PROFITABILITY OF STORAGE HEDGES FOR KANSAS WHEAT PRODUCERS

by

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Abstract

Hard Red Winter Wheat is an extremely important part of the Kansas agricultural industry. In Kansas, this type of wheat is planted in the fall and harvested in mid-June. After harvest, producers have the option to either store or sell their wheat. If they decide to store, the wheat can be stored on-farm or in a commercial facility. Another storage decision is whether to store the wheat hedged or unhedged (speculative) storage. Hedging is a technique to limit the price risk associated with selling or buying commodities.

This study compared hedged and speculative decisions for both on-farm and commercial storage scenarios for 108 locations geographically dispersed across Kansas. Wednesday prices were gathered for each location during the 10-year time period from 2004 to 2013. All monthly storage period possibilities from July to May were examined to determine the storage returns potential. All results are displayed as the profit or loss achieved compared to selling in June at harvest. Averages for Kansas were negative or slightly positive for all storage scenarios, but hedged returns showed much less variability in results compared to speculative returns. Regional differences showed that North Central Kansas displayed the highest level of basis improvement over the 10-year period followed by South Central Kansas.

A regression analysis using nearby basis in June, harvest price, and futures contract spreads as independent variables and storage returns as a dependent variable showed emphasis on the futures spread having the biggest influence on storage profits.

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Acknowledgements

My time at K-State has been an amazing experience. First of all, I would first like to thank all of the professors who have provided me with opportunities to experience things that I normally would not in the classroom. This thesis project started out as one of those opportunities when Dr. Sean Fox asked me if I would like to work on a storage hedge presentation with him for the 2014 Risk & Profit Conference. I would like to thank Dr. Fox for giving me this opportunity and for always having an open door whenever I need help--whether it was in my job search or with this thesis project. He always has a very logical way to think through issues when it feels like my brain is going in 10,000 directions. I am very thankful for the help that my committee members, Dr. Craig Smith and Dr. Mykel Taylor, have provided. Dr. Smith inspired me to learn more about agricultural economics in my time at Fort Hays State University. He helped me discover what my true interests are and led me to develop a rather strong liking for Microsoft Excel. In my quest of finding data, Dr. Taylor helped me beyond belief. She provided me with the data set that my analysis is mainly based on.

Another great opportunity I've had at K-State is being involved in the Center for Risk Management Education & Research under the direction of Dr. Ted Schroeder and Dr. Sean Fox. The Center has provided me with an immense exposure to industry, and has led me to be more interested in how farmers manage their risk.

Last, and certainly not least, I thank God for giving me strength throughout the whole graduate school process, and my parents, Rodney and Janice, for always being supportive. My mother pushed me to go to graduate school and provided any support possible to get me there. She is a great role model to follow because of her kindness and incredibly strong work ethic. I would also like to thank my boyfriend, Clint, for "putting up with me" all during graduate school

and for always being supportive and making sure that I see the positive side of things. My sisters, Melissa and Miranda, and nephews and niece: Tye, Oakley, and Lane, have always been there to brighten up my day and offer support.

I worked at our local grain elevator throughout high school as a scale operator, and that is where I first became interested in grain marketing. Then after a grain merchandising internship during college, I was hooked. One thing I noticed in my work experience, is that some producers have a lack of information of what determines the cash grain bid at their particular location. In my dream career, I would love to go around and teach farmers more about grain marketing, so I hope that this research can be used as a tool to help farmers make better marketing decisions.

Chapter 1 - Introduction

Hard Red Winter Wheat is a very important crop to the Kansas agricultural industry--so important that Kansas is deemed "The Wheat State." This type of wheat is planted in the fall and harvested typically mid-June. At the time of harvest, producers have the option to sell or store their grain. Typically this decision is made according to market signals or the need to defer income until the following year. If the farmer decides to store, he or she can store the grain hedged or unhedged. Unhedged, otherwise known as speculative, storage leaves the producer open to risk associated with the futures price and basis, while hedged storage only leaves the basis to vary.

There are two parts to every cash price that is quoted at an elevator. The first part is the futures price. The futures contract for Hard Red Winter Wheat is the Kansas City Wheat Futures. The second part of a cash price is the basis. "Basis" is the adjustment to the futures contract price due to local supply and demand. Futures and basis come together in this equation to create the cash price:

$$Cash = Futures + Basis$$

Futures make up the majority of the cash price; therefore, futures makes the larger part of the price risk as well. Basis is the smaller portion of the price encompassing a much smaller portion of the total cash price risk. Basis is somewhat predictable by looking at historical trends, forward contract bids, and transportation costs. Because of this, farmers can look to hedge their production. Hedging, a technique used to manage price risk, locks in the futures portion of the price but leaves the basis to vary. This tactic protects against drops in the futures price, but prohibits gains from an increase in price. Speculative storage allows a producer to gain from an increase in price but also leaves him or her vulnerable to price decreases.

A farmer will choose to store grain if the expected gain in price is greater than the cost of storage. As mentioned before, if a farmer decides to store, it can be hedged or left unhedged. Hedging grain after it has been harvested is called a *storage hedge*. Since in a hedge the futures portion is locked in, a farmer participating in a store hedge, is anticipating the gains, or strengthening, in basis will outweigh the storage costs. In speculative, or unhedged storage, neither the futures price or basis is locked in, so the farmer is expecting the gains in the cash price to outweigh the storage costs. The process of these storage tactics is further discussed in Chapter 4.

This study's purpose was to compare the different storage options that farmers have in terms of how profitable each option has been historically as well as the differences in risk and variability between the different options. Ten years of data for 108 locations across Kansas were analyzed. This analysis first assumes commercial storage, where the farmer would be storing grain at a commercial elevator and assuming the costs of that transaction. Second, an on-farm storage scenario is analyzed.

The following portions of this paper will examine literature on this subject, describe the data collection process, explain the methods used for analysis, and discuss conclusions made according to the findings.

Chapter 2 - Literature Review

Dhuyvetter et al. (2007) analyzed the costs and feasibility of on-farm storage. This publication served as a guide for producers in deciding whether to participate in on-farm storage. Dhuyvetter et al. (2007) found that speculative storage returns (for on-farm storage) over the time period from 1977/1978 through 2006/2007 were positive for soybeans but negative for wheat, corn, and sorghum for each of the different sized on-farm storage systems considered.

This publication pointed out that historical returns to storage can be used as a guide, but changing fundamentals of a market can change relationships. One instance of changing market fundaments was the ethanol boom in 2006 where typical price relationships were changed.

Another topic this study looked at is the comparison between on-farm and commercial storage. A question that may arise from the first part of this study is, "What would the results be if on-farm storage rates were used instead of commercial storage rates?" The authors compared the costs of storing on-farm and storing at a commercial elevator on the basis of length of storage. Commercial storage rates used were a flat 3.13 cents per bushel per month, based on the authors' survey of commercial storage rates across Kansas during June 2007. If grain is stored for four months or longer, the variable costs of on-farm storage are less than the costs of commercial storage using a harvest price of $3.41/bushel. Recall that in economics, decisions are to be made only on the variable costs because the fixed costs will occur whether grain is stored in the bin or if the bin is left empty. But, before on-farm storage facilities are built, all costs are variable. The total costs of storage (variable costs and fixed costs) have been shown to be less than the cost of commercial storage after eight to nine months of storage using a harvest price of $3.47/bushel. Further details of on-farm storage costs will be later discussed in Chapter 5.

Walters, McNeill, and Johnson (2012) considered how a storage hedge is put in place, when it should be used, and the financial costs and risks incurred by having a hedge in place. The authors summarized the advantages and disadvantages of participating in a storage hedge. First, an advantage of a storage hedge is that a large futures carry can be capitalized on. With a storage hedge, the futures part of the price is locked in using the distant futures price. If the distant futures price is higher than the nearby futures price, these gains can be captured. Also, in a storage hedge, there are potential gains from a strengthening basis, and hedging protects against downside futures price risk. The disadvantages were also discussed with the first being the possibility of incurring losses due to a weakening basis. Even if the basis weakens, there is still an obligation to pay the storage and interest costs. Margin calls on the futures contract may also become an issue. Although hedging does protect against the downside price risk, it eliminates potential gains from a price increase. The authors emphasized that holding grain unhedged is speculation.

Walters, McNeill, and Johnson (2012) also discussed the two types of markets: carry market and inverted market. In a carry market, the deferred futures contracts are trading at a higher price than the nearby futures. In this type of market, the market is giving producers an incentive to store grain. With an inverted market, the market wants the grain now and gives a producer no incentive to store. The type of market typically depends on supply issues at the current point in time. During period of an excess supply, there will be a large carry in the market.

Siaplay, Adam, Brorsen, and Anderson (2012) examined the typical rules of thumb used in deciding whether or not to store. The barometers the authors considered were strength and weakness of basis, futures spread, and futures price. This study chose Oklahoma wheat as their commodity of choice and gathered monthly state average wheat prices from 1975 to 2005. Storage periods analyzed were June to September and June to November.

Five regression models were used to determine which rule of thumb showed the most influence. The dependent variables of each of the regressions were gross revenue, basis change, basis change less cost of carry, and futures price change. Gross revenue is defined as the change in cash price from the beginning of the storage period until the end of the storage period. Basis change, referred to in this paper as basis improvement, is the change in the basis level from June to September or November. The futures price change is simply the change in futures price of the same contract from June to the end of the storage period.

Independent variables considered were basis deviation, futures price deviation, and futures price spread. Initial basis is used instead of basis deviation only in the basis change model. In these definitions, the storage period of June to November is used as an example. Basis deviation can be defined as the opening basis in June versus the December futures minus the average of the basis in November versus the December futures for the five years prior. Futures price deviation is the December futures price in June of the current year minus the average of the December futures price in November for the five years prior. The futures spread is the December futures minus the July futures in June of the current year. Several model misspecification tests were run on this data before the results were concluded.

The results of the five models showed only the coefficients on initial basis (for the basis change model) and basis deviation statistically significant at the 5% level. Recall that basis deviation is the June opening basis minus the average basis for November (September) for the five years prior, and initial basis is the June cash price minus the December futures price. For the November basis change model, the coefficient on basis deviation was -0.4182. This means a

$1.00 increase in the basis deviation (June nearby basis minus November prior 5-year average) would results in $0.4182 less basis change. In terms of cents, a 1 cent increase in basis deviation would result in 0.4182 cents less basis change. On the November basis change model, the coefficient on initial basis is -0.5393. This means a $1.00 higher initial basis should result in lowering the basis change by $0.5393.

The coefficients on the futures price spread coefficient for the basis change and basis change less cost of carry models had p-values of 0.4480 and 0.3920, respectively. This makes them statistically insignificant, but the values of these coefficients are 0.2578 and 0.1992, respectively. This means for the basis change model for November, and increase of $1.00 in the futures spread between the July and December futures contract would result in $0.2578 higher basis change. In cents terms, this would be an increase in 1 cent in the futures spread would increase the basis change by 0.2578 cents. The authors concluded that basis was the most important market signal in determining the profitability of storage (Siaplay, Adam, Brorsen, & Anderson, 2012).

Joseph, Irwin, and Garcia (2015) examined commodity storage during periods of backwardation, also known as a periods when the market is inverted. This is when the price of a deferred futures contract is lower than the price of the nearby contract. When one looks at the situation, he or she may wonder why a farmer would continue to store during an inverted period. The authors examined the concept of convenience yield and the Working Curve. This theory deems to explain why participants in the grain market continue to store even though the expectation of profitability from storage is not there. Convenience yield applies to those who need to use the commodity and are willing to continue to store to guarantee having the commodity for use later on.

The authors analyzed twenty years of data from 1990 through 2010. The commodities included in the analysis were Chicago Board of Trade (CBOT) corn, soybeans, and wheat and Kansas City Board of Trade (KCBT) wheat. Major futures contract delivery points were considered. Convenience yield was most apparent for KCBT wheat at the delivery point in Kansas City. The high convenience yield in Kansas City may be due to the commodity being stored for milling and processing operations in the area. Joseph, Irwin, and Garcia (2015) showed support for the concept of convenience yield and concluded the Working Curve does still work.

Chapter 3 - Data

The data for this analysis is a combination of three databases maintained in the Department of Agricultural Economics at Kansas State University. The primary database contains all of the wheat price data for Kansas that is available on ProphetX. ProphetX is a futures portal as well as historical database created by DTN. DTN calls elevators daily requesting cash grain bids, and makes the prices available on ProphetX.

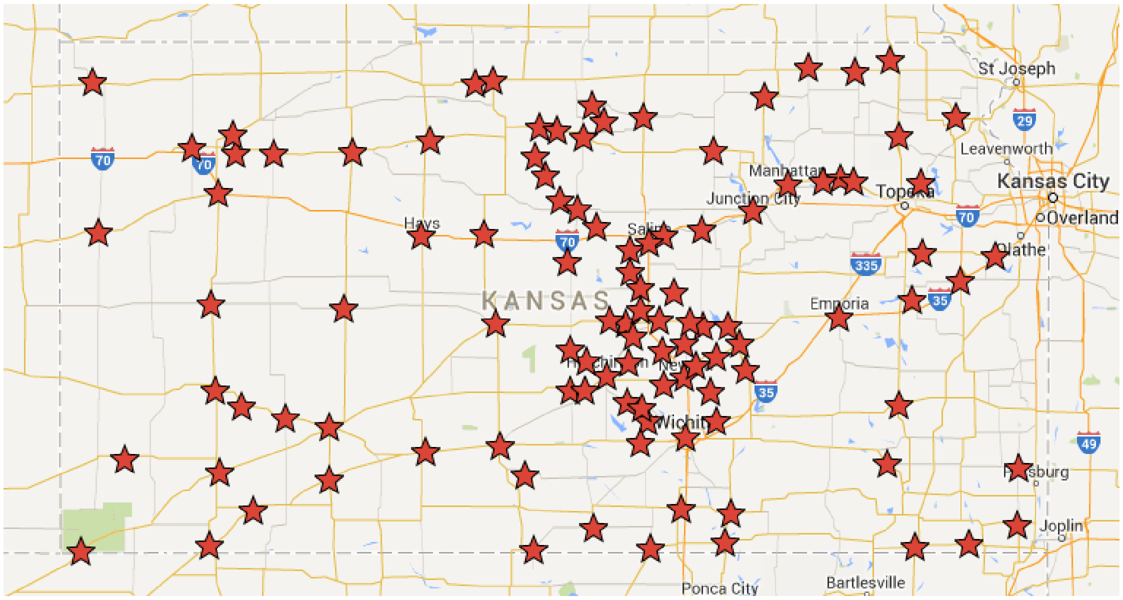
The second database consists of a compilation of cash grain bids published daily in the *Wichita Eagle* newspaper. This Excel database contains the Wednesday bid for each of its 18 locations since 1982. The final database is maintained by an administrative assistant in the Department of Agricultural Economics (hereafter referred to as the Department database) and consists of Wednesday prices collected from the Wichita Eagle, as well as cash grain bids quoted via phone calls to elevators. In this analysis, the ProphetX database was given first priority followed by the *Wichita Eagle* database and then the Department database.

The “most complete” locations were pulled from the ProphetX database first—“most complete” meaning containing the locations that have the largest number of days with a wheat bid reported. Next, locations in the *Wichita Eagle* database that were not in the ProphetX database were added followed by the same procedure with the Department’s database. At any point when the same location was included in multiple databases, the database that was the “most complete” for that location was chosen.

Overall, 108 locations across Kansas were included in this analysis. Ninety-two of which came from ProphetX, while 10 locations originated from the *Wichita Eagle* database. The remaining six locations came from the Department’s database. The Wednesday wheat bids from these three databases were combined into one database, which is the foundation of this study.

Figure 3.1 below shows a mapping of the locations used for this analysis. A complete listing of all of the locations including the source of data for each location is included in Appendix A.

Figure 3.1 Kansas Locations Used for Analysis



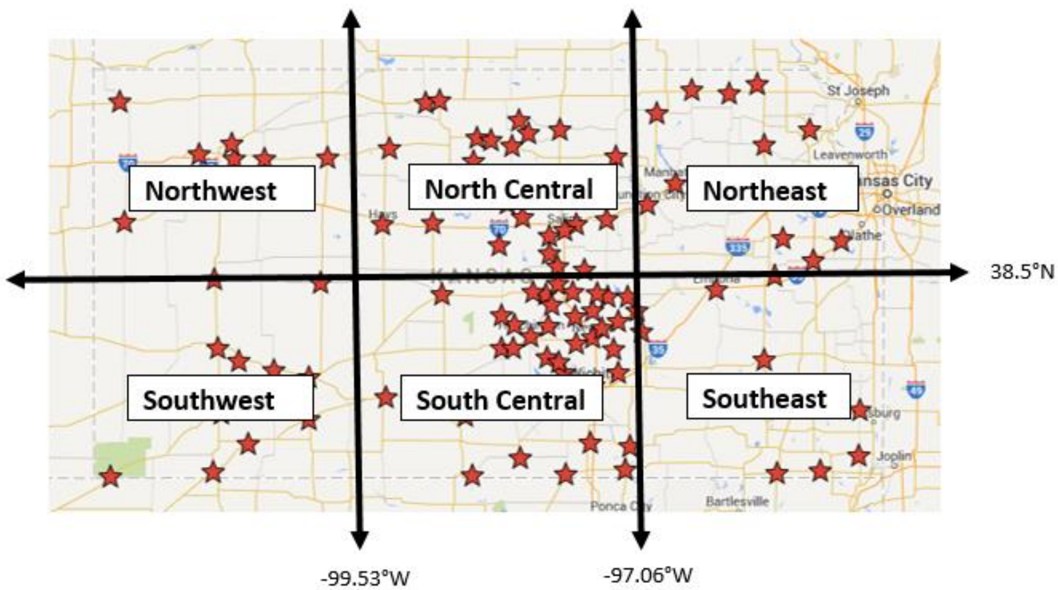
Geographical Dispersion

In order in analyze whether location has an impact on storage returns, the locations were divided in 6 regions of Kansas: North Central, Northeast, Northwest, South Central, Southeast, and Southwest. The availability of data is much less for the Northwest, Southwest, and Southeast regions of Kansas. The dividing lines for regions were made according to latitude and longitude coordinates.

The Western border of Kansas approximately runs along the longitude line of -102°W, while the eastern border runs at approximately -94.6°W. The difference between the two was divided into three, making Eastern, Central, and Western regions. The dividing line between the Eastern and Central region is -97.06°W, and the line between the Western and Central regions is -99.53°W.

The Northern border of Kansas lies in conjunction with the 40°N line of latitude. On the Southern border runs the line of 37°N. The difference was divided into two to create Northern and Southern regions with the dividing line at 38.5°N. Intersecting the latitude and longitude lines of division create the six regions of Kansas mentioned above. Below, Figure 3.2 summarizes the regional division.

Figure 3.2 Regional Division of Kansas Locations



The South Central region of Kansas had the highest number of locations included at 34. The North Central region followed in number at 25, while the Northeast encompassed 17. The Southeast region was equal with the Southwest each at 12 locations. Northwest Kansas was the most data-lacking region included in the study at 8 locations.

The time period analyzed for this study is June 2004 through May 2014. Profitability results are calculated for each marketing year. For example, the first marketing year runs from June 2004 until May 2005. That time period is referred to as "2004" in this study. The last marketing year runs from June 2013 to May 2014. This marketing year is referred to as "2013."

Correlations between Databases

Fourteen of the 108 locations included in this study were included in 2 or more of the initial databases. In an effort to test the accuracy of the data, correlations were done on the data from those locations. These locations are Beloit, Coffeyville, Colby, Concordia, Dodge City, Garden City, Hays, Hutchinson, Ottawa, Pratt, Salina, Scott City, Wellington, and Whitewater. For example, Coffeyville was included in both the ProphetX and *Wichita Eagle* databases, so a correlation was done on the Coffeyville data from ProphetX compared to the Coffeyville data in the *Wichita Eagle* database. This procedure compared only the days where both databases contained a price entry. The correlation results were very strong ranging from 0.9713 to 0.9999. A summary of the results is included below in Table 3.1.

Table 3.1 Correlation among Databases

Correlation among Databases			
	ProphetX - Wichita Eagle	Wichita Eagle - Department	ProphetX - Department
Beloit	0.9996	0.9999	0.9996
Coffeyville	0.9979		
Colby		0.9996	
Concordia	0.9997	0.9998	0.9998
Dodge City		0.9996	
Garden City	0.9880	0.9998	0.9879
Hays	0.9713		
Hutchinson	0.9971		
Ottawa			0.9970
Pratt		0.9999	
Salina	0.9996	0.9996	0.9992
Scott City	0.9996	0.9996	0.9992
Wellington	0.9988		
Whitewater	0.9998		

Procedure for Filling in Missing Data

Reporting grain bids to entities like DTN and the *Wichita Eagle* is voluntary for grain elevators to do. Because of this, there are days or weeks where certain elevators may just stop reporting. This presents an issue when trying to analyze the profitability of grain storage. A procedure was followed to fill in these missing data points. If a certain location did not report for an entire month, results were not included for that time. There were a few instances where a location was thrown out for an entire year because of lack of data. Results were analyzed before and after filling in the missing data points, and the outcomes were much more consistent after the missing data points were filled in using the following procedure.

The first choice when filling in a missing data point was using a price quoted in another database if the location was one of the 14 occurring in duplicate databases. Because only 14 of the 108 locations occurred in multiple databases, most of the time the second option was used, which was using the Thursday price to fill in the missing Wednesday price. If a Thursday price was not available, Tuesday was used instead. Furthermore, if none of the previous options were available the average price change between weeks was calculated for 4-5 randomly selected locations. This price change was used to create a reasonable bid for the missing Wednesday. The typical spread between locations was looked at as well when filling in missing bids.

Chapter 4 - Methodology

As stated before, after harvest a farmer can decide to store grain or sell it. If the decision is to store, they can hedge the grain or store it speculatively. Hedging stored grain is referred to as a *storage hedge*. With a storage hedge, the producer is expecting the basis improvement to outweigh the storage costs. On the other hand, with speculative storage, the producer is expecting the price improvement to be greater than the storage costs.

Basics of a Storage Hedge

To begin a storage hedge, the producer goes “short” in the futures market by selling the futures contract that is associated with the time period he or she would like to store to. For example, if the farmer plans to store until December, he or she will sell a December futures contract. Because this is a hedge, the futures part of the price is locked in, so only the basis matters. He or she will sell December futures in June, and the *opening basis* is calculated by taking the June cash price minus the December futures price.

The producer needs to make an expectation of what the *closing basis* will be. This is what he or she expects the cash price minus the nearby futures to be at the end of the storage period. This is when he or she plans to physically sell grain in the cash market. In the example above where the farmer plans to store until December, the closing basis is the December cash price minus the December futures contract price during December. A producer can make an expectation of what he or she expects the closing basis to be by looking at historical basis levels, forward contract bids, and transportation costs. Typically when looking at historical basis levels, the basis at the time of actually selling the grain in the cash market is analyzed for the last three to five years. An average of the previous years can be taken, or, for a conservative estimate, the minimum of the previous years can be used as an *expected closing basis* at the end of storage.

Taylor, Tonsor, and Dhuyvetter (2014) analyzed basis variability from 2001 to 2012 and showed that basis was much more variable later in the time period. In late 2007, the basis levels changed drastically compared to historical patterns. This makes basis more variable and harder to predict.

Other methods for calculating the expected basis include forward contract bids and transportation cost. If one would call an elevator and ask for a bid for grain to be delivered at the end of the storage period and then calculate the basis compared to the respective futures contract month, he or she could come up with an expectation of what basis could be. Another option is looking at the transportation costs. One should not be able to buy grain in one location and sell it in another at the same time period at a price difference greater than the transportation costs. Kansas City is a delivery point for the Hard Red Winter Wheat futures contract. So, if it costs 40 cents per bushel to haul wheat to Kansas City from a specific location, the basis for that specific location should not be greater than 40 cents/bushel under the Kansas City Hard Red Winter Wheat futures.

To enter into a storage hedge, the *expected basis improvement*, which is the *expected closing basis* minus the *opening basis*, should be greater than the *storage costs*. Storing grain is not free; it comes with the physical costs of storage as well as *opportunity costs*. Physical costs of storage come from the elevator charges for storage or the costs of storage a farmer faces from storing grain in a bin. Opportunity costs come from the interest that could have been saved if a farmer would have sold his or her grain in June and paid off operating loans or the interest gained if a farmer would have invested the grain sale proceeds. This study calculates results for both returns to commercial and on-farm storage.

Commercial storage rates are different for different regions of Kansas. Eastern Kansas has higher commercial storage charges than Central and Western Kansas. Commercial storage rates are set according to supply and demand. Storage costs are also higher for 2008 through 2013 than for 2004 to 2007. From 2004 to 2007 for Eastern Kansas, the storage rate of $0.040 per bushel per month is used. For the same time period in Central and Western Kansas, the rate of $0.030 per bushel per month is used. In 2008, the storage costs increased, so for 2008 through 2013, the storage rate of $0.050 per bushel per month was used for Eastern Kansas while $0.040 per bushel per month was used for Central and Western Kansas. These storage rates were gathered from a merchandiser at the Manhattan, Kansas elevator and confirmed similar by AgMark, LLC in Beloit, Kansas. Commercial storage costs per bushel per month for each region are summarized in the Table 4.1 below:

Table 4.1 Summary of Commercial Storage Costs

	NC	NE	NW	SC	SE	SW
2004 to 2007	$ 0.03	$ 0.04	$ 0.03	$ 0.03	$ 0.04	$ 0.03
2008 to 2013	$ 0.04	$ 0.05	$ 0.04	$ 0.04	$ 0.05	$ 0.04

On-farm storage costs were calculated using research done by Dhuyvetter et al. (2007). The authors summarize the cost of on-farm storage in Kansas based on the size of bin. Six months of storage is assumed. This study will use the costs associated with a 50,000 bushel bin.

The purpose of adding in on-farm storage as a possibility in this study is to make the results meaningful for the farmer who has bins built that are already paid for and no longer have taxable depreciation. As a result, for the returns to on-farm storage calculations, only the variable costs are used. These variable costs can be split into two categories: one-time costs and ongoing costs.

One-time costs consist of conveyance, drying, aeration, repairs, insecticide application, and 1% shrinkage. These are costs that do not depend on how long you store the grain. Ongoing costs depend on how long the grain is stored. Shrinkage is the only ongoing cost assumed by this study. This amounts to 0.1% per bushel per month. Total variable costs per bushel are brought together in the formula below (Dhuyvetter, Harner, III, Tajchman, & Kastens, 2007):

Total Variable Costs = Conveyance + Drying + Aeration + Insecticide + Repairs + Shrinkage

For this study, the numbers used are:

TVC = 0.011+0.000+0.013+0.040+0.051 + [(0.01 + (0.001 x Months Stored)) x Harvest Price]

Commercial storages rates are a constant rate per month, while on-farm storage rates differ per month. On-farm rates have a large upfront cost, but the longer that grain is stored, the more months those initial costs can be spread across. Consequently, on-farm storage costs per bushel per month decrease as the number of months in storage increases. Table 4.2 shows an example of the storage costs for Abilene, Kansas in the 2013/2014 marketing year. Commercial storage costs are calculated by taking the constant storage rate of $0.04/bushel/month times the number of months in storage. The on-farm storage rates in Table 4.2 show the high initial costs followed by only a slight increase in the cumulative costs as the number of months in storage increases. The per month on-farm storage costs are high at first, but then decrease significantly.

When the storage costs in Table 4.2 are compared on a graph, the breakeven point between on-farm storage and commercial storage can be found. At this point, one would be indifferent between storing in a commercial facility or in on-farm storage. Figure 4.2 shows this occurring at about five months of storage. After five months of storage the variable costs of on-farm storage per month is less than the cost of commercial storage per month.

Data was found online for the amount of storage capacity available on- and off-farm for the State of Kansas for 2005 - 2012. This is summarized in Figure 4.2. On-farm storage capacity remained steady throughout the time period at 380 million bushels. Each number is the tabulation of storage capacity on December 1st of the corresponding year. Off-farm storage increased from 890 million bushels of storage in 2005 to 940 million bushels of storage in 2012 (Kansas Department of Agriculture, 2013).

