris	34.13
Marshall	33.16
Morton	17.89
Nemaha	34.61
Neosho	41.25
Ness	22.42
Norton	22.62
Osborne	26.12

County	Rainfall (inches)
Osage	37.26
Ottawa	30.97
Phillips	23.44
Pawnee	23.99
Pratt	27.85
Pottawatomie	34.97
Rawlins	21.75
Rice	28.25
Rush	23.63
Riley	32.41
Reno	30.32
Rooks	23.86
Republic	30.89
Russell	25.96
Saline	31.34
Scott	20.7
Sheridan	20.8
Stafford	26.03
Sedgwick	31.2
Sherman	19.84
Smith	25.97
Shawnee	36.2
Stanton	14.6
Sumner	32.46
Stevens	18.43
Seward	19.73
Thomas	20.43
Trego	22.24
Wallace	20.11
Wabaunsee	36.49
Wichita	18.44
Wilson	40.69
Woodson	42.12
Washington	31.62

SOURCE: (Kansas Statistical Abstract 2012 n.d.)

APPENDIX B

Population by County

County	County Abbreviation	2010 Population	2011 Population	2012 Population	2013 Population
Allen	AL	13,371	13,350	13,319	13,124
Anderson	AN	8,102	8,065	7,917	7,897
Atchison	AT	16,924	16,788	16,813	16,749
Barber	BA	4,861	4,933	4,861	4,947
Bourbon	BB	15,173	14,953	14,897	14,852
Brown	BR	9,984	9,987	9,881	9,997
Barton	BT	27,674	27,709	27,557	27,509
Butler	BU	65,880	65,861	65,827	65,803
Clark	CA	2,215	2,129	2,181	2,193
Cloud	CD	9,533	9,376	9,397	9,292
Coffey	CF	8,601	8,524	8,502	8,412
Cherokee	CK	21,603	21,392	21,226	20,978
Cowley	CL	36,311	36,216	36,288	36,204
Comanche	CM	1,891	1,885	1,913	1,955
Cheyenne	CN	2,726	2,702	2,678	2,694
Chautauqua	CQ	3,669	3,611	3,571	3,552
Crawford	CR	39,134	39,159	39,361	39,278
Chase	CS	2,790	2,795	2,757	2,700

Clay	CY	8,535	8,523	8,531	8,406
Decatur	DC	2,961	2,920	2,871	2,930
Douglas	DG	110,826	112,372	112,864	114,322
Dickinson	DK	19,754	19,725	19,762	19,609
Doniphan	DP	7,945	7,944	7,864	7,851
Edwards	ED	3,037	3,016	2,979	2,945
Elk	EK	2,882	2,797	2,720	2,655
Ellis	EL	28,452	28,768	29,053	29,061
Ellsworth	EW	6,497	6,457	6,494	6,398
Finney	FI	36,776	37,097	37,200	37,098
Ford	FO	33,848	34,378	34,752	34,819
Franklin	FR	25,992	25,898	25,906	25,740
Geary	GE	34,362	35,433	38,013	37,384
Graham	GH	2,597	2,641	2,578	2,593
Greeley	GL	1,247	1,250	1,298	1,290
Gove	GO	2,695	2,687	2,729	2,769
Grant	GT	7,829	7,912	7,923	7,950
Greenwood	GW	6,689	6,614	6,454	6,424
Gray	GY	6,006	6,106	6,030	6,009
Hodgeman	HG	1,916	1,983	1,963	1,950
Hamilton	HM	2,690	2,625	2,639	2,609
Harper	HP	6,034	5,946	5,911	5,860
Haskell	HS	4,256	4,242	4,256	4,141

Harvey	HV	34,684	34,725	34,852	34,741
Jackson	JA	13,462	13,472	13,449	13,366
Jefferson	JF	19,126	18,981	18,945	18,813
Jewell	JW	3,077	3,088	3,046	3,046
Kearny	KE	3,977	3,959	3,968	3,923
Kingman	KM	7,858	7,896	7,863	7,844
Kiowa	KW	2,553	2,557	2,496	2,523
Labette	LB	21,607	21,425	21,284	20,916
Lincoln	LC	3,241	3,203	3,174	3,147
Lane	LE	1,750	1,764	1,704	1,720
Logan	LG	2,756	2,770	2,784	2,798
Linn	LN	9,656	9,603	9,441	9,516
Leavenworth	LV	76,227	77,109	77,739	78,185
Lyon	LY	33,690	33,646	33,748	33,510
Mitchell	MC	6373	6312	6355	6378
Meade	ME	4575	4542	4396	4343
Montgomery	MG	35,471	34,738	34,459	34,292
Miami	MI	32,787	32,669	32,612	32,835
Marion	MN	12,660	12,405	12,347	12,208
McPherson	MP	29,180	29,202	29,356	29,241
Morris	MR	5923	5865	5854	5741
Marshall	MS	10,117	12,542	10,022	12,219
Morton	MT	3233	3173	3169	3143

