The effects of transportation on wheat prices to local Kansas wheat farmers

by

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ABSTRACT

Wheat farmers in Kansas play a critical role in helping feed the world. They work under volatile conditions that are unpredictable each year such as weather, basis, prices and yield. There are many factors that play into the volatility, specifically for basis prices, like transportation. This can be affected by the price of diesel, rail, ocean freight and futures price. While diesel is a major transportation input on farm operations and in grain transport, costs such as ocean freight and rail for exported commodities can be overlooked. Ocean freight plays a factor as roughly 50% of the wheat grown in Kansas is exported.

The goal of this thesis is to examine how prices of diesel, rail, ocean freight and futures affect wheat basis for local wheat farmers across Kansas. The data for this study were collected from AgManager.info, the United States Department of Agriculture Agricultural Marketing Service, the United States Energy Information Administration and the Federal Reserve Economic Data. Data were collected as monthly averages from 2015 to 2023, a nine-year span, which included diesel prices, rail tariff rates, ocean freight rates, wheat futures prices and basis from elevators across Kansas including 21 towns from three counties in each of the seven agriculture districts.

Elasticity has some variability across the models. Combining all seven districts, results indicated that on average, a 1% increase in futures would result in a 0.47% decrease in basis, a 1% increase in ocean freight would result in 2.47% increase in basis, a 1% increase in diesel would result in a 0.89% decrease in basis and a 1% increase in rail would result in a 0.12% increase in basis.

Farmers should look at futures price, ocean freight, local diesel price and rail tariff rate before making decisions at elevators as all four factors affect wheat basis, with futures and diesel commonly decreasing basis and ocean freight and rail tariff rates commonly increasing basis. By looking at these factors, it will help farmers determine whether to sell their wheat or wait.

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ACKNOWLEDGMENTS

I would first like to thank my family, who have helped provide me the resources and encouragement to pursue an education and career in agriculture while they manage my family's operation each and every day, and providing me a passion for such an amazing industry. It is with much pride that I get to say my family helps feed, clothe and fuel the world.

Pursuing a master's degree while working full time is not for the weak. It wouldn't be right for me to not thank the faculty of the Agricultural Economics Department and Master of Agribusiness program at Kansas State University for their guidance and seamless education programs.

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CHAPTER I: INTRODUCTION

Kansas, the "Wheat State," has been the leading producer of hard red winter wheat in the United States for decades. Wheat farmers in Kansas play a critical role in helping feed the world. They work under volatile conditions that are unpredictable each year such as weather, basis, prices and yield. There are many factors that play into the volatility, specifically for basis, like transportation. This can be affected by the price of diesel and ocean freight. While diesel is a major transportation input on farm operations and grain transportation, costs such as ocean freight and rail rates for exported commodities can be overlooked. Ocean freight plays a factor as roughly 50% of the wheat grown in Kansas is exported. Rail transportation is used to move grain from elevators to port locations for exports as well as moving grain around the state and country for demands of mills and protein plants.

Basis is important to farmers as it affects the amount of payment for their wheat crop, and these prices are affected by futures prices, production and freight. Basis price is the amount in cents per bushel above or below a futures price for each month.

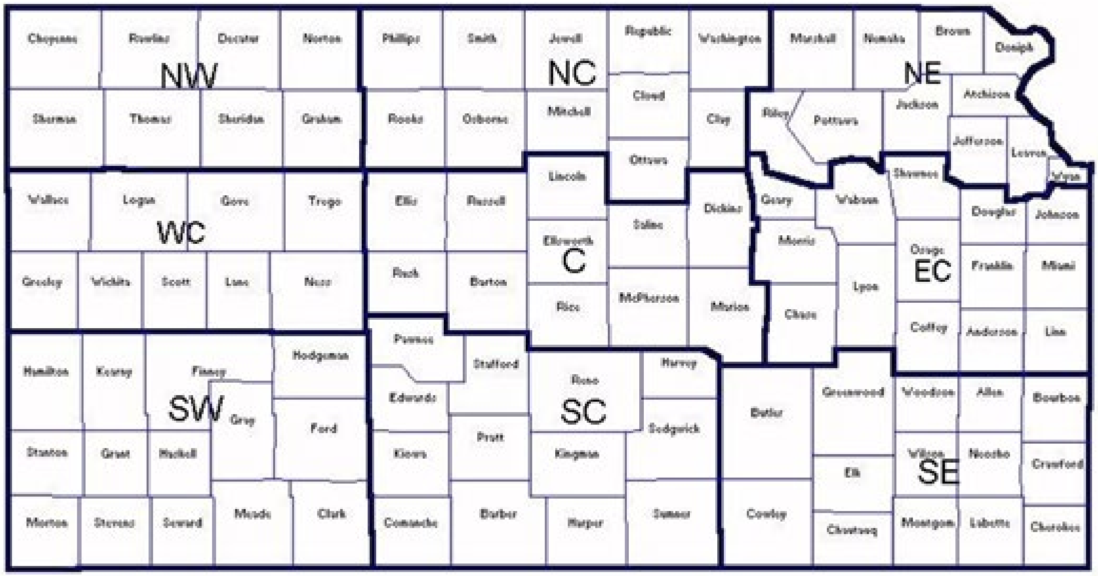
The data for this study were collected from AgManager.info, the United States Department of Agriculture Agricultural Marketing Service, the United States Energy Information Administration and the Federal Reserve Economic Data. Data were collected as monthly averages from 2015 to 2023, a nine-year span, which included diesel prices, rail tariff rates, ocean freight rates, wheat futures prices and basis from elevators across Kansas, including 21 towns from three counties in each of the seven Kansas Wheat agriculture districts. The nine-year span will examine how the variables have affected basis over time and if specific variables have had their own changes over time. The towns used in this study from district one included Herndon (Rawlins County), Goodland (Sherman County) and Colby (Thomas County). The towns used in this study from district two included Ness City (Ness County), Oakley (Logan County) and Grainfield (Gove County). The towns used in this study from district three included Garden Plain (Finney County), Bucklin (Ford County) and Meade (Meade County). The towns used in this study from district four included Morganville (Clay County), Minneapolis (Ottawa County) and Osborne (Osborne County). The towns used in this study from district five included Hays (Ellis County), Salina (Saline County) and Gorham (Russell County). The town used in this study from district six included Viola (Sedgwick County), Milton (Sumner County) and Isabel (Barber County). The towns used in in this study from district seven included Whitewater (Butler County), Junction City (Geary County) and Columbus (Cherokee County). By using three locations in different counties in each of the seven districts Kansas Wheat defines, this study can produce an understanding of the effects on wheat basis across the state.

The elevators used in this study from district one contained basis data from Decatur Cooperative Association in Rawlins County, Frontier Equity Cooperative in Sherman County and Cornerstone Ag in Thomas County. The elevators used in this study from district two contained basis data from De Bondurant Grain Cooperative in Ness County, Frontier Ag in Logan County and Frontier Ag Inc. in Gove County. The elevators used in this study from district three contained basis data from Garden Plain Cooperative in Finney County, Offerle Cooperative in Ford County and Cooperative Elevator in Meade County. The elevators used in this study from district four contained basis data from Farmer

Cooperative in Clay County, Scoular Grain Co. in Ottawa County and Midway in Osborne County. The elevators used in this study from district five contained basis data from Midland Marketing in Ellis County, Scoular Grain Co. in Saline County and United Ag in Russell County. The elevators used in this study from district six contained basis data from Garden Plain Cooperative in Sedgwick County, Farmers Cooperative in Sumner County and Farmers Cooperative Equity in Barber County. The elevators used in this study from district seven contained basis data from Mid Kansas Cooperative in Butler County, Geary Grain Inc. in Geary County and Farmers Cooperative in Cherokee County.

Figure 1.1 shows the Kansas agricultural districts. District one is NW on the map, district two is WC, district three is SW, district four is NC, district five is C, district 6 is SC and district seven is NE, EC and SE. District seven contains three areas where there is not as much wheat grown in the eastern third of the state compared the other two thirds.

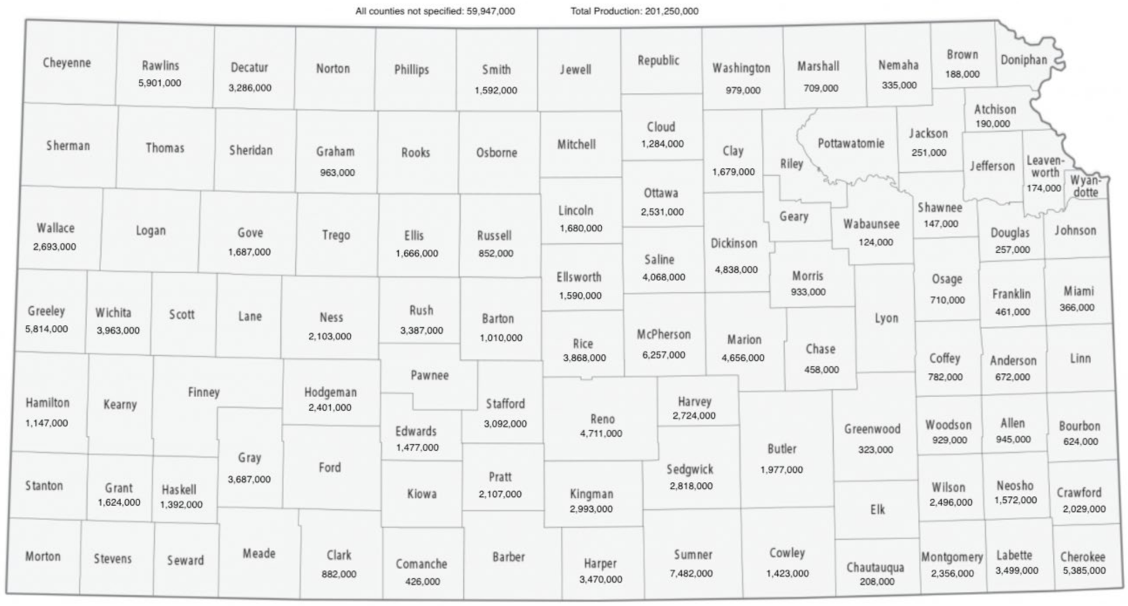
Figure 1.1: Kansas Agricultural Statistics Districts



Source: https://barber.ks.gov/uploads/5/6/1/9/56198487/ag_stats_crd_map.pdf

Production in wheat varies around the state from county to county – as shown in Figure 1.2. From east to west and north to south there is a large variation in in production between the counties with some clusters of higher producing counties and some clusters of lower producing counties. Notably, higher production numbers are more often seen on the west two thirds of the state compared to the east third of the state. Additionally, larger production numbers are seen in the south-central part of the state. This is where Sumner County is located, which is the highest producing wheat county in the state of Kansas.

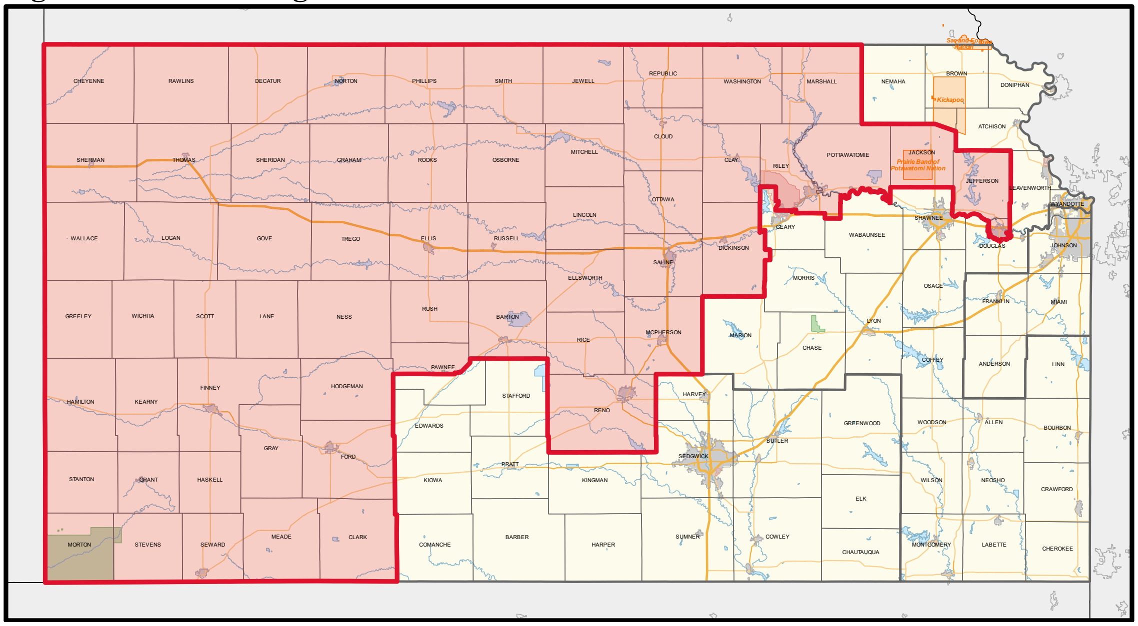
Figure 1.2: 2023 Kansas Wheat Production in Bushels



Source: https://quickstats.nass.usda.gov/results/545DE8BC-635A-35FC-8CEE-F5CC107E8BA1#D70FA63D-421E-376E-8DFE-3D08489B4A92

These counties produce large amounts of wheat and have contributed to the first district of Kansas being the 6th largest producing United States House of Representatives congressional district in the United States of grains (The Big First District). With Kansas' large role in wheat production in the U.S., it's important to understand the scale of production these counties are contributing to the overall production for the country. The overall scale of the First District and the amount of wheat acres planted is an important factor in Kansas' economy. This contributes to the importance of understanding what factors are affecting wheat farmers basis – especially transportation.

