**A LOOK AT ELEVATOR CHARATERISTICS
AND BASIS VALUES**

by

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ABSTRACT

The agricultural commodity market has been experiencing previously unseen high prices in recent years. This new era of prices brings with it new challenges within agriculture for farmers and grain buyers within agriculture. This research explores the basis values of hard red winter wheat in Kansas and the elevator characteristics that provide a competitive advantage for elevators buying wheat in Kansas.

This research explores hard red winter wheat basis values from elevators located around Kansas from 2002 to 2013. Two hundred twenty eight locations from around Kansas were used in the research. These locations provided the price data that was used for this research. The elevator characteristics used in the research were collected from the Kansas Grain and Feed Directory and the Burlington Northern-Santa Fe and Union Pacific railway companies. Five elevator characteristics were researched that may have a significant impact on an elevators basis. These characteristics are thought to provide a competitive advantage to the location in the form of stronger or narrower basis bids to the farmer, giving the farmer a higher price for his grain.

The characteristics researched included elevator capacity, transportation capabilities, elevator terminal status, shuttle loading status, and cooperative or investor-owned business structure. Each characteristic was compared against their counterpart. For example, a location is either a shuttle loader or it is not. The research provides grain companies and farmers some data that they may find useful in marketing grain and setting basis levels in the ever changing and volatile market place in today's grain industry.

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CHAPTER I: INTRODUCTION

1.1 Introduction

U.S. agriculture has been transforming over the past century and it is most apparent in today's marketplace. Over time, farm managers have learned to adopt strategies that help protect them against risks. Farmer managers have to plan in advance to deal with unknown production results, grain prices, and input costs. These challenges have provided opportunities for agribusinesses to offer the services and tools that allow farm managers to reduce their exposure to price risk, whether it be input prices or output prices.

Pre-pricing inputs has been a common practice for farmers managing input costs. Farm managers traditionally pre-price input costs such as fertilizer, chemicals, and diesel fuel based on their needs for the upcoming crop year. This risk management practice is still used today by farmers. However, with the competitiveness in the global marketplace, the demand for crop inputs such as fertilizer continues to grow on the world market. The increased volatility makes it more difficult for farmers to know when to price inputs. One miscalculated move can reduce potential profits at the end of the year.

In more recent years, farmers have taken advantage of crop insurance to minimize the exposure to crop failure from natural disasters. Crop insurance is another risk management tool that minimizes the risk exposure to a farmer after the input costs of planting and growing have been applied in the field. Crop insurance will protect a farmer's investment and guarantee them the ability to cover most if not all of their input costs depending on the level of insurance they choose.

Farmers are also susceptible to output price risk. Price risk is the unintended consequence of commodity prices moving lower in the future than what the farmer could

have marketed grain for today. A cash sales marketing strategy has the greatest price risk exposure. Traditionally, cash prices were predictable and farmers were not exposed to big swings in the futures market price throughout the year, resulting in many farmers being comfortable with the risks of cash sales. With above average commodity prices in recent years, the volatility in commodity prices has increased and thousands of dollars are at risk if a farm managers does not manage price risk to some degree. Futures hedging and options are risk management tools farm managers have adopted to reduce price risk. Options allows farmers to buy price insurance for a premium. The premium will depend on the price and the amount of time allowed to exercise the options before expiration. Buying options create a price floor protecting them from lower market prices. Options trading is like buying insurance against price decline, but their complexity has turned farmers to other risk management alternatives like hedging with futures markets.

Hedging with futures contracts allows farmers to lock in the price for a specific commodity to be delivered at a specific time and place in the future, with the exception of basis risk. Hedging does not come without its costs, however. A farmer who wants to hedge their grain has to open an account with a commodity broker. As a farmer hedges grain, a margin account must be maintained and brokerage fees are charged to the farmer for transactions. Margin accounts have a minimum dollar requirement that account holders must maintain. When the market moves against a farmer position, margin calls are issued to the manager and they must deposit money into their account that meets the minimum dollar requirement. Depending on a farmer's access to cash or short term financing, margin calls can exhaust a farmer's capital. Hedging does reduce price risk to the farmer, but it does not eliminate it completely. A farmer that hedges their grain is still susceptible to the

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market's basis risk. Adverse basis movements expose farmers to negative returns on their hedge, therefore the stability of local basis values over time is important to farmers.

Basis is the difference between a local elevator's cash price and the futures market price. Basis is driven by local demand and supply conditions. This research focuses on the relationship between basis and elevator characteristics. What impact do elevator characteristics have on basis? The basis values might depend on a number of different characteristics such as the business structure of a cooperative versus a private grain company; access to and realized costs of transportation via rail; or truck or an elevator's storage capacity. The objective is to determine if different physical and business structure characteristics affect the basis an elevator bids to farmers in their area.

1.2 Objective & Motivation

This research is intended to explore the basis values of hard red winter wheat and the impact the physical and business structure characteristics of grain elevators in Kansas may have on the basis price of hard red winter wheat. The objective of this thesis is to understand if there is any correlation between elevator characteristics, such as bushels capacity, access to rail, shuttle loading status, and co-op business structure, and basis values. These characteristics and the basis values from 2002-2013 of two hundred twenty eight Kansas elevators are categorized and evaluated to determine if there is any statistical significance between basis and specific characteristics.