Table 4.2 Storage Cost Example

Storage Costs for Abilene Kansas				
Region: North Central				
Marketing Year 2013/2014				
Harvest Price: $7.28				
	Cumulative		Per Month	
Months	Commercial	On-Farm	Commercial	On-Farm
0.5	$ 0.02	$ 0.19	$ 0.04	$ 0.38
1.0	$ 0.04	$ 0.20	$ 0.04	$ 0.20
1.5	$ 0.06	$ 0.20	$ 0.04	$ 0.13
2.0	$ 0.08	$ 0.20	$ 0.04	$ 0.10
2.5	$ 0.10	$ 0.21	$ 0.04	$ 0.08
3.0	$ 0.12	$ 0.21	$ 0.04	$ 0.07
3.5	$ 0.14	$ 0.21	$ 0.04	$ 0.06
4.0	$ 0.16	$ 0.22	$ 0.04	$ 0.05
4.5	$ 0.18	$ 0.22	$ 0.04	$ 0.05
5.0	$ 0.20	$ 0.22	$ 0.04	$ 0.04
5.5	$ 0.22	$ 0.23	$ 0.04	$ 0.04
6.0	$ 0.24	$ 0.23	$ 0.04	$ 0.04
6.5	$ 0.26	$ 0.24	$ 0.04	$ 0.04
7.0	$ 0.28	$ 0.24	$ 0.04	$ 0.03
8.5	$ 0.34	$ 0.25	$ 0.04	$ 0.03
8.0	$ 0.32	$ 0.25	$ 0.04	$ 0.03
8.5	$ 0.34	$ 0.25	$ 0.04	$ 0.03
9.0	$ 0.36	$ 0.25	$ 0.04	$ 0.03
9.5	$ 0.38	$ 0.26	$ 0.04	$ 0.03
10.0	$ 0.40	$ 0.26	$ 0.04	$ 0.03
10.5	$ 0.42	$ 0.26	$ 0.04	$ 0.03
11.0	$ 0.44	$ 0.27	$ 0.04	$ 0.02
11.5	$ 0.46	$ 0.27	$ 0.04	$ 0.02
12.0	$ 0.48	$ 0.28	$ 0.04	$ 0.02

Figure 4.1 Graphical Comparison of Commercial and On-Farm Storage Costs

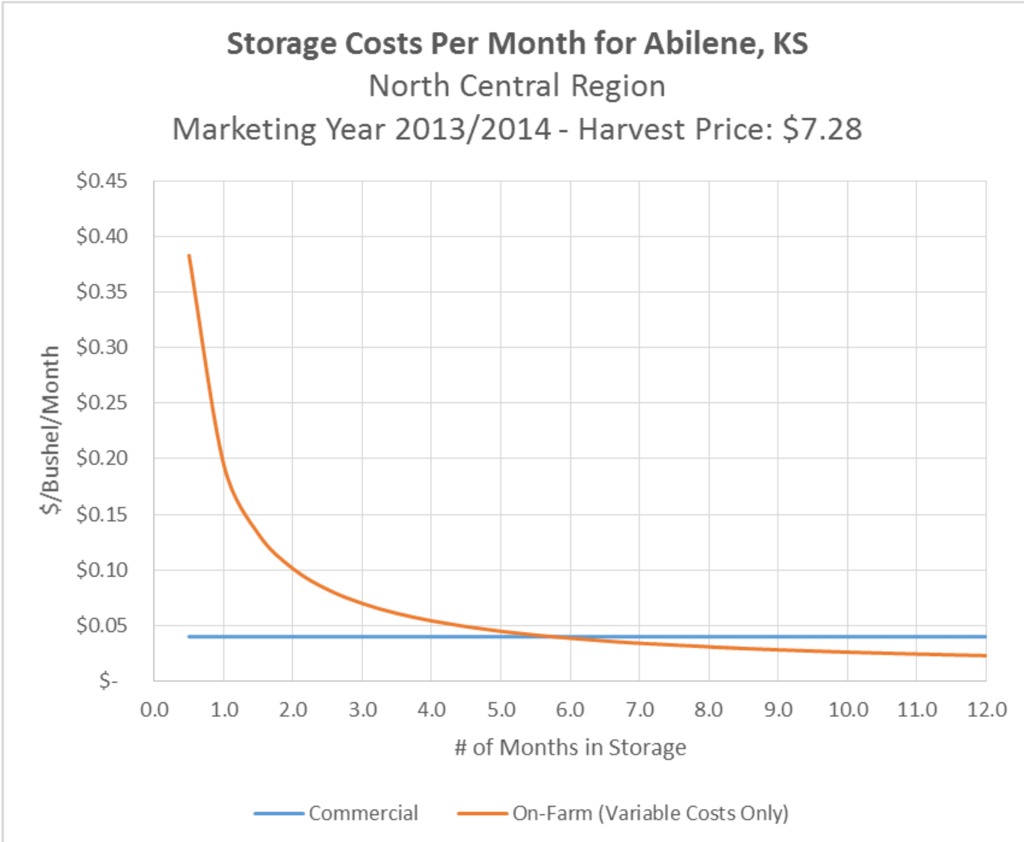
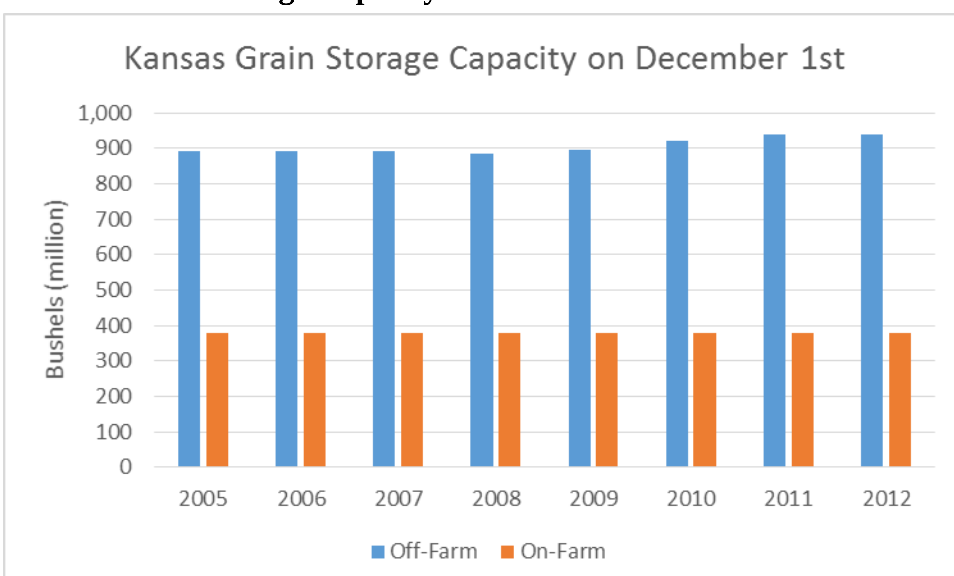


Figure 4.2 Kansas Grain Storage Capacity



Opportunity cost needs to be included into the total cost of storage. This aspect is important because if a farmer would have sold the grain at harvest in June, the money could be used to invest or payoff operating loans. For this study, a typical operating loan interest rate is used. That interest rate is multiplied by the June cash price and then divided by 12 to get it on a per month basis. Opportunity cost is on a per bushel per month basis. The operating loan rates used are summarized in Table 4.3. Total storage costs are also on a per bushel per month basis and encompass the physical storage cost as well as the opportunity cost.

In June, when assessing the profitability of the storage hedge, the expected basis improvement should be greater than the total storage cost for the farmer to place the grain into a storage hedge. The expected basis improvement minus the total storage costs is the expected profit.

At the end of storage, the *actual closing basis* can be determined. This is the cash price at the time of physically selling the grain versus the nearby futures contract. In the example above where the plan is to store wheat until December, this would be the cash price in December minus the December futures. The actual closing basis minus the opening basis is the *actual basis improvement.* The actual basis improvement minus the total storage costs is actual realized profit/loss from the storage hedge.

This study calculated the actual realized profit for a storage hedge for each of the 108 locations from June to: July, August, September, October, November, December, January, February, March, April, and May.

Basics of Speculative Storage

Speculative storage is also known as unhedged storage. Neither the futures price nor the basis is locked in. For this reason, speculative storage is definitely a riskier venture than hedged storage. The goal of speculative storage is for the *price improvement* to exceed the total storage costs. Price improvement can be defined as the increase or decrease in price from June to the end of the storage period. In the example where the storage period is until December, price improvement would equal the December cash price minus the June cash price.

Total storage costs are calculated in the same matter as with a storage hedge. Commercial storage and opportunity cost are both included. Price improvement minus the total storage costs equals the actual realized profit/loss from speculative storage.

Interest Rates for Opportunity Cost Calculations

As stated above, opportunity costs need to be included in the total storage cost calculations because the money gained from selling wheat at harvest could be used to pay off operating loans. Interest expenses can be saved if the operating loan is paid off earlier. Operating loan interest rates were only found on-line for the time period of 1998 through 2009.

The London Interbank Offer Rate (LIBOR) is a standard interest rate for the financial industry. The monthly one-month, three-month, six-month, and twelve-month LIBOR interest rates were all averaged to create one LIBOR interest rate for each month. The monthly LIBOR interest rates were averaged to create a yearly LIBOR interest rate.

The yearly operating loan interest rates found for 1998 through 2009 were matched with the corresponding LIBOR average for the specific year. On average, the yearly operating loan interest rate was 3.47% higher that the LIBOR yearly average. The yearly average LIBOR interest rates were expanded to include the years through 2013. Each yearly average LIBOR interest rate from 2004 to 2013 had 3.47% added to it to create the operating loan interest rate used for this analysis. The operating loan rates used for this study are summarized below in Table 4.3. Interest rates range from 3.893% in 2011 to 8.670% in 2007.

Table 4.3 Summary of Operating Loan Interest Rates

2004	5.234%	2009	4.347%
2005	7.173%	2010	3.932%
2006	8.670%	2011	3.893%
2007	8.649%	2012	4.008%
2008	6.341%	2013	3.804%

Average Price Calculations

As stated before, weekly prices (typically Wednesday) make up the database used in this study. To lessen the effect of possible errors in the database, four or five weekly prices make up a monthly price. For example the 4 (or 5) Wednesdays in June make up the harvest price used for that marketing year. The middle of this time period, June 15th, is considered the starting point for storage. Kansas City wheat futures are only for the months of July, September, December, March, and May. Typically, the futures contract expires half way through the month, so storage in these months only goes until the 1st of the month (i.e., July 1, September 1, etc.). The two weekly prices before the first of the month and the two weekly prices after are averaged to create a price for that futures contract month[1].

For months that are not futures contract months (August, October, November, January, February, and April), the 4 (or 5) weekly prices gathered in that month are averaged to create a monthly cash price.

Storage Time Periods

As stated above, for this analysis storage of wheat starts on June 15th of each year. For futures contract months, storage runs until the 1st of the month, while with non-contract months'

[1] The prices used are only offered bids. We do not know if farmers with more grain can get a price premium.

storage runs until the 15th of the month. The profitability of each storage period is analyzed in this study. The storage period and the months in storage for each period are summarized in Table 4.4. The amount of time in storage ranges from ½ of a month to 10 ½ in an effort to analyze the most profitable storage period.

Table 4.4 Storage Periods Analyzed

Storage Period	# of Months in Storage
June 15th to July 1st	0.5
June 15th to August 15th	2.0
June 15th to September 1st	2.5
June 15th to October 15th	4.0
June 15th to November 15th	5.0
June 15th to December 1st	5.5
June 15th to January 15th	7.0
June 15th to February 15th	8.0
June 15th to March 1st	8.5
June 15th to April 15th	10.0
June 15th to May 1st	10.5

Data for Regression Analysis

Two models were run for this analysis: returns to hedged storage and returns to speculative storage. The independent variables in each model were average harvest price, nearby basis, and futures contract month spread between July and the nearby contract when the grain is physically sold in the cash market. The two models are summarized below:

Hedged Storage Returns = $\beta_0 + \beta_1$ (Average Harvest Price) + β_2 (Nearby Basis) + β_3 (Spread)

Speculative Storage Returns = $\beta_0 + \beta_1$ (Average Harvest Price) + β_2 (Nearby Basis) + β_3 (Spread)

All of the information required for the independent variables can be obtained in June to attempt to project the storage returns. The expected sign of β_1 is uncertain and left to be determined. β_2 is expected to be negative. The stronger (less negative) the basis the less it should increase therefore resulting in lower returns to storage. β_3 is expected to be positive. The larger the spread, the more the price is expected to increase. Price increases can translate into storage returns for speculative storage.

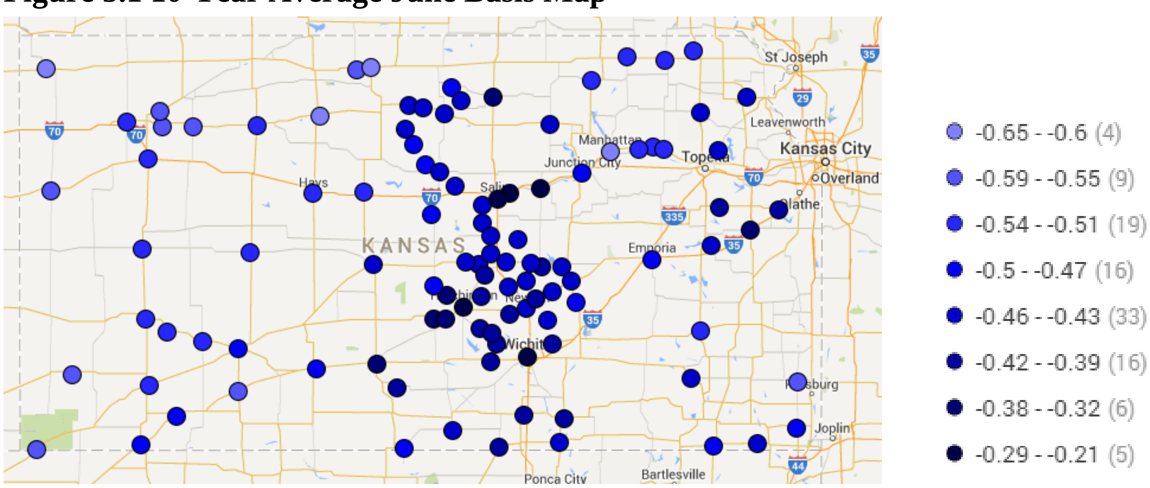
Chapter 5 - Results

Basis Levels

First this analysis calculated the average Wednesday price in June at all locations for each of the years from 2004 – 2013. The average Wednesday July futures price was subtracted from this June cash price to calculate the June nearby basis. Nearby basis is the cash price compared to the closest upcoming futures contract. This nearby basis will be used in the regression analysis.

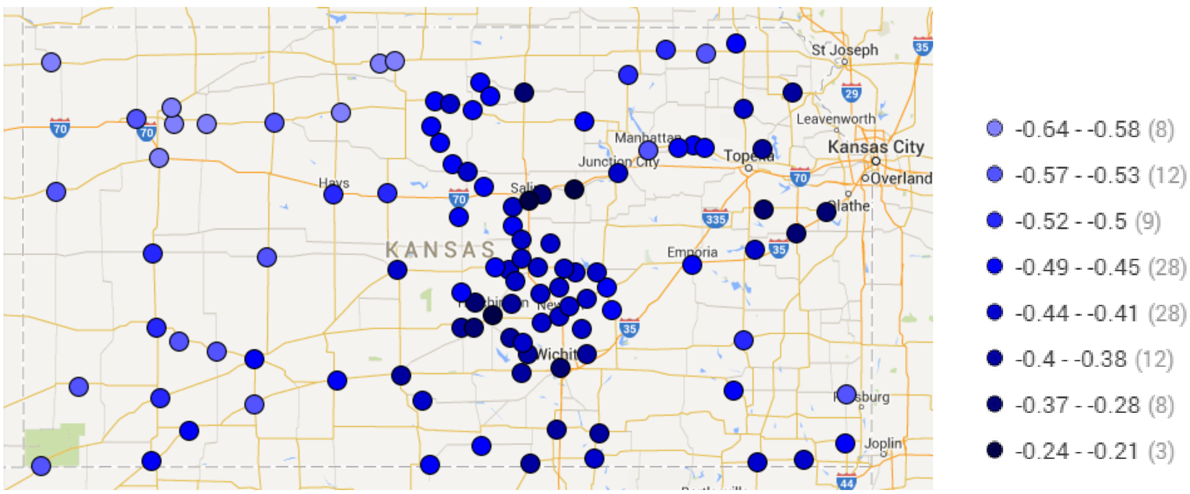
The June basis for each of the ten years were averaged to create a 10-year average June basis for each location. Figure 5.1 shows a mapping of these results. This illustration was created in Google My Maps. The average June basis ranges from $0.65 to $0.21 under the July Kansas City Hard Red Winter Wheat futures. Each range is depicted by a different shade. The lightest shade shows the weakest (most negative) basis level. The strongest basis levels, which are the darkest shade, are at locations with the highest demand. These are at grain hubs such as Salina, Hutchinson, and Wichita. The number of locations included in each range is the number in parentheses in the legend. The average June basis in these grain hubs range from $0.29 to $0.21 under July futures. The data behind these basis maps is included in Appendix B.

Figure 5.1 10-Year Average June Basis Map



A similar method was done to calculate the basis in July. The results are shown in figure 5.2. The last two Wednesdays in June and the first two Wednesdays in July make up the July cash price. This price is calculated against the July futures to get a July basis for each location. In July, the 10-year average nearby basis ranged from $0.64 to $0.21 under the July futures. Again, the basis is the weakest in Western Kansas where the wheat supply is high. The strongest basis again are in areas of high demand.

Figure 5.2 10-Year Average July Basis Map



The same procedure was completed for the rest of the months. These maps could ideally give producers an idea of historical basis levels in a particular areas. The results for 10-year nearby basis averages for August, September, October, November, December, January, February, March, April, and May are displayed as Figures 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11, and 5.12, respectively. All of the following maps are basis levels compared to each month's nearby futures contract. These basis levels are used as the *closing basis* for calculations.