Figure 1.3: Kansas Big First District



Source: https://en.wikipedia.org/wiki/Kansas%27s_1st_congressional_district

The intent of this research is to understand the factors that affect wheat basis for local farmers, specifically looking at transportation including diesel, rail and ocean freight. This looks at nine years of historical prices and data to determine the factors causing basis changes, including years between 2015 – 2023. The nine years of data contains enough years to study the volatile basis that occurred from 2015 and 2016, when basis plummeted. Nine years of data helps to determine how volatility in transportation has directly affected prices by seeing the fluctuation over those years. This data provide farmers with a better understanding on how basis directly affects them, and what causes the basis to move. Fifty percent of the wheat in Kansas is exported, so it must have a mode of transportation to get it to its final destination – which in many cases is ocean freight when it gets exported globally. It may also, in some circumstances, be able to give farmers and economists a look into the future as to what could be expected of basis prices based on historical data. This study will examine how transportation directly affects farmers and their basis given at the local elevator.

CHAPTER II: LITERATURE REVIEW

Kansas, the "Wheat State," has been the leading producer of hard red winter wheat in the United States for decades, with records of wheat production pre-dating statehood (Bounds, 2019). There are indications that wheat was produced in the area as early as 1839 (Bounds, 2019).

To better understand how basis can be affected by future prices and transportation prices, an overview of the technical meaning of each term is necessary. Basis is defined as the amount in cents per bushel a specified local cash price is above or below a futures price for a specified delivery month (Baldwin). A futures price is a quote for a purchase contract – the agreed-upon cost of the commodity by the two parties, the buyer and the seller (Nickolas, 2022). The futures price locks in the cost of the commodity that will be delivered at some point other than the present (Nickolas, 2022). Individuals who observe basis carefully are likely to make more profitable decisions (Anderson). With knowledge of basis, individuals may more easily decide whether to accept a given price, whether to store a crop, and whether, when, and what delivery month to hedge (Anderson). It is also easier to decide when to close or lift a hedge and when and how to turn an unusual basis situation into a profit opportunity (Anderson). Basis is a key to effective marketing (Anderson).

Changes in the difference between cash and futures market prices (basis) often indicate the real gains or losses to be made by hedging (Maass and Waller, 2001). For this reason, the ability to understand/predict basis movements is important for producers and merchandisers (Maass and Waller, 2001). Maass and Waller's research indicated that taking advantage of seasonal patterns that exist and understanding the factors that hold over time can lead to better decisions in selling grain.

A study done in 2011 on grain pricing and transportation found that basis prices have become more volatile and less predictable over the years (Wilson and Dahl, 2011). This greater volatility results in more risk for producers and shippers, and exacerbates planning and investment for handling and shipping infrastructure (Wilson and Dahl, 2011).

Bekkerman, Taylor, Ridder, and Briggeman's research on impacts of shuttle loading grain facilities on basis patterns concluded that a more complete understanding of how changes in the efficiency of grain handling affect elevators' willingness to bid for grain facilitates several practical outcomes. First, grain producers can increase their understanding of relative basis bid behavior by shuttle-loading and conventional competitive advantage (Bekkerman, Taylor, Ridder and Briggeman, 2014). Second, this research can help identify spatio-temporal factors affecting basis patterns in response to changing conditions in Great Plains wheat markets (Bekkerman, Taylor, Ridder and Briggeman, 2014).

Bekkerman, Brester and Taylor found that hard red winter wheat, which is the primary type of wheat grown in Kansas, is easier to forecast than spring wheat. In addition, it found that winter wheat handling facilities consider both global market information and local demand and supply factors when making pricing decisions. Winter wheat models showed relative importance of both local and futures market information (Bekkerman, Brester and Taylor, 2016).

Saline County, Kansas is one of the top 10 producing winter wheat counties in Kansas. In 2005, a study by Tajchman found that the price of fuel, rail rates and labor costs played a role in determining basis for any location. The significance of the monthly basis moving average variable indicated using previous prices to predict a future value will result in a dependable basis calculation (Tajchman, 2005). Additionally, if producers notice the basis stronger than usual during the timeframe of July – August, which was the widest months of basis, they should take advantage of the opportunity (Tajchman, 2005).

CHAPTER III: METHODS AND DATA

Transportation takes various forms including, diesel, which is used by semi-trucks, combines or tractors, rail, which is used to transport wheat around to destinations either across the state or country and ocean freight, which is sea transportation used for exports and imports of grain. Diesel is used every day on farms – whether it's filling up the truck, planting wheat, harvesting wheat or transporting wheat to local elevators or central markets. Rail transportation is used for a variety of different reasons. Wheat is transported by rail to get it near the coast for ocean freight or moving it from elevator to mills. Ocean freight plays a role in wheat transportation as 50% of the wheat produced in Kansas is exported. Ocean freight plays an important role in shipping grain to the countries that purchase and import wheat. Unless it's Mexico or Canada, truck or rail transportation of grain to its destination is not possible. The expected effect of transportation on wheat basis is that if cost increases, this will weaken prices to wheat farmers.

This study looks at the other factors – pricing. Futures price represent a world price for wheat at a future date. Basis price is the dependent variable for this study – seeing how futures price, ocean freight, rail and diesel affect it. The expected effect of an increase in futures price is that it will strengthen basis price at local elevators and strengthen prices to wheat farmers.

To conduct this study, a regression analysis was conducted for 21 towns in Kansas, which were from different counties in the seven agriculture districts (three counties/towns per district). The towns used in this study from district one included Herndon (Rawlins County), Goodland (Sherman County) and Colby (Thomas County). The towns used in this study from district two included Ness City (Ness County), Oakley (Logan County) and

Grainfield (Gove County). The towns used in this study from district three included Garden Plain (Finney County), Bucklin (Ford County) and Meade (Meade County). The towns used in this study from district four included Morganville (Clay County), Minneapolis (Ottawa County) and Osborne (Osborne County). The towns used in this study from district five included Hays (Ellis County), Salina (Saline County) and Gorham (Russell County). The town used in this study from district six included Viola (Sedgwick County), Milton (Sumner County) and Isabel (Barber County). The towns used in in this study from district 7 included Whitewater (Butler County), Junction City (Geary County) and Columbus (Cherokee County).

The basis prices for each location were different, but they were regressed against the same variables of futures price, ocean freight, rail and diesel price. These were all collected in monthly increments from the years 2015-2023. All four variables – ocean freight, diesel, rail and futures price are national data.

3.1 Analysis Results

Wheat basis, futures price, diesel, rail and ocean freight all have fluctuations over the nine-year time period. The basis price data for this study was obtained from DTN information that Kansas State University uses to calculate basis, that is available on AgManager.info. Futures prices, diesel, rail and ocean freight were all taken from historical records.

Figure 3.1: Wheat Basis 2015-2023 District 1

District one shows variability in basis prices from 2015 – 2023, with a large decrease in 2016 and 2022. District one also shows a major increase in 2020, where all three towns consistently increased at the same time. All three counties followed a relatively similar pattern in basis, with Herndon showing the biggest difference, showing a lower basis in 2022.

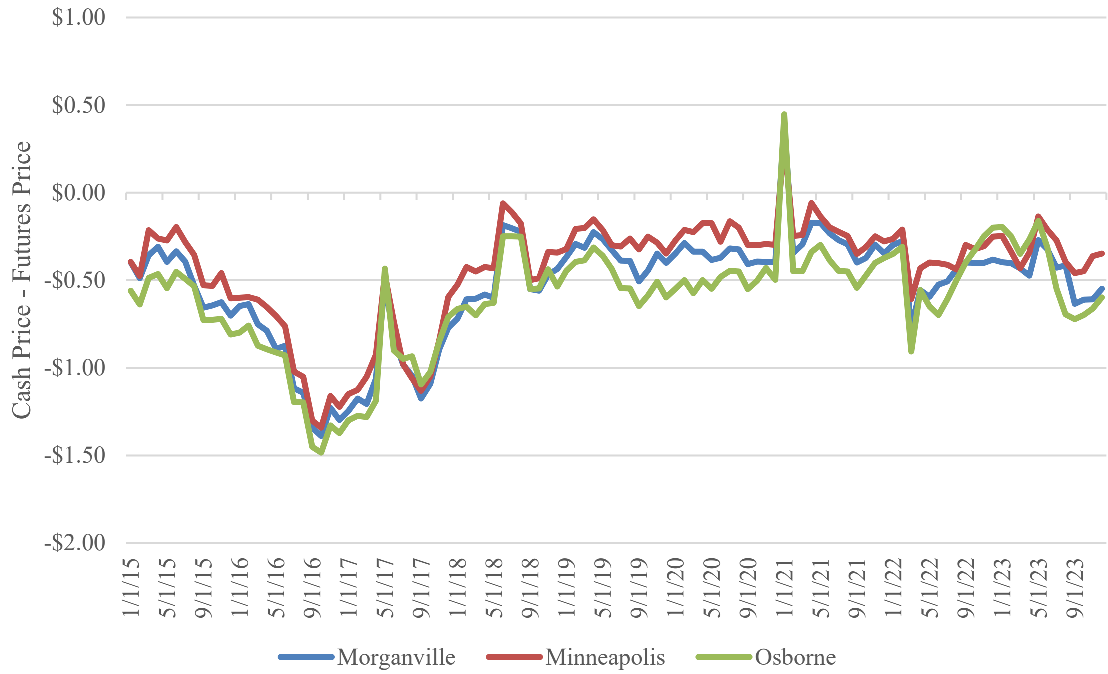
Figure 3.2: Wheat Basis 2015-2023 District 2

District two shows a very consistent basis from the three counties, except for July 2022 when Oakley saw a major decrease and Ness City and Grainfield stayed at the same basis. District two shows a basis decrease in 2016, along with all of the other districts, a steady increase with minor changes in basis from early 2017 to 2020. In early 2021, there was a basis increase throughout all of the towns, and a decrease in early 2022 before leveling out and then seeing another decrease in late 2023.

Figure 3.3: Wheat Basis 2015-2023 District 3

District three shows a higher decrease in basis in 2016, an increase in the beginning 2017 with another decrease the end of 2017, an increase in 2018 and a steadier basis through 2020. The end of 2020 shows another basis increase, with the beginning of 2022 showing another decrease before it levels out into 2023. While basis from the different counties followed a similar pattern for most of the 9-years, Garden Plain saw a notably higher basis June of 2015, the end of 2016 to beginning of 2017 and 2019 through 2020.

Figure 3.4: Wheat Basis 2015-2023 District 4



District four which shows a noticeable decrease in basis in 2016, an increase in the beginning 2017 with another decrease the end of 2017, an increase in 2018 and a steadier basis through 2020. The end of 2020 shows another basis increase, with the beginning of 2022 showing another decrease before it levels out into 2023.

Figure 3.5: Wheat Basis 2015-2023 District 5

District five shows an almost identical graph to district four and very similar to district three, which shows a noticeable decrease in basis in 2016, an increase in the beginning 2017 with another decrease the end of 2017, an increase in 2018 and a steadier basis through 2020. The end of 2020 shows another basis increase, with the beginning of 2022 showing another decrease before it levels out into 2023. District five shows more difference between the counties in the district compared to some of the other districts that have a similar basis.

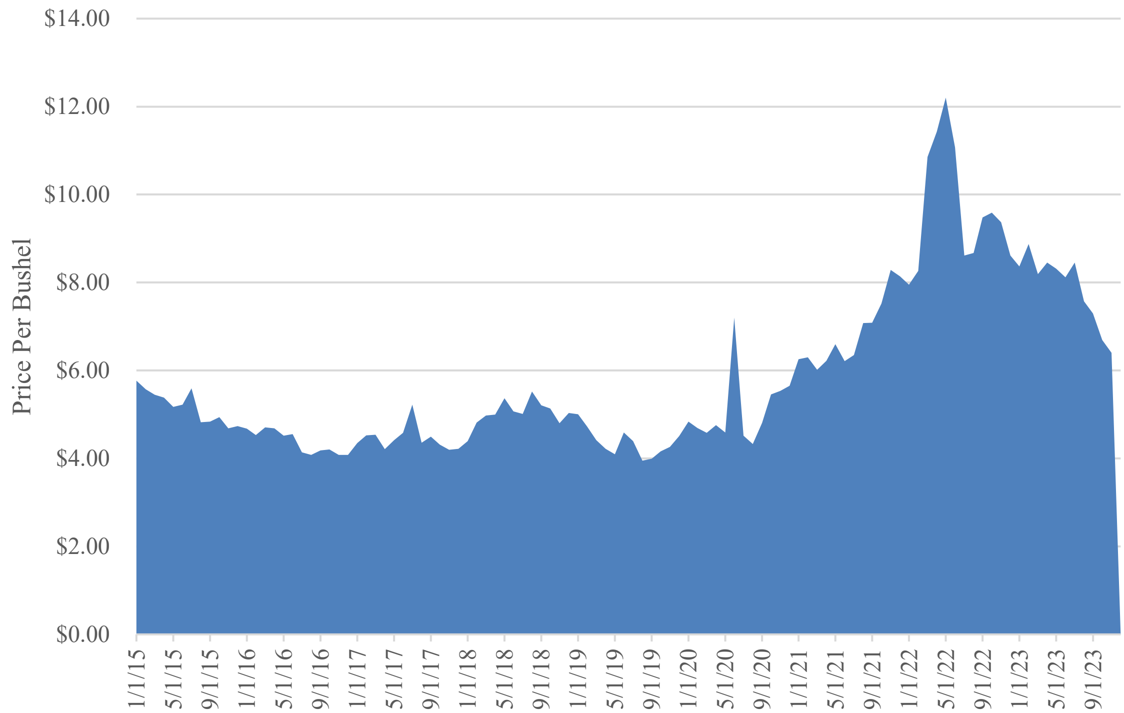
Figure 3.6: Wheat Basis 2015-2023 District 6

District six shows the largest jumps in basis, with a steep decline in 2016, a large increase in mid 2017, another decrease in late 2017 and a large increase beginning of 2018. Throughout the rest of 2018 – 2023 there are sudden, noticeable changes in basis with another increase in the beginning of 2021 and another large decrease the beginning of 2022. District 6 has the largest producing wheat county, Sumner County, and produces a substantial amount of wheat in the area.