There are two groups who might find this analysis useful: Kansas grain farmers (grain sellers) and grain elevator owners (grain buyers). Farmers will be able use this research when to look for locations with the elevator characteristics that provide stronger basis values when forward contracting or selling cash at harvest. For example, a farmer that

is looking to forward contract grain six months or more into the future may want to contract a portion of his crop with an elevator with stronger basis values. Then when harvest gets closer, he may look to more local markets to sell their grain if freight and logistics play a more important role than price. This would allow the farmer to capture stronger basis values at other locations that are not their closest elevator. The research may show that some elevator characteristics have a competitive advantage over other elevators. This will allow farmers understand which grain elevator managers are more willing to negotiate basis or cash prices for grain.

Grain elevators or grain buyers may use this research to better understand their location characteristics and their ability to set their basis in local markets, especially in forward months where there is more basis risk. Grain companies interested in growth by investing in new construction or acquisitions may find the results of this research helpful in the decision making process. By understanding what characteristics carry those competitive advantages in the grain industry, companies can carefully choose assets that match what they are looking for. This research sets out to discover the competitive advantages that lay within different elevator characteristics for both the grain seller and buyer.

This research focuses on Kansas elevators and hard red winter wheat basis values. The research objective is to determine if the physical characteristics of grain elevators in Kansas have an impact on the location's basis and cash bid for hard red winter wheat. Elevators yearly average basis from 2002 -2013 are evaluated and a statistical t-test is used to provide the p-values to determine which grain elevator characteristics are correlated with stronger or narrower basis values, and those with weaker or wider basis values, and whether they are statistically significant.

CHAPTER II: LITERATURE REVIEW

2.1 Hedging

Cash markets, where a farmer sells his grain at the local elevator price, have been the preferred outlet used by producers to market they grain for years. Cash markets provide the producer with a simple alternative to the more complex marketing strategies of futures market hedging, forward contracting, and options. However, the cash market can leave a producer susceptible to price and local basis level changes that can result in a potential loss in farm revenue.

Basis risk is the relationship between the local cash price and the nearby futures contract price (Dhuyvetter 1992). Basis is determined by the local demand for a commodity and can be positive or negative based of the futures market price for that commodity. Basis can be calculated for the nearby futures contract or deferred futures contracts, depending on when the producer wants to sell his grain.

Some farmers prefer forward contracting to futures hedging because they can avoid basis risk. Basis refers to the difference in the local price of grain and a specific futures price with respect to the location. Forward contracting allows producers to contract grain with grain buyers such as elevators, processors, and feed-yards before grain is produced at a specified quality, quantity, and delivery date for an agreed price. Forward contracting removes price and basis risk from the equation and replaces it with yield risk that a producer can manage through crop insurance.

When a producer hedges grain using the futures market to remove price risk, the producer is only exposed to local basis risk where they intend to deliver their grain. Producers who choose to forward contract, as opposed to hedging or cash markets,

eliminate price risk exposure completely and transfer basis risk to the grain buyer. Forward contracting has set the price the producer will receive for their grain and obligates them to deliver the agreed amount of bushels to the grain buyer. This leaves the producer with the risk of producing what they forward contract, which is referred to as yield risk.

2.2 Basis and Forward Contracting

"The cost of forward contracting can be viewed as the expected difference between the cash price at harvest and the forward contract price" (Townsend and Brorsen 2000). As a producer enters into a forward contract agreement with a grain buyer, price risk is then transferred to the grain buyer. The additional price risk an elevator or other grain buyers takes on has a cost because of the exposure the buyer has to increasing transportation costs, basis risk, and default risk from producers they enter into contracts with. The farmer who enters into a forward contract with a grain buyer is then protected from price risk. At this point, the grain buyer will take care of the paperwork and assume the risk involved, such as margin calls and basis risk (Brorsen, Coombs, and Anderson 1995).

Grain companies understand there are additional risks associated with forward contracting and have to manage those risks through basis values. Grain elevators have different variable and fixed costs depending on location that may or may not impact their basis values in forward contracting grain. By looking at the basis values and comparing physical and business structure characteristics across grain elevators, the research will look for correlations that will reveal if some elevators have a competitive advantage in narrower basis values over other locations. The characteristics that will be evaluated in this model are elevator capacity, terminal elevators, transportation capabilities (e.g. whether it can

deliver grain by rail, truck, or both), shuttle loading elevators, and cooperative versus investor-owned business structures.

2.3 Elevator Characteristics Impact on Basis

Class I railroads like the Burlington Northern Santa Fe and Union Pacific are still the most economical form of transportation for large quantities of grain from the Midwest to export terminals located along the coast. These railroads adopted a Shuttle Loading Program that would provide incentives to its customers through reduced rail tariffs to load 100 or 110 car unit trains, called shuttle trains, with grain in a specific time period from the train's arrival at their facility. Grain elevators with this ability are known as "shuttle loaders" and are required to have the capability of loading a shuttle train in less than fifteen hours (Bekkerman 2013). The decrease in loading time by grain elevators increases the efficiency of the railroad. The shuttle loading program was a game changer for the grain industry. Contracts between grain companies and the railroad that require shuttle trains to be filled to capacity imply that shuttle loading facilities would have higher demand for grain than elevators without shuttle loading capability (Bekkerman 2013). The increased demand for grain at shuttle loading facilities is going affect how those locations look at forward contracting and the price risk they are willing take to guarantee shipment of those bushels at their locations. Bekkerman suggests that new shuttle loading entries into areas with existing facilities will raise the local competition and increase a merchants' willingness to pay higher prices for wheat.