Figure 5.3 10-Year Average August Basis Map

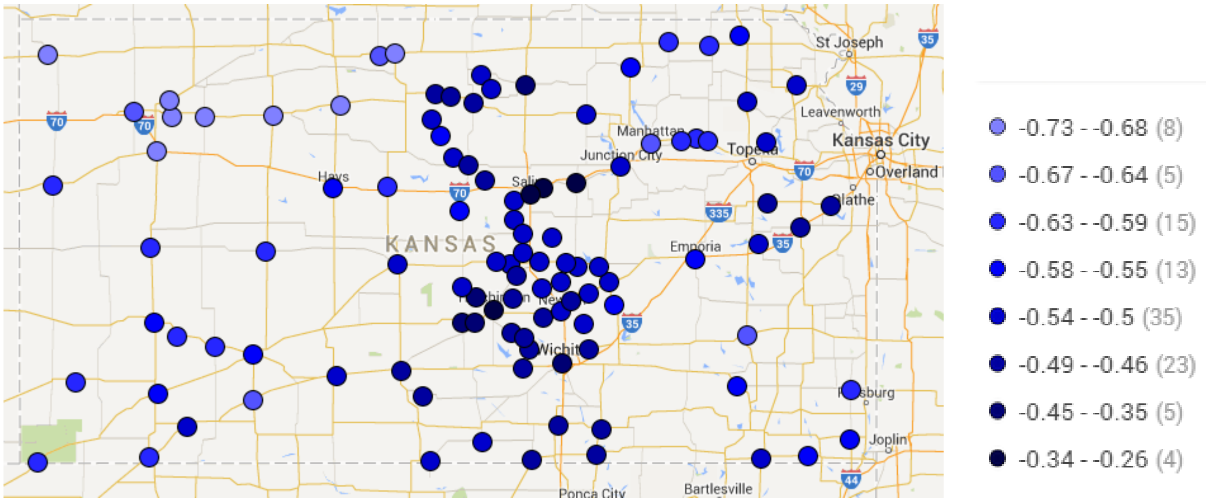


Figure 5.4 10-Year Average September Basis Map

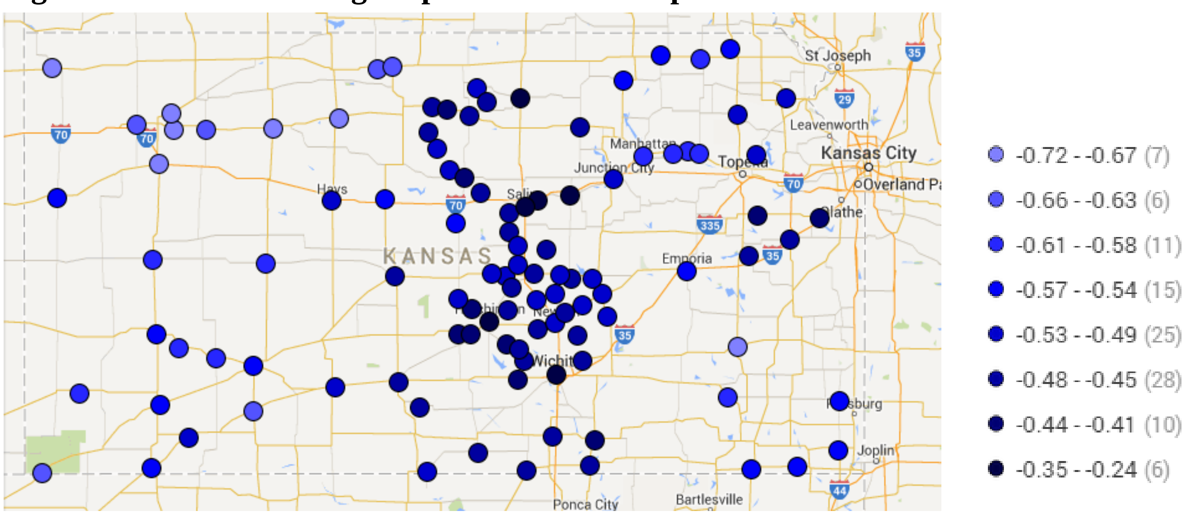


Figure 5.5 10-Year Average October Basis Map

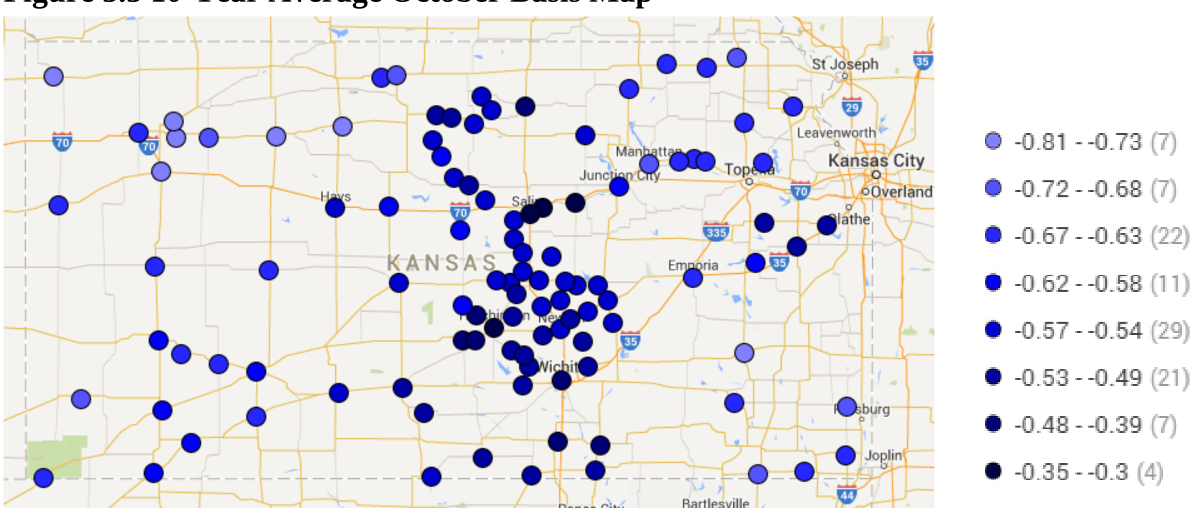


Figure 5.6 10-Year Average November Basis Map

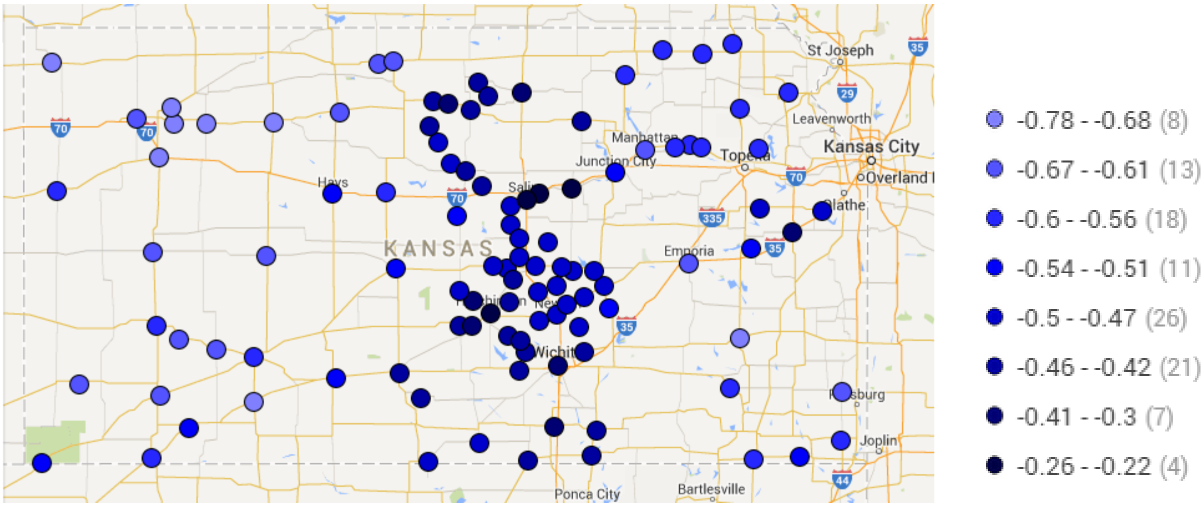


Figure 5.7 10-Year Average December Basis Map

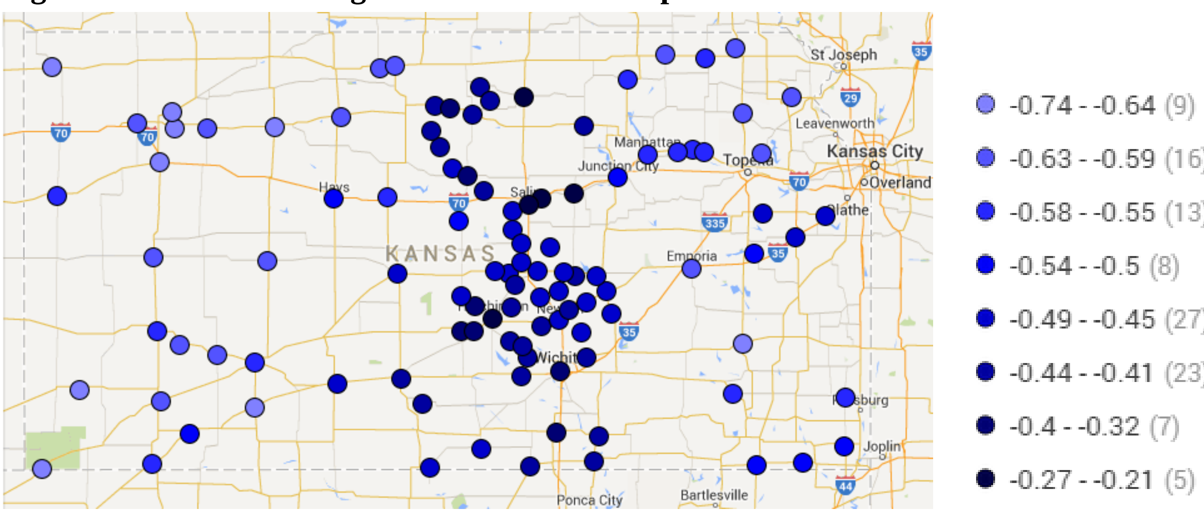


Figure 5.8 10-Year Average January Basis Map

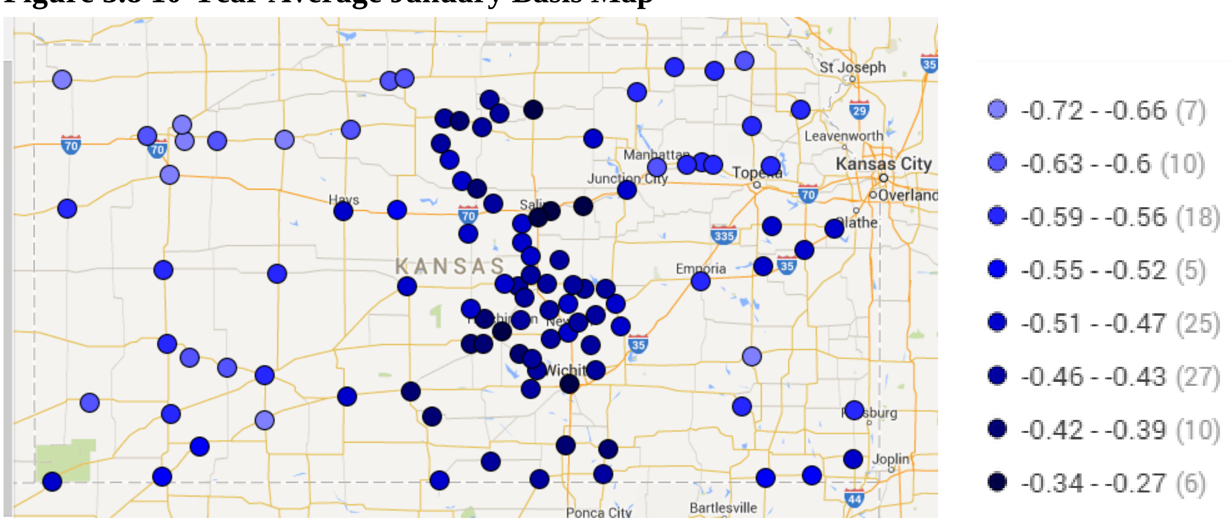


Figure 5.9 10-Year Average February Basis Map

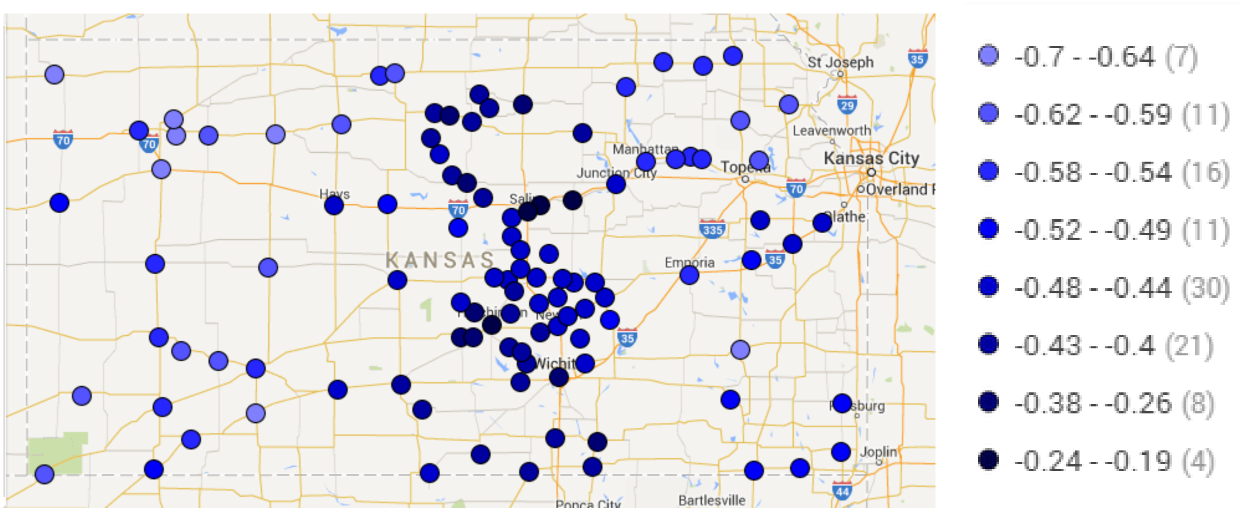


Figure 5.10 10-Year Average March Basis Map

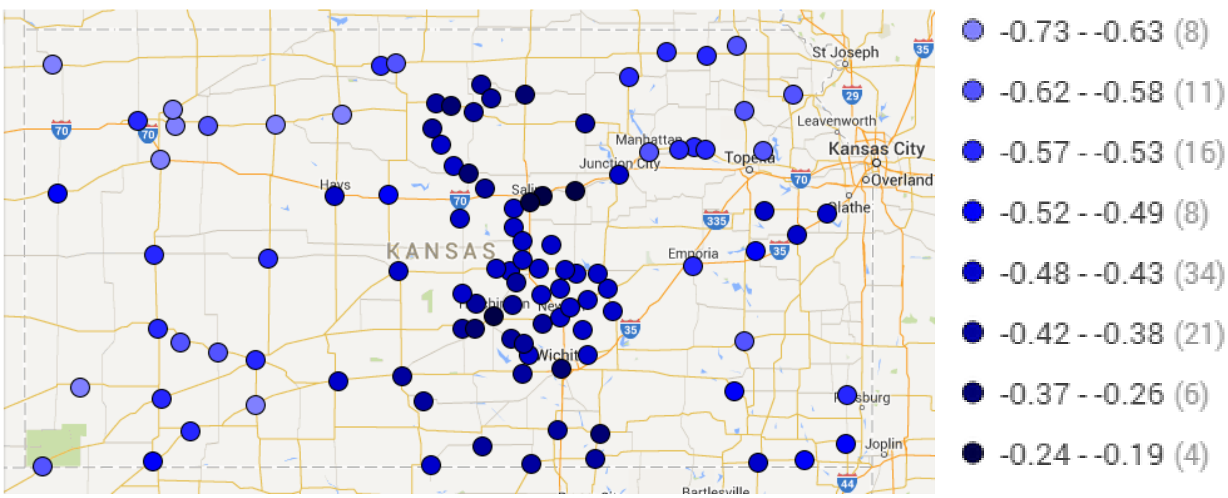


Figure 5.11 10-Year Average April Basis Map

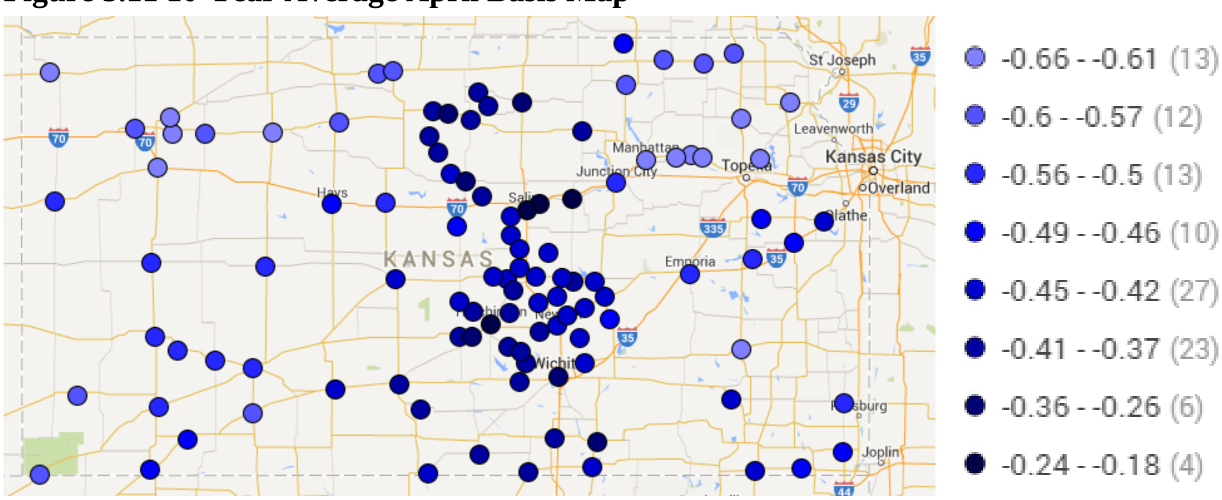
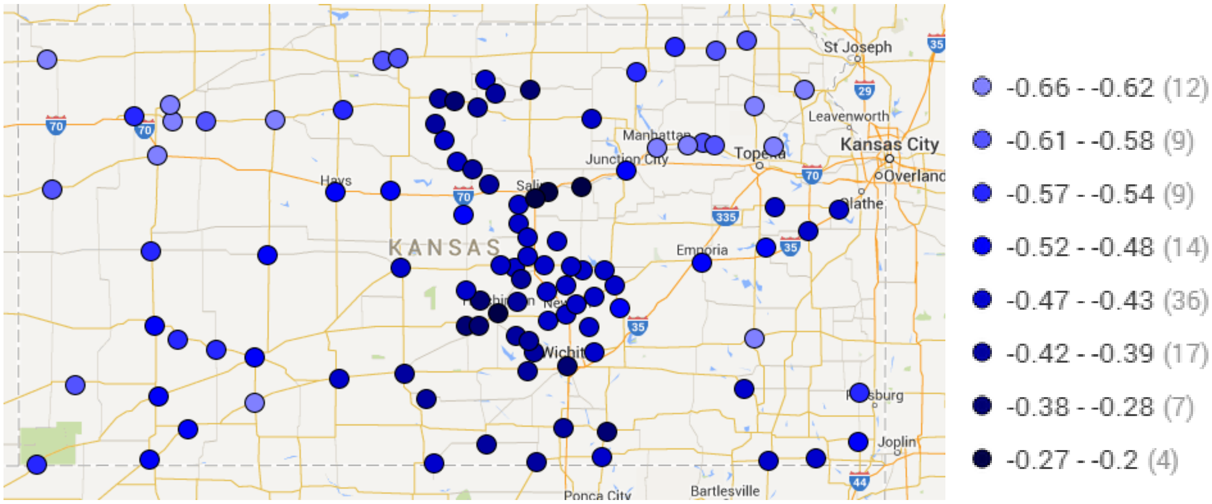


Figure 5.12 10-Year Average May Basis Map



Basis Improvement

Recall, *basis improvement* is the *closing basis* minus the *opening basis*. For example, basis improvement for storage until December is the closing basis in December minus the opening basis in June. Opening basis is calculated by taking the June cash price minus the December futures price in June. Closing basis is calculated in December and is the December cash price minus the December futures contract price. Basis improvement minus total storage costs gives the returns to hedged storage compared to simply selling in June at harvest time.

Basis improvement was calculated for all possible storage months for all locations. A 10-year average across all locations in Kansas for each storage month is presented in Table 5.1. Also, included is the Olympic average which removes the years with the highest and lowest basis improvement and averages the basis improvement of the leftover eight years.

Table 5.1 Kansas Basis Improvement 10-Year Average

Kansas Basis Improvement from Opening Basis in June($/bu) (10-Year Average for all of Kansas)						
	Average	Olympic Avg			Average	Olympic Avg
July	$ 0.01	$ 0.00		January	$ 0.35	$ 0.35
August	$ 0.05	$ 0.05		February	$ 0.38	$ 0.37
September	$ 0.07	$ 0.07		March	$ 0.38	$ 0.37
October	$ 0.16	$ 0.16		April	$ 0.42	$ 0.44
November	$ 0.22	$ 0.22		May	$ 0.41	$ 0.44
December	$ 0.24	$ 0.24				

For example in Table 5.1, the 10-year average closing basis in December was $0.24/bushel higher than the opening basis versus the December futures contract in June. The basis improvement, on average, continues to increase until April. As a reminder, one should stay in a storage hedge as long as the expected basis improvement is greater than the storage costs.

The calculations shown in Table 5.1 required that an average of the basis improvement for each month for all locations be computed. For example, the basis improvement for each December from 2004-2013 for Abilene, Kansas was averaged to calculate a typical basis improvement from June to December for Abilene. The average across all locations was used to create Table 5.1. The variability in basis improvement levels was also important to analyze, so the standard deviation of the basis improvement for each specific month was calculated for each location. For instance, the basis improvement variability for December was calculated for Abilene by calculating the standard deviation of all December basis improvement observations from 2004-2013. The average of these standard deviation results was taken to create an average standard deviation for Kansas.

Figure 5.13 shows the average basis improvement and variability for each month across Kansas. The dotted lines represent one standard deviation out from the mean in each direction. The basis improvement average line in Figure 5.13 corresponds to the 10-year averages displayed in Table 5.1. Figure 5.14 shows the Olympic averages of the data included in the average line of Figure 5.13. The years with maximum and minimum return observations were taken out and the average of the eight years left was taken. An Olympic average was done to lessen the effects of extreme years. The standard deviation on those eight years was also calculated and is represented by the ± 1 standard deviation lines in Figure 5.14. The minimum and maximum lines in Figure 5.14 represent the two years that were taken out of the average calculations.

Referring back to the December example, the basis improved $0.24/bushel from June to December, on average, from 2004 to 2013. The standard deviation of this improvement averaged across all locations is $0.25/bushel. As a result, 68% of the time (± 1 standard deviation) the basis improvement was between weakening $0.01/bushel and strengthening $0.49/bushel. The variability of basis improvement increases as the number of months in storage increase. This can be seen by the widening gap between the average and standard deviation lines in Figure 5.13.

Figure 5.13 Kansas Monthly Basis Improvement Averages and Variability

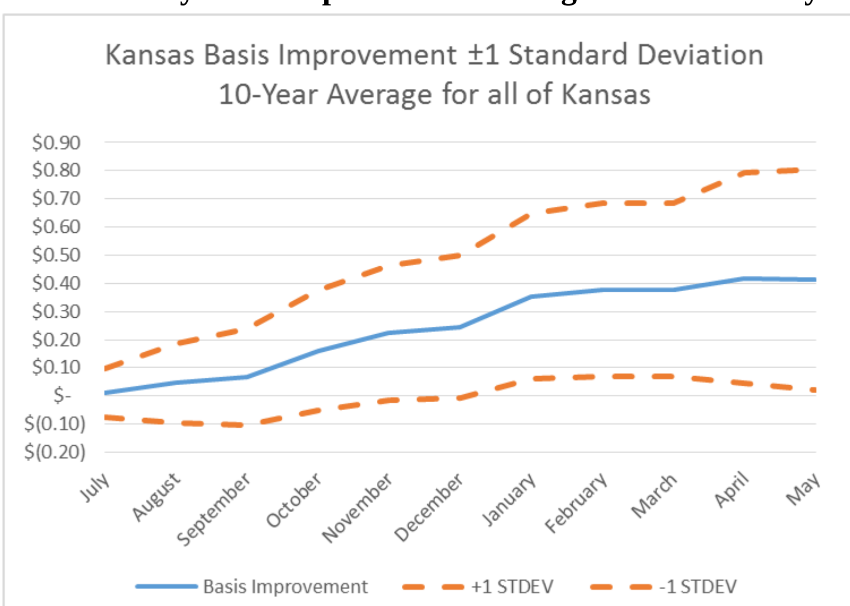
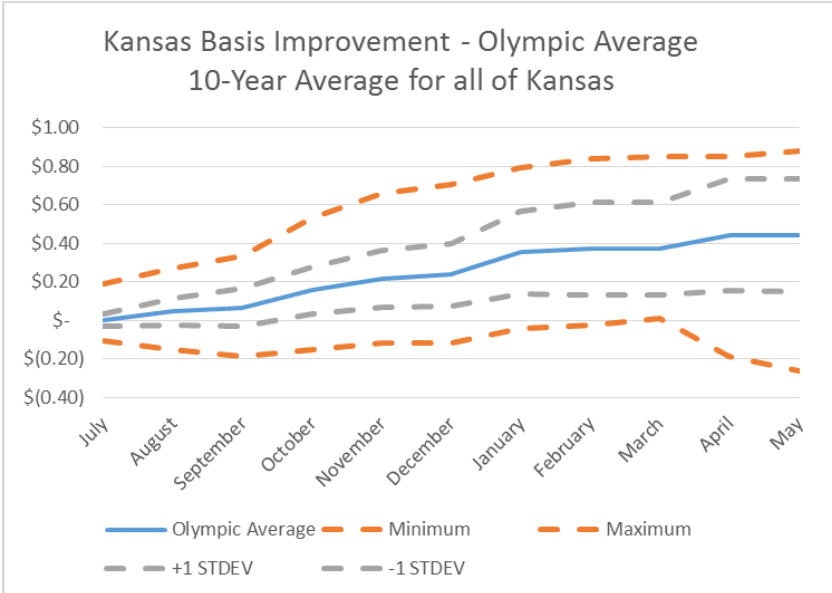


Figure 5.14 Kansas Monthly Basis Improvement Olympic Averages and Variability



Basis improvement was averaged in the same manner regionally to tease out any regional differences in the data. These results are displayed as Figure 5.15. North Central Kansas showed the highest level of basis improvement starting in August and continuing into all subsequent months. South Central Kansas had the second highest basis improvement, also beginning in August. Northwest Kansas showed the lowest amount of basis improvement, but recall that this is the region with the lowest number of locations included in the study. The basis improvement for all locations begins to level off or decrease after April.

Google My Maps was once again used to display this regional data. Figure 5.16 shows the locational average basis improvement from June to December. Google My Maps divides the results into eight ranges. Basis improvement for December on average ranged from $0.08/bushel to $0.34/bushel. The darkest areas show the locations with the highest basis improvement levels. The highest concentration of dark-shaded areas is in North Central Kansas. This corresponds to the results in Figure 5.15.

Figure 5.15 Kansas Regional Basis Improvement

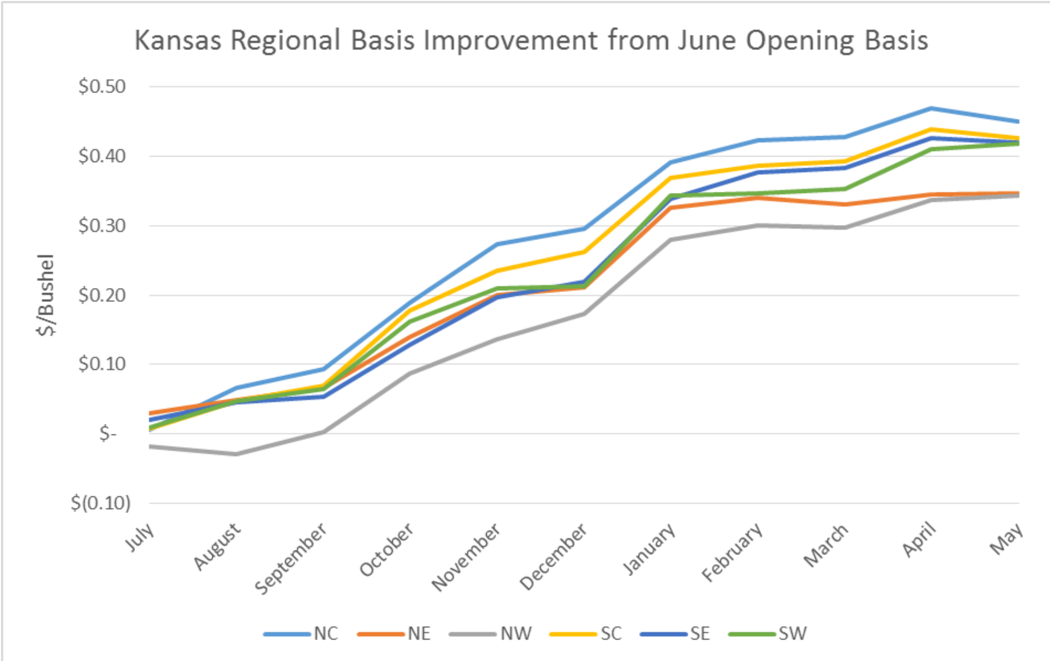


Figure 5.16 10-Year Average December Basis Improvement Map

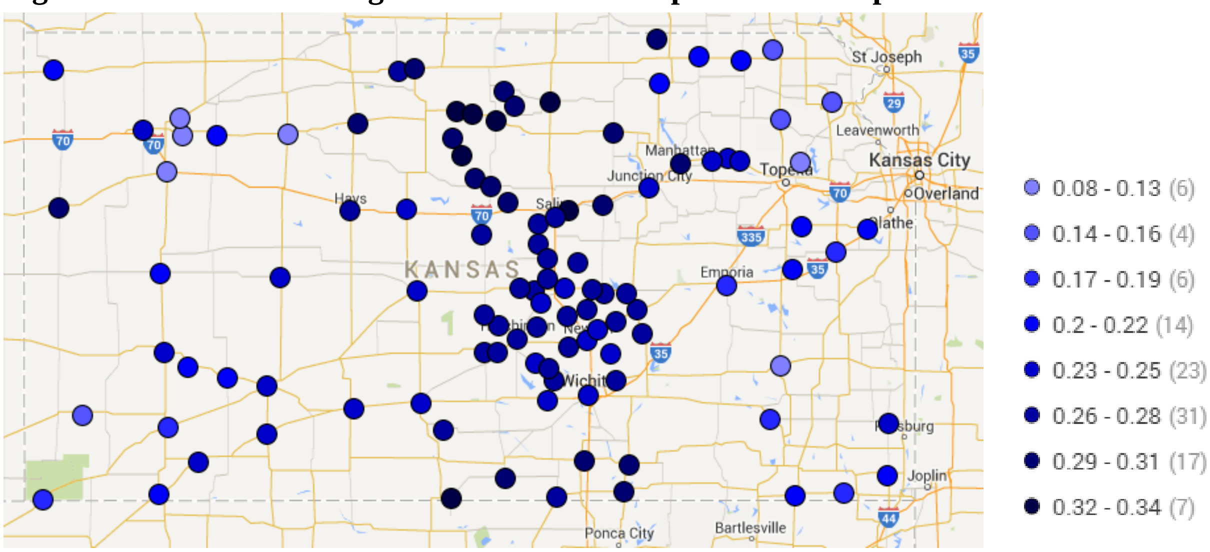
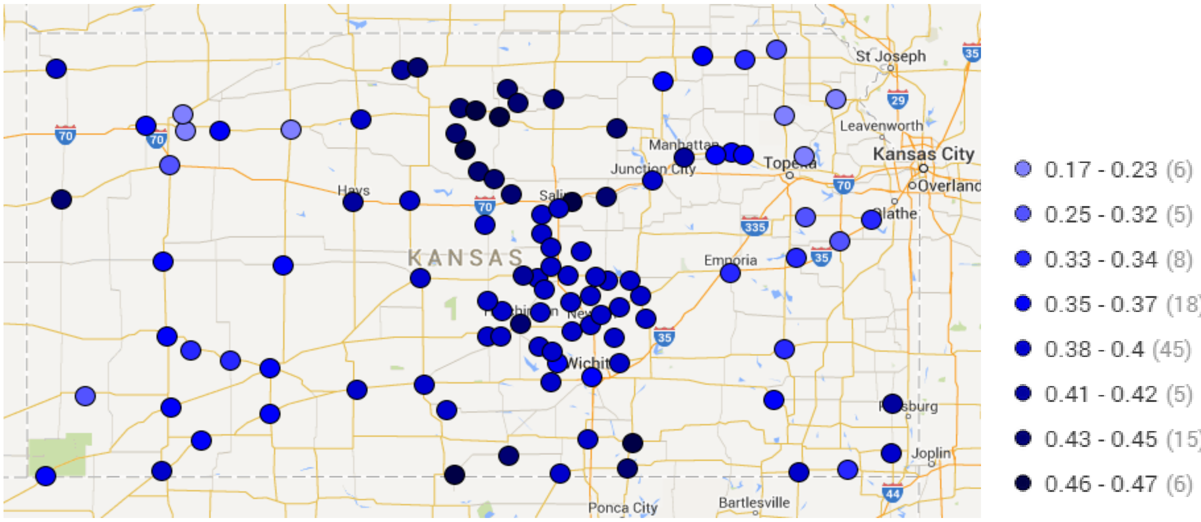


Figure 5.17 shows similar results for March. The darkest areas are clustered typically in North Central Kansas. The basis improvement for June to March on average ranges from $0.17/bushel to $0.47/bushel. For results of the rest of the possible storage months, refer to Appendix C.

Figure 5.17 10-Year Average March Basis Improvement Map



Price Improvement

For speculative storage to be profitable, the *price improvement* during the storage period must be greater than the *total storage costs*. Price improvement can be defined as the cash price at the end of the storage period minus the cash price in June. The typical price improvement for each location for each month was calculated by averaging the price improvement for a specific month across all years for each location. For example, the price improvement for December from 2004 to 2013 for Abilene, Kansas was averaged to create a typical price improvement from June to December for Abilene. These values for each location were averaged to calculate an average price improvement for each storage month for all of Kansas. Results of this analysis are included as Table 5.2. The cash price improvement typically continues to rise until March before dropping off significantly in April. The highest price improvement achieved on average is $0.62/bushel in March compared to the cash price in June. The second column of Table 5.2 includes the Olympic average of the first column. The years with the maximum and minimum amount of price improvement were taken out and the leftover eight years were averaged.

Table 5.2 Kansas Price Improvement 10-Year Averages and Olympic Averages

Kansas Price Improvement from June Cash Price ($/bu) (10-Year Average for all of Kansas)						
	Average	Olympic Avg			Average	Olympic Avg
July	$ 0.04	$ 0.01		January	$ 0.31	$ 0.18
August	$ 0.23	$ 0.21		February	$ 0.54	$ 0.38
September	$ 0.27	$ 0.28		March	$ 0.62	$ 0.36
October	$ 0.22	$ 0.32		April	$ 0.33	$ 0.20
November	$ 0.16	$ 0.27		May	$ 0.32	$ 0.17
December	$ 0.18	$ 0.27				

The averages were plotted in Figure 5.18, and the Olympic averages are plotted in Figure 5.19. The Olympic average removes the highest and lowest years and averages the returns of the leftover eight years. Also included are the lines portraying ± 1 standard deviation away from the mean. Comparing basis improvement in Figure 5.13 with price improvement in Figure 5.18, one can see the variation in price improvement is much higher than the variation in basis improvement. This makes sense because hedged storage locks in the futures part of the price and only leaves the basis to vary while speculative storage leaves both the futures price and the basis to vary. Basis is a much smaller portion of the total price; thus, a much smaller portion of the price variability.

Using December as an example again, the average price improvement from June to December across Kansas was $0.18/bushel. The standard deviation was $2.08/bushel. This means that 68% of the time (±1 standard deviation) the price improvement from June to December is between a price decrease of $1.90/bushel and a price increase of $2.26/bushel. The variability of the price improvement increases from July to March, then decreases. Figure 5.19 shows the Olympic average of the monthly price improvement. For the Olympic average, the lowest and highest years are taken out and the average of the left over eight years is taken. The standard deviation on the price improvement for those eight years is taken and is represented in the same figure.