Figure 3.7: Wheat Basis 2015-2023 District 7

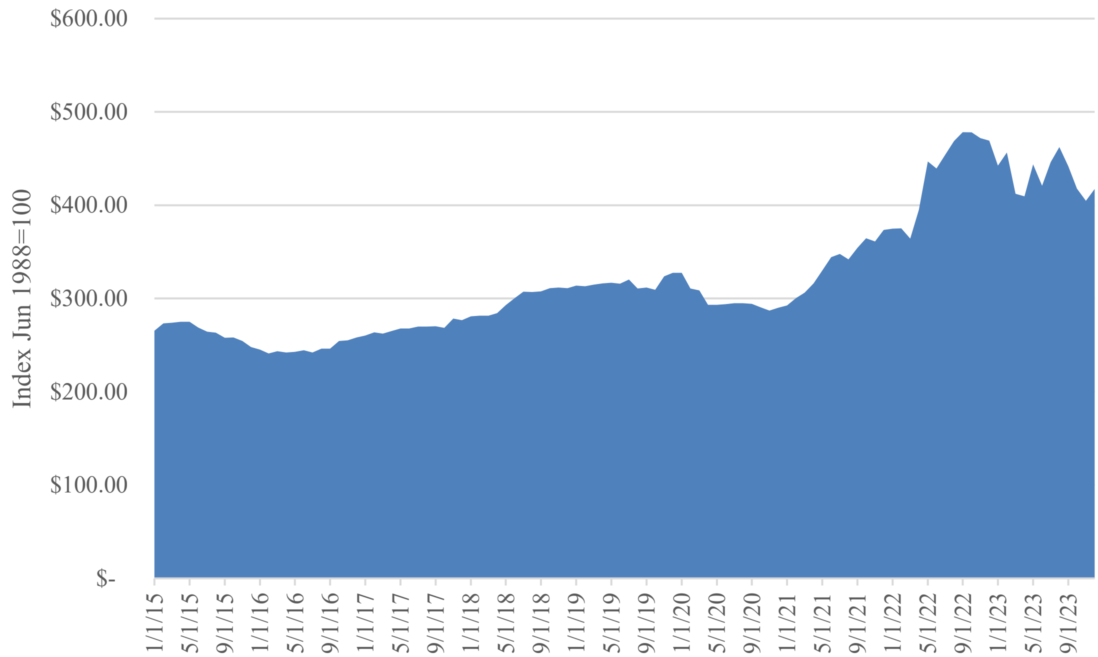
District seven has the most differences compared to other graphs, with an increase in 2017, as well as an increase at the end of 2020/beginning of 2021. Figure 3.7 shows smaller variations in basis, compared to the other districts that have more drastic changes throughout. District seven has the largest amount of area with the largest cities and the least amount of wheat grown, which could be what lead to different numbers on the graph.

Figure 3.8: Wheat Futures Price 2015 - 2023



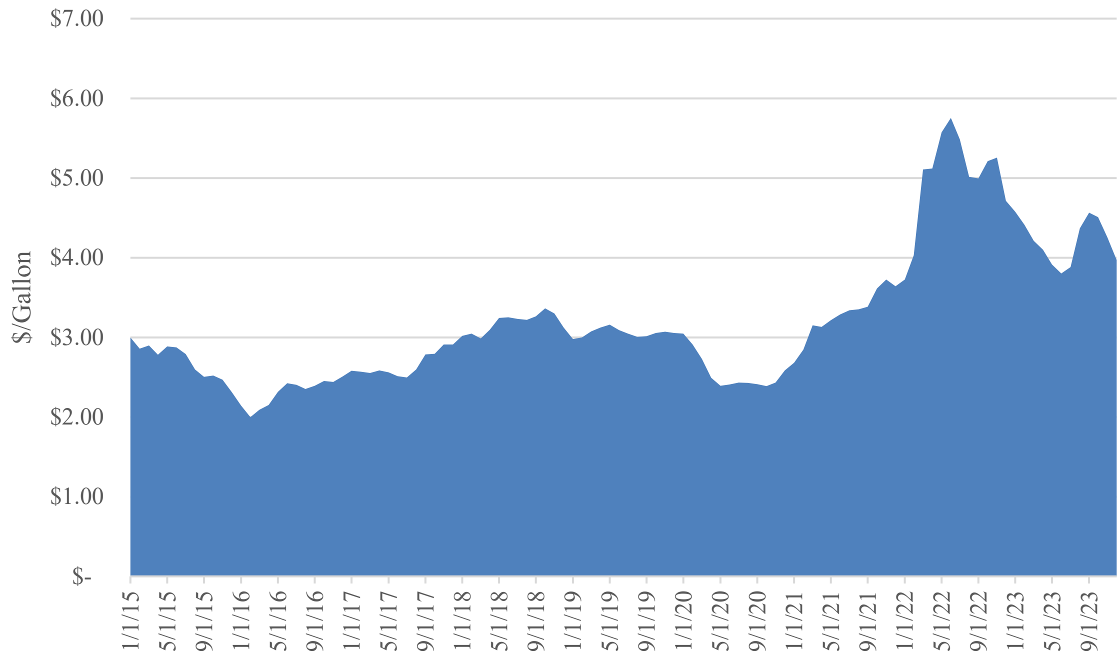
When comparing basis and futures price figures, there are some similarities, but quite a few differences in variability on the graphs. The noticeable differences in price occurred in May of 2017 for basis, where there was an increase in futures and in January 2021 basis sees a spike, where futures show a steady increase. In further comparison, it's noticeable that futures price increases in May of 2020, and basis stays level. Futures price tends to have a steadier incline and decline in price in certain years, with a few major movements, compared to basis prices, which tend to stay more level but have higher increases. Basis 'localizes' the futures price with respect to location, time and quality (Dhuyvetter).

Figure 3.9: Ocean Freight Rates 2015 - 2023



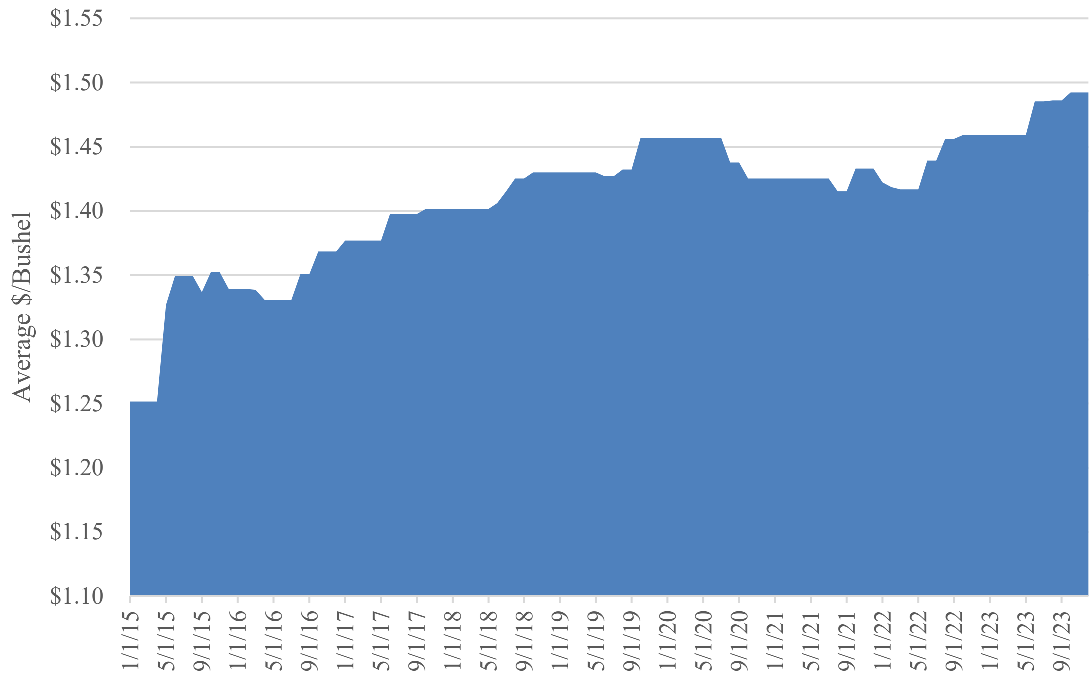
When initially looking at ocean freight, there is not a whole lot of variability throughout the time period. Notably, there is a rise in price in April of 2021, with a major increase in April of 2022. When comparing to the basis and futures price, those exact times, specifically April of 2022, the start of the Russia Ukraine conflict, saw a large decrease in basis and an increase in futures price. Another noticeable similarity between ocean freight and futures price graphs is that they both stay at an increased price after the large increase in April of 2022. The increases in prices were due to the COVID-19 pandemic and the Russia invasion of Ukraine. The COVID-19 pandemic started in March of 2020, and Russia invaded Ukraine in February of 2022.

Figure 3.10: Diesel Price 2015 - 2023



Diesel prices seem to follow a similar pattern as ocean freight, but with more variability. Despite the similarities, there are also a few differences. While both diesel and ocean freight saw decreases in price in a few periods, particularly 2016, 2020 and May of 2023, diesel had much more higher decreases compared to ocean freight. Additionally, diesel saw a larger spike in May of 2022 compared to ocean freight. The COVID-19 pandemic lead to decreased diesel and ocean freight prices initially in March of 2020, but then steadily increased from there with some slight decreases into 2023.

Figure 3.11: Rail Tariff Rate 2015 - 2023



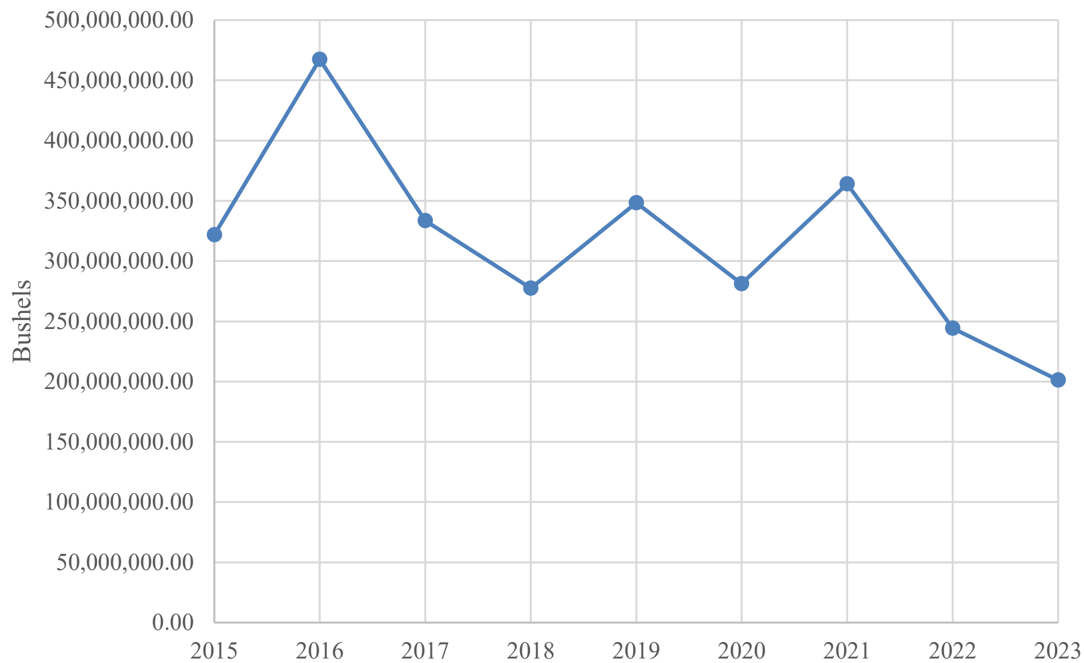
Rail tariff rates were the steadiest compared to the other transportation variables of diesel and ocean freight. The graph shows a drastic and permanent increase in rail rates in June of 2015, which slowly increased into 2023. Additionally, the graph shows steady prices for periods at a time, that other variables, such as ocean freight, diesel futures price or basis price did not see. Rail tends to lock in more future contracts, showing a steadier average $/bushel.

Table 3.1: Correlation Among Independent Variables

	Futures	Ocean Freight	Diesel	Rail
Futures	1			
Ocean Freight	0.836	1		
Diesel	0.877	0.923	1	
Rail	0.382	0.678	0.512	1

A correlation was estimated between futures, ocean freight, diesel and rail. These variables are highly correlated with the smallest being 0.38 between futures and rail and largest being 0.92 between diesel and ocean freight. Multicollinearity is likely to occur in the regressions as the independent variables are all highly correlated. Multicollinearity deflects the statistical significance of the variables but should not bias the coefficient estimates. Table 3.1 indicates that the regression analysis may produce a lower t-stat, but that does not affect the predictions from it.