CHAPTER III: CONCEPTUAL ISSUES

As grain prices have increased over the past decade, farmers are using more tools to protect themselves from price risk. In a 1992 survey of 539 Kansas farms, over 32% of those farms forward contracted wheat (Kastens and Schroeder 1994). Since then, the grain industry has been experiencing increased market volatility in the futures market price that has carried over into local markets and basis. Whether it is the competitive global market of today, or just supply and demand economics, this increase in market volatility brings reason for farmers and grain elevators to evaluate how they manage risk. The increase in risk management practices like forward contracting can impact how grain companies establish basis values at local elevators.

How are local grain prices established? Is it supply and demand or is there more to it than that? Grain companies will not provide internal strategies for public research. Therefore, this research is using the physical characteristics of grain elevators as proxies for strategies elevators employ to affect how they bid for wheat in Kansas. This is done by evaluating individual characteristics of grain elevators against those elevators without that characteristic and the corresponding basis values at those locations to see if an advantage is reflected.

Theoretically, storage capacity should carry cost savings through economies of scale which are reflected in narrower basis values. This research will evaluate this theory and if cost savings are reflected in the elevators' basis bids to farmers. Transportation costs are an important variable when shipping grain to markets. This research explores the role transportation plays on basis whether by rail cars, truck, or shuttle trains and which mode of transportation meets market demand in the most cost efficient manner. For example, do

elevators with shuttle loading capability reflect transportation cost savings with narrower

basis or higher cash values to farmers than those elevators without shuttle loading

capability? The theory that transportation costs decrease with volume movement by railcars

will be evaluated against those elevators that use truck transportation to meet market

demand for wheat in Kansas.

Finally, the evaluation of the business structure of the elevator will be compared.

Kansas elevators consist of cooperatives and private business. The co-op elevator consists

of member farmers that support local elevators in return for patronage from the elevator.

Private grain companies have a different philosophy to create revenue for the company.

These two business structures will be evaluated in this research to recognize if a difference

in basis values is reflected between them.

CHAPTER IV: METHODS AND MODEL

4.1 Methods Introduction

This research is based on a collection of data from two sources: The Department of Agricultural Economics at Kansas State University and the Kansas Grain and Feed Association (KGFA). The Department of Agricultural Economics collects wheat prices from grain elevators across Kansas (DTN 2013). The weekly bid prices offered from elevators are collected and recorded along with futures market prices from the Kansas City Board of Trade to establish local basis values around Kansas (KCBOT 2013). These two data series were used to calculate basis bids for 228 locations across twelve years (2002-2013).

The KGFA membership is comprised of grain and feed businesses across Kansas. KGFA collects location information from member elevators in Kansas and publishes them in a yearly directory for members' use. The directories were used to gather data on elevator bushel capacity, access to rail, and business structure between 2002 and 2013.

4.2 Basis Trends

Basis risk is the change in price the farmer will receive from their local elevator or other local markets. Basis is a function of local supply and demand and can be calculated for the nearby futures contract or deferred futures contracts depending on when the producer wants to deliver their grain. Traditionally, the basis values at local elevators were predictable. Farmers could look at basis trends and market grain at times when basis values were stronger (narrower) and receive a higher cash price. The basis risk exposure was very minimal and farmers were willing to take on basis risk with cash sales and hedging. Today's market environment is very different and grain markets have experienced

significant supply and price uncertainties throughout the 2000's" (Bekkerman 2013). This recent increase in volatility is a result from a combination of production inconsistencies and political barriers to trade (Bekkerman 2013). These market place uncertainties are impacting basis values like never before.

Figure 4.1: Nearby Wheat Basis at Four Kansas Locations (Jan. 2001 – Jan. 2012)
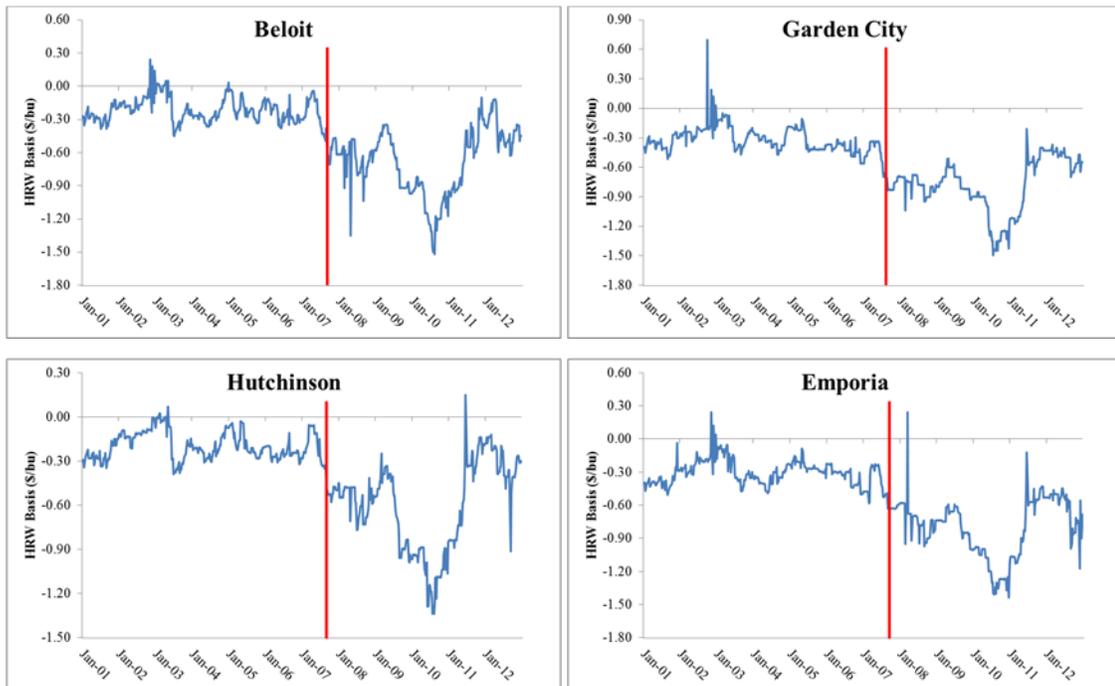
Source: Taylor, Dhuyvetter, and Tonsor (2013)