Figure 5.18 Kansas Monthly Price Improvement Averages and Variability

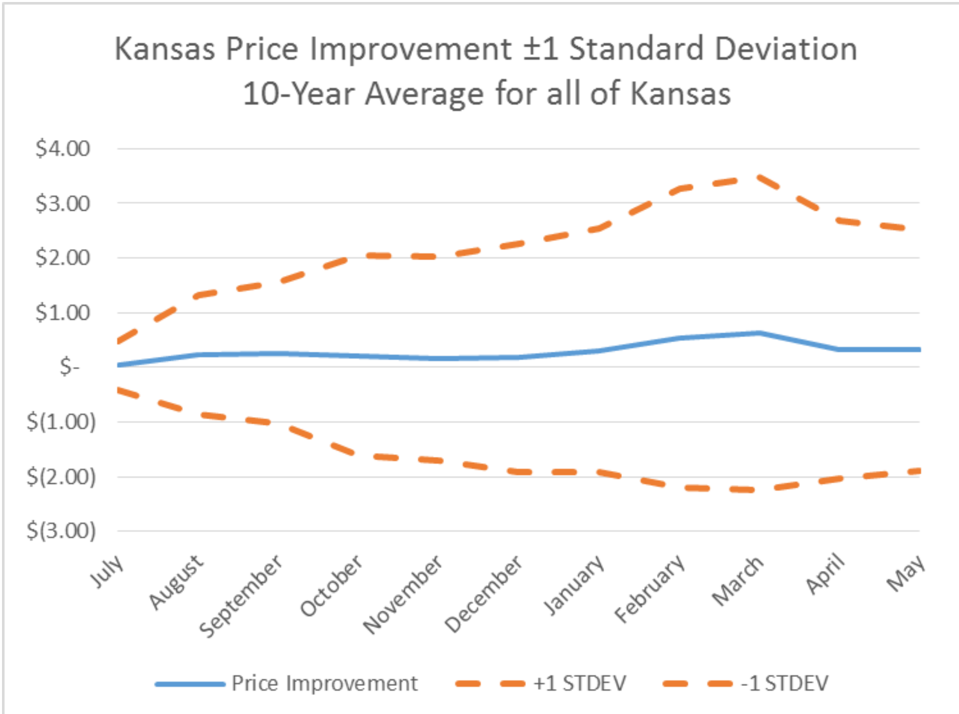
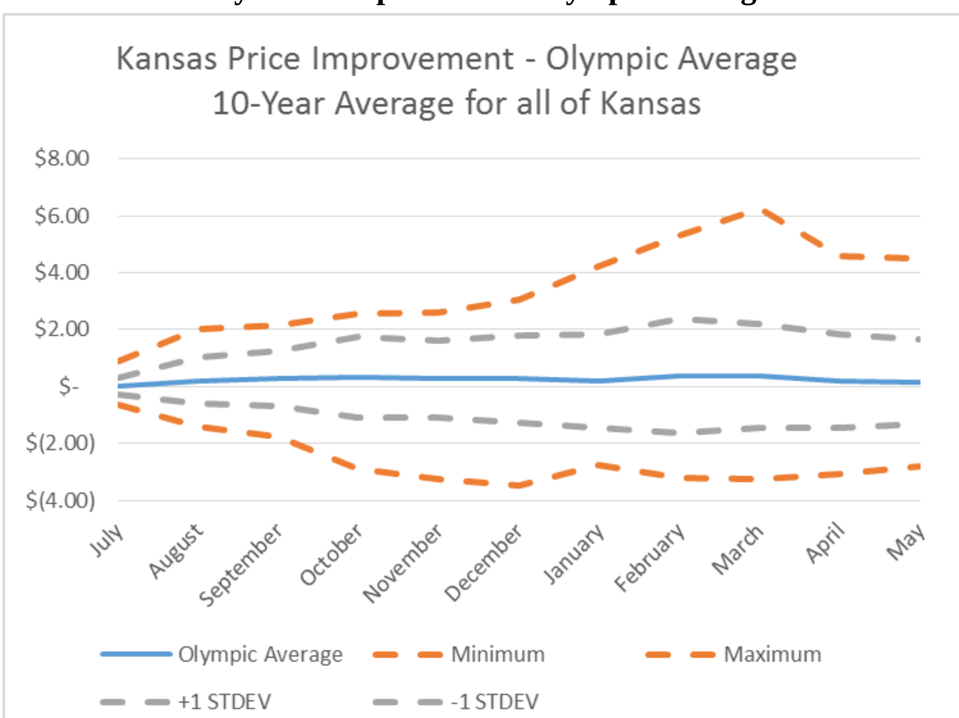
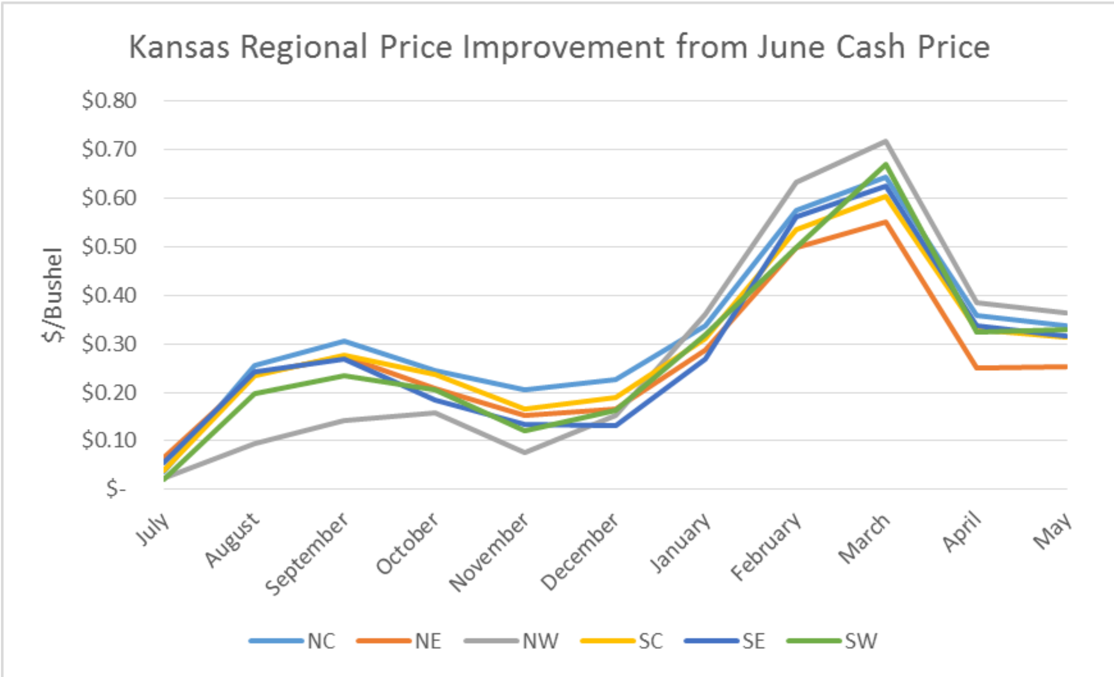


Figure 5.19 Kansas Monthly Price Improvement Olympic Average and Variability



Results of a regional analysis of price improvement are shown in Figure 5.20. The results of this portion are not as clear cut as the results of the regional analysis of basis improvement. No single region displays consistent higher levels of price improvement across all months. This graph also shows that price improvement peaks around March and decreases thereafter.

Figure 5.20 Kansas Regional Price Improvement



Google My Maps was used to display the price improvement results for each location. Examples shown are the price improvement to December and March as Figure 5.21 and 5.22, respectively. In both examples, there is no clear pattern of where the areas of highest price improvement will be. December ranges from a price decrease of $0.16/bushel to a price increase of $0.37/bushel. March varies from a price increase of $0.43/bushel to $0.99/bushel. The data behind these maps, as well as data for the other months are included as Appendix D.

Figure 5.21 10-Year Average December Price Improvement Map

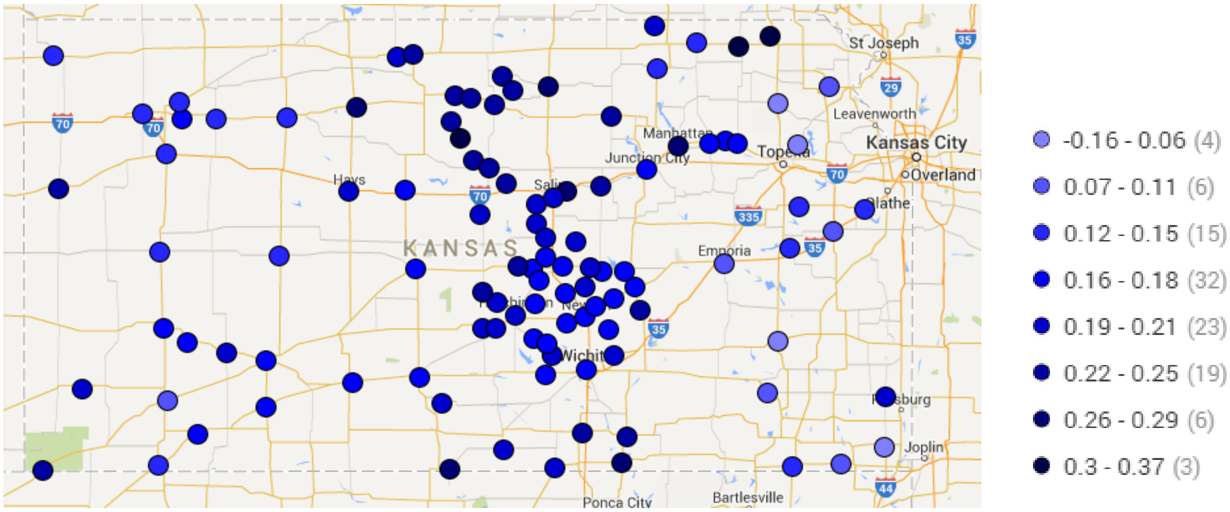
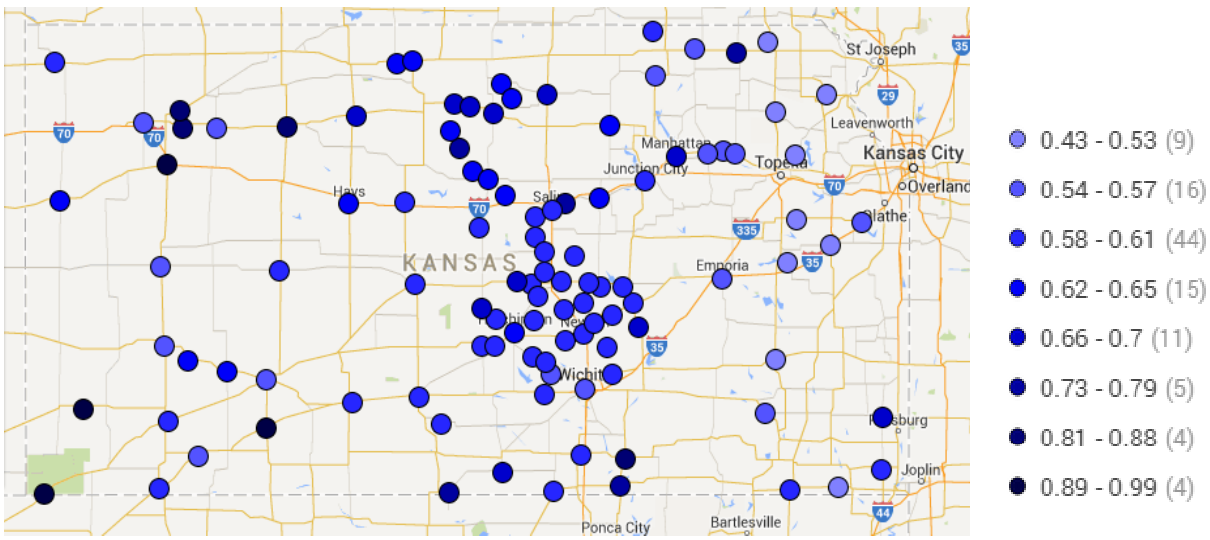


Figure 5.22 10-Year Average March Price Improvement Map



Storage Costs

Recall that the returns to hedged storage is calculated by subtracting the total storage costs from the basis improvement. Returns to speculative storage can be calculated by taking the price improvement minus the total storage costs. Total storage costs consist of commercial storage fees and opportunity costs, if storing in a commercial facility. Total storage costs of on-farm storage were also considered. This consists of the variable costs associated with storing wheat in a bin as well as the opportunity cost. On-farm storage in this situation assumes the bins were built many years back, and there is no longer depreciation on the facility. Taxes and insurance rates are also not included in this analysis. Another cost that is not included that maybe incurred is the labor spent monitoring the grain during the storage period.

Commercial storage rates are a flat rate per bushel per month depending on the year, but the opportunity costs depend on the harvest price and the operating loan rate for that year. On-farm storage costs are dependent only on the harvest price because shrinkage enters the equation as a percent of the harvest price.

Average storage costs over the ten years for each month were calculated for each location. These results were then averaged to create an average storage cost for Kansas up to each possible storage month. These results are displayed in Figure 5.23. The storage cost line is almost at a constant rate throughout, but it is not completely constant because opportunity costs are included as well. Also inlayed in Figure 5.23, are price improvement and basis improvement averages for each month compared to the levels in June. Points where the price improvement line is higher than the storage cost line, indicate where, on average, there are positive returns to speculative storage. There are no points on the graph where the basis improvement is greater than the storage costs. This means over the 10-year average, positive returns were not shown for storage hedges. This doesn't not mean that there were not individual years where hedged storage was not profitable—but the average over the ten-year period it was not.

Figure 5.23 Commercial Storage Cost Summary

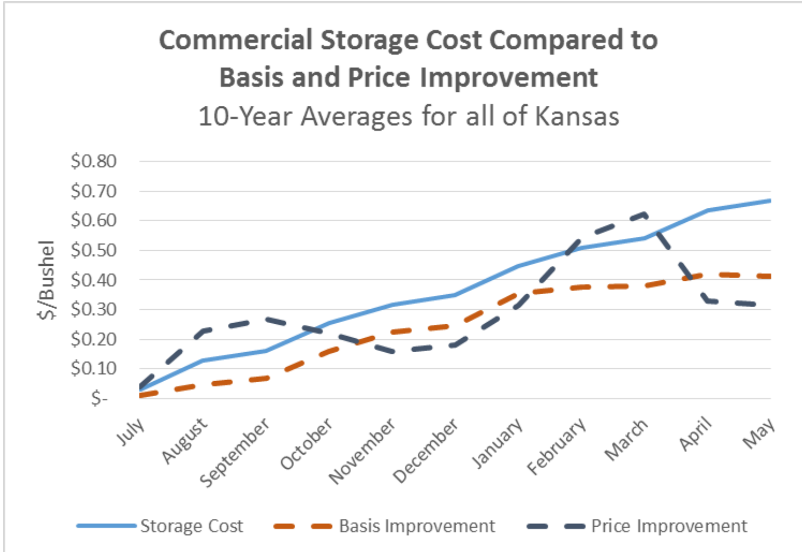
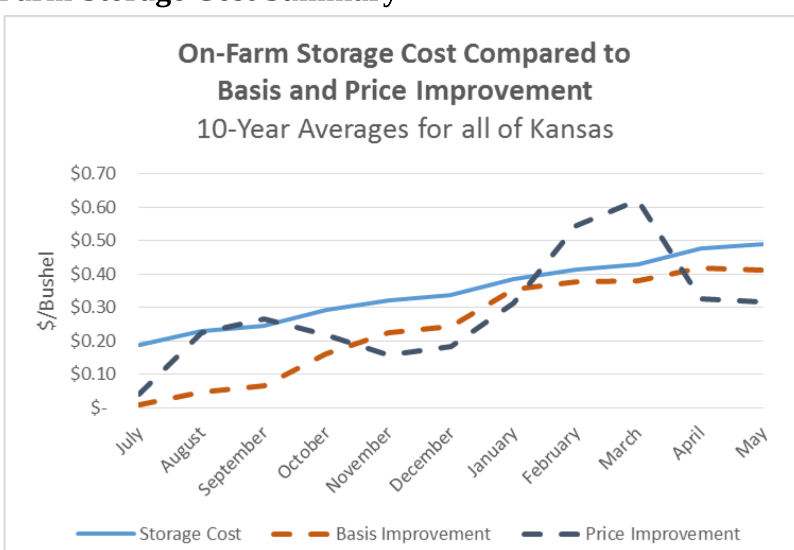


Figure 5.24 shows the results of a similar process performed for on-farm storage. The high initial cost per bushel for on-farm storage can be seen, but the costs later on are not as high. This graph also shows two periods where the price improvement was greater than the cost of storage. These occur in September, February, and March. This means in February the cost of on-farm storage was less than the price improvement from June to February, promoting positive returns to on-farm storage. This did not occur for hedged storage on average.

Figure 5.24 On-Farm Storage Cost Summary



Returns to Commercial Storage

As stated before returns to hedged storage is the basis improvement above the total storage while returns to speculative storage is the price improvement minus the total storage costs. Returns to storage are profit/loss received compared to simply selling the wheat in June at harvest. Averages across all locations and years are summarized in Figure 5.25 to show a typical monthly return to hedged and speculative commercial storage. The returns to hedged storage are negative throughout, but returns to speculative storage are positive for July, August, September, February, and March. The data behind this graph is included in Appendix E.

Figure 5.25 Monthly Returns to Commercial Storage

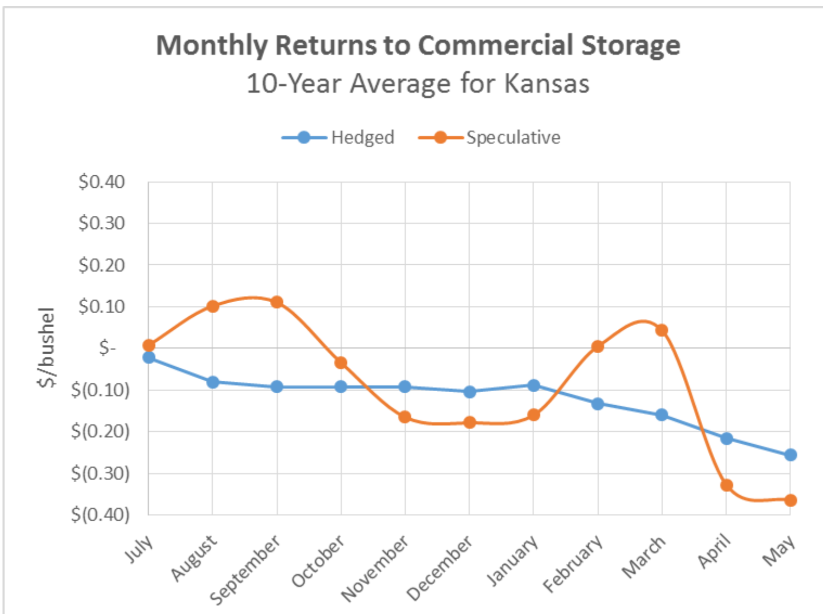
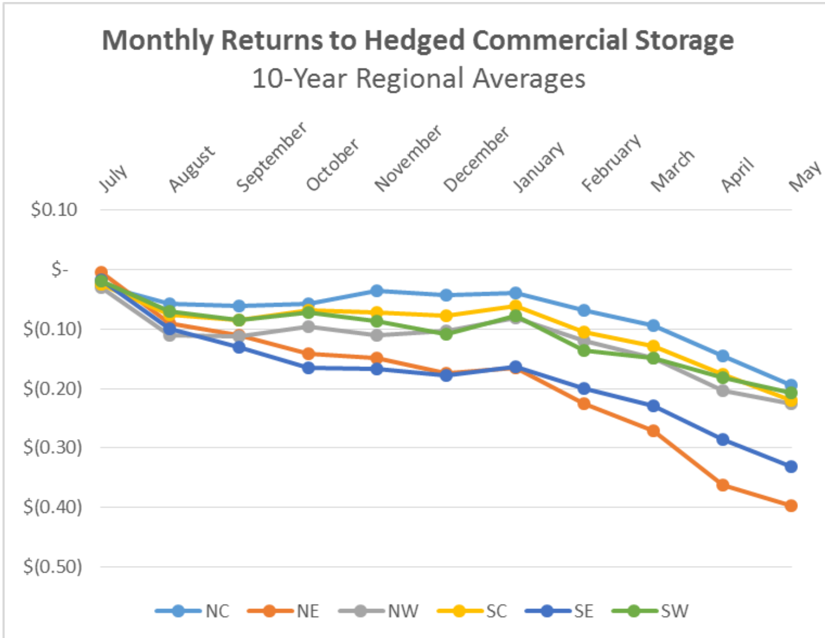


Figure 5.26 shows a regional analysis of monthly hedged storage returns. Although all hedged storage returns on average resulted in a loss compared to selling at harvest, North Central Kansas showed the highest returns for hedged storage followed by South Central Kansas. These results are similar to those found in the basis improvement analysis.

Figure 5.26 Regional Monthly Returns to Hedged Commercial Storage



For further analysis, this study looked at the returns for each month. Shown as examples are December and March. Figure 5.27 shows the yearly returns to speculative and hedged storage for the storage period of June through December. The 10-year average to hedged storage for December is a loss of $0.10 per bushel. Speculative storage until December returns an average loss of $0.18/bushel over the 10-year span. A key take away of this graph is that is the long term average of returns to hedged and speculative storage will be close to the same number, but speculative returns are much more variable than hedged returns. The purpose of hedging is to lower the amount of price risk. Hedging results in basically the same long term average return as speculative storage but saves a producer from large hurtful swings in profit.

Table 5.3 shows the main points of the graph presented in Figure 5.27. As stated above, hedged storage until December resulted in a loss of $0.10/bushel on average compared to selling at harvest. Speculative storage until December resulted in a loss of $0.18/bushel on average. The maximum return for hedged storage until December occurred in 2011 and resulted in a profit of $0.33/bushel. The biggest loss for hedged storage until December occurred in 2009 and was a negative return of $0.47/bushel compared to selling at harvest. The maximum return for speculative storage until December occurred in 2007 and was a gain of $2.67/bushel. Just the year after, in 2008, the biggest loss to speculative storage was realized. Returns for speculative storage until December were $3.95 less than selling at harvest. The sporadic moves in returns to speculative storage give it a standard deviation of $2.08/bushel. Hedged returns show a much lower standard deviation at $0.24/bushel.

Figure 5.27 Returns to Commercial Storage until December

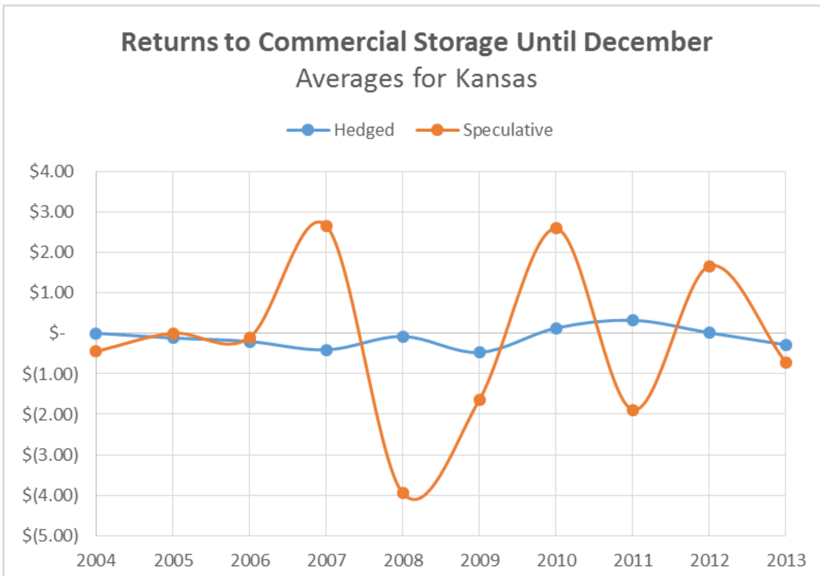


Table 5.3 Analysis of Returns of Commercial Storage until December

Returns for Storing Until December			
Average for Kansas			
Hedged		Speculative	
Average	$ (0.10)	Average	$ (0.18)
Minimum	$ (0.47)	Minimum	$ (3.95)
Maximum	$ 0.33	Maximum	$ 2.67
Standard Deviation	$ 0.24	Standard Deviation	$ 2.08

A similar approach is shown for the returns to commercial storage from June until March. Results for other possible storage periods are included in Appendix E. A graphical display of commercial storage returns until March is shown in Figure 5.28. March returns show similar results as December, but shows even larger swings in returns to speculative storage than December did. Across all ten years, hedged storage until March shows average returns of a loss of $0.16/bushel, while speculate storage shows a profits of $0.04/bushel compared to selling at harvest. Similar to December, the variability of speculate storage returns was much greater than the variability of hedged returns. Returns to hedged storage shows a standard deviation of $0.29/bushel, while speculative storage has a standard deviation of $2.83/bushel. The highest return for hedged storage until March was in 2011 and resulted in a gain of $0.27/bushel compared to selling at harvest. The biggest loss to hedged storage occurred in 2007 and ended in a loss of $0.60/bushel. The range of returns to speculative storage until March was much greater with the high being a positive return of $5.64/bushel in 2007 to the low being a loss of $3.98/bushel in 2008.

Figure 5.28 Returns to Commercial Storage until March

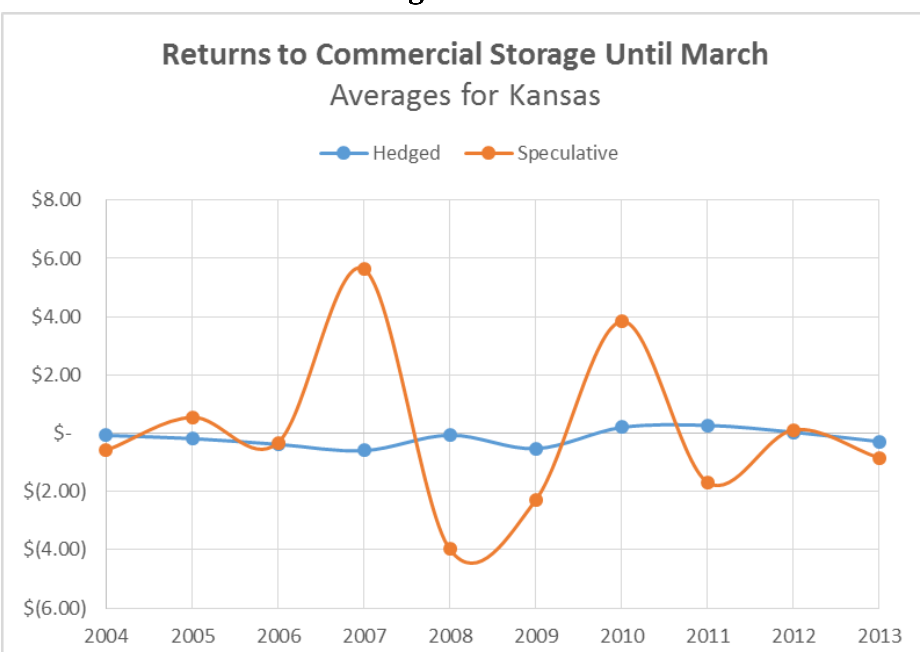


Table 5.4 Analysis of Returns of Commercial Storage until March

Returns for Storing Until March			
Average for Kansas			
Hedged		Speculative	
Average	$ (0.16)	Average	$ 0.04
Minimum	$ (0.60)	Minimum	$ (3.98)
Maximum	$ 0.27	Maximum	$ 5.64
Standard Deviation	$ 0.29	Standard Deviation	$ 2.83

Returns to On-Farm Storage

The analysis for on-farm storage compared to commercial storage only differed in the fact that different storage costs were used. The opportunity cost for each time period of storage remained the same throughout both analyses.

The 10-year average return for each storage month was calculated and is displayed in Figure 5.29. Hedged storage shows negative average returns through all possible storage periods. The high initial costs of on-farm storage make storage very unprofitable early on compared to the later storage time periods. Speculative storage shows possible returns to storage on average for the months of September, February, and March. For example, on average over the 10 years, speculative storage showed positive returns of $0.15/bushel for participating in on-farm storage until March compared to simply selling in June during harvest. The data behind Figure 5.29 is included as Appendix F.

Regional differences in on-farm storage returns were assessed in the same manner as regional differences in commercial storage. Figure 5.30 shows the 10-year average return for each month of storage for each region of Kansas. Although no positive returns were present, North Central Kansas had the highest returns to hedged on-farm storage. For both January and February, returns were at $0.00/bushel. This means on average a producer would be indifferent between participating in hedged on-farm storage versus selling at harvest. The very negative returns early on in storage can be attributed to the high initial costs associated with on-farm storage.

Figure 5.29 Monthly Returns to On-Farm Storage

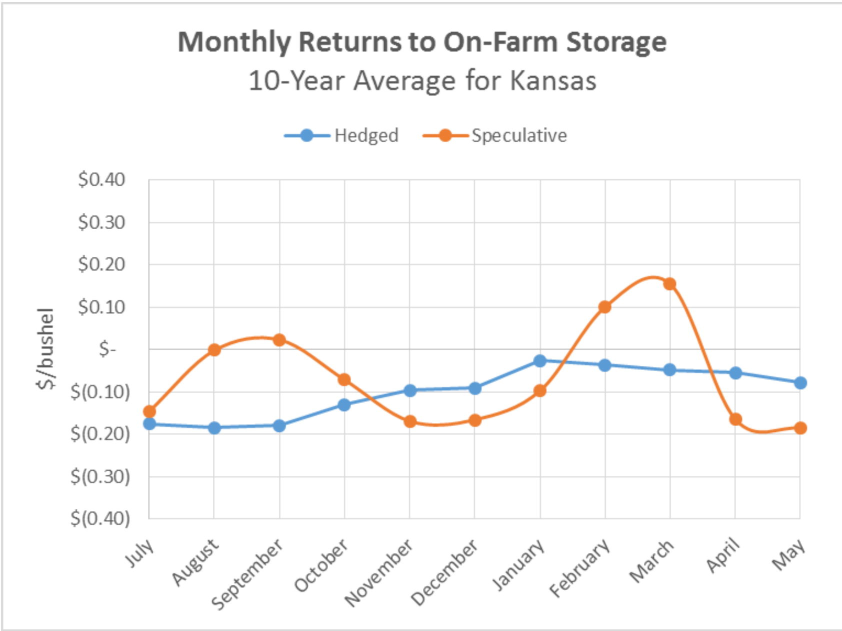
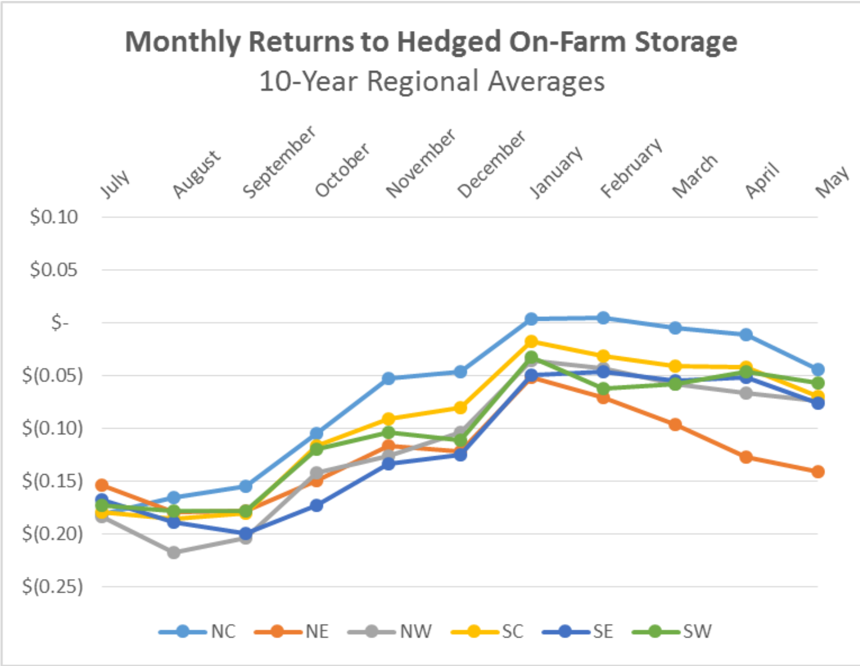


Figure 5.30 Regional Monthly Returns to Hedged On-Farm Storage



As with commercial storage, December and March will be used as monthly examples. The averages and variability are very similar to what was found in the commercial storage analysis.   Figure 5.31 is a graphical expression of the returns to on-farm storage until December while Table 5.5 summarizes the graph. Hedged storage from June to December shows an average return over the ten years as a loss of $0.09/bushel. Speculative storage averaged a loss of $0.17/bushel compared to selling at harvest.