Figure 3.12: Kansas Wheat Total Production 2015 - 2023



The data used in this study were from years 2015 – 2023. There is fluctuation in production over the nine years due to a drought that occurred and took a large hit on western Kansas wheat production in 2022 and 2023. There is a noticeable drop in production in 2022 and 2023 (Figure 3.12).

Table 3.2: Wheat Acres Planted and Harvested, Yield, Production, Price and Farm Value – Kansas: 2015 – 2023

Year	Area Planted (1,000 Acres)	Area Harvested (1,000 Acres)	Yield Per Acre (Bushels)	Production (1,000 Bushels)	Price Received (Per Bushel)
2015	9,200	8,700	37.0	321,900	$4.74
2016	8,500	8,200	57.0	467,400	$3.20
2017	7,600	6,950	48.0	333,600	$4.07
2018	7,700	7,300	38.0	277,400	$4.93
2019	7,100	6,700	52.0	348,400	$4.08
2020	6,600	6,250	45.0	281,250	$4.53
2021	7,300	7,000	52.0	364,000	$6.74
2022	7,300	6,600	37.0	244,200	$8.80
2023	8,100	5,750	35.0	201,250	$7.50

Table 3.2 shows the variability in planted acres, harvested acres, yield, production and price from 2015 through 2023. While planted area remained the same or increased in 2022 and 2023, lower production occurred due to a lower yield and many acres were abandoned. The lower production in wheat resulted in a higher price received in 2022 and 2023.

CHAPTER IV: ANALYSIS AND DISCUSSION

The regression analysis outputs from each of the 21 towns showed similarities and differences – some more significant than others. The differences had to do with production and vicinity to wheat demand such as mills or protein plants.

Table 4.1: District 1 Wheat Basis Analysis

District 1	Herndon (Rawlins Co.)	Goodland (Sherman Co.)	Colby (Thomas Co.)
Intercept	0.169 [0.176] (0.861) {0.0966}	0.356 [0.384] (0.702) {0.927}	-0.148 [-0.164] (0.870) {0.906}
Futures	-0.049 [-2.479] (0.015) {0.020}	-0.050 [-2.614] (0.010) {0.019}	-0.037 [-1.971] (0.051) {0.188}
Ocean Freight	0.004 [3.034] (0.003) {0.001}	0.004 [3.209] (0.002) {0.001}	0.004 [3.133] (0.002) {0.001}
Diesel	-0.167 [-1.83] (0.069) {0.091}	-0.135 [-1.539] (0.127) {0.088}	-0.139 [-1.623] (0.108) {0.086}
Rail	-0.958 [-1.209] (0.229) {0.792}	-1.116 [-1.468] (0.145) {0.760}	-0.721 [-0.970] (0.334) {0.743}
Multiple R	0.352	0.372	0.379
R Squared	0.124	0.139	0.144
Adj. R Squared	0.089	0.105	0.111
Significance F	0.008	0.004	0.003
Standard Error	0.277	0.266	0.259

*Cells with four numbers; top is coefficient, bracket is t-Stat, parentheses are p-value and braces are standard error.

District 1 included data from Herndon (Rawlins County), Goodland (Sherman County) and Colby (Thomas County). Herndon's regression analysis showed statistical significance at the 5% level in futures and ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.05, a $1.00 change in ocean freight index would result in $0.004 increase in basis, a $1.00 change in diesel per gallon would result in a -$0.17 change in basis and a $1.00 change in rail tariff rate would result in a -$0.96 change in basis. Herndon's R Squared indicates the independent variables explained 12.3% of the movement in basis, leaving roughly 87% of the movement unexplained.

Goodland's regression analysis showed statistical significance at the 5% level in futures and ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.05, a $1.00 change in index in ocean freight would result in $0.004 affect in basis, a $1.00 change in diesel per gallon would result in a -$0.14 change in basis and a $1.00 change in rail tariff rate would result in a -$1.12 change in basis. Goodland's R Square indicates the independent variables explained 13.9% of the movement in basis, leaving roughly 86% of the movement unexplained.

Colby's regression analysis showed statistical significance at the 5% level in ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.04, a $1.00 change in index in ocean freight would result in $0.004 increase in basis, a $1.00 change in diesel would result in a -$0.14 change in basis and a $1.00 change in rail tariff rate would result in a -$0.72 change in basis. Colby's R Square projected the variables s explained 14.4% of the movement in basis, leaving roughly 85% of the movement unexplained from the data. Of note, Herndon has the NKC railway go through town, and Goodland and Colby have KYLE railway go through the towns.

In comparison, all three towns in district 1 showed significance in ocean freight from the p-value, with Colby being the only one of the three not showing significance in futures. All three towns showed a significance F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. The coefficients for futures, ocean freight, diesel and rail all showed similar results across the board, with the most fluctuation in rail across towns.

Table 4.2: District 2 Wheat Basis Analysis

District 2	Ness City (Ness Co.)	Oakley (Logan Co.)	Grainfield (Gove Co.)
Intercept	-0.475 [-0.501] (0.617) {0.947}	0.137 [0.133] (0.894) {1.027}	0.216 [0.235] (0.815) {0.919}
Futures	-0.052 [-2.633] (0.009) {0.019}	-0.033 [-1.573] (0.119) {0.021}	-0.048 [-2.503] (0.014) {0.019}
Ocean Freight	0.005 [3.867] (0.000) {0.001}	0.004 [3.004] (0.003) {0.001}	0.004 [3.417] (0.001) {0.001}
Diesel	-0.181 [-2.017] (0.046) {-0.089}	-0.231 [-2.380] (0.019) {0.097}	-0.155 [-1.779] (0.0783) {0.087}
Rail	-0.634 [-0.816] (0.416) {0.777}	-0.857 [-1.017] (0.312) {0.842}	-1.032 [-1.369] (0.174) {-1.032}
Multiple R	0.473	0.324	0.369
R Squared	0.224	0.105	0.152
Adj. R Squared	0.194	0.07	0.119
Significance F	2.688E-05	0.021	0.002
Standard Error	0.272	0.294	0.264

*Cells with four numbers; top is coefficient, bracket is t-Stat, parentheses are p-value and braces are standard error.

District 2 included data from Ness City (Ness County), Oakley (Logan County) and Grainfield (Gove County). Ness City's regression analysis showed statistical significance at the 5% level in futures, ocean freight and diesel from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.05, a $1.00 change in index in ocean freight would result in $0.005 increase in basis, a $1.00 change in diesel would result in a -$0.18 change in basis and a $1.00 change in rail tariff rate would result in a -$0.63 change in basis. Ness City's R Square indicated the independent variables explained 22.4% of the movement in basis, leaving roughly 77% of the movement unexplained.

Oakley's regression analysis showed statistical significance at the 5% level in ocean freight and diesel from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.03, a $1.00 change in index in ocean freight would result in $0.004 affect in basis, a $1.00 change in diesel would result in a -$0.23 change in basis and a $1.00 change in rail tariff rate would result in a -$0.86 change in basis. Oakley's R Square indicated the independent variables explained 10.5% of the movement in basis, leaving roughly 89% of the movement unexplained.

Grainfield's regression analysis showed statistical significance at the 5% level in futures and ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.05, a $1.00 change in index in ocean freight would result in $0.004 increase in basis, a $1.00 change in diesel would result in a -$0.15 change in basis and a $1.00 change in rail tariff rate would result in a -$1.03 change in basis. Grainfield's R Square indicated the independent variables explained 15.2% of the movement in basis, leaving roughly 84% of the movement unexplained. Of note, Ness City has the K and O railways go through town.

In comparison, ocean freight was statistically significant in each town. All three towns showed a statistical significance F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. Futures, ocean freight and diesel all showed similar results for each town, while the rail coefficient showed more fluctuation.

Table 4.3: District 3 Wheat Basis Analysis

District 3	Garden Plain (Finney Co.)	Bucklin (Ford Co.)	Meade (Meade Co.)
Intercept	-1.792 [-1.881] (0.063) {0.953}	-1.113 [-1.215] (0.227) {0.916}	-0.693 [-0.739] (0.462) {0.938}
Futures	-0.043 [-2.166] (0.326) {0.197}	-0.037 [-1.968] (0.052) {0.018}	-0.028 [-1.447] (0.151) {0.019}
Ocean Freight	0.003 [2.376] (0.019) {0.001}	0.005 [3.866] (0.000) {0.001}	0.005 [3.503] (0.000) {0.001}
Diesel	-0.107 [-1.183] (0.239) {0.090}	-0.179 [-2.071] (0.041) {0.087}	-0.169 [-1.903] (0.059) {0.089}
Rail	0.662 [0.847] (0.399) {0.782}	-0.178 [-0.238] (0.812) {0.751}	-0.438 [-0.569] (0.571) {0.769}
Multiple R	0.436	0.518	0.462
R Squared	0.190	0.268	0.213
Adj. R Squared	0.159	0.239	0.183
Significance F	0.000	1.561E-06	5.19E-05
Standard Error	0.273	0.262	0.269

*Cells with four numbers; top is coefficient, bracket is t-Stat, parentheses are p-value and braces are standard error.

District 3 included data from Garden Plain (Finney County), Bucklin (Ford County) and Meade (Meade County). Garden Plain's regression analysis showed statistical significance at the 5% level in futures and ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.04, a $1.00 change in index in ocean freight would result in \$0.003 increase in basis, a \$1.00 change in diesel would result in a -\$0.11 change in basis and a \$1.00 change in rail tariff rate would result in a \$0.66 change in basis. Garden Plain's R Square indicated the independent variables explained 19.0% of the movement in basis, leaving roughly 81% of the movement unexplained.

Bucklin's regression analysis showed statistical significance at the 5% level in ocean freight and diesel from the p-value. The results indicated a \$1.00 change in futures will change basis by -\$0.04, a \$1.00 change in index in ocean freight would result in \$0.005 increase in basis, a \$1.00 change in diesel would result in a -\$0.18 change in basis and a \$1.00 change in rail tariff rate would result in a -\$0.18 change in basis. Bucklin's R Square indicated the independent variables explained 26.8% of the movement in basis, leaving roughly 73% of the movement unexplained.

Meade's regression analysis showed statistical significance at the 5% level in ocean freight from the p-value. The results indicated a \$1.00 change in futures will change basis by -\$0.03, a \$1.00 change in index in ocean freight would result in \$0.005 increase in basis, a \$1.00 change in diesel would result in a -\$0.17 change in basis and a \$1.00 change in rail tariff rate would result in a -\$0.44 change in basis. Meade's R Square indicated the independent variables explained 21.3% of the movement in basis, leaving roughly 78% of the movement unexplained. Of note, Meade and Bucklin have the BNSF railway go through town.

In comparison, districts three's data was much more variability compared to districts 1 and 2. None of the town's p-value significance was the same, but they did all result in ocean freight being statistically significant in each model. All three towns showed a statistically significant F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. Futures, ocean freight and diesel all showed similar results across the board, while rail showed a bit of fluctuation with almost a 1.00 difference between the counties. The sign for rail was different in Garden Plain than Bucklin and Meade.

Table 4.4: District 4 Wheat Basis Analysis

District 4	Morganville (Clay Co.)	Minneapolis (Ottawa Co.)	Osborne (Osborne Co.)
Intercept	-1.274 [-1.333] (0.185) {0.956}	-1.660 [-1.729] (0.087) {0.966}	-1.246 [-1.358] (0.177) {0.917}
Futures	-0.044 [-2.212] (0.029) {0.019}	-0.033 [-1.675] (0.097) {0.019}	-0.052 [-2.754] (0.007) {0.019}
Ocean Freight	0.004 [3.226] (0.002) {0.001}	0.004 [2.735] (0.007) {0.001}	0.005 [3.639] (0.000) {0.001}
Diesel	-0.127 [-1.399] (0.165) {0.090}	-0.107 [-1.183] (0.239) {0.091}	-0.099 [-1.143] (0.256) {0.087}
Rail	0.011 [0.014] (0.989) {0.784}	0.413 [0.524] (0.601) {0.788}	-0.166 [-0.221] (0.826) {0.752}
Multiple R	0.489	0.479	0.558
R Squared	0.239	0.229	0.311
Adj. R Squared	0.209	0.199	0.284
Significance F	1.019E-05	1.881E-05	7.912E-08
Standard Error	0.274	0.275	0.263

*Cells with four numbers; top is coefficient, bracket is t-Stat, parentheses are p-value and braces are standard error.

District 4 included data from Morganville (Clay County), Minneapolis (Ottawa County) and Osborne (Osborne County). Morganville's regression analysis showed statistical significance at the 5% level in futures and ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.04, a $1.00 change in index in ocean freight would result in $0.004 increase in basis, a $1.00 change in diesel would result in a -$0.23 change in basis and a $1.00 change in rail tariff rate would result in a $0.01 change in basis. Morganville's R Square indicated the independent variables explained 23.9% of the movement in basis, leaving roughly 76% of the movement unexplained.

Minneapolis's regression analysis statistical showed significance at the 5% level in futures and ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.03, a $1.00 change in index in ocean freight would result in $0.004 increase in basis, a $1.00 change in diesel would result in a -$0.12 change in basis and a $1.00 change in rail tariff rate would result in a $0.41 change in basis. Minneapolis' R Square indicated the independent variables explained 22.9% of the movement in basis, leaving roughly 77% of the movement unexplained.