Basis risk is higher today than in previous years. Figure 4.1 displays the basis volatility in wheat basis at four elevators located in different regions on Kansas. The red vertical line indicates a structural shift in the volatility of basis that occurred in the fall of 2007. This shift corresponds to the beginning of the Great Recession.

The aggressive market swings can impact profitability for a farmer when basis was traditionally stable. This kind of volatility has caused farmers and grain companies to alter their risk management strategies. Farmers that want to forward contract will likely find weaker basis values as grain companies protect themselves from basis risk. As aggressive

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competition for grain between companies becomes more apparent, grain elevators will need to offer stronger or narrower basis values to farmers who are willing to contract grain for delivery in order to stay price competitive.

4.3 Futures Markets

Hard Red Winter Wheat prices are based off the Kansas City Board of Trade located in Kansas City, Missouri. Hard red winter wheat prices are priced against five delivery months throughout the current crop year and beyond. These five months March, May, July, September, and December. As each month expires off the board of trade, wheat prices are rolled to the next delivery month. Hard red wheat harvest takes place in late spring and early summer in Kansas. Therefore, new crop hard red winter wheat prices are priced off the Kansas City July futures month. Hard red wheat prices are recorded each day the market is trading and used by grain merchandisers around Kansas to set their local basis values at their elevator location. The hard red wheat prices used in this research are based on the closing price of the day in the nearby delivery month from 2002 thru 2013.

4.4 Model Setup and Verification

The research identified 228 member locations, shown in Figure 4.2 that reported cash wheat prices between the 2002 and 2013. Those locations were identified by using their location ID number and a data set was created from KGFA to collect the physical characteristics of each location. This information includes elevators company name, bushels capacity, access to rail transportation, and other information about the location that is included in the KGFA directory. This research collected three important characteristics that have the potential to impact basis. These characteristics are bushel capacity, access to rail, and co-op status in addition to shuttle loading and terminal status.

Figure 4.2: Number of Elevators in Sample (total = 228)
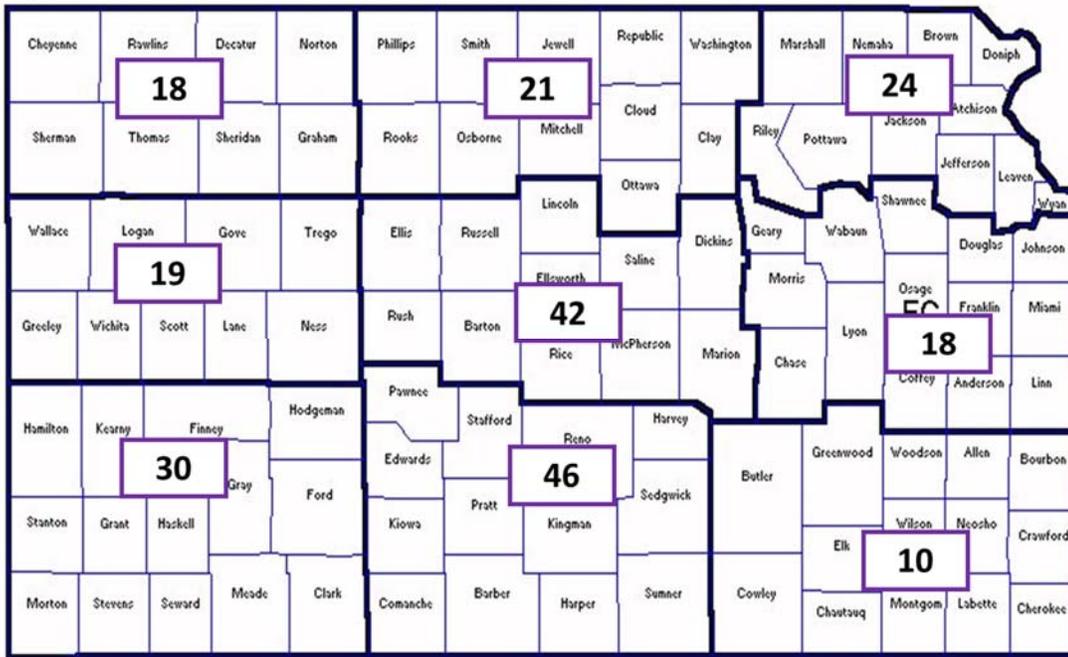
Between 2003 and 2012, the landscape of the grain industry was beginning to change again in Kansas. Co-ops were consolidating and storage was being added throughout the industry as profits were increasing in grain companies. Because the cash bids dataset was over a ten year period, each location was reviewed in the KGFA directory from 2003 to 2012 to record any changes in location bushel capacity over time. This was to maintain time period consistency between bushels capacity and basis value. Consistency between the physical characteristics and basis price is important for this research.

In order to verify the research results statistical significance, this study uses a pairwise t-test to determine if there is a statistically significant difference in the average basis values ($/bushel) by each characteristic. This research will use a cut off of less than or equal to ten percent as a threshold to substantiate that an elevator characteristic's average basis bid is statistically different than its counterpart.