Although, the average return of each type of storage was close to the same, the variability of speculative returns was much higher than the variability in hedged returns. The maximum return to hedged storage until December over the time period occurred in 2011 and was a positive return of $0.33/bushel. The biggest loss to hedged storage to December occurred in 2009. Returns were $0.44/bushel less than selling at harvest. The range in returns to speculative storage were much higher spanning from a gain of $2.66/bushel in 2007 and 2010 to a loss of $3.96/bushel in 2008. The resulting standard deviation over the period for hedged storage was $0.30/bushel, while the standard deviation of speculative storage returns until December was $2.09/bushel.

Figure 5.31 Returns to On-Farm Storage until December

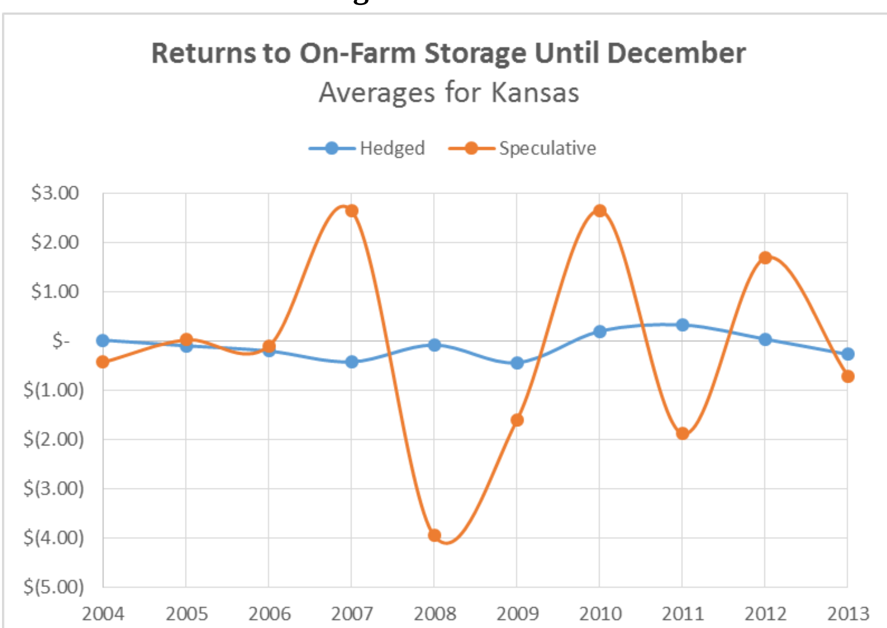


Table 5.5 Analysis of Returns to On-Farm Storage to December

Returns for On-Farm Storage Until December			
Average for Kansas			
Hedged		Speculative	
Average	$ (0.09)	Average	$ (0.17)
Minimum	$ (0.44)	Minimum	$ (3.96)
Maximum	$ 0.33	Maximum	$ 2.66
Standard Deviation	$ 0.25	Standard Deviation	$ 2.09

Returns of on-farm storage until March are shown graphically at Figure 5.32. A summary of this figure is included as Table 5.6. The average return of hedged storage was a loss of $0.05/bushel compared to a gain of $0.15/bushel for speculate storage. The highest return experienced for hedged storage during the time period was a gain of $0.38/bushel (2010 and 2011) compared to selling in June at harvest. The minimum return of hedged storage until March was a loss of $0.53/bushel (2007). Speculative returns varied from a loss of $3.89/bushel (2008) to a gain of $5.70/bushel (2007). As a result, the standard deviation of the hedged returns was $0.31/bushel, while the standard deviation of the speculative returns was $2.83/bushel.

Figure 5.32 Returns to On-Farm Storage until March

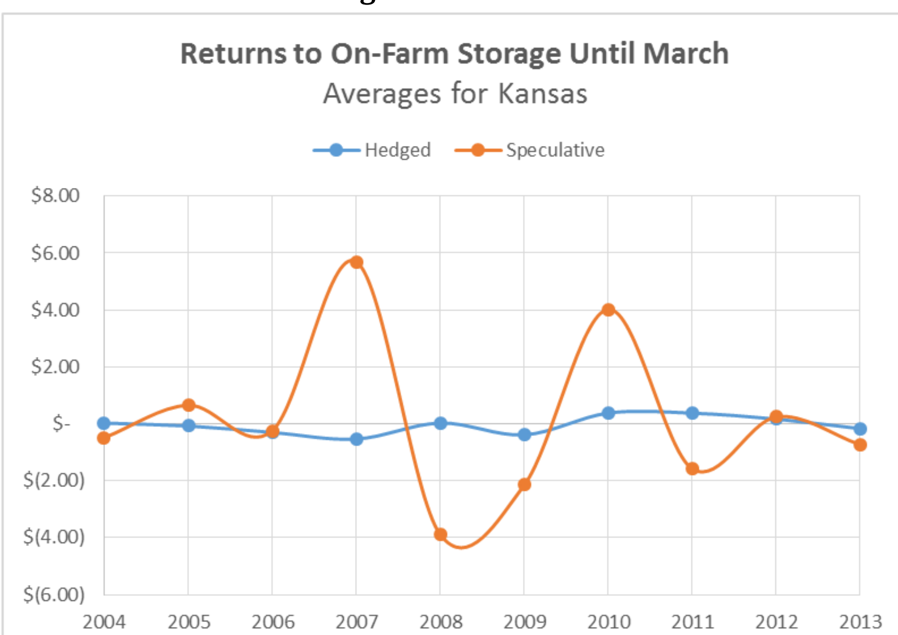


Table 5.6 Analysis of Returns to On-Farm Storage to March

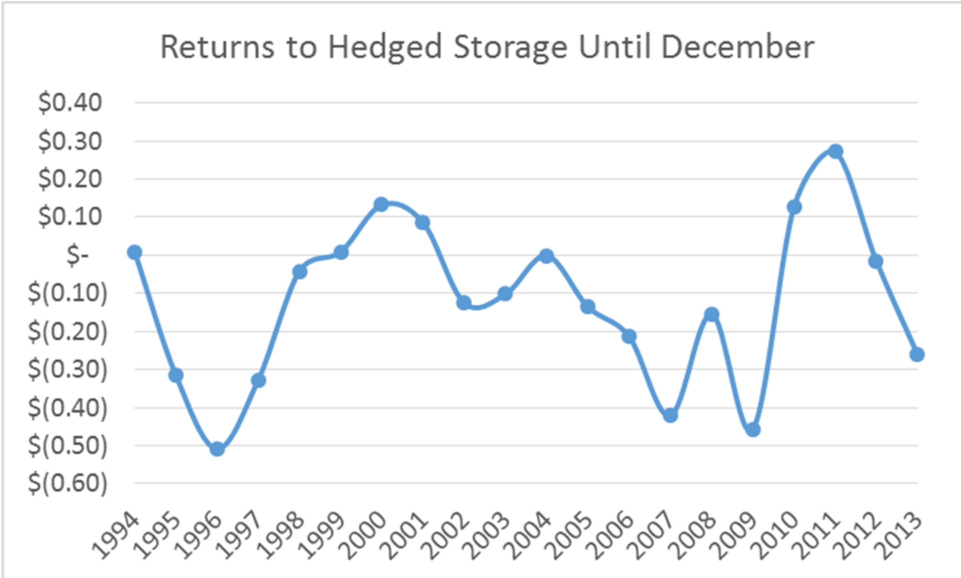
Returns for On-Farm Storage Until March			
Average for Kansas			
Hedged		Speculative	
Average	$ (0.05)	Average	$ 0.15
Minimum	$ (0.53)	Minimum	$ (3.89)
Maximum	$ 0.38	Maximum	$ 5.70
Standard Deviation	$ 0.31	Standard Deviation	$ 2.83

Regression Results

When the regression model was run on the 10-years of data, most variables of interest were not statistically significant. Twenty years of data is available for the 15 locations included in the *Wichita Eagle* database. These locations are Andale, Beloit, Coffeyville, Colby, Dodge City, Emporia, Garden City, Great Bend, Hays, Hutchinson, Pratt, Salina, Scott City, Wellington, and Whitewater. Having 20 years of data versus having 10 years adds 10 observations to our model therefore increasing the statistical significance. It was first checked to see if these 15 locations were representative of the 108 locations, so 10 years of returns for these locations were calculated using only the *Wichita Eagle* data and compared to the returns of the 108 locations over the same time period. The results were very similar and are included in Tables G.9 and G.10 in Appendix G. These results can be compared to the tables in Appendix E.

Figures 5.27, 5.28, 5.31, and 5.32 make it appear that returns to hedged storage are not variable. "Zooming" in on the y-axis of Figure 5.27 and adding the ten years of data prior show the variation in hedged storage returns until December. This graph is included as Figure 5.33. There is variation in hedged storage returns, so can this variation be explained with a regression?

Figure 5.33 Returns to Hedged Storage until December 1994-2013



Models were run for commercial storage returns for both hedged and speculative storage types. The storage periods modeled were June to: September, December, March, and May. The independent variables included are average harvest price, average nearby basis in June, and the futures spread. The first independent variable, average harvest price, is illustrated in Figure 5.34. The average harvest price peaked in in 2008 at $8.33/bushel. In 1999, the harvest price was at the lowest of the 20 years at $2.34/bushel. The standard deviation of the harvest price during the 20-year period is $1.86/bushel.

The independent variables, average nearby basis and futures spread, are illustrated in Figure 5.35 for the December storage models. Average nearby basis is weakest at harvest in 2010 at $1.21 under the July Kansas City Wheat Futures. This was an abnormal year in the grain markets because of the lack of convergence is the cash and futures markets. The strongest nearby basis at harvest occurred in 2013 at $0.13 under the Kansas City Wheat Futures. The standard deviation of the average nearby basis in June is $0.24/bushel. The July-December futures spread was the highest in 2011 at $0.19/bushel and the lowest in 1996 at -$0.16. In June

1996, the July futures were $0.16 higher than the December futures representing an inverted market. The standard deviation of the July-December futures spread in this 20-year period is $0.08/bushel. The data behind Figures 5.34 and 5.35 and used for the December regression models is summarized in Table 5.7.

Figure 5.34 Average Kansas Harvest Price (1994-2013)

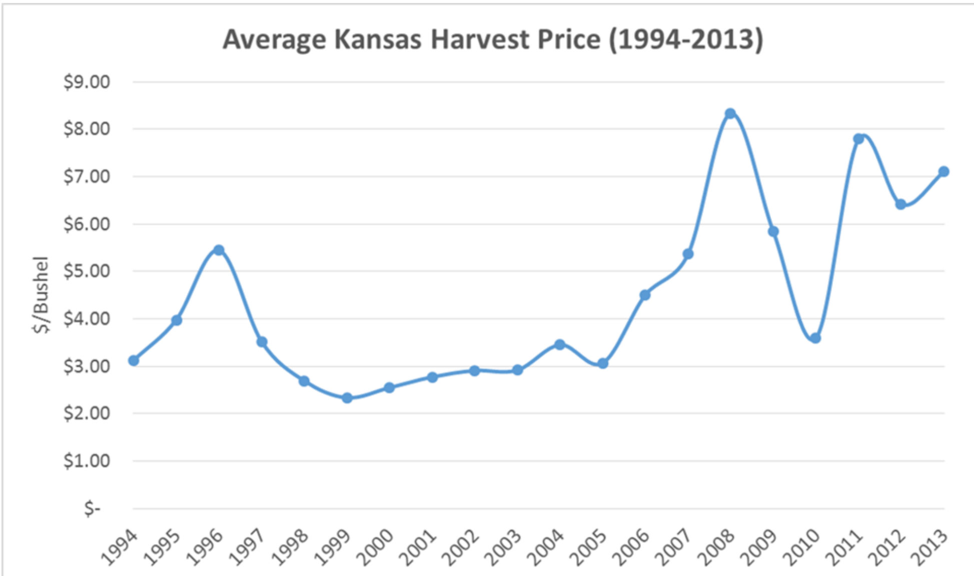


Figure 5.35 Regression Independent Variables for December Models

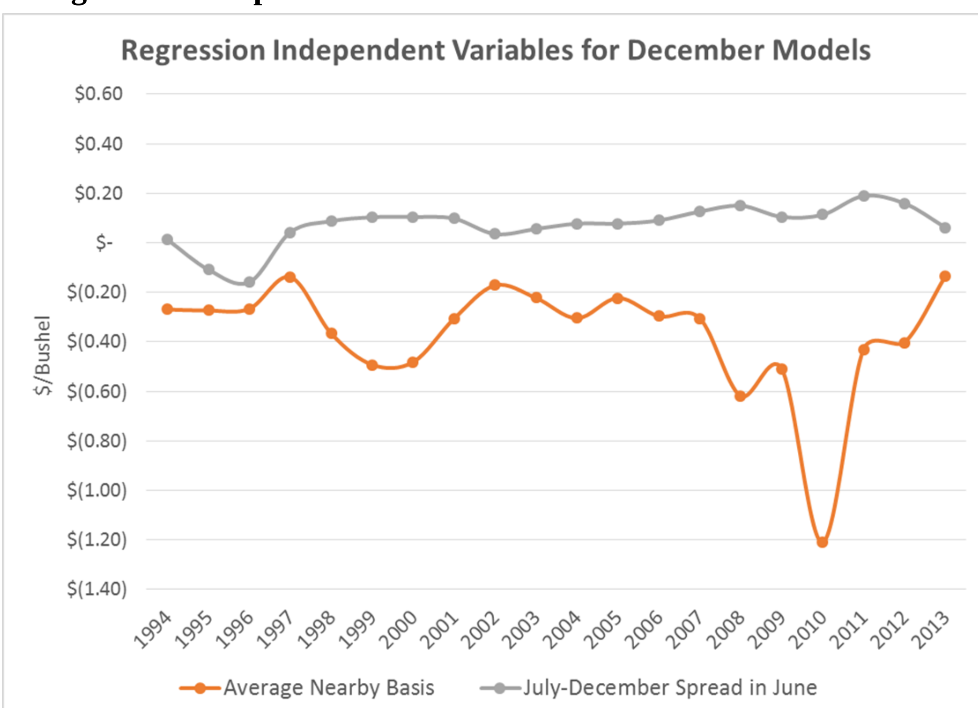


Table 5.7 Data for December Regression Models

Year	December Hedged Return	December Speculative Return	Average Harvest Price	Average Nearby Basis	July-December Spread in June
1994	$ 0.01	$ 0.26	$ 3.13	$ (0.27)	$ 0.01
1995	$ (0.32)	$ 0.66	$ 3.98	$ (0.27)	$ (0.11)
1996	$ (0.51)	$ (1.60)	$ 5.45	$ (0.27)	$ (0.16)
1997	$ (0.33)	$ (0.55)	$ 3.52	$ (0.14)	$ 0.04
1998	$ (0.04)	$ (0.18)	$ 2.70	$ (0.37)	$ 0.09
1999	$ 0.01	$ (0.41)	$ 2.34	$ (0.49)	$ 0.10
2000	$ 0.13	$ (0.04)	$ 2.55	$ (0.48)	$ 0.10
2001	$ 0.09	$ (0.37)	$ 2.78	$ (0.31)	$ 0.10
2002	$ (0.13)	$ 0.88	$ 2.91	$ (0.17)	$ 0.04
2003	$ (0.10)	$ 0.54	$ 2.92	$ (0.22)	$ 0.06
2004	$ (0.00)	$ (0.44)	$ 3.45	$ (0.30)	$ 0.08
2005	$ (0.14)	$ 0.00	$ 3.07	$ (0.22)	$ 0.08
2006	$ (0.21)	$ (0.09)	$ 4.51	$ (0.30)	$ 0.09
2007	$ (0.42)	$ 2.69	$ 5.36	$ (0.30)	$ 0.13
2008	$ (0.15)	$ (4.00)	$ 8.33	$ (0.62)	$ 0.15
2009	$ (0.46)	$ (1.60)	$ 5.84	$ (0.51)	$ 0.11
2010	$ 0.13	$ 2.60	$ 3.60	$ (1.21)	$ 0.11
2011	$ 0.27	$ (1.92)	$ 7.79	$ (0.43)	$ 0.19
2012	$ (0.01)	$ 1.66	$ 6.41	$ (0.40)	$ 0.16
2013	$ (0.26)	$ (0.67)	$ 7.10	$ (0.13)	$ 0.06

Results of these models are included in Table 5.8. The complete summary output from Excel for each model is included in Appendix G. Statistical significance is an issue for many of the coefficients, but the results that are statistically significant are denoted with asterisks in Table 5.8. The equation for the December hedged storage model, as an example, is:

Dec Hedged Returns = -0.109 – 0.042(Avg Harv Price) – 0.184(Nearby Basis) + 1.427(Spread)

In all models, the futures contract spread has the most impact on returns, but only in the hedged models for December, March, and May is the futures spread coefficient statistically significant. This coefficient is 1.460, 1.908, and 3.125 for December, March, and May, respectively. All variables are in units of dollars per bushel. When looking at the hedged model for December, one can say an increase of $1.00 in the July-December futures contract spread will increase the returns of hedged storage by $1.46/bushel. Looking at this result in terms of cents/bushel, if the

July-December futures spread is increased by 1 cent/bushel, the hedged returns will be increased 1.46 cents/bushel.

The signs for both the harvest price and nearby basis coefficients came out as expected, but were usually not statistically significant. It was expected that a higher harvest price would cause a lower return to storage because if the price is already high, it may not increase much more. A higher nearby basis leaves the basis less room to improve, which is instrumental to hedged returns. As a result, both of these coefficient signed were expected to be negative. Both were, but most were not statistically significant. The average harvest price coefficient for the speculative storage until December model was significant. This coefficient at the value of -0.392 means an increase in the harvest price by $1.00/bushel would decrease the speculative storage returns until December by $0.392. Thinking of this in terms of cents an increase in the harvest price by 1 cents/bushel would decrease the returns by 0.392 cents/bushel.

Siaplay, Adam, Brorsen, and Anderson's (2012) results did not show statistical significance in the futures spread coefficients, but did show the largest impact being held by the basis deviation and initial basis variables. Basis deviation in their study is defined as the opening basis in June minus expected closing basis. Comparatively to this study, basis deviation is basis improvement with the opposite sign. Initial basis is the opening basis. The authors analyzed the years from 1975 to 2005 for the state of Oklahoma. The storage periods considered were June to September and June to November.

In the author's November model with basis change as the dependent variable, the coefficient on initial basis was -0.5393. This means increasing the initial basis by 1 cent would decrease the basis change by 0.5393 cents. This study considered the nearby basis in June—not the opening basis, but similar results were found that a higher basis is associated with lower returns (or basis change). In a separate November model with basis change as the dependent variable, the independent variable basis deviation replaced the initial basis variable. The coefficient on basis deviation in this model was -0.4182. This means if basis deviation (opening basis minus closing basis) is increased by 1 cent, the basis change will be decreased by 0.4182.

Table 5.8 Results of the Regression Analysis

Regression Results								
Model:	September		December		March		May	
	Hedged	Speculative	Hedged	Speculative	Hedged	Speculative	Hedged	Speculative
Intercept	-0.106	0.027	-0.109	1.163	-0.278*	0.825	-0.419**	0.655
	(0.080)	(0.654)	(0.114)	(0.967)	(0.141)	(1.339)	(0.186)	(1.024)
Average Harvest Price Coefficient	-0.020	-0.117	-0.042*	-0.392**	-0.043	-0.403	-0.072*	-0.391*
	(0.015)	(0.125)	(0.022)	(0.185)	(0.027)	(0.256)	(0.036)	(0.196)
Average Nearby Basis Coefficient	-0.080	-0.950	-0.184	-0.926	-0.344	-1.847	-0.495	-2.634
	(0.125)	(1.026)	(0.178)	(1.518)	(0.222)	(2.102)	(0.292)	(1.608)
Futures Spread Coefficient	0.582	2.102	1.427**	1.208	1.838**	1.679	3.042***	-3.358
	(0.369)	(3.030)	(0.526)	(4.482)	(0.655)	(6.206)	(0.862)	(4.747)
R Square	0.232	0.136	0.452	0.233	0.496	0.172	0.593	0.308

***Significant at 99% confidence level; **Significant at 95% confidence level; *Significant at 90% confidence level
(Standard error values in parenthesis)

Recall, the time period considered in this regression analysis is 1994 – 2013. The later years included are when extreme events in the market occurred. This is reflected in the results of this analysis. For instance, the returns from 2007 and 2008 are affected by the Great Recession. In mid-2010, basis levels were extremely low, because there was a lack of convergence between the cash and futures markets. Therefore, dummy variables for 2007 and 2008 were added into the speculative and hedged models to account for the abnormal results during the recession. A dummy variable for the year 2009 (which is marketing year 2009/2010) was also included in the hedged models to account for the extremely weak basis levels during mid-2010 due to the lack of convergence. The opening basis levels in June 2009 were normal, but the closing basis toward the end of the marketing year, in May 2010, were weaker than normal.

The results of the regression analysis including the dummy variables is included as Table 5.9. Adding the dummy variables increased the statistical significance on many variables. The intercepts went from only being statistically significant in the hedged models for March and May to being significant in all hedged models. The signs of all average harvest price coefficients remained negative, but the coefficient went from being significant in the December and May models to only being statistically significant in the March speculative model. In the March speculative model, the coefficient on average harvest price is -0.283. This means if the average harvest price increases by 1 cent the return to speculative storage will decrease by 0.283 cents.

The coefficient on average nearby basis is negative for all models, but only significant in the models including dummy variables. For the March hedged model, the coefficient on average nearby basis is -0.365. This means if the average nearby basis in June goes up by 1 cent the returns to speculative storage will go down by 0.365 cents. The futures spread coefficient is statistically significant for the December, March, and May models not including dummy variables, and also for September when dummy variables are included. The coefficients on futures spread become higher when dummy variables are included. For instance, in the December hedged storage model, the coefficient on futures spread goes from 1.427 without dummy variables to 1.672 when dummy variables are included.

The 2007 dummy variables are statistically significant for all models except for September speculative storage returns. The coefficients are negative in the hedged model and positive in the speculative storage models. This was a year of an extreme high price increase after harvest. The 2008 dummy variables are statistically significant for the December, March, and May speculative storage models. Coefficient signs are all negative for this variable. The year 2008 saw a large futures price decrease after harvest. Dummy variables for 2009 were only included in the hedged storage models and were statistically significant for all models. This was a year where the basis became weaker as the marketing year presumed. Therefore, these coefficients are negative because a weakening basis translates into hedged storage losses. The R-square values improved to a high of 0.874 from 0.593 for the May hedged storage model when the dummy variables were added. The summary output of these regression results is included in Appendix H.

Table 5.9 Results of Regression Analysis Including Dummy Variables

Regression Results								
Model:	September		December		March		May	
	Hedged	Speculative	Hedged	Speculative	Hedged	Speculative	Hedged	Speculative
Intercept	-0.167**	-0.335	-0.196**	0.163	-0.376***	-0.200	-0.484***	-0.202
	(0.074)	(0.696)	(0.087)	(0.758)	(0.108)	(0.764)	(0.131)	(0.958)
Average Harvest Price	-0.003	-0.061	-0.016	-0.230	-0.012	-0.283*	-0.044492	-0.253
	(0.015)	(0.137)	(0.017)	(0.149)	(0.021)	(0.150)	(0.026)	(0.188)
Average Nearby Basis	-0.106	-1.367	-0.216	-1.981*	-0.365**	-3.331***	-0.452**	-3.551**
	(0.105)	(1.004)	(0.124)	(1.094)	(0.154)	(1.102)	(0.187)	(1.382)
Futures Spread Coefficient	0.727**	1.509	1.672***	-0.042	2.174***	-1.282	3.533***	-4.482
	(0.303)	(2.932)	(0.359)	(3.194)	(0.445)	(3.219)	(0.541)	(4.036)
2007 Dummy Coefficient	-0.240**	1.419	-0.415***	3.159**	-0.583***	6.500***	-0.909***	2.812*
	(0.103)	(0.992)	(0.122)	(1.081)	(0.151)	(1.089)	(0.184)	(1.366)
2008 Dummy Coefficient	-0.152	-1.243	-0.206	-3.470**	-0.247	-3.358**	-0.144	-2.969*
	(0.122)	(1.148)	(0.144)	(1.251)	(0.179)	(1.261)	(0.217)	(1.581)
2009 Dummy Coefficient	-0.277**		-0.450***		-0.491***		-0.478**	
	(0.104)		(0.124)		(0.153)		(0.186)	
R Square	0.592	0.315	0.800	0.671	0.817	0.811	0.874	0.577

***Significant at 99% confidence level; **Significant at 95% confidence level; *Significant at 90% confidence level
(Standard error values in parenthesis)

Chapter 6 - Conclusions

The results of this study do not typically show positive returns for hedged storage or speculative storage. Returns on average (compared to simply selling wheat at harvest) were slightly negative across most months, but producers can store for other reasons as well. One of these could be to defer income into the next year. This study did show how hedging immensely lowers your price risk compared to that of speculative storage. The variability in the speculative storage returns will be much higher than that of hedged returns. These price swings can be very good or very bad for a producer. As a result, a producer’s choice will be affected by his or her risk preference and ability to bear risk.

One possible reason for the negative returns on average for hedged storage is this study does not consider the possibility of having the opportunity to roll a hedge. Rolling a hedge allows one to liquidate a current futures position and replace it with a futures position in a later contract month. This can allow a producer to take advantage of circumstances where rolling a hedge will improve the return.

Another point to discuss is the comparison between commercial and on-farm storage. Commercial storage is at a constant rate per month throughout the storage period, but on-farm storage results in high initial costs and lower costs towards the end of the storage period. This makes commercial storage more profitable if storing for short period and on-farm more profitable for storing for longer periods of time.

When looking at regional differences in hedged storage, North Central Kansas shows the highest level of basis improvement followed by South Central Kansas. Reasoning for this maybe that there are major terminal facilities in these regions of Kansas. Salina, Hutchinson, and

Wichita, Kansas all have rail facilities where grain can be sent to the Gulf of Mexico. There was not a clear regional pattern seen in the speculative storage price improvement analysis.

Looking at these results, one may ask why a farmer continues to store wheat if on average they are receiving negative returns compared to selling at harvest. One explanation for this was mentioned above, which is to defer income into the next year. If a farmer has a really good year, he or she may want to wait and realize that income after the first of the year. Lowering his or her taxable income can move the producer down to a lower tax bracket. It should be analyzed to determine if the tax savings will be more than the opportunity and storage costs. Also, if farmers have on-farm storage available, they are not at the mercy of the elevator for what time they can unload their grain after it has been harvested. Truck lines at elevators can be extremely long during harvest, so having on-farm storage capacity can allow more efficiency for the farmer during harvest. Having on-farm storage allows the possibility to negotiate better prices later on because farmers can be more flexible with the delivery time and may have a larger quantity to sell.

Joseph, Irwin, and Garcia (2015) showed that convenience yield does still exist in the market today—especially in the Kansas City area wheat market. Convenience yield is the theory that market participants who use the grain will continue to store even though the market is not giving an incentive to store. This could be another reason why we still see storage even though on average positive returns have not been shown.

Another reason for continuing to store is farmers are known to be very optimistic people. They always think the price will get better. Another issue in agriculture that comes up in many aspects is some producers just do what they have always done and never question if there is a better way. The comment "Well that is what my dad did. It worked for him, so why should I change it?" is heard many times. This research will hopefully make producers challenge what they have always done and not store just because. There are times when storing pays off, but there are other times when it does not.

Other marketing strategies worthy of consideration are summarized by Bau and Weness (2006). The authors emphasize sticking to a written marketing plan and not letting emotions take control. One interesting strategy discussed is selling 12 equal amounts of grain following harvest. In other words, sell 1/12 of the crop each month.

This research aims to provide a framework for storage decisions. The first recommendation for farmers would be know what your basis levels and futures prices have been in the past. Knowing the typical basis level for your area can help you determine whether the basis is stronger or weaker than usual. Table 6.1 is a well-known diagram that provides a framework for the storage decision process. If both your futures price and basis are stronger than usual, it is suggested that you sell in the cash market. When the basis is strong and the futures is weak, you can sell in the cash market to lock in the basis part of your price and re-own your wheat in the futures market to give the futures part of the price time to possibly improve. If the basis is weak and the futures price is strong, you can enter into a storage hedge. When both the futures price and the basis are weaker than usual, it is recommended that you participate in speculative storage.