Osborne's regression analysis showed statistical significance at the 5% level in futures and ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.05, a $1.00 change in index in ocean freight would result in $0.005 increase in basis, a $1.00 change in diesel would result in a -$0.09 change in basis and a $1.00 change in rail tariff rate would result in a -$0.17 change in basis. Osborne's R Square indicated the independent variables explained 31.1% of the movement in basis, leaving roughly 69% of the movement unexplained. Of note, Osborne and Minneapolis have the KYLE railway go through their towns.

In comparison, all three locations showed the same statistical significance of futures and ocean freight. All three towns showed a significance F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. Futures, ocean freight and diesel all showed similar results across the model, while rail showed a bit of fluctuation with almost a 0.50 difference between the counties.

Table 4.5: District 5 Wheat Basis Analysis

District 5	Hays (Ellis Co.)	Salina (Saline Co.)	Gorham (Russell Co.)
Intercept	-0.826 [-0.853] (0.396) {0.969}	-1.413 [-1.535] (0.128) {0.921}	-1.027 [-1.093] (0.277) {0.939}
Futures	-0.049 [-2.485] (0.015) {0.020}	-0.018 [-0.949] (0.345) {0.019}	-0.038 [-1.928] (0.056) {0.019}
Ocean Freight	0.005 [0.001] (0.000) {0.001}	0.004 [2.775] (0.007) {0.001}	0.005 [3.575] (0.001) {0.001}
Diesel	-0.205 [0.092] (0.028) {0.092}	-0.110 [-1.264] (0.209) {0.087}	-0.177 [-1.993] (0.049) {0.889}
Rail	-0.245 [0.794] (0.759) {0.794}	0.298 [0.395] (0.694) {0.755}	-0.116 [-0.150] (0.881) {0.771}
Multiple R	0.456	0.495	0.483
R Squared	0.208	0.245	0.233
Adj. R Squared	0.177	0.216	0.204
Significance F	7.193E-05	7.079E-06	1.472E-05
Standard Error	0.278	0.264	0.269

*Cells with four numbers; top is coefficient, bracket is t-Stat, parentheses are p-value and braces are standard error.

District 5 included data from Hays (Ellis County), Salina (Saline County) and Gorham (Russell County). Hays' regression analysis showed statical significance at the 5% level in futures, ocean freight and diesel from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.05, a $1.00 change in index in ocean freight would result in \$0.005 increase in basis, a \$1.00 change in diesel would result in a -\$0.21 change in basis and a \$1.00 change in rail tariff rate would result in a -\$0.25 change in basis. Hays' R Square indicated the independent variables explained 20.8% of the movement in basis, leaving roughly 79% of the movement unexplained.

Salina's regression analysis showed statistical significance at the 5% level in ocean freight from the p-value. The results indicated a \$1.00 change in futures will change basis by -\$0.02, a \$1.00 change in index in ocean freight would result in \$0.004 increase in basis, a \$1.00 change in diesel would result in a -\$0.11 change in basis and a \$1.00 change in rail tariff rate would result in a \$0.29 change in basis. Salina's R Square indicated the independent variables explained 24.5% of the movement in basis, leaving roughly 75% of the movement unexplained.

Gorham's regression analysis showed statistical significance at the 5% level in ocean freight and diesel from the p-value. The results indicated a \$1.00 change in futures will change basis by -\$0.04, a \$1.00 change in index in ocean freight would result in \$0.005 increase in basis, a \$1.00 change in diesel would result in a -\$0.18 change in basis and a \$1.00 change in rail tariff rate would result in a -\$0.12 change in basis. Gorham's R Square indicated the independent variables explained 23.3% of the movement in basis, leaving roughly 76% of the movement unexplained. This district contains a few flour mills, including locations in McPherson County, Saline County and is a KC Board of Trade Contract point – hauling wheat via rail to purchasers. These create stronger basis as they are demand for local wheat.

In comparison, all three locations showed different statistical significance, but ocean freight was significant at the 5% level for all models. Futures, ocean freight and diesel all showed similar results across the board, while rail showed a bit of fluctuation with almost a 0.50 difference between the counties. All three towns showed a statistical significance F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. Phillipsburg, Kansas, located in Phillips County, which falls in district five, has a wheat protein plant, Amber Waves. This protein plant has demand pulls that can affect wheat basis, as well as hauling wheat that can reduce basis. District five did show smaller rail numbers compared to districts one, two, three and four. Of note, all three towns have the Union Pacific railway go through, with a meeting of the Union Pacific and K and O railways in Salina.

Table 4.6: District 6 Wheat Basis Analysis

District 6	Viola (Sedgwick Co.)	Milton (Sumner Co.)	Isabel (Barber Co.)
Intercept	-1.643 [-1.721] (0.088) {0.956}	-1.765 [-1.833] (0.069) {0.963}	-1.101 [-1.106] (0.271) {0.996}
Futures	-0.043 [-2.159] (0.033) {0.198}	-0.043 [-2.155] (0.033) {0.019}	-0.042 [-2.056] (0.042) {0.021}
Ocean Freight	0.003 [2.461] (0.016) {0.001}	0.003 [2.362] (0.200) {0.001}	0.003 [2.248] (0.027) {0.001}
Diesel	-0.109 [-1.212] (0.228) {0.090}	-0.107 [-1.177] (0.242) {0.091}	-0.096 [-1.022] (0.309) {0.094}
Rail	0.545 [0.696] (0.488) {0.783}	0.646 [0.817] (0.416) {0.789}	0.159 [0.195] (0.846) {0.817}
Multiple R	0.434	0.432	0.369
R Squared	0.188	0.186	0.137
Adj. R Squared	0.156	0.155	0.103
Significance F	0.000	0.000	0.004
Standard Error	0.274	0.276	0.286

*Cells with four numbers; top is coefficient, bracket is t-Stat, parentheses are p-value and braces are standard error.

District 6 included data from Viola (Sedgwick County), Milton (Sumner County) and Isabel (Barber County). Viola’s regression analysis showed statistical significance at the 5% level in futures and ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.04, a $1.00 change in index in ocean freight would result in $0.003 increase in basis, a $1.00 change in diesel would result in a -$0.11 change in basis and a $1.00 change in rail tariff rate would result in a $0.55 change in basis.

Viola's R Square indicated the independent variables explained 18.8% of the movement in basis, leaving roughly 81% of the movement unexplained from the data.

Milton's regression analysis showed statistical significance at the 5% level in futures and ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.04, a $1.00 change in index in ocean freight would result in $0.003 increase in basis, a $1.00 change in diesel would result in a -$0.12 change in basis and a $1.00 change in rail tariff rate would result in a $0.65 change in basis. Milton's R Square indicated the independent variables explained 18.6% of the movement in basis, leaving roughly 81% of the movement unexplained.

Isabel's regression analysis showed statistical significance at the 5% level in futures and ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.04, a $1.00 change in index in ocean freight would result in $0.003 affect in basis, a $1.00 change in diesel would result in a -$0.09 change in basis and a $1.00 change in rail tariff rate would result in a $0.16 change in basis. Isabel's R Square indicated the independent variables explained 13.7% of the movement in basis, leaving roughly 86% of the movement unexplained. Wichita, Kansas in Sedgwick County is the home to Grain Craft, Stafford County Flour Mill and Ardent Mills wheat mills, pulling demand for local wheat. Additionally, it contains a Kansas City Board of Trade contract point. The mills and KC Board of Trade contract points create a stronger basis near demand levels, which narrows the basis.

In comparison, this district is the only one that all three locations have the exact same statistical significance from the p-value: futures and ocean freight. All three towns showed a statistically significant F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. Futures, ocean freight and diesel all showed similar results across the board, while rail showed a bit of fluctuation with almost a 0.40 difference between the counties.

Table 4.7: District 7 Wheat Basis Analysis

District 7	Whitewater (Butler Co.)	Junction City (Geary Co.)	Columbus (Cherokee Co.)
Intercept	-1.988 [-1.909] (0.059) {1.041}	-1.726 [-1.568] (0.120) {1.101}	-3.056 [-2.248] (0.027) {1.359}
Futures	-0.054 [-2.495] (0.014) {0.022}	-0.041 [-1.794] (0.076) {0.023}	-0.030 [-1.079] (0.283) {0.028}
Ocean Freight	0.004 [2.484] (0.015) {0.001}	0.004 [2.463] (0.015) {0.002}	0.002 [1.195] (0.235) {0.002}
Diesel	-0.096 [-0.977] (0.331) {0.098}	-0.126 [-1.207] (0.230) {0.104}	-0.199 [-1.544] (0.126) {0.129}
Rail	0.666 [0.779] (0.437) {0.854}	0.454 [0.503] (0.616) {0.903}	1.859 [1.667] (0.099) {1.115}
Multiple R	0.464	0.420	0.351
R Squared	0.215	0.177	0.123
Adj. R Squared	0.185	0.145	0.089
Significance F	4.601E-05	0.000	0.008
Standard Error	0.298	0.316	0.389

*Cells with four numbers; top is coefficient, bracket is t-Stat, parentheses are p-value and braces are standard error.

District 7 included data from Whitewater (Butler County), Junction City (Geary County) and Columbus (Cherokee County). Whitewater's regression analysis showed statistical significance at the 5% level in futures and ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.05, a $1.00 change in index in ocean freight would result in $0.004 increase in basis, a $1.00 change in diesel would result in a -$0.09 change in basis and a $1.00 change in rail tariff rate would result in a $0.67 change in basis. Whitewater's R Square indicated the independent variables explained 21.5% of the movement in basis, leaving roughly 78% of the movement unexplained.

Junction City's regression analysis showed statistical significance at the 5% level in futures and ocean freight from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.04, a $1.00 change in index in ocean freight would result in $0.004 increase in basis, a $1.00 change in diesel would result in a -$0.13 change in basis and a $1.00 change in rail tariff rate would result in a $0.45 change in basis. Junction City's R Square indicated the independent variables explained 17.7% of the movement in basis, leaving roughly 82% of the movement unexplained.

Columbus' regression analysis did not show statistical significance at the 5% level in anything from the p-value. The results indicated a $1.00 change in futures will change basis by -$0.03, a $1.00 change in index in ocean freight would result in $0.002 increase in basis, a $1.00 change in diesel would result in a -$0.19 change in basis and a $1.00 change in rail tariff rate would result in a $1.00.86 change in basis. Columbus's R Square indicated the independent variables explained 12.3% of the movement in basis, leaving roughly 87% of the movement unexplained. This district contains mills in Montgomery County, Riley County and Cowley County. While the least amount of wheat is produced in the eastern third of the state, there is still demand in the district for wheat creating a lower basis. Of note, Whitewater has the Union Pacific railway go through town, Junction City has the

Union Pacific railway go through town and Columbus has the BNSF railway go through town.

In comparison the three locations had differences, where Columbus did not have any statistically significant variables and was the only one of the data set that did not show any significance at all. All three towns showed a statistically significant F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. District seven showed the most variation in variables, with futures, ocean freight and diesel showing similar results, while rail showed a bit of fluctuation with almost a 1.20 difference between the counties.

Table 4.8: Elasticity Estimates for Futures Price, Ocean Freight Rates, Diesel Prices, and Rail Rates

	Futures	Ocean Freight	Diesel	Rail
Herndon	0.42	-1.89	0.78	1.95
Goodland	0.53	-2.39	0.78	2.83
Colby	0.36	-2.08	0.73	1.67
Ness City	0.50	-2.69	0.96	1.47
Oakley	0.31	-2.20	1.19	1.92
Grainfield	0.46	-2.32	0.82	2.40
Garden Plain	0.58	-2.32	0.79	-2.14
Bucklin	0.38	-2.76	1.01	0.44
Meade	0.30	-2.69	1.00	1.13
Morganville	0.48	-2.56	0.76	-0.03
Minneapolis	0.44	-2.66	0.78	-1.32
Osborne	0.51	-2.46	0.53	0.39
Hays	0.53	-2.84	1.20	0.63
Salina	0.34	-3.71	1.15	-1.36
Gorham	0.46	-3.17	1.20	0.35
Viola	0.59	-2.49	0.83	-1.82
Milton	0.59	-2.37	0.80	-2.12
Isabel	0.58	-2.33	0.72	-0.52
Whitewater	0.62	-2.26	0.60	-1.83
Junction City	0.47	-2.37	0.79	-1.25
Columbus	0.34	-1.39	1.22	-5.01

Table 4.8 showed for district one, Herndon, results indicated a 1% increase in futures price will decrease the basis by 0.42%, a 1% increase in ocean freight will

increase the basis by 1.89%, a 1% increase in diesel will decrease the basis by 0.78% and a 1% increase in rail will decrease basis by 1.95%. For Goodland, results indicated a 1% increase in futures price will decrease basis by 0.53%, a 1% increase in ocean freight would result in 2.39% increase in basis, a 1% increase in diesel would result in a 0.78% decrease in basis and a 1% increase in rail would result in a 2.83% decrease in basis. For Colby, results indicated a 1% increase in futures would result in a 0.36% decrease of basis, a 1% increase in ocean freight would result in 2.08% increase in basis, a 1% increase in diesel would result in a 0.73% decrease in basis and a 1% increase in rail would result in a 1.67% decrease in basis.