4.5 Elevator Capacity

A grain elevator's capacity is the most fundamental characteristic of an elevator. Economies of scale give elevators the ability to spread costs over more bushels. An elevator's capacity is dependent on the location's licensed space; whether it is concrete silos, steel bins, or flat storage. The KGFA directory categorizes each location's capacity by upright or bin capacity and flat storage capacity. The capacity an elevator has is measured in bushels, which is the standard measurement for grain. The total capacity of each location is calculated by adding the upright and flat storage together.

Elevators with larger capacities have an advantage over elevators with less capacity because they can buy volume on smaller margins and still be profitable. Along with capacity, comes the ability to store grain. Farmers unwilling to sell grain immediately during harvest if market prices are low can store grain at the elevator for a storage cost. This is important because grain elevators cannot ship grain that is in storage and still owned by the farmer. Elevators with smaller bushel capacity have to purchase the grain at harvest in order to sell and move it to market to clear space for more grain to be purchased.

Elevators that have the space for grain will want to fill that space during harvest. Narrow or stronger basis should occur as an elevator's capacity increases. In regards to the cost of forward contracting, that would mean larger elevators have economies of scale, smaller operating costs, and reduced costs in forward contracting grain.

4.6 Terminal Elevators

With capacity comes purchasing power and terminal elevators are at the top of the supply chain in the grain industry. Terminal elevators were built to store large amounts of grain when the government subsidized elevators to store grain during crop years when

supplies were limited. Typically terminal elevators store millions of bushels of grain and are located in larger cities where grain is transported from the country side to rail hubs and then transported to export markets via rail or barge.

For this model, a terminal elevator is defined as an elevator with greater than two million bushels in capacity and access to the rail road. Today, elevators with smaller amounts of storage capacity can transport just as much grain throughout the year as the traditional terminal elevator. However, these smaller capacity elevators are located next to major rail lines and are shuttle loading facilities.

4.7 Shuttle Loading Elevator

Shuttle loaders are elevators that have agreements with Class I rail roads, such as the Burlington Northern Santa Fe (BNSF) or the Union Pacific (UP). Elevators are required to follow strict guidelines when loading shuttle trains. The advantage is the successful execution of these guidelines in the form of a monetary incentive per train. This incentive provides reduced transportation costs and increased margins for a grain elevator. This research sets out to discover the cost saving value reflected in shuttle loaders basis value through basis comparison. The expectation is that shuttle loading elevators have lower operating costs than non-shuttle loaders because the railroad passes these cost savings to their customers (Bekkerman 2013). Therefore those cost savings is expected to be reflected in stronger basis values and cash prices to farmers.

4.8 Rail versus Truck Transportation

An elevator that cannot load unit shuttle trains may still have rail access to transport their grain to market in the form of single car units. The amount of railcars that a location can load at one time will depend on the amount of track space they have. Even though an

elevator does not load shuttles, rail access allows them to ship large amounts of grain to markets further away at lower transportation costs than they could by truck. This characteristic of an elevator is still important in that it should have a competitive advantage over an elevator that can only reach markets through truck transportation.

The KGFA directory records which locations have rail access and what rail road the location has access to. Many elevators still have access rail lines. Whether or not these locations use the rail road is unknown. The issue with this characteristic is whether or not the rail line is being used. Short line railways that have been removed from service could still be listed in the directory as rail access for the location.

Elevators listed without rail access have only one way to transport grain to market and that is by truck. Truck transportation is the most expensive way to transport grain to market and typically does not travel as far away from the origin as grain transported by rail. This leaves an elevator limited options for marketing grain. The rail versus truck characteristic will be able to show if the competitive advantage through lower transportation costs is reflected in an elevator's basis bid. The expectation is that locations that transport grain by truck only will have a wider basis, or lower cash price, than elevators that can use transport grain by railcars or shuttle trains.

4.9 Cooperative Elevators

The final characteristic in the model is the identification of cooperative business structures. Cooperative elevators operate differently than investor-owned grain companies. Cooperatives exist to provide their members a resource to bring their grain to market at fair market values. This characteristic was chosen to see if there is a difference in the cost

structure between a cooperative and investor-owned grain company that is reflected in their

relative basis bids.

CHAPTER V: DATA

Although there are many different agricultural products grown in Kansas, hard red winter wheat was chosen because it is consistently grown by farmers across different regions of Kansas. One of the resources used for this research was a set of weekly basis bids calculated from price data collected from DTN and the KCBOT. The database consists of basis bids from 2003 to 2013 from elevators across Kansas.

The second resource used to collect data for the project is the Kansas Grain and Feed Association. The Kansas Grain and Feed Association is a voluntary organization with membership encompassing the entire spectrum of agriculture from grain receiving, storage, processing, and shipping industry in Kansas. Kansas Grain and Feed Association members represent ninety nine percent of the commercially licensed grain storage in Kansas (Kansas Grain and Feed Directory 2013). Since the KGFA represents such a large percent of the commercially licensed grain storage in Kansas, non-members of the KGFA should not have a large impact on the results of this study. KGFA members are included in a directory every year that publishes each location's contact information and grain elevator characteristics some of which were used in this research.

The KGFA directory provided all the characteristics needed for this research except one. Railroad access is listed in the directory; however the directory does not tell us if a location can load shuttle trains. The Burlington Northern-Santa Fe (BNSF) and Union Pacific (UP) are the only two Class I railroads that service Kansas (Burlington Northern-Santa Fe 2013, Union Pacific 2013). The BNSF and UP websites provided the list of locations in Kansas that are signed up on the BNSF and UP shuttle loading program. The

locations that the BNSF and UP recognized as shuttle loaders were identified in our data with the shuttle loading characteristic of the elevator.