Table 6.1 Summarization of Marketing Decisions

		Basis	
		Strong	***Weak***
Futures	***Strong***	Sell in Cash Market	Storage Hedge
	Weak	Sell in Cash Market Re-Own Futures	Speculative Storage

This analysis contains 10-year average basis levels (Appendix B) for 108 locations geographically dispersed across Kansas. These average basis levels can be compared to current basis levels to conclude if the basis is stronger or weaker than usual. This can be used to determine an expected closing basis as well as see where the current basis is compared to where it is typically. The regression portion of this study emphasized the importance of the impact of the harvest nearby basis and the futures spread. A farmer could look at the typical harvest basis levels and compare it to the current harvest basis level to see if it is higher or lower than normal. The regression results shows that a higher harvest nearby basis is associated with lower storage returns. Also, and most importantly, a larger spread is associated with a larger amount of hedged storage returns. When there is a large spread, selling the deferred contract allows a producer to capture that spread.

When this analysis is compared to the results found by Siaplay, Adam, Brorsen, and Anderson (2012), the findings are quite different. The futures spread coefficient in each of their storage models was deemed insignificant whereas in this analysis the coefficient was significant for the December, March, and May hedged storage models (without dummy variables). Granted the time periods considered in each analysis were different—with this analysis studying from 1994 to 2013 and Siaplay, Adam, Brorsen, and Anderson completing an analysis on 1975 – 2005. These authors found basis deviation to be the highest determinant of storage returns. Basis deviation related to this study is the opening basis minus the expected closing basis. This simply opposite in sign compared to this analysis's expected basis improvement calculations.

In conclusion, a producer should gain past and current information about basis levels, futures prices, and futures spreads to analyze the profitability of participating in grain storage.

Hopefully by looking at this research and the typical basis levels associated with each location, a producer can make more profitable storage decisions.

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Appendix A - Listing of All Locations

Table A.1 Listing of Locations Used From Northern Kansas

North Central		North East		North West	
Location	Source	Location	Source	Location	Source
Abilene	ProphetX	Beattie	ProphetX	Colby	Wichita Eagle
Athol	ProphetX	Belvue	ProphetX	Hill City	ProphetX
Bavaria	ProphetX	Edgerton	ProphetX	Hoxie	Carla
Beloit	ProphetX	Herkimer	Carla	Menlo	ProphetX
Cawker City	ProphetX	Holton	ProphetX	Oakley	ProphetX
Clay Center	ProphetX	Junction City	ProphetX	Rexford	ProphetX
Concordia	ProphetX	Lancaster	ProphetX	Sharon Springs	ProphetX
Denmark	ProphetX	Manhattan	ProphetX	St. Francis	Carla
Ellsworth	ProphetX	Melvern	ProphetX		
Falun	ProphetX	Meriden	ProphetX		
Glen Elder	ProphetX	Ottawa	Carla		
Hays	ProphetX	Overbrook	ProphetX		
Hunter	ProphetX	Sabetha	ProphetX		
Lincoln	ProphetX	Saint Marys	ProphetX		
Lindsborg	ProphetX	Seneca	ProphetX		
New Cambria	ProphetX	Wamego	ProphetX		
Randall	ProphetX	Waterville	ProphetX		
Roxbury	ProphetX				
Russell	Carla				
Salina	Wichita Eagle				
Scottsville	ProphetX				
Smith Center	ProphetX				
Stockton	ProphetX				
Tipton	ProphetX				
Westfall	ProphetX				

Table A.2 Listing of Locations Used From Southern Kansas

South Central		South East		South West	
Location	Source	Location	Source	Location	Source
Abbyville	ProphetX	Arkansas City	ProphetX	Big Bow	ProphetX
Andale	Wichita Eagle	Bartlett	ProphetX	Cimarron	ProphetX
Anthony	ProphetX	Burns	ProphetX	Dodge City	Wichita Eagle
Benton	ProphetX	Coffeyville	Wichita Eagle	Elkhart	ProphetX
Buhler	ProphetX	Columbus	ProphetX	Garden City	ProphetX
Caldwell	ProphetX	Emporia	Wichita Eagle	Liberal	Carla
Conway	ProphetX	Florence	ProphetX	Minneola	ProphetX
Galva	ProphetX	Fredonia	ProphetX	Ness City	ProphetX
Garden Plain	Wichita Eagle	Girard	ProphetX	Pierceville	ProphetX
Goessel	ProphetX	Marion	ProphetX	Plains	ProphetX
Great Bend	Wichita Eagle	Winfield	ProphetX	Scott City	Wichita Eagle
Greensburg	ProphetX	Yates Center	ProphetX	Sublette	ProphetX
Groveland	ProphetX				
Halstead	ProphetX				
Haven	ProphetX				
Hillsboro	ProphetX				
Hilton	ProphetX				
Hutchinson	ProphetX				
Isabel	ProphetX				
Kiowa	ProphetX				
Lehigh	ProphetX				
Moundridge	ProphetX				
Mount Hope	ProphetX				
Newton	ProphetX				
Nickerson	ProphetX				
Partridge	ProphetX				
Peabody	ProphetX				
Pratt	Wichita Eagle				
Sterling	ProphetX				
Walton	ProphetX				
Wellington	ProphetX				
Whitewater	ProphetX				
Wichita	ProphetX				
Windom	ProphetX				

Appendix B - 10-Year Basis Averages

Table B.1 Nearby Basis Averages for Each Location (1 of 3)

10-Year Nearby Basis Averages for Each Location												
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Abilene	-0.26	-0.24	-0.27	-0.24	-0.34	-0.25	-0.23	-0.27	-0.23	-0.22	-0.22	-0.25
Abbyville	-0.38	-0.38	-0.45	-0.42	-0.48	-0.42	-0.39	-0.39	-0.37	-0.38	-0.37	-0.38
Andale	-0.41	-0.40	-0.48	-0.46	-0.49	-0.46	-0.42	-0.43	-0.42	-0.44	-0.40	-0.41
Anthony	-0.46	-0.45	-0.50	-0.47	-0.52	-0.47	-0.45	-0.45	-0.42	-0.40	-0.40	-0.42
Arkansas City	-0.46	-0.42	-0.48	-0.45	-0.51	-0.44	-0.43	-0.44	-0.41	-0.41	-0.42	-0.43
Athol	-0.59	-0.58	-0.67	-0.64	-0.67	-0.61	-0.60	-0.61	-0.57	-0.56	-0.57	-0.60
Bartlett	-0.44	-0.44	-0.56	-0.55	-0.65	-0.54	-0.53	-0.54	-0.49	-0.50	-0.46	-0.47
Bavaria	-0.44	-0.44	-0.50	-0.47	-0.55	-0.47	-0.45	-0.47	-0.45	-0.45	-0.44	-0.45
Beattie	-0.52	-0.52	-0.59	-0.56	-0.63	-0.58	-0.59	-0.57	-0.54	-0.55	-0.58	-0.56
Beloit	-0.46	-0.45	-0.49	-0.46	-0.54	-0.44	-0.42	-0.44	-0.40	-0.40	-0.39	-0.42
Belvue	-0.53	-0.49	-0.60	-0.58	-0.64	-0.58	-0.56	-0.57	-0.56	-0.57	-0.61	-0.61
Benton	-0.42	-0.40	-0.49	-0.45	-0.51	-0.46	-0.44	-0.45	-0.44	-0.43	-0.43	-0.43
Big Bow	-0.55	-0.56	-0.62	-0.61	-0.68	-0.64	-0.64	-0.62	-0.61	-0.63	-0.57	-0.58
Buhler	-0.41	-0.40	-0.48	-0.45	-0.51	-0.45	-0.42	-0.43	-0.42	-0.41	-0.40	-0.42
Burns	-0.49	-0.48	-0.55	-0.52	-0.57	-0.53	-0.49	-0.51	-0.49	-0.48	-0.46	-0.48
Caldwell	-0.42	-0.40	-0.48	-0.45	-0.50	-0.44	-0.42	-0.44	-0.42	-0.41	-0.40	-0.41
Cawker City	-0.46	-0.45	-0.49	-0.46	-0.53	-0.44	-0.42	-0.46	-0.40	-0.40	-0.39	-0.41
Cimarron	-0.53	-0.53	-0.61	-0.58	-0.67	-0.62	-0.59	-0.60	-0.60	-0.58	-0.55	-0.54
Clay Center	-0.46	-0.47	-0.51	-0.48	-0.54	-0.46	-0.43	-0.47	-0.41	-0.40	-0.41	-0.44
Coffeyville	-0.47	-0.43	-0.52	-0.55	-0.69	-0.59	-0.54	-0.52	-0.49	-0.48	-0.43	-0.46
Colby	-0.54	-0.57	-0.66	-0.63	-0.67	-0.64	-0.59	-0.60	-0.58	-0.57	-0.57	-0.56
Columbus	-0.49	-0.47	-0.56	-0.57	-0.65	-0.57	-0.50	-0.48	-0.50	-0.50	-0.49	-0.49
Concordia	-0.32	-0.32	-0.35	-0.32	-0.39	-0.30	-0.27	-0.30	-0.26	-0.26	-0.26	-0.28
Conway	-0.44	-0.44	-0.51	-0.49	-0.55	-0.48	-0.46	-0.46	-0.45	-0.44	-0.43	-0.45
Denmark	-0.48	-0.47	-0.52	-0.49	-0.57	-0.47	-0.45	-0.47	-0.43	-0.43	-0.42	-0.44
Dodge City	-0.50	-0.49	-0.57	-0.55	-0.62	-0.58	-0.55	-0.56	-0.56	-0.54	-0.52	-0.51
Edgerton	-0.40	-0.37	-0.46	-0.43	-0.53	-0.49	-0.47	-0.47	-0.46	-0.45	-0.45	-0.46
Elkhart	-0.59	-0.57	-0.63	-0.64	-0.67	-0.53	-0.64	-0.49	-0.59	-0.58	-0.59	-0.56
Ellsworth	-0.49	-0.49	-0.56	-0.54	-0.58	-0.51	-0.50	-0.50	-0.49	-0.48	-0.47	-0.48
Emporia	-0.50	-0.48	-0.57	-0.57	-0.65	-0.62	-0.61	-0.58	-0.56	-0.56	-0.52	-0.52
Falun	-0.44	-0.45	-0.51	-0.48	-0.56	-0.48	-0.46	-0.47	-0.46	-0.46	-0.44	-0.46
Florence	-0.45	-0.45	-0.53	-0.51	-0.56	-0.50	-0.47	-0.48	-0.47	-0.46	-0.45	-0.47
Fredonia	-0.46	-0.45	-0.57	-0.58	-0.67	-0.58	-0.56	-0.57	-0.51	-0.50	-0.44	-0.46
Galva	-0.43	-0.43	-0.51	-0.48	-0.55	-0.48	-0.45	-0.46	-0.45	-0.44	-0.42	-0.44
Garden City	-0.52	-0.52	-0.57	-0.56	-0.62	-0.57	-0.55	-0.56	-0.55	-0.54	-0.52	-0.51
Garden Plain	-0.41	-0.38	-0.47	-0.44	-0.49	-0.45	-0.44	-0.43	-0.41	-0.40	-0.39	-0.39

Table B.2 Nearby Basis Averages for Each Location (2 of 3)

10-Year Nearby Basis Averages for Each Location												
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Girard	-0.55	-0.54	-0.59	-0.56	-0.70	-0.61	-0.58	-0.56	-0.52	-0.53	-0.54	-0.56
Glen Elder	-0.43	-0.41	-0.46	-0.44	-0.51	-0.41	-0.39	-0.41	-0.37	-0.36	-0.35	-0.38
Goessel	-0.45	-0.44	-0.52	-0.50	-0.54	-0.48	-0.46	-0.47	-0.45	-0.45	-0.43	-0.46
Great Bend	-0.44	-0.44	-0.51	-0.48	-0.56	-0.51	-0.48	-0.47	-0.45	-0.45	-0.44	-0.44
Greensburg	-0.47	-0.45	-0.52	-0.51	-0.55	-0.51	-0.49	-0.49	-0.46	-0.46	-0.44	-0.44
Groveland	-0.41	-0.41	-0.49	-0.46	-0.52	-0.46	-0.43	-0.44	-0.43	-0.42	-0.41	-0.42
Halstead	-0.42	-0.41	-0.49	-0.47	-0.52	-0.47	-0.44	-0.44	-0.43	-0.42	-0.41	-0.43
Haven	-0.39	-0.39	-0.47	-0.44	-0.50	-0.44	-0.41	-0.42	-0.40	-0.39	-0.39	-0.40
Hays	-0.51	-0.50	-0.56	-0.53	-0.57	-0.51	-0.51	-0.51	-0.48	-0.48	-0.49	-0.48
Herkimer	-0.50	-0.50	-0.54	-0.52	-0.57	-0.51	-0.49	-0.49	-0.48	-0.51	-0.48	-0.46
Hill City	-0.53	-0.57	-0.71	-0.67	-0.76	-0.70	-0.69	-0.68	-0.65	-0.65	-0.65	-0.63
Hillsboro	-0.42	-0.42	-0.50	-0.48	-0.54	-0.48	-0.44	-0.45	-0.44	-0.43	-0.41	-0.43
Hilton	-0.43	-0.43	-0.51	-0.49	-0.55	-0.48	-0.45	-0.46	-0.45	-0.44	-0.42	-0.44
Holton	-0.45	-0.41	-0.52	-0.52	-0.64	-0.60	-0.59	-0.57	-0.59	-0.62	-0.63	-0.62
Hoxie	-0.58	-0.60	-0.69	-0.66	-0.70	-0.68	-0.63	-0.63	-0.61	-0.61	-0.59	-0.59
Hunter	-0.50	-0.49	-0.55	-0.51	-0.58	-0.48	-0.44	-0.48	-0.44	-0.43	-0.41	-0.44
Hutchinson	-0.22	-0.21	-0.26	-0.24	-0.30	-0.24	-0.23	-0.28	-0.19	-0.19	-0.18	-0.20
Isabel	-0.41	-0.41	-0.47	-0.45	-0.49	-0.42	-0.42	-0.42	-0.40	-0.39	-0.39	-0.40
Junction City	-0.47	-0.44	-0.54	-0.50	-0.60	-0.53	-0.50	-0.50	-0.47	-0.48	-0.50	-0.52
Kiowa	-0.50	-0.48	-0.53	-0.49	-0.56	-0.49	-0.46	-0.48	-0.45	-0.44	-0.42	-0.44
Lancaster	-0.46	-0.39	-0.53	-0.53	-0.63	-0.60	-0.59	-0.57	-0.59	-0.62	-0.63	-0.62
Lehigh	-0.44	-0.43	-0.51	-0.49	-0.55	-0.48	-0.45	-0.46	-0.44	-0.44	-0.42	-0.44
Liberal	-0.49	-0.48	-0.59	-0.57	-0.62	-0.56	-0.55	-0.55	-0.51	-0.49	-0.48	-0.48
Lincoln	-0.43	-0.43	-0.46	-0.44	-0.51	-0.42	-0.40	-0.41	-0.37	-0.37	-0.36	-0.39
Lindsborg	-0.44	-0.44	-0.51	-0.49	-0.55	-0.48	-0.46	-0.47	-0.46	-0.45	-0.43	-0.45
Manhattan	-0.60	-0.56	-0.64	-0.61	-0.72	-0.61	-0.57	-0.60	-0.57	-0.59	-0.63	-0.66
Marion	-0.43	-0.43	-0.51	-0.49	-0.55	-0.49	-0.45	-0.46	-0.44	-0.44	-0.42	-0.44
Melvern	-0.44	-0.41	-0.51	-0.48	-0.58	-0.52	-0.50	-0.51	-0.51	-0.50	-0.50	-0.51
Menlo	-0.55	-0.58	-0.73	-0.69	-0.77	-0.72	-0.67	-0.69	-0.70	-0.73	-0.66	-0.65
Meriden	-0.45	-0.39	-0.52	-0.53	-0.64	-0.60	-0.60	-0.58	-0.59	-0.62	-0.63	-0.62
Minneola	-0.56	-0.56	-0.64	-0.65	-0.64	-0.68	-0.67	-0.66	-0.64	-0.64	-0.59	-0.62
Moundridge	-0.43	-0.43	-0.51	-0.49	-0.54	-0.48	-0.45	-0.46	-0.44	-0.44	-0.42	-0.44
Mount Hope	-0.41	-0.41	-0.49	-0.47	-0.51	-0.46	-0.43	-0.43	-0.42	-0.41	-0.40	-0.42
Ness City	-0.54	-0.54	-0.61	-0.58	-0.65	-0.61	-0.59	-0.58	-0.59	-0.56	-0.52	-0.52
New Cambria	-0.29	-0.28	-0.34	-0.31	-0.35	-0.26	-0.24	-0.27	-0.24	-0.24	-0.24	-0.27

Table B.3 Nearby Basis Averages for Each Location (3 of 3)

10-Year Nearby Basis Averages for Each Location												
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Newton	-0.44	-0.43	-0.51	-0.49	-0.54	-0.49	-0.46	-0.47	-0.45	-0.44	-0.44	-0.45
Nickerson	-0.37	-0.37	-0.44	-0.42	-0.47	-0.41	-0.39	-0.40	-0.38	-0.38	-0.37	-0.38
Oakley	-0.54	-0.58	-0.73	-0.70	-0.75	-0.71	-0.68	-0.68	-0.65	-0.63	-0.66	-0.63
Ottawa	-0.38	-0.36	-0.46	-0.46	-0.53	-0.41	-0.47	-0.47	-0.46	-0.45	-0.47	-0.46
Overbrook	-0.39	-0.36	-0.46	-0.43	-0.53	-0.47	-0.45	-0.47	-0.46	-0.46	-0.48	-0.46
Partridge	-0.36	-0.36	-0.43	-0.41	-0.46	-0.40	-0.37	-0.39	-0.37	-0.37	-0.36	-0.37
Peabody	-0.43	-0.43	-0.51	-0.49	-0.54	-0.48	-0.45	-0.46	-0.45	-0.45	-0.43	-0.45
Pierceville	-0.53	-0.53	-0.62	-0.59	-0.67	-0.62	-0.59	-0.60	-0.61	-0.59	-0.55	-0.54
Plains	-0.48	-0.48	-0.53	-0.52	-0.59	-0.54	-0.53	-0.54	-0.54	-0.53	-0.48	-0.48
Pratt	-0.38	-0.38	-0.48	-0.45	-0.50	-0.43	-0.41	-0.41	-0.40	-0.40	-0.38	-0.40
Randall	-0.47	-0.48	-0.51	-0.49	-0.56	-0.46	-0.44	-0.46	-0.42	-0.42	-0.41	-0.43
Rexford	-0.56	-0.58	-0.72	-0.69	-0.76	-0.72	-0.68	-0.69	-0.69	-0.72	-0.66	-0.64
Roxbury	-0.44	-0.44	-0.51	-0.48	-0.55	-0.49	-0.45	-0.46	-0.45	-0.45	-0.43	-0.45
Russell	-0.51	-0.51	-0.59	-0.57	-0.60	-0.56	-0.55	-0.53	-0.52	-0.51	-0.52	-0.52
Sabetha	-0.52	-0.49	-0.57	-0.56	-0.68	-0.59	-0.59	-0.60	-0.58	-0.59	-0.59	-0.59
Saint Marys	-0.53	-0.49	-0.60	-0.58	-0.65	-0.58	-0.56	-0.57	-0.56	-0.57	-0.61	-0.61
Salina	-0.21	-0.22	-0.28	-0.24	-0.31	-0.22	-0.21	-0.27	-0.22	-0.21	-0.21	-0.22
Scott City	-0.53	-0.51	-0.62	-0.60	-0.66	-0.61	-0.60	-0.59	-0.58	-0.57	-0.56	-0.55
Scottsville	-0.46	-0.45	-0.50	-0.47	-0.55	-0.45	-0.42	-0.45	-0.41	-0.40	-0.40	-0.42
Seneca	-0.53	-0.53	-0.61	-0.60	-0.67	-0.60	-0.58	-0.58	-0.57	-0.56	-0.59	-0.60
Sharon Springs	-0.56	-0.54	-0.60	-0.57	-0.64	-0.58	-0.55	-0.57	-0.51	-0.52	-0.56	-0.58
Smith Center	-0.62	-0.60	-0.68	-0.64	-0.69	-0.61	-0.60	-0.62	-0.60	-0.58	-0.58	-0.59
St. Francis	-0.63	-0.62	-0.73	-0.72	-0.77	-0.71	-0.68	-0.67	-0.66	-0.64	-0.65	-0.65
Sterling	-0.47	-0.47	-0.53	-0.50	-0.58	-0.49	-0.48	-0.48	-0.47	-0.48	-0.44	-0.44
Stockton	-0.65	-0.64	-0.71	-0.68	-0.73	-0.67	-0.63	-0.63	-0.62	-0.64	-0.60	-0.57
Sublette	-0.52	-0.50	-0.57	-0.57	-0.62	-0.61	-0.61	-0.59	-0.56	-0.54	-0.52	-0.51
Tipton	-0.46	-0.45	-0.50	-0.47	-0.55	-0.45	-0.42	-0.45	-0.41	-0.40	-0.40	-0.42
Walton	-0.42	-0.41	-0.49	-0.47	-0.52	-0.47	-0.44	-0.45	-0.44	-0.43	-0.42	-0.43
Wamego	-0.53	-0.49	-0.60	-0.58	-0.65	-0.58	-0.56	-0.57	-0.56	-0.57	-0.61	-0.62
Waterville	-0.52	-0.51	-0.58	-0.56	-0.63	-0.58	-0.58	-0.57	-0.54	-0.55	-0.58	-0.56
Wellington	-0.41	-0.38	-0.47	-0.45	-0.48	-0.41	-0.39	-0.42	-0.41	-0.40	-0.40	-0.40
Westfall	-0.45	-0.45	-0.49	-0.46	-0.54	-0.44	-0.42	-0.44	-0.40	-0.40	-0.39	-0.42
Whitewater	-0.43	-0.42	-0.50	-0.48	-0.52	-0.48	-0.45	-0.46	-0.45	-0.44	-0.43	-0.44
Wichita	-0.29	-0.28	-0.36	-0.35	-0.39	-0.35	-0.32	-0.34	-0.32	-0.31	-0.31	-0.31
Windom	-0.46	-0.45	-0.52	-0.49	-0.55	-0.48	-0.45	-0.47	-0.45	-0.44	-0.42	-0.44
Winfield	-0.42	-0.38	-0.46	-0.44	-0.48	-0.42	-0.41	-0.42	-0.36	-0.35	-0.36	-0.37
Yates Center	-0.54	-0.52	-0.65	-0.67	-0.81	-0.78	-0.74	-0.72	-0.65	-0.60	-0.64	-0.62

Appendix C - 10-Year Basis Improvement Averages

Table C.1 Basis Improvement Averages for Each Location (1 of 3)

10-Year Basis Improvement from June Basis (Averages for Each Location)											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Abilene	0.02	0.10	0.13	0.19	0.28	0.30	0.38	0.42	0.43	0.47	0.43
Abbyville	0.01	0.03	0.06	0.19	0.26	0.27	0.37	0.41	0.42	0.44	0.42
Andale	0.00	0.05	0.08	0.16	0.24	0.27	0.36	0.38	0.38	0.43	0.41
Anthony	0.01	0.09	0.11	0.20	0.30	0.32	0.41	0.45	0.46	0.50	0.47
Arkansas City	0.01	0.09	0.11	0.20	0.29	0.32	0.39	0.45	0.45	0.50	0.47
Athol	-0.01	0.07	0.09	0.19	0.27	0.30	0.38	0.45	0.45	0.48	0.45
Bartlett	0.00	0.09	0.12	0.21	0.30	0.33	0.41	0.45	0.45	0.49	0.47
Bavaria	0.00	0.07	0.10	0.18	0.28	0.31	0.40	0.44	0.44	0.47	0.46
Beattie	0.01	0.04	0.07	0.19	0.26	0.27	0.39	0.40	0.40	0.46	0.44
Beloit	0.00	0.05	0.08	0.16	0.24	0.26	0.36	0.38	0.38	0.44	0.41
Belvue	0.01	0.08	0.10	0.19	0.29	0.32	0.41	0.45	0.46	0.51	0.48
Benton	0.00	0.06	0.09	0.21	0.27	0.28	0.39	0.42	0.42	0.44	0.45
Big Bow	0.02	0.08	0.11	0.20	0.30	0.34	0.41	0.46	0.46	0.51	0.48
Buhler	-0.01	0.08	0.11	0.19	0.29	0.31	0.41	0.45	0.45	0.49	0.47
Burns	0.00	0.04	0.07	0.16	0.23	0.26	0.37	0.38	0.38	0.44	0.42
Caldwell	0.01	0.08	0.11	0.23	0.32	0.34	0.44	0.47	0.47	0.52	0.48
Cawker City	0.00	0.07	0.10	0.18	0.29	0.31	0.40	0.44	0.44	0.48	0.46
Cimarron	0.00	0.05	0.07	0.16	0.22	0.26	0.37	0.38	0.38	0.45	0.42
Clay Center	0.00	0.03	0.05	0.18	0.22	0.24	0.37	0.38	0.39	0.37	0.41
Coffeyville	0.00	0.05	0.08	0.18	0.27	0.28	0.34	0.38	0.39	0.45	0.42
Colby	0.00	0.08	0.10	0.18	0.28	0.31	0.40	0.44	0.44	0.49	0.46
Columbus	0.02	0.06	0.10	0.20	0.28	0.30	0.40	0.42	0.43	0.48	0.46
Concordia	0.01	0.06	0.09	0.19	0.26	0.30	0.41	0.42	0.40	0.45	0.50
Conway	0.01	0.08	0.10	0.19	0.29	0.31	0.40	0.44	0.45	0.49	0.46
Denmark	0.01	0.08	0.11	0.19	0.29	0.31	0.40	0.44	0.45	0.48	0.46
Dodge City	0.01	0.05	0.07	0.17	0.21	0.21	0.34	0.38	0.36	0.36	0.38
Edgerton	0.04	0.05	0.06	0.17	0.23	0.25	0.35	0.36	0.35	0.36	0.35
Elkhart	0.02	0.05	0.08	0.14	0.18	0.20	0.32	0.33	0.34	0.35	0.36
Ellsworth	0.04	0.05	0.05	0.09	0.13	0.14	0.28	0.26	0.23	0.28	0.26
Emporia	0.00	0.07	0.10	0.21	0.27	0.29	0.40	0.41	0.39	0.44	0.46
Falun	0.03	0.05	0.08	0.14	0.22	0.24	0.36	0.39	0.38	0.38	0.38
Florence	0.07	0.04	0.04	0.10	0.13	0.14	0.28	0.26	0.23	0.28	0.26
Fredonia	0.04	0.08	0.11	0.16	0.27	0.31	0.40	0.42	0.41	0.39	0.36
Galva	0.02	0.04	0.07	0.13	0.19	0.21	0.31	0.32	0.33	0.34	0.35
Garden City	0.07	0.05	0.04	0.09	0.13	0.13	0.26	0.26	0.23	0.27	0.26
Garden Plain	0.02	0.03	0.03	0.12	0.24	0.19	0.30	0.31	0.32	0.33	0.34

Table C.2 Basis Improvement Averages for Each Location (2 of 3)