Table 4.8 showed for district two, Ness City, results indicated a 1% increase in futures would result in a 0.50% decrease of basis, a 1% increase in ocean freight would result in 2.69% increase in basis, a 1% increase in diesel would result in a 0.96% decrease in basis and a 1% increase in rail would result in a 1.47% decrease in basis. For Oakley, results indicated a 1% increase in futures would result in a 0.31% decrease of basis, a 1% increase in ocean freight would result in 2.20% increase in basis, a 1% increase in diesel would result in a 1.19% decrease in basis and a 1% increase in rail would result in a 1.92% decrease in basis. For Grainfield, results indicated a 1% increase in futures would result in a 0.46% decrease of basis, a 1% increase in ocean freight would result in 2.32% increase in basis, a 1% increase in diesel would result in a 0.82% decrease in basis and a 1% increase in rail would result in a 2.40% decrease in basis.

Table 4.8 showed for district three, Garden Plain results indicated a 1% increase in futures would result in a 0.58% decrease of basis, a 1% increase in ocean freight would result in 2.32% increase in basis, a 1% increase in diesel would result in a 0.79%

decrease in basis and a 1% increase in rail would result in a 2.14% increase in basis. For Bucklin, results indicated a 1% increase in futures would result in a 0.38% decrease of basis, a 1% increase in ocean freight would result in 2.76% increase in basis, a 1% increase in diesel would result in a 1.01% decrease in basis and a 1% increase in rail would result in a 0.44% decrease in basis. For Meade, results indicated a 1% increase in futures would result in a 0.30% decrease of basis, a 1% increase in ocean freight would result in 2.69% increase in basis, a 1% increase in diesel would result in a 1.00% decrease in basis and a 1% increase in rail would result in a 1.13% decrease in basis.

Table 4.8 showed for district four, Morganville, results indicated a 1% increase in futures would result in a 0.48% decrease of basis, a 1% increase in ocean freight would result in 2.56% increase in basis, a 1% increase in diesel would result in a 0.76% decrease in basis and a 1% increase in rail would result in a 0.03% increase in basis. For Minneapolis, results indicated a 1% increase in futures would result in a 0.44% decrease of basis, a 1% increase in ocean freight would result in 2.66% increase in basis, a 1% increase in diesel would result in a 0.78% decrease in basis and a 1% increase in rail would result in a 1.32% increase in basis. For Osborne, results indicated a 1% increase in futures would result in a 0.51% decrease of basis, a 1% increase in ocean freight would result in 2.46% increase in basis, a 1% increase in diesel would result in a 0.53% decrease in basis and a 1% increase in rail would result in a 0.39% decrease in basis.

Table 4.8 showed for district five, Hays results indicated a 1% increase in futures would result in a 0.53% decrease of basis, a 1% increase in ocean freight would result in 2.84% increase in basis, a 1% increase in diesel would result in a 1.20% decrease in basis and a 1% increase in rail would result in a 0.63% decrease in basis. For Salina results indicated a 1% increase in futures would result in a 0.34% decrease of basis, a 1% increase in ocean freight would result in 3.71% increase in basis, a 1% increase in diesel would result in a 1.15% decrease in basis and a 1% increase in rail would result in a 1.36% increase in basis. For Gorham results indicated a 1% increase in futures would result in a 0.46% decrease of basis, a 1% increase in ocean freight would result in 3.17% increase in basis, a 1% increase in diesel would result in a 1.20% decrease in basis and a 1% increase in rail would result in a 0.35% decrease in basis.

Table 4.8 showed for district six, Viola results indicated a 1% increase in futures would result in a 0.59% decrease of basis, a 1% increase in ocean freight would result in -2.49% increase in basis, a 1% increase in diesel would result in a 0.83% decrease in basis and a 1% increase in rail would result in a 1.82% increase in basis. For Milton, results indicated a 1% increase in futures would result in a 0.59% decrease of basis, a 1% increase in ocean freight would result in 2.37% increase in basis, a 1% increase in diesel would result in a 0.80% decrease in basis and a 1% increase in rail would result in a 2.12% increase in basis. For Isabel, results indicated a 1% increase in futures would result in a 0.58% decrease of basis, a 1% increase in ocean freight would result in 2.33% increase in basis, a 1% increase in diesel would result in a 0.72% decrease in basis and a 1% increase in rail would result in a 0.52% increase in basis.

Table 4.8 showed for district seven, Whitewater results indicated a 1% increase in futures would result in a 0.62% decrease of basis, a 1% increase in ocean freight would result in 2.26% increase in basis, a 1% increase in diesel would result in a 0.60% decrease in basis and a 1% increase in rail would result in a 1.83% increase in basis. For Junction City results indicated a 1% increase in futures would result in a 0.47% decrease of basis, a 1% increase in ocean freight would result in 2.37% increase in basis, a 1% increase in diesel would result in a 0.79% decrease in basis and a 1% increase in rail would result in a 1.25% increase in basis. For Columbus results indicated a 1% increase in futures would result in a 0.34% decrease of basis, a 1% increase in ocean freight would result in 1.39% increase in basis, a 1% increase in diesel would result in a 1.22% decrease in basis and a 1% increase in rail would result in a 5.01% increase in basis.

Combining all seven districts, results indicated that on average, a 1% increase in futures would result in a 0.47% decrease in basis, a 1% increase in ocean freight would result in 2.47% increase in basis, a 1% increase in diesel would result in a 0.89% decrease in basis and a 1% increase in rail would result in a 0.12% increase in basis.

CHAPTER V: SUMMARY AND CONCLUSION

The purpose of this thesis was to examine factors, specifically transportation and futures price that are affecting basis prices of wheat to local Kansas farmers and see if they are consistent throughout the state. This will give farmers a tool to be able to determine how basis is affected by factors of diesel, rail rates, ocean freight and futures price and make decisions based off the data and their own operation and elevator. This will also give insight into how the world around farmers, both near and far, affects basis price. The importance can be evaluated by farmers – showing the variables that were identified and researched and how they can affect their business. Maintaining an understanding of variables that can affect farmers business and income is beneficial to farmers to make more profitable marketing decisions. By providing this information to farmers, the purpose of this thesis is to hopefully enhance their understanding of how the world around them can come into effect of their wheat prices, even for factor such as ocean freight. Farmers can utilize this data in many ways – one is to help make future decisions that are more profitable for them by understanding when to sell grain and at what price. If a farmer has knowledge of basis, they may more easily decide whether to accept a given price. Additionally, it can give them better insight into grain basis and when and where they should sell their wheat. Understanding basis and what factors can affect it can make farmers more profitable decisions when selling.

This thesis analyzed the factors that could potentially effect basis prices to local wheat farmers in Kansas, with basis data collected from AgManager.info, which is managed by Kansas State University. In addition, monthly ocean freight rate data was collected from Federal Reserve Economic Data, monthly diesel information was collected from United States Energy Information Administration and monthly rail data was collected from United States Department of Agriculture Agricultural Marketing Service.

From 2015 to 2023, a nine-year span, monthly data was collected on basis price from three towns in different counties in the 7 Kansas wheat agriculture districts, which totaled 21 towns. The nine-year span will show how the variables have affected basis over time and if specific variables have had their own changes over time. The towns used in this study from district one included Herndon (Rawlins County), Goodland (Sherman County) and Colby (Thomas County). The towns used in this study from district two included Ness City (Ness County), Oakley (Logan County) and Grainfield (Gove County). The towns used in this study from district three included Garden Plain (Finney County), Bucklin (Ford County) and Meade (Meade County). The towns used in this study from district four included Morganville (Clay County), Minneapolis (Ottawa County) and Osborne (Osborne County). The towns used in this study from district five included Hays (Ellis County), Salina (Saline County) and Gorham (Russell County). The town used in this study from district six included Viola (Sedgwick County), Milton (Sumner County) and Isabel (Barber County). The towns used in in this study from district 7 included Whitewater (Butler County), Junction City (Geary County) and Columbus (Cherokee County). By using three locations in different counties in each of the seven districts Kansas Wheat utilizes, this study can produce a more robust analysis of the effects on wheat basis across the state. Regression analysis was estimated for the 21 towns and compared by district.

District 1 included data from Herndon (Rawlins County), Goodland (Sherman County) and Colby (Thomas County). All three towns in district 1 showed statistical significance in ocean freight from the p-value, with Colby being the only one of the three not showing significance in futures. All three towns showed a significance F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. The coefficients for futures, ocean freight, diesel and rail all showed similar results across the board, with the most fluctuation in rail across towns.

District 2 included data from Ness City (Ness County), Oakley (Logan County) and Grainfield (Gove County). Ocean freight was statistically significant in each town. All three towns showed a statistical significance F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. Futures, ocean freight and diesel all showed similar results for each town, while the rail coefficient showed more fluctuation.

District 3 included data from Garden Plain (Finney County), Bucklin (Ford County) and Meade (Meade County). Districts three's results were more variable compared to districts 1 and 2. None of the town's p-value significance was the same, but they did all result in ocean freight being statistically significant in each model. All three towns showed a statistically significant F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. Futures, ocean freight and diesel showed similar results across the board, while rail showed a bit of fluctuation with almost a 1.00 difference between the counties. The sign for rail was different in Garden Plain compared to Bucklin and Meade.

District 4 included data from Morganville (Clay County), Minneapolis (Ottawa County) and Osborne (Osborne County). All three locations showed the same statistical significance of futures and ocean freight. All three towns showed a significance F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. Futures, ocean freight and diesel all showed similar results across the model, while rail showed a bit of fluctuation with almost a 0.50 difference between the counties.

District 5 included data from Hays (Ellis County), Salina (Saline County) and Gorham (Russell County). All three locations showed different statistical significance, but ocean freight was significant at the 5% level for all models. Futures, ocean freight and diesel all showed similar results across the board, while rail showed a bit of fluctuation with almost a 0.50 difference between the counties. All three towns showed a statistical significance F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. Phillipsburg, Kansas, located in Phillips County, which falls in district five, has a wheat protein plant, Amber Waves. This protein plant has demand pulls that can affect wheat basis, as well as hauling wheat that can reduce basis. District five did show smaller rail numbers compared to districts one, two, three and four. Of note, all three towns have the Union Pacific railway go through, with a meeting of the Union Pacific and K and O railways in Salina.

District 6 included data from Viola (Sedgwick County), Milton (Sumner County) and Isabel (Barber County). District six is the only one that all three locations have the same statistical significance from the p-value: futures and ocean freight. All three towns showed a statistically significant F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. Futures, ocean freight and diesel all showed similar results across the board, while rail showed more variability with almost a 0.40 difference between the counties.

District 7 included data from Whitewater (Butler County), Junction City (Geary County) and Columbus (Cherokee County). The three locations had differences, where Columbus did not have any statistically significant variables and was the only one of the data set that did not show any significance at all. All three towns showed a statistically significant F less than 5%, meaning that they are good from a statistical perspective – beta estimates that there is good explanatory power. District seven showed the most variation in variables, with futures, ocean freight and diesel showing similar results, while rail showed more variability with almost a 1.20 difference between the counties.

Elasticity has some variability in models. Combining all seven districts, results indicated that on average, a 1% increase in futures would result in a 0.47% decrease in basis, a 1% increase in ocean freight would result in 2.47% increase in basis, a 1% increase in diesel would result in a 0.89% decrease in basis and a 1% increase in rail would result in a 0.12% increase in basis.

Farmers should look at futures price, ocean freight, local diesel price and rail tariff rates when making decisions at elevators as all four factors play into their basis, with futures and diesel commonly decreasing basis and ocean freight and rail tariff rates commonly increasing basis. By looking at these factors, it will help farmers determine whether to sell their wheat or wait.