The elevators included in the research basis values were calculated from 2002 - 2013. Basis values were broken down into yearly averages for each location. Following the basis value comparison is the basis value difference followed by a statistical p-value used to test for statistical significance. This research covers the basis values for hard red winter wheat in Kansas and does not reflect the basis values of other commodities. However, the results from this data could be used to discuss further research on the basis values of other commodities grown in Kansas or around the country.

CHAPTER VI: RESULTS

6.1 Elevator Capacity

The ability to store grain is critical to a grain elevator. The theory of economies of scale tells us that elevators with more storage capacity would have a competitive advantage over elevators with less capacity because their costs are spread over more bushels. If this is true, then elevators with greater capacities have the ability to offer farmers better cash bids through stronger basis values than elevators with less capacity. This research tests the economies of scale theory and capacity by separating locations into different levels of capacity starting at 1.5 million bushels up to 3 million bushels. By testing different levels of capacities, this research can establish if there is an increase in statistical significance with elevators with greater capacities than those with less. Each table establishes the number of elevators that meet the capacity requirements; basis values from 2002-2013; difference in basis values; p-values from t-tests of pairwise statistical significance; and an asterisk identifying tests with statistical significance.

Table 6.1.1 shows elevators with greater than 1.5 million bushels of capacity and those that are not. The results in Table 6.1.1 identify three years where elevators capacity greater than 1.5 million bushels had a statistically significant different basis bid than those with less than 1.5 million bushels of capacity. Table 6.1.2 breaks out the elevators with capacity greater than 2.0 million bushels. The results in Table 6.1.2 identify six years that are statistically significant. Table 6.1.3 establishes elevators with capacities greater than 2.5 million bushel capacity level. The results in Table 6.1.3 identified seven years with statistical significance. The final table in the capacity results is Table 6.1.4 that identifies elevators with greater than 3.0 million bushels. The results in Table 6.1.4 show that 2003 is

the only year that does not prove to be statistically significant with elevators with capacities greater than 3 million bushels.

From the results, we can conclude that capacity is an important characteristic to elevators and can affect an elevator's basis bids. Our results show that there is statistical significance in different years at different capacity levels. We can conclude that elevators with bushel capacities greater than 3.0 million consistently have stronger basis values than those elevators with less than 3.0 million bushels. These results support the theory of economies of scale and the assumption that elevators with greater capacities can offer higher cash bids to farmers through stronger basis values than elevators with smaller capacity amounts.

Table 6.1.1: Elevators with Greater than 1.5 Million Bushel Capacity

Capacity > 1.5 Million Bu	Number of Observations	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
No	179	-0.17	-0.18	-0.27	-0.24	-0.30	-0.44	-0.71	-0.72	-1.16	-0.80	-0.45	-0.33
Yes	49	-0.18	-0.19	-0.27	-0.22	-0.30	-0.44	-0.68	-0.67	-1.10	-0.78	-0.39	-0.30
Difference		-0.01	-0.02	0.00	0.01	0.00	0.00	0.03	0.04	0.05	0.02	0.05	0.02
P-Value		0.531	0.413	0.943	0.268	0.940	0.960	0.184	0.027	0.027	0.582	0.059	0.428
* Statistically Significant									*	*		*	

Table 6.1.2: Elevators with Greater than 2.0 Million Bushel Capacity

Capacity > 2.0 Million Bu	Number of Observations	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
No	202	-0.17	-0.18	-0.27	-0.24	-0.30	-0.44	-0.71	-0.72	-1.15	-0.80	-0.45	-0.33
Yes	26	-0.17	-0.17	-0.27	-0.20	-0.29	-0.42	-0.65	-0.63	-1.07	-0.73	-0.33	-0.25
Difference		0.00	0.01	0.01	0.04	0.02	0.03	0.07	0.08	0.09	0.07	0.12	0.08
P-Value		0.987	0.774	0.603	0.012	0.383	0.307	0.009	0.000	0.005	0.131	0.001	0.039
* Statistically Significant					*			*	*	*		*	*

Table 6.1.3: Elevators with Greater than 2.5 Million Bushel Capacity

Capacity > 2.5 Million Bu	Number of Observations	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
No	210	-0.17	-0.18	-0.28	-0.24	-0.30	-0.45	-0.71	-0.72	-1.15	-0.80	-0.45	-0.33
Yes	18	-0.16	-0.18	-0.25	-0.15	-0.27	-0.39	-0.61	-0.60	-1.05	-0.70	-0.32	-0.24
Difference		0.01	0.00	0.03	0.09	0.04	0.06	0.10	0.11	0.10	0.09	0.13	0.10
P-Value		0.566	0.936	0.200	0.000	0.101	0.063	0.001	0.000	0.006	0.110	0.001	0.024
* Statistically Significant					*			*	*	*	*		*	*

Table 6.1.4: Elevators with Greater than 3.0 Million Bushel Capacity

Capacity > 3.0 Million Bu	Number of Observations	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
No	218	-0.17	-0.18	-0.28	-0.24	-0.31	-0.45	-0.71	-0.71	-1.15	-0.80	-0.44	-0.33
Yes	10	-0.11	-0.15	-0.21	-0.06	-0.18	-0.27	-0.52	-0.53	-0.97	-0.59	-0.30	-0.19
Difference		0.06	0.03	0.07	0.18	0.13	0.18	0.20	0.19	0.18	0.22	0.14	0.14
P-Value		0.073	0.622	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.003	0.003
* Statistically Significant		*		*	*	*	*	*	*	*	*	*	*