Nemaha	NM	10,178	10,127	10,132	10,161
Neosho	NO	16,512	16,460	16,406	16,430
Ness	NS	3107	3128	3068	3073
Norton	NT	5671	5671	5612	5622
Osborne	OB	3858	3843	3806	3818
Osage	OS	16,295	16,360	16,142	16,142
Ottawa	OT	6091	6083	6072	6042
Phillips	PL	5642	5547	5519	5540
Pawnee	PN	6973	7041	6928	6971
Pratt	PR	9656	9654	9728	9878
Pottawatomie	PT	21,604	22,044	22,302	22,691
Rawlins	RA	2519	2544	2560	2589
Rice	RC	10,083	10,092	9985	10,011
Rush	RH	3307	3201	3220	3186
Riley	RL	71,115	73,254	75,508	75,394
Reno	RN	64,511	64,400	64,438	64,190
Rooks	RO	5181	5191	5223	5190
Republic	RP	4980	4914	4858	4820
Russell	RS	6970	6962	6946	6933
Saline	SA	55,606	55,698	55,988	55,740
Scott	SC	4936	4913	4937	5035
Sheridan	SD	2556	2545	2538	2553
Stafford	SF	4437	4396	4358	4359

Sedgwick	SG	498,365	500,715	503,889	505,415
Sherman	SH	6010	6050	6113	6115
Smith	SM	3853	3789	3765	3706
Shawnee	SN	177,934	178,936	178,991	178,831
Stanton	ST	2235	2237	2175	2194
Sumner	SU	24,132	23,860	23,674	23,591
Stevens	SV	5724	5646	5756	5816
Seward	SW	22,952	23,204	23,547	23,390
Thomas	TH	7900	7943	7941	7948
Trego	TR	3001	2981	2986	2980
Wallace	WA	1485	1526	1517	1569
Wabaunsee	WB	7053	7047	7039	7051
Wichita	WH	2234	2261	2256	2192
Wilson	WL	9409	9240	9105	9105
Woodson	WO	3309	3305	3278	3221
Washington	WS	5799	5859	5758	5629

SOURCE: (Bureau, Kansas County Selection Map n.d.)

APPENDIX C

Change in Land Value Price by Distance from Ethanol Plant

Distance (miles)	Price	Change in Price	Distance (miles)	Price	Change in Price	Distance (miles)	Price	Change in Price
0	$1,488.38		33	$1,246.89	$6.67	67	$1,041.33	$5.50
1	$1,480.37	$8.01	34	$1,240.26	$6.63	68	$1,035.86	$5.47
2	$1,472.41	$7.96	35	$1,233.67	$6.59	69	$1,030.42	$5.44
3	$1,464.49	$7.92	36	$1,227.11	$6.55	70	$1,025.01	$5.41
4	$1,456.62	$7.87	37	$1,220.60	$6.52	71	$1,019.64	$5.38
5	$1,448.79	$7.83	38	$1,214.12	$6.48	72	$1,014.29	$5.35
6	$1,441.00	$7.78	39	$1,207.67	$6.44	73	$1,008.98	$5.32
7	$1,433.27	$7.74	40	$1,201.27	$6.41	74	$1,003.69	$5.29
8	$1,425.57	$7.69	41	$1,194.89	$6.37	75	$998.43	$5.26
9	$1,417.92	$7.65	42	$1,188.56	$6.33	76	$993.21	$5.23
10	$1,410.32	$7.61	43	$1,182.26	$6.30	77	$988.01	$5.20
11	$1,402.75	$7.56	44	$1,176.00	$6.26	78	$982.84	$5.17
12	$1,395.23	$7.52	45	$1,169.77	$6.23	79	$977.70	$5.14
13	$1,387.76	$7.48	46	$1,163.58	$6.19	80	$972.59	$5.11
14	$1,380.33	$7.43	47	$1,157.42	$6.16	81	$967.51	$5.08
15	$1,372.93	$7.39	48	$1,151.30	$6.12	82	$962.45	$5.05
16	$1,365.59	$7.35	49	$1,145.21	$6.09	83	$957.43	$5.03
17	$1,358.28	$7.31	50	$1,139.16	$6.05	84	$952.43	$5.00
18	$1,351.01	$7.26	51	$1,133.14	$6.02	85	$947.46	$4.97
19	$1,343.79	$7.22	52	$1,127.15	$5.98	86	$942.52	$4.94
20	$1,336.61	$7.18	53	$1,121.20	$5.95	87	$937.60	$4.91
21	$1,329.47	$7.14	54	$1,115.29	$5.92	88	$932.72	$4.89
22	$1,322.37	$7.10	55	$1,109.40	$5.88	89	$927.86	$4.86
23	$1,315.31	$7.06	56	$1,103.55	$5.85	90	$923.03	$4.83
24	$1,308.29	$7.02	57	$1,097.73	$5.82	91	$918.22	$4.81
25	$1,301.31	$6.98	58	$1,091.95	$5.79	92	$913.44	$4.78
26	$1,294.37	$6.94	59	$1,086.20	$5.75	93	$908.69	$4.75
27	$1,287.47	$6.90	60	$1,080.48	$5.72	94	$903.96	$4.73
28	$1,280.61	$6.86	61	$1,074.79	$5.69	95	$899.26	$4.70
29	$1,273.79	$6.82	62	$1,069.13	$5.66	96	$894.59	$4.67
30	$1,267.01	$6.78	63	$1,063.51	$5.62	97	$889.94	$4.65
31	$1,260.26	$6.74	64	$1,057.91	$5.59	98	$885.32	$4.62
32	$1,253.56	$6.71	65	$1,052.35	$5.56	99	$880.73	$4.60
			66	$1,046.82	$5.53	100	$876.16	$4.57