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APPENDIX A

Appendix Table A.1 Data Use in the Thesis

Month	Futures	Ocean Freight	Diesel	Rail
1/1/15	$5.77	$ 265.50	$ 3.00	$ 1.25
2/1/15	5.570625	$ 273.20	$ 2.86	$ 1.25
3/1/15	5.450625	$ 273.90	$ 2.90	$ 1.25
4/1/15	5.385375	$ 275.00	$ 2.78	$ 1.25
5/1/15	5.175	$ 274.90	$ 2.89	$ 1.33
6/1/15	5.224375	$ 268.80	$ 2.87	$ 1.35
7/1/15	5.591575	$ 264.50	$ 2.79	$ 1.35
8/1/15	4.820625	$ 263.40	$ 2.60	$ 1.35
9/1/15	4.83875	$ 258.00	$ 2.51	$ 1.34
10/1/15	4.940625	$ 258.20	$ 2.52	$ 1.35
11/1/15	4.6825	$ 254.60	$ 2.47	$ 1.35
12/1/15	4.733775	$ 247.90	$ 2.31	$ 1.34
1/1/16	4.679375	$ 245.20	$ 2.14	$ 1.34
2/1/16	4.52875	$ 241.10	$ 2.00	$ 1.34
3/1/16	4.708675	$ 243.50	$ 2.09	$ 1.34
4/1/16	4.6825	$ 242.20	$ 2.15	$ 1.33
5/1/16	4.519375	$ 242.90	$ 2.32	$ 1.33
6/1/16	4.554	$ 244.40	$ 2.42	$ 1.33
7/1/16	4.14125	$ 242.10	$ 2.41	$ 1.33
8/1/16	4.08125	$ 246.10	$ 2.35	$ 1.35
9/1/16	4.181875	$ 246.10	$ 2.39	$ 1.35
10/1/16	4.206875	$ 254.50	$ 2.45	$ 1.37
11/1/16	4.081975	$ 255.10	$ 2.44	$ 1.37
12/1/16	4.07875	$ 258.20	$ 2.51	$ 1.37
1/1/17	4.351875	$ 260.40	$ 2.58	$ 1.38
2/1/17	4.52375	$ 263.80	$ 2.57	$ 1.38
3/1/17	4.53845	$ 262.30	$ 2.55	$ 1.38
4/1/17	4.21	$ 265.00	$ 2.58	$ 1.38
5/1/17	4.41205	$ 267.90	$ 2.56	$ 1.38
6/1/17	4.581875	$ 267.80	$ 2.51	$ 1.40

7/1/17	5.223125	$	269.80	$	2.50	$	1.40
8/1/17	4.35495	$	270.00	$	2.60	$	1.40
9/1/17	4.495	$	270.40	$	2.79	$	1.40
10/1/17	4.314375	$	268.70	$	2.79	$	1.40
11/1/17	4.195375	$	278.40	$	2.91	$	1.40
12/1/17	4.219375	$	276.70	$	2.91	$	1.40
1/1/18	4.39395	$	281.00	$	3.02	$	1.40
2/1/18	4.811875	$	281.40	$	3.05	$	1.40
3/1/18	4.9775	$	281.50	$	2.99	$	1.40
4/1/18	4.99625	$	284.30	$	3.10	$	1.40
5/1/18	5.367475	$	292.80	$	3.24	$	1.40
6/1/18	5.069375	$	300.50	$	3.25	$	1.41
7/1/18	5.014375	$	307.30	$	3.23	$	1.42
8/1/18	5.5204	$	307.00	$	3.22	$	1.43
9/1/18	5.205	$	307.60	$	3.26	$	1.43
10/1/18	5.137825	$	311.10	$	3.37	$	1.43
11/1/18	4.798125	$	311.80	$	3.30	$	1.43
12/1/18	5.033125	$	311.10	$	3.12	$	1.43
1/1/19	5.004425	$	313.80	$	2.98	$	1.43
2/1/19	4.73	$	313.20	$	3.00	$	1.43
3/1/19	4.416875	$	314.80	$	3.08	$	1.43
4/1/19	4.22	$	316.10	$	3.12	$	1.43
5/1/19	4.097825	$	316.90	$	3.16	$	1.43
6/1/19	4.5875	$	316.00	$	3.09	$	1.43
7/1/19	4.395	$	320.40	$	3.05	$	1.43
8/1/19	3.9525	$	310.80	$	3.01	$	1.43
9/1/19	3.991875	$	311.60	$	3.02	$	1.43
10/1/19	4.161775	$	309.40	$	3.05	$	1.46
11/1/19	4.263125	$	323.70	$	3.07	$	1.46
12/1/19	4.51	$	327.50	$	3.06	$	1.46
1/1/20	4.834325	$	327.70	$	3.05	$	1.46
2/1/20	4.691875	$	310.70	$	2.91	$	1.46
3/1/20	4.58375	$	308.60	$	2.73	$	1.46
4/1/20	4.75465	$	293.10	$	2.49	$	1.46

5/1/20	4.591875	$	293.20	$	2.39	$	1.46
6/1/20	7.199744231	$	294.00	$	2.41	$	1.46
7/1/20	4.515225	$	294.80	$	2.43	$	1.46
8/1/20	4.33	$	295.00	$	2.43	$	1.44
9/1/20	4.806025	$	294.40	$	2.41	$	1.44
10/1/20	5.458125	$	290.50	$	2.39	$	1.43
11/1/20	5.535625	$	287.20	$	2.43	$	1.43
12/1/20	5.65445	$	290.10	$	2.59	$	1.43
1/1/21	$6.26	$	292.50	$	2.68	$	1.43
2/1/21	6.3	$	300.60	$	2.85	$	1.43
3/1/21	6.01375	$	306.40	$	3.15	$	1.43
4/1/21	6.216875	$	316.20	$	3.13	$	1.43
5/1/21	6.600625	$	329.90	$	3.22	$	1.43
6/1/21	6.211175	$	344.20	$	3.29	$	1.43
7/1/21	6.35125	$	347.65	$	3.34	$	1.43
8/1/21	7.075625	$	342.09	$	3.35	$	1.42
9/1/21	7.08405	$	354.38	$	3.38	$	1.42
10/1/21	7.523125	$	364.57	$	3.61	$	1.43
11/1/21	8.28875	$	361.07	$	3.73	$	1.43
12/1/21	8.14015	$	373.59	$	3.64	$	1.43
1/1/22	7.951875	$	374.97	$	3.72	$	1.42
2/1/22	8.265	$	375.19	$	4.03	$	1.42
3/1/22	10.85095	$	364.17	$	5.11	$	1.42
4/1/22	11.42625	$	395.27	$	5.12	$	1.42
5/1/22	12.20375	$	446.98	$	5.57	$	1.42
6/1/22	11.0707	$	439.18	$	5.75	$	1.44
7/1/22	8.615	$	454.41	$	5.49	$	1.44
8/1/22	8.67305	$	468.72	$	5.01	$	1.46
9/1/22	9.47875	$	478.26	$	4.99	$	1.46
10/1/22	9.585625	$	478.22	$	5.21	$	1.46
11/1/22	9.36965	$	471.88	$	5.26	$	1.46
12/1/22	8.613125	$	469.29	$	4.71	$	1.46
1/1/23	8.369375	$	442.59	$	4.58	$	1.46
2/1/23	8.876875	$	456.58	$	4.41	$	1.46

3/1/23	8.1932	$	412.08	$	4.21	$	1.46
4/1/23	8.450625	$	409.60	$	4.10	$	1.46
5/1/23	8.31805	$	443.80	$	3.92	$	1.46
6/1/23	8.120625	$	420.69	$	3.80	$	1.49
7/1/23	8.453125	$	446.21	$	3.88	$	1.49
8/1/23	7.5722	$	462.46	$	4.37	$	1.49
9/1/23	7.294375	$	441.86	$	4.56	$	1.49
10/1/23	6.693125	$	417.75	$	4.51	$	1.49
11/1/23	6.403775	$	404.78	$	4.25	$	1.49
12/1/23	6.403125	$	417.25	$	3.97	$	1.49

SUMMARY OUTPUT
Herndon

Regression Statistics	
Multiple R	0.35171411
R Square	0.12370282
Adjusted R Square	0.08967186
Standard Error	0.27688779
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.11473851	0.27868463	3.63500834	0.00820458
Residual	103	7.89668521	0.07666685		
Total	107	9.01142372			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.16965864	0.96559896	0.175703	0.86087224	-1.7453792	2.08469644	-1.7453792	2.08469644
Futures	-0.0495887	0.0200003	-2.4794007	0.01478264	-0.0892546	-0.0099229	-0.0892546	-0.0099229
Ocean Freight	0.00407226	0.00134225	3.03390681	0.00305573	0.00141022	0.0067343	0.00141022	0.0067343
Diesel	-0.1672347	0.09132609	-1.8311826	0.06996393	-0.3483585	0.01388901	-0.3483585	0.01388901
Rail	-0.9579299	0.79206269	-1.2094117	0.22927339	-2.5287994	0.61293965	-2.5287994	0.61293965

SUMMARY OUTPUT

Goodland

Regression Statistics	
Multiple R	0.3723396
R Square	0.13863678
Adjusted R Square	0.10518578
Standard Error	0.2657889
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.17112436	0.29278109	4.14447339	0.0037386
Residual	103	7.27630495	0.07064374		
Total	107	8.44742931			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.35605821	0.92689347	0.38414146	0.7016655	-1.4822164	2.19433281	-1.4822164	2.19433281
Futures	-0.0501819	0.0191986	-2.6138315	0.01029452	-0.0882578	-0.012106	-0.0882578	-0.012106
Ocean Freight	0.0041352	0.00128845	3.20944326	0.00177357	0.00157987	0.00669053	0.00157987	0.00669053
Diesel	-0.1348872	0.08766534	-1.5386602	0.12695379	-0.3087507	0.03897636	-0.3087507	0.03897636
Rail	-1.1162847	0.7603133	-1.4681905	0.14509979	-2.6241869	0.39161737	-2.6241869	0.39161737

SUMMARY OUTPUT

Colby

Regression Statistics	
Multiple R	0.37963984
R Square	0.14412641
Adjusted R Square	0.1108886
Standard Error	0.25984229
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.1710915	0.29277288	4.3362186	0.00278315
Residual	103	6.95435562	0.06751802		
Total	107	8.12544712			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.1483734	0.9061557	-0.1637394	0.87025718	-1.9455195	1.64877273	-1.9455195	1.64877273
Futures	-0.0369875	0.01876906	-1.9706611	0.05144642	-0.0742115	0.00023655	-0.0742115	0.00023655
Ocean Freight	0.00394665	0.00125962	3.13320582	0.00225206	0.00144849	0.00644481	0.00144849	0.00644481
Diesel	-0.1390918	0.08570396	-1.6229335	0.10766049	-0.3090654	0.03088177	-0.3090654	0.03088177
Rail	-0.7211967	0.7433025	-0.9702601	0.33418981	-2.1953619	0.75296844	-2.1953619	0.75296844

SUMMARY OUTPUT

Ness City

Regression Statistics	
Multiple R	0.47308189
R Square	0.22380648
Adjusted R Square	0.19366304
Standard Error	0.27159515
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2.19070484	0.54767621	7.42471638	2.6994E-05
Residual	103	7.59768412	0.07376392		
Total	107	9.78838896			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.4747968	0.94714178	-0.5012944	0.61723369	-2.3532292	1.4036355	-2.3532292	1.4036355
Futures	-0.0516526	0.019618	-2.6329172	0.00976854	-0.0905602	-0.0127449	-0.0905602	-0.0127449
Ocean Freight	0.0050916	0.00131659	3.86725334	0.00019302	0.00248045	0.00770275	0.00248045	0.00770275
Diesel	-0.1806965	0.08958041	-2.0171424	0.0462823	-0.3583581	-0.0030348	-0.3583581	-0.0030348
Rail	-0.6338443	0.77692261	-0.8158397	0.4164745	-2.1746871	0.90699843	-2.1746871	0.90699843

SUMMARY OUTPUT

Oakley

Regression Statistics	
Multiple R	0.3244061
R Square	0.10523932
Adjusted R Square	0.07049133
Standard Error	0.29443006
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.05020155	0.26255039	3.02864492	0.02091357
Residual	103	8.92897336	0.08668906		
Total	107	9.9791749			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.13688741	1.02677466	0.13331787	0.89420212	-1.899478	2.17325278	-1.899478	2.17325278
Futures	-0.0334475	0.02126742	-1.5727108	0.11885266	-0.0756264	0.00873141	-0.0756264	0.00873141
Ocean Freight	0.00428705	0.00142729	3.00363204	0.00334917	0.00145636	0.00711774	0.00145636	0.00711774
Diesel	-0.2311466	0.09711207	-2.3802048	0.01914232	-0.4237455	-0.0385477	-0.4237455	-0.0385477
Rail	-0.8565986	0.84224396	-1.0170434	0.31151584	-2.5269909	0.81379361	-2.5269909	0.81379361

SUMMARY OUTPUT

Grainfield

Regression Statistics	
Multiple R	0.38974426
R Square	0.15190059
Adjusted R Square	0.11896469
Standard Error	0.26359444
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.28180632	0.32045158	4.6120068	0.00182229
Residual	103	7.15664876	0.06948203		
Total	107	8.43845508			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.21560706	0.91924067	0.23454909	0.81502435	-1.60749	2.03870412	-1.60749	2.03870412
Futures	-0.0476511	0.01904008	-2.5026747	0.01389819	-0.0854127	-0.0098896	-0.0854127	-0.0098896
Ocean Freight	0.00436607	0.00127781	3.41684144	0.00090809	0.00183184	0.0069003	0.00183184	0.0069003
Diesel	-0.1546364	0.08694154	-1.7786253	0.07825151	-0.3270644	0.01779161	-0.3270644	0.01779161
Rail	-1.0320381	0.75403585	-1.3686857	0.17407529	-2.5274904	0.46341417	-2.5274904	0.46341417

SUMMARY OUTPUT
Garden Plain

Regression Statistics	
Multiple R	0.43594462
R Square	0.19004771
Adjusted R Square	0.15859325
Standard Error	0.27319806
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.80383017	0.45095754	6.04199599	0.00020825
Residual	103	7.68762954	0.07463718		
Total	107	9.49145971			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.7921814	0.95273167	-1.8810978	0.0627828	-3.6817	0.09733715	-3.6817	0.09733715
Futures	-0.0427517	0.01973378	-2.1664205	0.03258512	-0.081889	-0.0036144	-0.081889	-0.0036144
Ocean Freight	0.00314671	0.00132436	2.37601592	0.01934926	0.00052015	0.00577327	0.00052015	0.00577327
Diesel	-0.1066155	0.0901091	-1.1831823	0.23946063	-0.2853257	0.07209465	-0.2853257	0.07209465
Rail	0.66208856	0.78150789	0.8471937	0.3988514	-0.887848	2.21202514	-0.887848	2.21202514