6.2 Terminal Elevators versus Non Terminal Elevators

The next characteristic studied was terminal elevator basis versus the basis of non-terminals. By definition for this research, terminal elevators have access to rail markets and storage capacity greater than two million bushels. Terminal elevators typically would have a higher demand for grain at their location due to their ability to transport large quantities of grain to market in a timely manner via rail. This higher demand would be reflected in narrower basis values and higher cash prices to farmers than those elevators that are not terminal elevators. In order to test the theory that terminal elevators offer stronger basis values than non-terminal elevators, this research tested terminals elevators at three different capacity levels to determine statistical significance.

Table 6.2.1 is the first table that breaks down basis values at with terminal elevators with 2.0 million bushels of capacity. The results from the pairwise t-test give us p-values in seven out of twelve years that are statistically significant. These results lend confidence to the theory that terminal elevators will, on average, have stronger basis values than non-terminal elevators. Table 6.2.2 continues to test this theory for stronger validation of terminals at the 3.0 million bushel capacity level. The results for terminal elevators at the 3.0 million bushel capacity increase in statistical significance. 2003 is the only year that is not statistically significant. Eleven out of the twelve years for terminal elevators with 3.0 million bushels capacity prove to offer a statistically significant stronger basis value than elevators that do not meet the 3.0 bushel terminal criteria. Table 6.2.2 has terminal elevators posting basis values from six cents a bushel to twenty two cents a bushel stronger than non-terminal elevators. Table 6.2.3 tests terminal elevators at the 4.0 million bushel capacity to confirm that there is statistical significance in the terminal elevator

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characteristic. The results in 6.2.3 show that there is statistical significance in each year that price data was provided. Terminal elevators at the 4.0 million bushel capacity level, on average, have stronger basis values than elevators that do not meet the 4.0 million bushel terminal definition.

Table 6.2.1: Terminal Elevators with Greater than 2.0 Million Bushel Capacity

Terminal Elevators at 2 million Bu	Number of Observations	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Non Terminal	203	-0.17	-0.18	-0.27	-0.24	-0.30	-0.45	-0.71	-0.72	-1.15	-0.80	-0.45	-0.33
Terminal	25	-0.17	-0.17	-0.27	-0.19	-0.28	-0.41	-0.64	-0.63	-1.06	-0.72	-0.33	-0.25
Difference		0.00	0.01	0.01	0.05	0.02	0.04	0.07	0.09	0.09	0.09	0.12	0.08
P-Value		0.920	0.783	0.606	0.004	0.267	0.192	0.004	0.000	0.003	0.078	0.001	0.039
* Statistically Significant					*			*	*	*	*	*	*

Table 6.2.2: Terminal Elevators with Greater than 3.0 Million Bushel Capacity

Terminal Elevators at 3 million Bu	Number of Observations	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Non Terminal	218	-0.17	-0.18	-0.28	-0.24	-0.31	-0.45	-0.71	-0.71	-1.15	-0.80	-0.44	-0.33
Terminal	10	-0.11	-0.15	-0.21	-0.06	-0.18	-0.27	-0.52	-0.53	-0.97	-0.59	-0.30	-0.19
Difference		0.06	0.03	0.07	0.18	0.13	0.18	0.20	0.19	0.18	0.22	0.14	0.14
P-Value		0.094	0.627	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.003	0.003
* Statistically Significant		*		*	*	*	*	*	*	*	*	*	*

Table 6.2.3: Terminal Elevators with Greater than 4.0 Million Bushel Capacity

Terminal Elevators at 4 million Bu	Number of Observations	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Non Terminal	221	-0.17	-0.18	-0.27	-0.24	-0.31	-0.45	-0.71	-0.71	-1.15	-0.80	-0.44	-0.33
Terminal	7				-0.01	-0.13	-0.24	-0.44	-0.48	-0.93	-0.52	-0.30	-0.18
Difference		First three years don't have prices from any elevators with >4.0 mil bu reported			0.23	0.18	0.21	0.27	0.23	0.22	0.28	0.14	0.15
P-Value					0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.008	0.006
* Statistically Significant					*	*	*	*	*	*	*	*	*

6.3 Shuttle Loading Elevators

The third elevator characteristic studied in this research is the shuttle loader. Several grain elevators being built today are shuttle loading facilities. The ability to transport large quantities of grain with lower transportation costs would be an advantage to a grain elevator in Kansas. The expectation is that elevators with the shuttle loading characteristic should have narrower basis levels than those elevators unable to load a unit train, based on the theory of lower transportation costs. This follows the assumption that shuttle loading elevators have a higher demand for wheat to meet the capacity requirements of unit trains. Storage capacity does not matter as much to shuttle loading facilities, as long as the elevator can store enough grain to load a shuttle train.

Table 6.3 shows compares shuttle loading facilities and non-shuttle loading facilities average basis values per year. By calculating the difference between these two characteristics, the data shows that shuttle loading facilities consistently have narrower basis than non-shuttle loading facilities by about fourteen cents. This difference ranges from nine cents a bushel to as much as nineteen cents a bushels. The t-test results show that there is statistical significance in the basis value of a shuttle loading elevator as compared to an elevator that is not a shuttle loader. The statistically significant results supported the idea that shuttle loading elevators have a competitive advantage over non-shuttle loading elevators, offering Kansas farmers narrower basis values through higher cash prices for hard red winter wheat.