10-Year Basis Improvement from June Basis (Averages for Each Location)											
	Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**
Girard	0.02	0.04	0.07	0.13	0.19	0.21	0.31	0.32	0.32	0.33	0.35
Glen Elder	0.03	0.06	0.07	0.14	0.16	0.16	0.27	0.33	0.32	0.34	0.35
Goessel	0.04	0.05	0.06	0.15	0.23	0.25	0.35	0.36	0.35	0.31	0.35
Great Bend	0.00	0.03	0.04	0.12	0.18	0.21	0.32	0.34	0.34	0.39	0.34
Greensburg	0.04	0.05	0.06	0.15	0.23	0.25	0.35	0.36	0.36	0.36	0.34
Groveland	0.01	0.05	0.07	0.16	0.22	0.22	0.34	0.37	0.36	0.37	0.38
Halstead	-0.03	0.00	0.03	0.14	0.18	0.23	0.33	0.36	0.37	0.34	0.41
Haven	-0.05	-0.08	-0.04	0.01	0.07	0.08	0.20	0.23	0.23	0.33	0.26
Hays	-0.02	0.00	0.04	0.15	0.17	0.22	0.34	0.36	0.36	0.35	0.42
Herkimer	-0.03	-0.07	-0.04	0.03	0.07	0.12	0.21	0.20	0.17	0.26	0.28
Hill City	-0.04	-0.09	-0.05	0.03	0.07	0.10	0.21	0.23	0.25	0.25	0.28
Hillsboro	-0.02	-0.06	-0.03	0.04	0.08	0.12	0.22	0.22	0.18	0.35	0.28
Hilton	0.03	0.05	0.08	0.16	0.25	0.29	0.38	0.45	0.44	0.45	0.41
Holton	0.01	0.01	0.03	0.13	0.19	0.22	0.35	0.36	0.38	0.37	0.41
Hoxie	0.00	0.05	0.07	0.18	0.24	0.26	0.38	0.40	0.40	0.45	0.43
Hunter	0.01	0.04	0.07	0.20	0.23	0.26	0.38	0.38	0.37	0.44	0.43
Hutchinson	0.02	0.08	0.11	0.22	0.27	0.29	0.41	0.43	0.45	0.49	0.47
Isabel	0.02	0.05	0.08	0.19	0.23	0.26	0.37	0.37	0.38	0.42	0.41
Junction City	0.00	0.04	0.07	0.17	0.23	0.26	0.37	0.38	0.39	0.43	0.41
Kiowa	0.01	0.06	0.09	0.19	0.25	0.28	0.37	0.39	0.40	0.45	0.44
Lancaster	0.00	0.04	0.06	0.16	0.23	0.26	0.36	0.38	0.38	0.44	0.42
Lehigh	0.00	0.04	0.06	0.16	0.22	0.25	0.36	0.38	0.38	0.43	0.41
Liberal	0.00	0.04	0.06	0.18	0.24	0.26	0.37	0.39	0.39	0.43	0.41
Lincoln	0.03	0.05	0.08	0.20	0.23	0.24	0.37	0.39	0.40	0.46	0.44
Lindsborg	0.00	0.04	0.07	0.16	0.20	0.23	0.36	0.38	0.38	0.44	0.43
Manhattan	0.02	0.06	0.07	0.19	0.23	0.25	0.37	0.40	0.40	0.44	0.45
Marion	0.00	0.04	0.06	0.16	0.23	0.25	0.36	0.38	0.38	0.43	0.41
Melvern	0.00	0.04	0.06	0.17	0.23	0.26	0.37	0.38	0.39	0.43	0.41
Menlo	0.00	0.03	0.06	0.16	0.22	0.25	0.36	0.38	0.38	0.43	0.41
Meriden	0.00	0.04	0.06	0.16	0.22	0.26	0.37	0.38	0.38	0.44	0.42
Minneola	0.00	0.04	0.06	0.16	0.23	0.26	0.37	0.38	0.38	0.44	0.42
Moundridge	0.01	0.07	0.10	0.20	0.26	0.27	0.34	0.43	0.43	0.46	0.45
Mount Hope	0.00	0.05	0.07	0.19	0.26	0.27	0.38	0.40	0.40	0.44	0.44
Ness City	0.02	0.09	0.13	0.22	0.29	0.32	0.41	0.45	0.46	0.51	0.48
New Cambria	0.00	0.04	0.06	0.17	0.23	0.26	0.37	0.38	0.39	0.44	0.42

Table C.3 Basis Improvement Averages for Each Location (3 of 3)

10-Year Basis Improvement from June Basis (Averages for Each Location)											
	Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**
Newton	0.00	0.04	0.06	0.17	0.23	0.26	0.37	0.38	0.39	0.43	0.41
Nickerson	0.00	0.04	0.06	0.17	0.23	0.26	0.37	0.39	0.39	0.43	0.41
Oakley	0.00	0.04	0.06	0.17	0.22	0.25	0.36	0.38	0.38	0.42	0.41
Ottawa	0.00	0.05	0.07	0.17	0.24	0.26	0.37	0.38	0.39	0.43	0.42
Overbrook	0.00	0.04	0.07	0.17	0.24	0.26	0.37	0.38	0.39	0.44	0.42
Partridge	0.00	0.04	0.06	0.17	0.23	0.26	0.36	0.38	0.38	0.42	0.41
Peabody	0.00	0.02	0.05	0.16	0.23	0.25	0.37	0.38	0.38	0.44	0.42
Pierceville	0.00	0.06	0.09	0.16	0.25	0.27	0.38	0.39	0.38	0.45	0.45
Plains	0.00	0.04	0.06	0.17	0.22	0.25	0.36	0.37	0.38	0.42	0.41
Pratt	0.03	0.05	0.07	0.20	0.27	0.29	0.38	0.39	0.40	0.44	0.43
Randall	0.01	0.04	0.06	0.18	0.22	0.25	0.36	0.37	0.38	0.42	0.41
Rexford	0.00	0.04	0.05	0.17	0.21	0.24	0.34	0.36	0.37	0.40	0.40
Roxbury	0.01	0.06	0.09	0.19	0.26	0.28	0.38	0.40	0.41	0.46	0.44
Russell	0.04	0.10	0.13	0.23	0.30	0.30	0.41	0.44	0.44	0.44	0.45
Sabetha	0.00	0.00	0.00	0.06	0.17	0.18	0.29	0.34	0.33	0.42	0.39
Saint Marys	0.01	0.06	0.09	0.20	0.24	0.28	0.38	0.39	0.40	0.44	0.44
Salina	0.04	0.07	0.04	0.06	0.16	0.21	0.34	0.38	0.39	0.48	0.44
Scott City	0.02	0.05	0.04	0.12	0.20	0.20	0.32	0.38	0.38	0.40	0.42
Scottsville	0.03	0.04	0.05	0.13	0.15	0.17	0.32	0.33	0.33	0.43	0.40
Seneca	0.00	0.04	0.05	0.17	0.23	0.26	0.36	0.38	0.38	0.45	0.41
Sharon Springs	0.01	0.00	-0.01	0.06	0.15	0.17	0.28	0.34	0.35	0.44	0.43
Smith Center	0.01	0.08	0.11	0.12	0.21	0.25	0.38	0.42	0.41	0.42	0.41
St. Francis	0.00	0.04	0.06	0.16	0.22	0.26	0.37	0.38	0.38	0.43	0.42
Sterling	0.05	0.08	0.10	0.22	0.28	0.29	0.39	0.46	0.46	0.46	0.48
Stockton	0.02	0.01	-0.01	0.01	0.04	0.08	0.22	0.29	0.33	0.29	0.34
Sublette	0.00	0.05	0.04	0.10	0.14	0.15	0.27	0.29	0.27	0.40	0.34
Tipton	0.00	0.04	0.07	0.14	0.19	0.22	0.32	0.33	0.34	0.40	0.41
Walton	0.01	0.05	0.07	0.16	0.20	0.23	0.34	0.34	0.36	0.42	0.42
Wamego	0.02	0.07	0.05	0.15	0.32	0.18	0.44	0.37	0.35	0.39	0.43
Waterville	0.00	0.06	0.07	0.18	0.22	0.24	0.35	0.36	0.37	0.43	0.44
Wellington	0.02	0.01	0.04	0.15	0.21	0.21	0.33	0.37	0.40	0.44	0.44
Westfall	0.00	0.03	0.11	0.26	0.23	0.23	0.41	0.42	0.37	0.39	0.42
Whitewater	0.00	0.05	0.07	0.17	0.21	0.23	0.35	0.35	0.37	0.43	0.44
Wichita	0.00	0.03	0.06	0.14	0.19	0.22	0.33	0.32	0.34	0.40	0.41
Windom	0.01	0.07	0.08	0.17	0.22	0.23	0.33	0.33	0.35	0.43	0.43
Winfield	0.02	0.03	0.05	0.14	0.19	0.21	0.33	0.34	0.36	0.41	0.41
Yates Center	0.02	0.06	0.07	0.17	0.18	0.19	0.32	0.35	0.37	0.38	0.44

Appendix D - 10-Year Price Improvement Averages

Table D.1 Price Improvement Averages for Each Location (1 of 3)

10-Year Price Improvement from June Cash Price (Averages for Each Location)											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Abilene	0.05	0.28	0.33	0.25	0.20	0.23	0.31	0.56	0.63	0.35	0.32
Abbyville	0.04	0.21	0.27	0.25	0.19	0.20	0.30	0.55	0.62	0.34	0.31
Andale	0.03	0.23	0.28	0.22	0.17	0.20	0.29	0.52	0.58	0.32	0.31
Anthony	0.04	0.27	0.32	0.26	0.22	0.24	0.34	0.59	0.66	0.39	0.37
Arkansas City	0.04	0.27	0.31	0.26	0.22	0.24	0.32	0.59	0.66	0.38	0.36
Athol	0.02	0.25	0.30	0.25	0.20	0.23	0.31	0.58	0.65	0.37	0.34
Bartlett	0.03	0.27	0.32	0.27	0.23	0.26	0.34	0.59	0.66	0.38	0.36
Bavaria	0.03	0.25	0.30	0.24	0.21	0.23	0.33	0.57	0.64	0.37	0.35
Beattie	0.04	0.23	0.27	0.25	0.18	0.20	0.32	0.54	0.61	0.34	0.33
Beloit	0.03	0.23	0.28	0.22	0.17	0.19	0.29	0.52	0.58	0.32	0.30
Belvue	0.04	0.26	0.31	0.25	0.22	0.24	0.34	0.59	0.66	0.39	0.37
Benton	0.03	0.24	0.30	0.27	0.20	0.20	0.32	0.55	0.62	0.33	0.35
Big Bow	0.07	0.31	0.37	0.25	0.27	0.30	0.48	0.71	0.75	0.40	0.33
Buhler	0.02	0.26	0.31	0.25	0.21	0.23	0.33	0.58	0.65	0.38	0.36
Burns	0.03	0.23	0.27	0.22	0.16	0.19	0.30	0.52	0.59	0.32	0.31
Caldwell	0.05	0.37	0.43	0.26	0.26	0.29	0.53	0.76	0.79	0.40	0.31
Cawker City	0.03	0.26	0.30	0.24	0.21	0.23	0.33	0.58	0.65	0.38	0.36
Cimarron	0.03	0.23	0.27	0.22	0.15	0.19	0.30	0.52	0.59	0.33	0.31
Clay Center	0.03	0.21	0.26	0.24	0.15	0.16	0.30	0.51	0.59	0.30	0.30
Coffeyville	0.02	0.24	0.29	0.24	0.20	0.21	0.27	0.52	0.60	0.32	0.31
Colby	0.03	0.26	0.30	0.24	0.21	0.23	0.33	0.58	0.65	0.38	0.35
Columbus	0.05	0.24	0.30	0.26	0.21	0.22	0.32	0.56	0.64	0.36	0.35
Concordia	0.06	0.30	0.34	0.25	0.22	0.26	0.48	0.67	0.69	0.36	0.35
Conway	0.04	0.26	0.31	0.24	0.21	0.24	0.33	0.58	0.65	0.38	0.35
Denmark	0.04	0.26	0.31	0.25	0.21	0.24	0.33	0.58	0.65	0.38	0.36
Dodge City	0.03	0.23	0.27	0.23	0.14	0.13	0.27	0.51	0.57	0.26	0.28
Edgerton	0.07	0.23	0.27	0.23	0.16	0.17	0.28	0.50	0.56	0.23	0.24
Elkhart	0.05	0.23	0.28	0.20	0.11	0.13	0.25	0.47	0.54	0.26	0.26
Ellsworth	0.07	0.23	0.25	0.15	0.06	0.06	0.20	0.40	0.43	0.14	0.15
Emporia	0.03	0.25	0.30	0.26	0.19	0.21	0.33	0.55	0.59	0.34	0.36
Falun	0.06	0.23	0.29	0.20	0.14	0.17	0.29	0.53	0.58	0.29	0.27
Florence	0.10	0.23	0.25	0.16	0.06	0.07	0.21	0.40	0.44	0.14	0.16
Fredonia	0.09	0.32	0.36	0.21	0.24	0.27	0.47	0.67	0.69	0.29	0.21
Galva	0.05	0.22	0.27	0.19	0.12	0.13	0.24	0.46	0.53	0.25	0.25
Garden City	0.09	0.23	0.24	0.15	0.06	0.05	0.19	0.40	0.43	0.14	0.15
Garden Plain	0.05	0.22	0.24	0.18	0.17	0.11	0.23	0.45	0.52	0.22	0.23

Table D.2 Price Improvement Averages for Each Location (2 of 3)

10-Year Price Improvement from June Cash Price (Averages for Each Location)											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Girard	0.05	0.22	0.27	0.19	0.11	0.13	0.24	0.45	0.52	0.22	0.25
Glen Elder	0.06	0.24	0.28	0.19	0.28	0.32	0.40	0.47	0.52	0.24	0.24
Goessel	0.07	0.23	0.27	0.21	0.16	0.17	0.28	0.50	0.56	0.24	0.24
Great Bend	0.12	0.25	0.28	0.36	0.31	0.37	0.45	0.69	0.78	0.49	0.51
Greensburg	0.07	0.23	0.27	0.21	0.16	0.17	0.28	0.50	0.56	0.24	0.24
Groveland	0.03	0.23	0.27	0.22	0.14	0.14	0.26	0.51	0.56	0.25	0.27
Halstead	0.00	0.18	0.24	0.20	0.11	0.15	0.26	0.49	0.57	0.29	0.30
Haven	0.01	-0.02	0.03	0.05	0.02	0.12	0.43	0.75	0.87	0.46	0.41
Hays	0.01	0.19	0.24	0.21	0.10	0.14	0.27	0.50	0.57	0.30	0.31
Herkimer	0.03	-0.01	0.03	0.07	0.02	0.16	0.44	0.73	0.81	0.47	0.43
Hill City	0.02	-0.03	0.02	0.07	0.03	0.14	0.44	0.76	0.89	0.46	0.43
Hillsboro	0.03	-0.01	0.04	0.08	0.03	0.15	0.45	0.74	0.82	0.47	0.43
Hilton	0.05	0.27	0.32	0.40	0.18	0.22	0.31	0.59	0.64	0.32	0.31
Holton	0.04	0.19	0.23	0.19	0.12	0.15	0.27	0.50	0.58	0.29	0.30
Hoxie	0.03	0.23	0.28	0.24	0.17	0.19	0.31	0.54	0.60	0.33	0.32
Hunter	0.04	0.22	0.27	0.26	0.15	0.19	0.31	0.52	0.57	0.33	0.32
Hutchinson	0.05	0.26	0.31	0.27	0.19	0.21	0.34	0.57	0.66	0.37	0.37
Isabel	0.05	0.23	0.29	0.25	0.16	0.19	0.30	0.51	0.59	0.31	0.31
Junction City	0.03	0.23	0.27	0.23	0.16	0.18	0.30	0.52	0.59	0.32	0.31
Kiowa	0.04	0.24	0.29	0.25	0.18	0.20	0.29	0.53	0.61	0.34	0.33
Lancaster	0.03	0.22	0.26	0.22	0.16	0.18	0.29	0.51	0.59	0.32	0.31
Lehigh	0.03	0.22	0.26	0.22	0.15	0.18	0.29	0.51	0.58	0.32	0.31
Liberal	0.03	0.22	0.26	0.24	0.16	0.19	0.30	0.52	0.59	0.33	0.31
Lincoln	0.06	0.24	0.28	0.25	0.16	0.17	0.30	0.53	0.60	0.34	0.34
Lindsborg	0.03	0.22	0.27	0.21	0.13	0.16	0.29	0.51	0.58	0.31	0.32
Manhattan	0.05	0.25	0.27	0.25	0.16	0.18	0.30	0.54	0.60	0.35	0.34
Marion	0.03	0.22	0.26	0.22	0.15	0.18	0.29	0.51	0.59	0.32	0.31
Melvern	0.03	0.22	0.26	0.23	0.15	0.18	0.30	0.52	0.59	0.32	0.31
Menlo	0.03	0.22	0.26	0.22	0.15	0.17	0.29	0.51	0.59	0.32	0.30
Meriden	0.03	0.22	0.26	0.22	0.15	0.18	0.29	0.52	0.59	0.33	0.31
Minneola	0.03	0.22	0.26	0.22	0.16	0.18	0.29	0.51	0.59	0.33	0.31
Moundridge	0.04	0.26	0.30	0.25	0.18	0.20	0.27	0.56	0.63	0.36	0.35
Mount Hope	0.03	0.24	0.28	0.25	0.19	0.19	0.31	0.53	0.61	0.33	0.33
Ness City	0.08	0.33	0.38	0.28	0.25	0.29	0.49	0.70	0.75	0.40	0.33
New Cambria	0.03	0.23	0.27	0.22	0.15	0.19	0.30	0.52	0.59	0.33	0.31

Table D.3 Price Improvement Averages for Each Location (3 of 3)

10-Year Price Improvement from June Cash Price (Averages for Each Location)											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Newton	0.03	0.22	0.26	0.23	0.15	0.18	0.29	0.52	0.59	0.32	0.31
Nickerson	0.03	0.22	0.26	0.23	0.16	0.18	0.30	0.52	0.60	0.32	0.31
Oakley	0.03	0.22	0.26	0.23	0.15	0.18	0.29	0.51	0.59	0.31	0.30
Ottawa	0.03	0.23	0.27	0.23	0.16	0.19	0.30	0.52	0.59	0.32	0.31
Overbrook	0.03	0.23	0.27	0.23	0.17	0.19	0.30	0.52	0.59	0.32	0.31
Partridge	0.03	0.22	0.26	0.23	0.16	0.18	0.29	0.51	0.58	0.32	0.30
Peabody	0.03	0.21	0.25	0.21	0.16	0.17	0.30	0.51	0.58	0.32	0.31
Pierceville	0.05	0.30	0.34	0.22	0.22	0.23	0.45	0.64	0.67	0.34	0.29
Plains	0.03	0.22	0.26	0.23	0.15	0.18	0.29	0.51	0.58	0.31	0.30
Pratt	0.06	0.23	0.27	0.26	0.20	0.22	0.31	0.53	0.60	0.32	0.32
Randall	0.04	0.23	0.26	0.24	0.15	0.18	0.29	0.51	0.59	0.31	0.31
Rexford	0.03	0.22	0.26	0.23	0.14	0.16	0.27	0.50	0.57	0.29	0.29
Roxbury	0.06	0.29	0.35	0.24	0.22	0.25	0.45	0.65	0.70	0.35	0.29
Russell	0.09	0.33	0.38	0.28	0.26	0.27	0.48	0.69	0.73	0.35	0.30
Sabetha	0.03	0.18	0.21	0.12	0.10	0.11	0.22	0.48	0.53	0.29	0.28
Saint Marys	0.06	0.30	0.35	0.25	0.21	0.25	0.45	0.64	0.69	0.34	0.28
Salina	0.07	0.25	0.24	0.12	0.09	0.13	0.27	0.51	0.59	0.36	0.34
Scott City	0.05	0.23	0.24	0.17	0.12	-0.16	-0.15	0.52	0.58	0.32	0.31
Scottsville	0.06	0.23	0.25	0.19	0.08	0.09	0.25	0.47	0.54	0.30	0.30
Seneca	0.03	0.22	0.26	0.22	0.16	0.18	0.29	0.52	0.59	0.32	0.31
Sharon Springs	0.04	0.18	0.20	0.12	0.08	0.09	0.20	0.48	0.55	0.33	0.32
Smith Center	0.06	0.31	0.36	0.18	0.18	0.21	0.45	0.67	0.70	0.33	0.26
St. Francis	0.03	0.22	0.26	0.22	0.15	0.18	0.30	0.52	0.59	0.33	0.31
Sterling	0.08	0.26	0.30	0.28	0.20	0.22	0.32	0.80	0.88	0.57	0.56
Stockton	0.05	0.19	0.19	0.07	-0.03	0.00	0.15	0.42	0.53	0.21	0.23
Sublette	-0.06	0.08	0.11	0.14	0.10	0.19	0.51	0.81	0.90	0.56	0.49
Tipton	0.05	0.28	0.32	0.20	0.16	0.19	0.40	0.58	0.63	0.30	0.26
Walton	0.04	0.23	0.27	0.22	0.13	0.16	0.27	0.47	0.56	0.31	0.31
Wamego	-0.03	0.09	0.12	0.19	0.05	0.22	0.67	0.60	0.99	0.28	0.23
Waterville	0.03	0.24	0.27	0.24	0.15	0.17	0.28	0.49	0.57	0.32	0.33
Wellington	0.05	0.20	0.24	0.21	0.13	0.14	0.26	0.51	0.60	0.33	0.33
Westfall	-0.05	0.05	0.08	0.19	0.07	0.16	-0.02	0.02	0.90	0.25	0.45
Whitewater	0.03	0.23	0.28	0.23	0.14	0.15	0.28	0.48	0.58	0.34	0.33
Wichita	0.05	0.27	0.31	0.20	0.16	0.18	0.40	0.57	0.63	0.29	0.26
Windom	0.04	0.25	0.29	0.23	0.15	0.16	0.26	0.47	0.55	0.32	0.32
Winfield	0.05	0.21	0.25	0.20	0.12	0.13	0.26	0.48	0.56	0.29	0.30
Yates Center	0.05	0.24	0.27	0.23	0.11	0.11	0.25	0.49	0.58	0.31	0.33

Appendix E - Returns to Commercial Storage

Table E.1 Returns to Hedged Commercial Storage

RETURNS TO HEDGED COMMERCIAL STORAGE (AVERAGE FOR KANSAS)											
Marketing Year	July	August	September	October	November	December	January	February	March	April	May
2004	$ 0.00	$ 0.03	$ 0.03	$ 0.05	$ 0.05	$ 0.01	$ 0.12	$ 0.04	$ (0.07)	$ (0.16)	$ (0.22)
2005	$ (0.04)	$ (0.07)	$ (0.06)	$ (0.12)	$ (0.13)	$ (0.11)	$ (0.08)	$ (0.14)	$ (0.18)	$ (0.16)	$ (0.16)
2006	$ 0.02	$ (0.03)	$ (0.01)	$ (0.13)	$ (0.18)	$ (0.20)	$ (0.35)	$ (0.35)	$ (0.38)	$ (0.45)	$ (0.45)
2007	$ (0.14)	$ (0.18)	$ (0.26)	$ (0.35)	$ (0.37)	$ (0.40)	$ (0.47)	$ (0.59)	$ (0.60)	$ (0.90)	$ (1.01)
2008	$ (0.07)	$ (0.04)	$ (0.08)	$ (0.11)	$ (0.07)	$ (0.07)	$ (0.05)	$ (0.07)	$ (0.07)	$ (0.05)	$ (0.08)
2009	$ (0.03)	$ (0.28)	$ (0.35)	$ (0.41)	$ (0.44)	$ (0.47)	$ (0.49)	$ (0.52)	$ (0.53)	$ (0.57)	$ (0.63)
2010	$ (0.03)	$ (0.15)	$ (0.03)	$ 0.09	$ 0.11	$ 0.14	$ 0.24	$ 0.22	$ 0.20	$ 0.29	$ 0.31
2011	$ 0.16	$ 0.13	$ 0.16	$ 0.26	$ 0.32	$ 0.33	$ 0.31	$ 0.29	$ 0.27	$ 0.17	$ 0.10
2012	$ (0.01)	$ (0.07)	$ (0.07)	$ (0.01)	$ 0.02	$ 0.02	$ 0.05	$ 0.06	$ 0.04	$ 0.04	$ (0.01)
2013	$ (0.08)	$ (0.15)	$ (0.25)	$ (0.18)	$ (0.23)	$ (0.28)	$ (0.17)	$ (0.26)	$ (0.29)	$ (0.38)	$ (0.40)
AVERAGE	$ (0.02)	$ (0.08)	$ (0.09)	$ (0.09)	$ (0.09)	$ (0.10)	$ (0.09)	$ (0.13)	$ (0.16)	$ (0.22)	$ (0.26)
MIN	$ (0.14)	$ (0.28)	$ (0.35)	$ (0.41)	$ (0.44)	$ (0.47)	$ (0.49)	$ (0.59)	$ (0.60)	$ (0.90)	$ (1.01)
MAX	$ 0.16	$ 0.13	$ 0.16	$ 0.26	$ 0.32	$ 0.33	$ 0.31	$ 0.29	$ 0.27	$ 0.29	$ 0.31
VARIANCE	0.006	0.013	0.023	0.040	0.052	0.060	0.080	0.090	0.084	0.132	0.146
STDEV	0.077	0.116	0.153	0.200	0.228	0.244	0.282	0.299	0.290	0.363	0.382

Table E.2 Returns to Speculative Commercial Storage

RETURNS TO SPECULATIVE COMMERCIAL STORAGE (AVERAGE FOR KANSAS)											
Marketing Year	July	August	September	October	November	December	January	February	March	April	May
2004	$ (0.09)	$ (0.54)	$ (0.54)	$ (0.49)	$ (0.39)	$ (0.44)	$ (0.53)	$ (0.64)	$ (0.59)	$ (0.87)	$ (0.86)
2005	$ 0.02	$ (0.04)	$ 0.01	$ 0.17	$ (0.00)	$ 0.01	$ 0.17	$ 0.46	$ 0.55	$ 0.58	$ 0.59
2006	$ 0.20	$ (0.26)	$ (0.31)	$ 0.15	$ 0.05	$ (0.10)	$ (0.47)	$ (0.41)	$ (0.32)	$ (0.51)	$ (0.46)
2007	$ 0.17	$ 0.65	$ 1.38	$ 2.28	$ 1.95	$ 2.67	$ 2.96	$ 4.74	$ 5.64	$ 2.64	$ 1.75
2008	$ 0.00	$ (0.57)	$ (0.95)	$ (3.24)	$ (3.68)	$ (3.95)	$ (3.38)	$ (3.91)	$ (3.98)	$ (3.92)	$ (3.70)
2009	$ (0.58)	$ (1.52)	$ (1.90)	$ (1.89)	$ (1.62)	$ (1.64)	$ (2.02)	$ (2.30)	$ (2.29)	$ (2.47)	$ (2.45)
2010	$ 0.38	$ 1.93	$ 2.03	$ 2.31	$ 2.35	$ 2.60	$ 3.83	$ 4.33	$ 3.84	$ 4.05	$ 3.94
2011	$ (0.65)	$ (0.05)	$ 0.03	$ (1.32)	$ (1.52)	$ (1.89)	$ (1.58)	$ (1.54)	$ (1.68)	$ (2.24)	$ (2.54)
2012	$ 0.87	$ 1.85	$ 1.85	$ 1.81	$ 1.86	$ 1.67	$ 0.95	$ 0.47	$ 0.11	$ (0.02)	$ 0.18
2013	$ (0.24)	$ (0.44)	$ (0.50)	$ (0.10)	$ (0.63)	$ (0.72)	$ (1.53)	$ (1.15)	$ (0.85)	$ (0.50)	$ (0.09)
AVERAGE	$ 0.01	$ 0.10	$ 0.11	$ (0.03)	$ (0.16)	$ (0.18)	$ (0.16)	$ 0.01	$ 0.04	$ (0.33)	$ (0.36)
MIN	$ (0.65)	$ (1.52)	$ (1.90)	$ (3.24)	$ (3.68)	$ (3.95)	$ (3.38)	$ (3.91)	$ (3.98)	$ (3.92)	$ (3.70)
MAX	$ 0.87	$ 1.93	$ 2.03	$ 2.31	$ 2.35	$ 2.67	$ 3.83	$ 4.74	$ 5.64	$ 4.05	$ 3.94
VARIANCE	0.201	1.182	1.613	3.325	3.503	4.328	4.998	7.386	7.991	5.604	4.975
STDEV	0.448	1.087	1.270	1.824	1.872	2.080	2.236	2.718	2.827	2.367	2.230