SUMMARY OUTPUT

Bucklin

Regression Statistics	
Multiple R	0.5176655
R Square	0.26797757
Adjusted R Square	0.23954951
Standard Error	0.26255549
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2.59928258	0.64982064	9.42651759	1.5606E-06
Residual	103	7.10034494	0.06893539		
Total	107	9.69962752			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.1127453	0.91561754	-1.2152948	0.22703203	-2.9286567	0.70316618	-2.9286567	0.70316618
Futures	-0.0373203	0.01896504	-1.9678473	0.05177416	-0.074933	0.00029238	-0.074933	0.00029238
Ocean Freight	0.00492117	0.00127277	3.86649972	0.00019354	0.00239693	0.00744542	0.00239693	0.00744542
Diesel	-0.1794118	0.08659886	-2.0717569	0.04078656	-0.3511602	-0.0076634	-0.3511602	-0.0076634
Rail	-0.1784935	0.75106387	-0.2376543	0.81262133	-1.6680516	1.31106448	-1.6680516	1.31106448

Meade

Regression Statistics	
Multiple R	0.46174863
R Square	0.21321179
Adjusted R Square	0.18265691
Standard Error	0.26902037
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2.02004446	0.50501112	6.97799442	5.1898E-05
Residual	103	7.45431163	0.07237196		
Total	107	9.4743561			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.6930856	0.93816267	-0.7387691	0.46172735	-2.55371	1.16753878	-2.55371	1.16753878
Futures	-0.0281164	0.01943201	-1.4469129	0.15095789	-0.0666552	0.01042238	-0.0666552	0.01042238
Ocean Freight	0.00456778	0.00130411	3.50259699	0.00068289	0.00198138	0.00715417	0.00198138	0.00715417
Diesel	-0.1688575	0.08873117	-1.9030236	0.05982965	-0.3448349	0.00711984	-0.3448349	0.00711984
Rail	-0.4376207	0.76955722	-0.5686656	0.57082094	-1.9638559	1.08861453	-1.9638559	1.08861453

SUMMARY OUTPUT

Morganville

Regression Statistics	
Multiple R	0.48915266
R Square	0.23927033
Adjusted R Square	0.20972743
Standard Error	0.27405154
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2.43310134	0.60827533	8.09908067	1.0185E-05
Residual	103	7.73573718	0.07510424		
Total	107	10.1688385			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.2740714	0.95570802	-1.3331179	0.18543427	-3.1694929	0.62135003	-3.169492	0.62135003
Futures	-0.0437891	0.01979543	-2.2120822	0.02916976	-0.0830487	-0.0045296	-0.083048	-0.0045296
Ocean Freight	0.00428547	0.0013285	3.22579286	0.00168415	0.0016507	0.00692024	0.0016507	0.00692024
Diesel	-0.1265394	0.09039061	-1.3999178	0.16454279	-0.3058079	0.05272903	-0.305807	0.05272903
Rail	0.01130868	0.78394934	0.01442527	0.9885186	-1.5434699	1.56608729	-1.543469	1.56608729

SUMMARY OUTPUT

Minneapolis

Regression Statistics	
Multiple R	0.47914543
R Square	0.22958035
Adjusted R Square	0.19966114
Standard Error	0.27537465
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2.32751509	0.58187877	7.67334259	1.8813E-05
Residual	103	7.81061355	0.0758312		
Total	107	10.1381286			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.6604627	0.96032217	-1.7290684	0.08679293	-3.5650352	0.24410982	-3.5650352	0.24410982
Futures	-0.0333118	0.019891	-1.6747167	0.09702359	-0.0727609	0.00613732	-0.0727609	0.00613732
Ocean Freight	0.00365091	0.00133491	2.73494263	0.00734736	0.00100343	0.0062984	0.00100343	0.0062984
Diesel	-0.1074911	0.09082701	-1.1834708	0.23934685	-0.2876251	0.07264284	-0.2876251	0.07264284
Rail	0.41300931	0.78773423	0.52430032	0.60119617	-1.1492757	1.97529437	-1.1492757	1.97529437

SUMMARY OUTPUT

Osborne

Regression Statistics	
Multiple R	0.55769948
R Square	0.3110287
Adjusted R Square	0.28427254
Standard Error	0.26302405
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	3.21682532	0.80420633	11.6245614	7.9116E-08
Residual	103	7.12570986	0.06918165		
Total	107	10.3425352			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.2457642	0.91725153	-1.358149	0.17738396	-3.0649163	0.57338786	-3.0649163	0.57338786
Futures	-0.0523229	0.01899888	-2.7539985	0.00696092	-0.0900027	-0.0146431	-0.0900027	-0.0146431
Ocean Freight	0.00463978	0.00127504	3.63891784	0.00042993	0.00211103	0.00716853	0.00211103	0.00716853
Diesel	-0.0991239	0.0867534	-1.142594	0.25585622	-0.2711788	0.072931	-0.2711788	0.072931
Rail	-0.1662073	0.7524042	-0.2209016	0.82560633	-1.6584236	1.32600896	-1.6584236	1.32600896

SUMMARY OUTPUT

Hays

Regression Statistics	
Multiple R	0.45590556
R Square	0.20784988
Adjusted R Square	0.17708676
Standard Error	0.27772475
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2.08453248	0.52113312	6.75646466	7.1933E-05
Residual	103	7.94449673	0.07713104		
Total	107	10.0290292			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.82618	0.96851773	-0.8530355	0.39561898	-2.7470064	1.09464651	-2.7470064	1.09464651
Futures	-0.0498539	0.02006075	-2.4851472	0.0145597	-0.0896397	-0.0100682	-0.0896397	-0.0100682
Ocean Freight	0.00486647	0.00134631	3.61468124	0.0004672	0.00219639	0.00753655	0.00219639	0.00753655
Diesel	-0.2047918	0.09160215	-2.2356655	0.02753142	-0.386463	-0.0231205	-0.386463	-0.0231205
Rail	-0.2446892	0.7944569	-0.3079955	0.75870771	-1.8203071	1.3309287	-1.8203071	1.3309287

SUMMARY OUTPUT
Salina

Regression Statistics	
Multiple R	0.49491557
R Square	0.24494142
Adjusted R Square	0.21561876
Standard Error	0.26399286
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2.3286445	0.58216112	8.3533144	7.0795E-06
Residual	103	7.17829989	0.06969223		
Total	107	9.50694438			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.4129139	0.92063011	-1.5347248	0.12791754	-3.2387666	0.4129388	-3.2387666	0.4129388
Futures	-0.0181111	0.01906886	-0.9497738	0.34445043	-0.0559297	0.01970749	-0.0559297	0.01970749
Ocean Freight	0.00355122	0.00127974	2.77495407	0.0065574	0.00101316	0.00608928	0.00101316	0.00608928
Diesel	-0.1100609	0.08707295	-1.2640081	0.20908022	-0.2827496	0.06262774	-0.2827496	0.06262774
Rail	0.29838635	0.75517559	0.39512182	0.69357008	-1.1993263	1.79609902	-1.1993263	1.79609902

SUMMARY OUTPUT

Gorham

Regression Statistics	
Multiple R	0.48318863
R Square	0.23347125
Adjusted R Square	0.20370314
Standard Error	0.26948906
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2.27837109	0.56959277	7.8429995	1.4721E-05
Residual	103	7.48030846	0.07262435		
Total	107	9.75867955			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.0267359	0.93979717	-1.0925079	0.27715866	-2.8906019	0.83713016	-2.8906019	0.83713016
Futures	-0.0375353	0.01946587	-1.9282629	0.05657582	-0.0761413	0.00107065	-0.0761413	0.00107065
Ocean Freight	0.00467065	0.00130638	3.57525047	0.00053443	0.00207974	0.00726155	0.00207974	0.00726155
Diesel	-0.1771192	0.08888576	-1.9926606	0.04894423	-0.3534031	-0.0008352	-0.3534031	-0.0008352
Rail	-0.1160171	0.77089796	-0.150496	0.88066763	-1.6449114	1.41287722	-1.6449114	1.41287722

SUMMARY OUTPUT

Viola

Regression Statistics	
Multiple R	0.43355228
R Square	0.18796758
Adjusted R Square	0.15643234
Standard Error	0.2737306
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.78646078	0.4466152	5.96055647	0.0002353
Residual	103	7.71762929	0.07492844		
Total	107	9.50409007			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.6431319	0.9545888	-1.7212981	0.08819902	-3.5363336	0.25006984	-3.5363336	0.25006984
Futures	-0.0427058	0.01977224	-2.1598865	0.03310123	-0.0819194	-0.0034922	-0.0819194	-0.0034922
Ocean Freight	0.00326571	0.00132694	2.4610777	0.015514	0.00063403	0.0058974	0.00063403	0.0058974
Diesel	-0.1094698	0.09028475	-1.2124948	0.22809682	-0.2885283	0.06958872	-0.2885283	0.06958872
Rail	0.54480796	0.78303126	0.69576782	0.48814117	-1.0081499	2.09776578	-1.0081499	2.09776578

SUMMARY OUTPUT

Milton

Regression Statistics	
Multiple R	0.43152371
R Square	0.18621272
Adjusted R Square	0.15460933
Standard Error	0.27610857
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.79678223	0.44919556	5.89217542	0.00026074
Residual	103	7.85230228	0.07623594		
Total	107	9.64908451			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.7647278	0.96288159	-1.8327568	0.06972743	-3.6743763	0.14492077	-3.674376	0.14492077
Futures	-0.0429869	0.01994401	-2.1553801	0.0334613	-0.0825412	-0.0034327	-0.082541	-0.0034327
Ocean Freight	0.00316114	0.00133847	2.36175478	0.02006875	0.0005066	0.00581569	0.0005066	0.00581569
Diesel	-0.1071806	0.09106908	-1.176915	0.24194205	-0.2877946	0.07343348	-0.287794	0.07343348
Rail	0.64557773	0.78983368	0.81735908	0.41560992	-0.9208711	2.21202655	-0.920871	2.21202655

SUMMARY OUTPUT

Isabel

Regression Statistics	
Multiple R	0.36948433
R Square	0.13651867
Adjusted R Square	0.10298541
Standard Error	0.28562276
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.32850115	0.33212529	4.07114267	0.00418583
Residual	103	8.40277718	0.08158036		
Total	107	9.73127833			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.101248	0.99606069	-1.1056033	0.27147403	-3.0766994	0.87420347	-3.0766994	0.87420347
Futures	-0.0424257	0.02063125	-2.0563826	0.04227381	-0.0833429	-0.0015085	-0.0833429	-0.0015085
Ocean Freight	0.00311198	0.00138459	2.24757798	0.02673489	0.00036597	0.005858	0.00036597	0.005858
Diesel	-0.0962666	0.09420715	-1.0218612	0.30924067	-0.2831043	0.09057103	-0.2831043	0.09057103
Rail	0.15925453	0.81704987	0.19491408	0.84584417	-1.4611712	1.77968025	-1.4611712	1.77968025

SUMMARY OUTPUT

Whitewater

Regression Statistics	
Multiple R	0.46387421
R Square	0.21517928
Adjusted R Square	0.18470081
Standard Error	0.29846128
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2.51560943	0.62890236	7.06004113	4.6005E-05
Residual	103	9.17515091	0.08907914		
Total	107	11.6907603			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.9877925	1.04083284	-1.9098096	0.05893969	-4.052039	0.0764539	-4.052039	0.0764539
Futures	-0.0537927	0.0215586	-2.495183	0.01417757	-0.0965491	-0.0110363	-0.0965491	-0.0110363
Ocean Freight	0.0035933	0.00144683	2.48356643	0.01462073	0.00072385	0.00646274	0.00072385	0.00646274
Diesel	-0.0962107	0.09844169	-0.9773368	0.33069235	-0.2914466	0.09902519	-0.2914466	0.09902519
Rail	0.66567736	0.85377563	0.77968653	0.43736332	-1.0275852	2.35893994	-1.0275852	2.35893994

SUMMARY OUTPUT

Junction City

Regression Statistics	
Multiple R	0.42034903
R Square	0.1766933
Adjusted R Square	0.14472023
Standard Error	0.31578537
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2.20434561	0.5510864	5.52631549	0.00045262
Residual	103	10.2712014	0.0997204		
Total	107	12.475547			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.7262156	1.10124767	-1.5675089	0.12006296	-3.9102806	0.45784945	-3.910280	0.45784945
Futures	-0.0409153	0.02280997	-1.7937472	0.0757878	-0.0861535	0.00432288	-0.086153	0.00432288
Ocean Freight	0.0037709	0.00153081	2.46333396	0.01542223	0.0007349	0.0068069	0.0007349	0.0068069
Diesel	-0.1257016	0.10415571	-1.206862	0.23024971	-0.3322699	0.08086671	-0.332269	0.08086671
Rail	0.45402783	0.90333277	0.50261415	0.61630854	-1.3375197	2.24557533	-1.337519	2.24557533

SUMMARY OUTPUT

Columbus

Regression Statistics	
Multiple R	0.35078317
R Square	0.12304884
Adjusted R Square	0.08899248
Standard Error	0.38983919
Observations	108

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2.19639428	0.54909857	3.61309458	0.00848698
Residual	103	15.6533829	0.15197459		
Total	107	17.8497772			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-3.0559257	1.35949772	-2.2478344	0.02671797	-5.7521688	-0.3596826	-5.752168	-0.3596826
Futures	-0.0303852	0.02815906	-1.0790575	0.2830825	-0.0862321	0.02546161	-0.086232	0.02546161
Ocean Freight	0.00225841	0.0018898	1.19505301	0.23481073	-0.0014896	0.00600637	-0.001489	0.00600637
Diesel	-0.1985759	0.12858093	-1.5443647	0.12556698	-0.4535858	0.05643409	-0.453585	0.05643409
Rail	1.85895319	1.11517044	1.66696778	0.09855885	-0.3527244	4.07063073	-0.352724	4.07063073