Table 6.3: Shuttle Loading Elevators versus Non Shuttle Loading Elevators

Shuttle Loaders	Number of Observations	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Non Shuttle	217	-0.17	-0.18	-0.28	-0.24	-0.31	-0.45	-0.71	-0.71	-1.15	-0.80	-0.44	-0.33
Shuttle Loader	11	-0.03	-0.07	-0.14	-0.13	-0.21	-0.35	-0.58	-0.58	-1.03	-0.66	-0.34	-0.24
Difference		0.15	0.11	0.14	0.11	0.09	0.09	0.13	0.13	0.12	0.14	0.10	0.09
P-Value		0.000	0.017	0.000	0.000	0.001	0.011	0.000	0.000	0.005	0.038	0.023	0.047
* Statistically Significant		*	*	*	*	*	*	*	*	*	*	*	*

6.4 Rail Access versus Truck Access

The next characteristic tests the theory that moving grain in bulk by railcars reduces transportation costs relative to moving grain by truck. The research compares elevators with railroad access versus those elevators that do not have rail access. Table 6.4 shows the distribution of elevators with rail access (151) and elevators without (77). Shuttle loading elevators are included in the data with the elevators that have rail access. The results in Table 6.4 show basis values remain almost equal between elevators with rail access and elevators without. The p-values results indicate two years in the data that are different at a statistically significant level. Therefore the average basis bid by an elevator with rail access is not narrower than it is from an elevator without rail access at a statistically significant level. The conclusion from these results is that, if elevators with rail access have lower transportation costs than those that do not have rail access, it is not reflected through narrower basis bids for wheat.

Table 6.4: Elevators with Rail Access versus Elevators without Rail Access (Truck Only)

Rail Access	Number of Observations	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Yes	151	-0.18	-0.17	-0.27	-0.24	-0.31	-0.44	-0.71	-0.71	-1.15	-0.79	-0.44	-0.32
No	77	-0.15	-0.20	-0.27	-0.23	-0.28	-0.44	-0.70	-0.71	-1.13	-0.79	-0.41	-0.32
Difference		0.02	-0.03	0.00	0.01	0.03	0.00	0.00	0.00	0.01	0.00	0.03	0.00
P-Value		0.069	0.132	0.833	0.257	0.026	0.885	0.840	0.903	0.526	0.915	0.223	0.960
* Statistically Significant		*				*							

6.5 Cooperative versus Investor-Owned Business Structures

The final characteristic considered in this research is the business structure of the grain elevator. Cooperatives and privately owned grain companies operate under a different business structure that might be reflected in their basis bids. Cooperative elevators were classified as cooperatives if their business name had "cooperative" included in the KGFA directory. The results indicate that in only one year (2011) were the bids from cooperative elevators different at a statistically significant level as compared to bids from investor-owned elevators. Results shown in Table 6.5 suggest that cooperatives and investor-owned elevators will have comparable basis values from year to year.

Table 6.5: Cooperative Elevators versus Investor-Owned Elevators

Co-op	Number of Observations	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
No	56	-0.17	-0.16	-0.27	-0.19	-0.29	-0.46	-0.69	-0.71	-1.16	-0.87	-0.42	-0.30
Yes	172	-0.17	-0.18	-0.27	-0.25	-0.30	-0.44	-0.71	-0.70	-1.14	-0.77	-0.43	-0.33
Difference		0.00	-0.02	-0.01	-0.06	-0.02	0.03	-0.02	0.01	0.02	0.10	-0.01	-0.02
P-Value		0.818	0.372	0.555	0.000	0.241	0.181	0.341	0.556	0.299	0.006	0.720	0.489
* Statistically Significant											*		

CHAPTER VII: CONCLUSION

The goal of this research was to explore grain elevator characteristics and the basis values associated with those characteristics. The characteristics examined were associated with size, transportation, and business structure. The research set out to discover statistical evidence that confirms one characteristic has a competitive advantage over its counterpart. If any advantage was present an elevator would reflect that competitive advantage through narrower or stronger basis values.

Bushel capacity was shown to be statistically significant and reflect narrower or stronger basis values. This theory was tested at four different bushel capacity levels to strengthen the argument that elevators with larger bushels capacities have narrower or stronger basis values based on the theory of economies of scale. The consistency of statistical significance in terminal elevators also increased as bushel capacity increased from 2.0 million bushels to 4.0 million bushels.

The transportation costs in moving grain around the country by rail or truck can vary throughout the year. Elevators with the lower transportation costs should have the ability to offer stronger basis values than those with more expensive transportation costs. The one statistically significant characteristic a grain elevator has over another is its ability to load shuttle train units. The assumption that a shuttle loader has a competitive advantage is widely accepted and this research proves that basis values reflect those savings in transportation costs compared to those that cannot load shuttle trains. However, when the analysis only considered those elevators with rail access versus those without rail access, there was insufficient evidence to say rail access provides a competitive advantage to a grain elevator through stronger or narrower basis values.

Farmers may find this analysis useful when researching basis bids at different locations as they consider the impacts of various physical and business structure characteristics on the average basis bids offered by different elevators. Grain companies may consider the ability of elevators with certain characteristics to offer more competitive basis bids as a reflection of a more competitive cost structure. This could impact future asset investment decisions by these companies. Future research needs to consider the interaction of these physical and business structure characteristics, as well as geographic proximity and market conditions, and how that may be impacting basis bids for wheat in Kansas.

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