Appendix F - Returns to On-Farm Storage

Table F.1 Returns to Hedged On-Farm Storage

RETURNS TO HEDGED ON-FARM STORAGE (AVERAGE FOR KANSAS)											
Marketing Year	July	August	September	October	November	December	January	February	March	April	May
2004	$ (0.13)	$ (0.07)	$ (0.05)	$ 0.02	$ 0.05	$ 0.02	$ 0.18	$ 0.13	$ 0.03	$ (0.01)	$ (0.06)
2005	$ (0.17)	$ (0.15)	$ (0.13)	$ (0.14)	$ (0.13)	$ (0.09)	$ (0.02)	$ (0.05)	$ (0.08)	$ (0.01)	$ 0.00
2006	$ (0.13)	$ (0.13)	$ (0.10)	$ (0.18)	$ (0.20)	$ (0.20)	$ (0.31)	$ (0.28)	$ (0.30)	$ (0.33)	$ (0.31)
2007	$ (0.30)	$ (0.30)	$ (0.36)	$ (0.41)	$ (0.40)	$ (0.42)	$ (0.45)	$ (0.54)	$ (0.53)	$ (0.80)	$ (0.89)
2008	$ (0.25)	$ (0.17)	$ (0.19)	$ (0.17)	$ (0.09)	$ (0.08)	$ (0.00)	$ 0.01	$ 0.03	$ 0.10	$ 0.08
2009	$ (0.19)	$ (0.38)	$ (0.43)	$ (0.43)	$ (0.43)	$ (0.44)	$ (0.40)	$ (0.40)	$ (0.39)	$ (0.37)	$ (0.42)
2010	$ (0.16)	$ (0.22)	$ (0.08)	$ 0.09	$ 0.15	$ 0.20	$ 0.36	$ 0.38	$ 0.38	$ 0.53	$ 0.57
2011	$ (0.02)	$ 0.01	$ 0.05	$ 0.20	$ 0.30	$ 0.33	$ 0.37	$ 0.38	$ 0.38	$ 0.33	$ 0.27
2012	$ (0.17)	$ (0.18)	$ (0.15)	$ (0.04)	$ 0.02	$ 0.04	$ 0.13	$ 0.17	$ 0.17	$ 0.23	$ 0.20
2013	$ (0.25)	$ (0.26)	$ (0.35)	$ (0.23)	$ (0.24)	$ (0.27)	$ (0.11)	$ (0.16)	$ (0.17)	$ (0.21)	$ (0.21)
AVERAGE	$ (0.18)	$ (0.18)	$ (0.18)	$ (0.13)	$ (0.10)	$ (0.09)	$ (0.03)	$ (0.04)	$ (0.05)	$ (0.05)	$ (0.08)
MIN	$ (0.30)	$ (0.38)	$ (0.43)	$ (0.43)	$ (0.43)	$ (0.44)	$ (0.45)	$ (0.54)	$ (0.53)	$ (0.80)	$ (0.89)
MAX	$ (0.02)	$ 0.01	$ 0.05	$ 0.20	$ 0.30	$ 0.33	$ 0.37	$ 0.38	$ 0.38	$ 0.53	$ 0.57
VARIANCE	0.006	0.013	0.024	0.042	0.054	0.063	0.087	0.099	0.095	0.150	0.167
STDEV	0.077	0.113	0.155	0.205	0.233	0.251	0.295	0.314	0.308	0.387	0.408

Table F.2 Returns to Speculative On-Farm Storage

RETURNS TO SPECULATIVE ON-FARM STORAGE (AVERAGE FOR KANSAS)											
Marketing Year	July	August	September	October	November	December	January	February	March	April	May
2004	$ (0.23)	$ (0.63)	$ (0.62)	$ (0.52)	$ (0.40)	$ (0.43)	$ (0.47)	$ (0.55)	$ (0.49)	$ (0.72)	$ (0.70)
2005	$ (0.11)	$ (0.13)	$ (0.06)	$ 0.15	$ 0.00	$ 0.03	$ 0.23	$ 0.55	$ 0.66	$ 0.73	$ 0.76
2006	$ 0.05	$ (0.36)	$ (0.40)	$ 0.10	$ 0.03	$ (0.10)	$ (0.43)	$ (0.34)	$ (0.24)	$ (0.39)	$ (0.32)
2007	$ 0.02	$ 0.54	$ 1.28	$ 2.22	$ 1.91	$ 2.66	$ 2.98	$ 4.79	$ 5.70	$ 2.74	$ 1.87
2008	$ (0.18)	$ (0.69)	$ (1.06)	$ (3.30)	$ (3.71)	$ (3.96)	$ (3.34)	$ (3.83)	$ (3.89)	$ (3.78)	$ (3.54)
2009	$ (0.74)	$ (1.62)	$ (1.99)	$ (1.92)	$ (1.61)	$ (1.61)	$ (1.94)	$ (2.18)	$ (2.15)	$ (2.27)	$ (2.24)
2010	$ 0.25	$ 1.86	$ 1.98	$ 2.31	$ 2.39	$ 2.66	$ 3.96	$ 4.49	$ 4.02	$ 4.29	$ 4.20
2011	$ (0.83)	$ (0.18)	$ (0.07)	$ (1.37)	$ (1.53)	$ (1.89)	$ (1.52)	$ (1.45)	$ (1.58)	$ (2.08)	$ (2.36)
2012	$ 0.71	$ 1.74	$ 1.77	$ 1.77	$ 1.86	$ 1.69	$ 1.03	$ 0.58	$ 0.24	$ 0.17	$ 0.39
2013	$ (0.41)	$ (0.55)	$ (0.60)	$ (0.15)	$ (0.64)	$ (0.71)	$ (1.47)	$ (1.05)	$ (0.73)	$ (0.33)	$ 0.10
AVERAGE	$ (0.15)	$ (0.00)	$ 0.02	$ (0.07)	$ (0.17)	$ (0.17)	$ (0.10)	$ 0.10	$ 0.15	$ (0.16)	$ (0.19)
MIN	$ (0.83)	$ (1.62)	$ (1.99)	$ (3.30)	$ (3.71)	$ (3.96)	$ (3.34)	$ (3.83)	$ (3.89)	$ (3.78)	$ (3.54)
MAX	$ 0.71	$ 1.86	$ 1.98	$ 2.31	$ 2.39	$ 2.66	$ 3.96	$ 4.79	$ 5.70	$ 4.29	$ 4.20
VARIANCE	0.206	1.195	1.627	3.353	3.537	4.361	5.037	7.412	7.997	5.645	5.026
STDEV	0.454	1.093	1.276	1.831	1.881	2.088	2.244	2.723	2.828	2.376	2.242

Appendix G - Results for the Regression Analysis of All Models

Table G.1 Regression Output for Hedged Storage until September

SUMMARY OUTPUT Hedged Storage Until September

Regression Statistics	
Multiple R	0.474364
R Square	0.225022
Adjusted R Square	0.079713
Standard Error	0.119169
Observations	20

ANOVA

	df	SS	MS	F	gnificance F
Regression	3	0.065975	0.021992	1.548579	0.240635
Residual	16	0.22722	0.014201		
Total	19	0.293196			

	Coefficients	andard Err	t Stat	P-value	Lower 95%	Upper 95%	ower 95.0%	pper 95.0%
Intercept	-0.09369	0.079266	-1.18201	0.25447	-0.26173	0.074343	-0.26173	0.074343
Average Harvest Price	-0.01865	0.015159	-1.23045	0.236311	-0.05079	0.013484	-0.05079	0.013484
Average Nearby Basis	-0.07939	0.124478	-0.63781	0.532623	-0.34327	0.184488	-0.34327	0.184488
July-September Spread in June	0.571419	0.367464	1.555033	0.139494	-0.20757	1.350408	-0.20757	1.350408

Table G.2 Regression Output for Speculative Storage until September

SUMMARY OUTPUT Speculative Storage Until September

Regression Statistics	
Multiple R	0.368834
R Square	0.136039
Adjusted R Square	-0.02595
Standard Error	0.982558
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	3	2.432231	0.810744	0.839782	0.491773
Residual	16	15.44674	0.965421		
Total	19	17.87897			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	0.027438	0.653555	0.041982	0.967032	-1.35804	1.412913	-1.35804	1.412913
Average Harvest Price	-0.11661	0.124991	-0.93293	0.36472	-0.38158	0.148361	-0.38158	0.148361
Average Nearby Basis	-0.95033	1.026327	-0.92595	0.368227	-3.12605	1.225385	-3.12605	1.225385
July-September Spread in June	2.102432	3.029771	0.693925	0.497682	-4.32039	8.525259	-4.32039	8.525259

Table G.3 Regression Output for Hedged Storage until December

SUMMARY OUTPUT Hedged Storage Until December

Regression Statistics	
Multiple R	0.691991
R Square	0.478852
Adjusted R Square	0.381137
Standard Error	0.162627
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	3	0.388818	0.129606	4.900485	0.013294
Residual	16	0.423161	0.026448		
Total	19	0.811979			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	-0.12066	0.108173	-1.11541	0.281148	-0.34997	0.108659	-0.34997	0.108659
Average Harvest Price	-0.03707	0.020688	-1.79186	0.092086	-0.08093	0.006787	-0.08093	0.006787
Average Nearby Basis	-0.19139	0.169871	-1.12668	0.276494	-0.5515	0.168721	-0.5515	0.168721
July-December Spread in June	1.46047	0.501469	2.912382	0.010176	0.397403	2.523538	0.397403	2.523538

Table G.4 Regression Output for Speculative Storage until December

SUMMARY OUTPUT Speculative Storage Until December

Regression Statistics	
Multiple R	0.483208
R Square	0.23349
Adjusted R Square	0.08977
Standard Error	1.453638
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	3	10.29874	3.432914	1.624614	0.223136
Residual	16	33.80903	2.113064		
Total	19	44.10777			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	1.162478	0.966897	1.202277	0.246748	-0.88725	3.212208	-0.88725	3.212208
Average Harvest Price	-0.39221	0.184917	-2.12102	0.049894	-0.78422	-0.00021	-0.78422	-0.00021
Average Nearby Basis	-0.92625	1.518391	-0.61002	0.550413	-4.1451	2.292592	-4.1451	2.292592
July-December Spread in June	1.20775	4.48237	0.269444	0.791032	-8.29445	10.70995	-8.29445	10.70995

Table G.5 Regression Output for Hedged Storage until March

SUMMARY OUTPUT Hedged Storage Until March

Regression Statistics	
Multiple R	0.736218
R Square	0.542016
Adjusted R Square	0.456144
Standard Error	0.199044
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	3	0.750208	0.250069	6.311912	0.004972
Residual	16	0.633898	0.039619		
Total	19	1.384106			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	-0.30962	0.132396	-2.3386	0.032664	-0.59029	-0.02895	-0.59029	-0.02895
Average Harvest Price	-0.03475	0.02532	-1.37227	0.188913	-0.08842	0.01893	-0.08842	0.01893
Average Nearby Basis	-0.35765	0.207911	-1.72019	0.104677	-0.7984	0.083106	-0.7984	0.083106
July-March Spread in June	1.907606	0.613763	3.108048	0.006765	0.606486	3.208727	0.606486	3.208727

Table G.6 Regression Output for Speculative Storage until March

SUMMARY OUTPUT Speculative Storage Until March

Regression Statistics	
Multiple R	0.414174
R Square	0.17154
Adjusted R Square	0.016204
Standard Error	2.012525
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	3	13.41826	4.472752	1.104313	0.376279
Residual	16	64.80411	4.050257		
Total	19	78.22236			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	0.824916	1.338644	0.616233	0.546409	-2.01288	3.662715	-2.01288	3.662715
Average Harvest Price	-0.40336	0.256013	-1.57554	0.134696	-0.94608	0.139365	-0.94608	0.139365
Average Nearby Basis	-1.84666	2.102174	-0.87845	0.392701	-6.30307	2.609755	-6.30307	2.609755
July-March Spread in June	1.678659	6.205726	0.270502	0.790233	-11.4769	14.83421	-11.4769	14.83421

Table G.7 Regression Output for Hedged Storage until May

SUMMARY OUTPUT Hedged Storage Until May

Regression Statistics	
Multiple R	0.802484
R Square	0.64398
Adjusted R Square	0.577226
Standard Error	0.255176
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	3	1.884502	0.628167	9.647099	0.000712
Residual	16	1.041834	0.065115		
Total	19	2.926336			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	-0.45974	0.169732	-2.70863	0.015496	-0.81956	-0.09992	-0.81956	-0.09992
Average Harvest Price	-0.06248	0.032461	-1.92465	0.072243	-0.13129	0.006338	-0.13129	0.006338
Average Nearby Basis	-0.51142	0.266543	-1.91871	0.073041	-1.07646	0.053626	-1.07646	0.053626
July-May Spread in June	3.124525	0.786848	3.97094	0.001097	1.456483	4.792568	1.456483	4.792568

Table G.8 Regression Output for Speculative Storage until May

SUMMARY OUTPUT Speculative Storage Until May

Regression Statistics	
Multiple R	0.55463
R Square	0.307615
Adjusted R Square	0.177792
Standard Error	1.539537
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	3	16.84842	5.61614	2.369506	0.108948
Residual	16	37.92277	2.370173		
Total	19	54.77118			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	0.655267	1.024033	0.639889	0.531302	-1.51559	2.82612	-1.51559	2.82612
Average Harvest Price	-0.39118	0.195844	-1.99739	0.06308	-0.80635	0.023993	-0.80635	0.023993
Average Nearby Basis	-2.63382	1.608116	-1.63783	0.120971	-6.04287	0.775235	-6.04287	0.775235
July-May Spread in June	-3.35752	4.747242	-0.70726	0.489581	-13.4212	6.706185	-13.4212	6.706185

Table G.9 Returns to Hedged Commercial Storage for Wichita Eagle Locations Only

RETURNS TO HEDGED COMMERCIAL STORAGE (AVERAGE FOR KANSAS - WICHITA EAGLE LOCATIONS ONLY)											
Marketing Year	July	August	September	October	November	December	January	February	March	April	May
2004	$ (0.00)	$ 0.02	$ 0.02	$ 0.05	$ 0.06	$ 0.02	$ 0.12	$ 0.04	$ (0.06)	$ (0.14)	$ (0.19)
2005	$ (0.05)	$ (0.08)	$ (0.06)	$ (0.10)	$ (0.13)	$ (0.12)	$ (0.09)	$ (0.13)	$ (0.17)	$ (0.15)	$ (0.14)
2006	$ 0.01	$ (0.03)	$ (0.01)	$ (0.12)	$ (0.17)	$ (0.19)	$ (0.34)	$ (0.35)	$ (0.37)	$ (0.44)	$ (0.44)
2007	$ (0.14)	$ (0.20)	$ (0.28)	$ (0.35)	$ (0.36)	$ (0.39)	$ (0.45)	$ (0.59)	$ (0.60)	$ (0.88)	$ (1.00)
2008	$ (0.04)	$ (0.13)	$ (0.15)	$ (0.18)	$ (0.13)	$ (0.12)	$ (0.11)	$ (0.13)	$ (0.13)	$ (0.11)	$ (0.13)
2009	$ (0.03)	$ (0.25)	$ (0.31)	$ (0.38)	$ (0.42)	$ (0.43)	$ (0.47)	$ (0.50)	$ (0.50)	$ (0.54)	$ (0.59)
2010	$ (0.03)	$ (0.10)	$ (0.01)	$ 0.12	$ 0.12	$ 0.14	$ 0.29	$ 0.25	$ 0.23	$ 0.32	$ 0.34
2011	$ 0.15	$ 0.08	$ 0.12	$ 0.20	$ 0.27	$ 0.30	$ 0.27	$ 0.24	$ 0.21	$ 0.12	$ 0.06
2012	$ 0.12	$ (0.05)	$ (0.06)	$ (0.01)	$ (0.00)	$ 0.01	$ 0.06	$ 0.09	$ 0.09	$ 0.12	$ 0.06
2013	$ (0.05)	$ (0.12)	$ (0.21)	$ (0.13)	$ (0.19)	$ (0.24)	$ (0.12)	$ (0.21)	$ (0.23)	$ (0.29)	$ (0.34)
AVERAGE	$ (0.01)	$ (0.08)	$ (0.09)	$ (0.09)	$ (0.09)	$ (0.10)	$ (0.08)	$ (0.13)	$ (0.15)	$ (0.20)	$ (0.24)
MIN	$ (0.14)	$ (0.25)	$ (0.31)	$ (0.38)	$ (0.42)	$ (0.43)	$ (0.47)	$ (0.59)	$ (0.60)	$ (0.88)	$ (1.00)
MAX	$ 0.15	$ 0.08	$ 0.12	$ 0.20	$ 0.27	$ 0.30	$ 0.29	$ 0.25	$ 0.23	$ 0.32	$ 0.34
VARIANCE	0.007	0.010	0.019	0.035	0.044	0.052	0.076	0.086	0.081	0.125	0.143
STDEV	0.084	0.098	0.139	0.187	0.211	0.227	0.275	0.292	0.284	0.354	0.378

Table G.10 Returns to Speculative Commercial Storage for Wichita Eagle Locations Only

RETURNS TO SPECULATIVE COMMERCIAL STORAGE (AVERAGE FOR KANSAS - WICHITA EAGLE LOCATIONS ONLY)											
Marketing Year	July	August	September	October	November	December	January	February	March	April	May
2004	$ (0.10)	$ (0.54)	$ (0.55)	$ (0.49)	$ (0.39)	$ (0.44)	$ (0.53)	$ (0.64)	$ (0.57)	$ (0.85)	$ (0.84)
2005	$ 0.01	$ (0.05)	$ 0.01	$ 0.19	$ 0.00	$ 0.00	$ 0.17	$ 0.48	$ 0.56	$ 0.59	$ 0.61
2006	$ 0.19	$ (0.26)	$ (0.30)	$ 0.16	$ 0.06	$ (0.09)	$ (0.46)	$ (0.41)	$ (0.31)	$ (0.50)	$ (0.45)
2007	$ 0.16	$ 0.64	$ 1.36	$ 2.28	$ 1.96	$ 2.69	$ 2.98	$ 4.74	$ 5.64	$ 2.66	$ 1.77
2008	$ 0.03	$ (0.66)	$ (1.02)	$ (3.31)	$ (3.74)	$ (4.00)	$ (3.45)	$ (3.98)	$ (4.05)	$ (3.98)	$ (3.76)
2009	$ (0.57)	$ (1.49)	$ (1.87)	$ (1.86)	$ (1.60)	$ (1.60)	$ (2.01)	$ (2.28)	$ (2.26)	$ (2.44)	$ (2.41)
2010	$ 0.37	$ 1.97	$ 2.05	$ 2.34	$ 2.36	$ 2.60	$ 3.88	$ 4.36	$ 3.88	$ 4.08	$ 3.98
2011	$ (0.66)	$ (0.10)	$ (0.01)	$ (1.38)	$ (1.56)	$ (1.92)	$ (1.62)	$ (1.59)	$ (1.74)	$ (2.30)	$ (2.57)
2012	$ 0.81	$ 1.87	$ 1.86	$ 1.81	$ 1.84	$ 1.66	$ 0.96	$ 0.50	$ 0.17	$ 0.06	$ 0.25
2013	$ (0.21)	$ (0.40)	$ (0.46)	$ (0.05)	$ (0.59)	$ (0.67)	$ (1.50)	$ (1.10)	$ (0.79)	$ (0.41)	$ (0.03)
AVERAGE	$ 0.00	$ 0.10	$ 0.11	$ (0.03)	$ (0.17)	$ (0.18)	$ (0.16)	$ 0.01	$ 0.05	$ (0.31)	$ (0.34)
MIN	$ (0.66)	$ (1.49)	$ (1.87)	$ (3.31)	$ (3.74)	$ (4.00)	$ (3.45)	$ (3.98)	$ (4.05)	$ (3.98)	$ (3.76)
MAX	$ 0.81	$ 1.97	$ 2.05	$ 2.34	$ 2.36	$ 2.69	$ 3.88	$ 4.74	$ 5.64	$ 4.08	$ 3.98
VARIANCE	0.188	1.208	1.614	3.396	3.552	4.374	5.099	7.480	8.074	5.712	5.068
STDEV	0.433	1.099	1.271	1.843	1.885	2.092	2.258	2.735	2.841	2.390	2.251

Appendix H - Results of Regression Analysis Including Dummy Variables for 2007, 2008, and 2009

Table H.1 Regression Output for Hedged Storage until September including Dummy Variables

SUMMARY OUTPUT Hedged Storage until September with Dummy Variables for 2007, 2008, and 2009

Regression Statistics	
Multiple R	0.769339
R Square	0.591882
Adjusted R Square	0.40352
Standard Error	0.096668
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	6	0.176182	0.029364	3.142261	0.039516
Residual	13	0.121482	0.009345		
Total	19	0.297665			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	-0.16681	0.073636	-2.26536	0.041221	-0.32589	-0.00773	-0.32589	-0.00773
Average Harvest Price	-0.00273	0.014614	-0.18658	0.85487	-0.0343	0.028846	-0.0343	0.028846
Average Nearby Basis	-0.10589	0.104892	-1.00953	0.331144	-0.33249	0.120714	-0.33249	0.120714
July-September Spread in June	0.727185	0.303329	2.397345	0.032245	0.071882	1.382488	0.071882	1.382488
2007 Dummy	-0.23958	0.103099	-2.32377	0.036989	-0.46231	-0.01685	-0.46231	-0.01685
2008 Dummy	-0.15219	0.121653	-1.25101	0.232977	-0.415	0.110626	-0.415	0.110626
2009 Dummy	-0.27652	0.10444	-2.64768	0.0201	-0.50215	-0.05089	-0.50215	-0.05089

Table H.2 Regression Output for Speculative Storage until September including Dummy Variables

SUMMARY OUTPUT Speculative Storage until September with Dummy Variables for 2007 and 2008

Regression Statistics	
Multiple R	0.561657
R Square	0.315458
Adjusted R Square	0.070979
Standard Error	0.93499
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	5	5.64007	1.128014	1.290327975	0.322582
Residual	14	12.2389	0.874207		
Total	19	17.87897			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	-0.335443	0.695704	-0.482163	0.637141275	-1.82758	1.156695	-1.82758	1.156695
Average Harvest Price	-0.061456	0.13663	-0.449796	0.659743054	-0.354498	0.231587	-0.354498	0.231587
Average Nearby Basis	-1.366798	1.003944	-1.361429	0.194887934	-3.520044	0.786447	-3.520044	0.786447
July-September Spread in June	1.508692	2.931897	0.514579	0.614874463	-4.779601	7.796986	-4.779601	7.796986
2007 Dummy	1.418938	0.992173	1.430132	0.1746168	-0.709061	3.546937	-0.709061	3.546937
2008 Dummy	-1.243232	1.148492	-1.082491	0.297327149	-3.706502	1.220038	-3.706502	1.220038

Table H.3 Regression Output for Hedged Storage until December including Dummy Variables

SUMMARY OUTPUT Hedged Storage until December with Dummy Variables for 2007, 2008, and 2009

Regression Statistics	
Multiple R	0.894568
R Square	0.800252
Adjusted R Square	0.70806
Standard Error	0.114317
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	6	0.680625	0.113437	8.680325	0.000619
Residual	13	0.169888	0.013068		
Total	19	0.850513			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	-0.19599	0.087079	-2.25067	0.042355	-0.38411	-0.00786	-0.38411	-0.00786
Average Harvest Price	-0.01638	0.017282	-0.94798	0.360428	-0.05372	0.020953	-0.05372	0.020953
Average Nearby Basis	-0.21607	0.124041	-1.74191	0.105118	-0.48404	0.051907	-0.48404	0.051907
July-December Spread in June	1.672034	0.358707	4.661278	0.000445	0.897094	2.446974	0.897094	2.446974
2007 Dummy	-0.41451	0.121922	-3.39978	0.004744	-0.6779	-0.15111	-0.6779	-0.15111
2008 Dummy	-0.20618	0.143862	-1.43318	0.175417	-0.51698	0.104616	-0.51698	0.104616
2009 Dummy	-0.45031	0.123507	-3.64599	0.00296	-0.71713	-0.18348	-0.71713	-0.18348

Table H.4 Regression Output for Speculative Storage until December including Dummy Variables

SUMMARY OUTPUT Speculative Storage until December with Dummy Variables for 2007 and 2008

Regression Statistics	
Multiple R	0.819006
R Square	0.670771
Adjusted R Square	0.553189
Standard Error	1.018457
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	5	29.58621	5.917242	5.704717221	0.004489
Residual	14	14.52156	1.037254		
Total	19	44.10777			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Ipper 95.0%*
Intercept	0.162889	0.75781	0.214948	0.832907813	-1.462451	1.78823	-1.462451	1.78823
Average Harvest Price	-0.229641	0.148827	-1.543003	0.145127414	-0.548843	0.089562	-0.548843	0.089562
Average Nearby Basis	-1.980543	1.093566	-1.811088	0.091632363	-4.326008	0.364922	-4.326008	0.364922
July-December Spread in June	-0.041563	3.193627	-0.013014	0.989799889	-6.891211	6.808085	-6.891211	6.808085
2007 Dummy	3.158535	1.080744	2.922557	0.011134317	0.84057	5.476499	0.84057	5.476499
2008 Dummy	-3.470203	1.251017	-2.773905	0.014927195	-6.153369	-0.787038	-6.153369	-0.787038

Table H.5 Regression Output for Hedged Storage until March including Dummy Variables

SUMMARY OUTPUT Hedged Storage until March with Dummy Variables for 2007, 2008, and 2009

Regression Statistics	
Multiple R	0.904139
R Square	0.817467
Adjusted R Square	0.73322
Standard Error	0.14196
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	6	1.173291	0.195548	9.703301	0.000357
Residual	13	0.261986	0.020153		
Total	19	1.435277			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	-0.37623	0.108136	-3.47921	0.004073	-0.60984	-0.14261	-0.60984	-0.14261
Average Harvest Price	-0.01249	0.021462	-0.58201	0.570517	-0.05886	0.033874	-0.05886	0.033874
Average Nearby Basis	-0.36515	0.154036	-2.37054	0.033902	-0.69792	-0.03237	-0.69792	-0.03237
July-March Spread in June	2.173714	0.445448	4.879835	0.000301	1.211382	3.136047	1.211382	3.136047
2007 Dummy	-0.58252	0.151404	-3.84742	0.002017	-0.90961	-0.25543	-0.90961	-0.25543
2008 Dummy	-0.24716	0.17865	-1.38347	0.189818	-0.63311	0.138793	-0.63311	0.138793
2009 Dummy	-0.49054	0.153373	-3.19835	0.00699	-0.82188	-0.1592	-0.82188	-0.1592

Table H.6 Regression Output for Speculative Storage until March including Dummy Variables

SUMMARY OUTPUT Speculative Storage until March with Dummy Variables for 2007 and 2008

Regression Statistics	
Multiple R	0.900783
R Square	0.81141
Adjusted R Square	0.744056
Standard Error	1.026506
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	5	63.47037	12.69407	12.04698686	0.000115
Residual	14	14.75199	1.053714		
Total	19	78.22236			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Ipper 95.0%*
Intercept	-0.19952	0.763799	-0.261221	0.797725857	-1.837705	1.438665	-1.837705	1.438665
Average Harvest Price	-0.283067	0.150003	-1.887074	0.080060498	-0.604792	0.038658	-0.604792	0.038658
Average Nearby Basis	-3.331303	1.102208	-3.02239	0.009136785	-5.695304	-0.967301	-5.695304	-0.967301
July-March Spread in June	-1.281671	3.218866	-0.398175	0.696507145	-8.185452	5.622109	-8.185452	5.622109
2007 Dummy	6.499815	1.089285	5.967049	3.44475E-05	4.163531	8.836098	4.163531	8.836098
2008 Dummy	-3.358089	1.260904	-2.663239	0.018543332	-6.062459	-0.653719	-6.062459	-0.653719

Table H.7 Regression Output for Hedged Storage until May including Dummy Variables

SUMMARY OUTPUT Hedged Storage until May with Dummy Variables for 2007, 2008, and 2009

Regression Statistics	
Multiple R	0.93499
R Square	0.874207
Adjusted R Square	0.816148
Standard Error	0.172398
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	6	2.685106	0.447518	15.05734	3.56E-05
Residual	13	0.386372	0.029721		
Total	19	3.071478			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	-0.48373	0.131321	-3.68356	0.002755	-0.76743	-0.20003	-0.76743	-0.20003
Average Harvest Price	-0.04449	0.026063	-1.7071	0.11156	-0.1008	0.011814	-0.1008	0.011814
Average Nearby Basis	-0.45218	0.187063	-2.41725	0.031065	-0.8563	-0.04805	-0.8563	-0.04805
July-May Spread in June	3.533063	0.540955	6.531164	1.91E-05	2.364402	4.701724	2.364402	4.701724
2007 Dummy	-0.90932	0.183866	-4.94555	0.000268	-1.30654	-0.5121	-1.30654	-0.5121
2008 Dummy	-0.14445	0.216954	-0.66582	0.517165	-0.61315	0.324248	-0.61315	0.324248
2009 Dummy	-0.47848	0.186257	-2.56891	0.023342	-0.88086	-0.07609	-0.88086	-0.07609

Table H.8 Regression Output for Speculative Storage until May including Dummy Variables

SUMMARY OUTPUT Speculative Storage until May with Dummy Variables for 2007 and 2008

Regression Statistics	
Multiple R	0.759282
R Square	0.57651
Adjusted R Square	0.425263
Standard Error	1.287163
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	5	31.57613	6.315226	3.811724318	0.021765
Residual	14	23.19506	1.65679		
Total	19	54.77118			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Ipper 95.0%*
Intercept	-0.201768	0.957748	-0.210669	0.836181108	-2.255933	1.852398	-2.255933	1.852398
Average Harvest Price	-0.253263	0.188093	-1.346479	0.199544124	-0.656683	0.150156	-0.656683	0.150156
Average Nearby Basis	-3.550604	1.382089	-2.569013	0.02227994	-6.51489	-0.586318	-6.51489	-0.586318
July-May Spread in June	-4.482078	4.036224	-1.110463	0.285508476	-13.13892	4.174761	-13.13892	4.174761
2007 Dummy	2.811829	1.365884	2.058615	0.058643443	-0.117701	5.741358	-0.117701	5.741358
2008 Dummy	-2.969003	1.581082	-1.87783	0.081394391	-6.360087	0.422081	-6.360087	0.422081