

**Factors Influencing Wheat Basis in Kansas:
Focus on Salina**

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Abstract

Factors Influencing Wheat Basis in Kansas: Focus on Salina

Based on crop-year data from 1998 through 2003, basis factors from Salina will be identified through the regression of key fundamental information. The simple basis model will include four-year monthly moving averages of the basis for Salina, United States monthly stocks-to-use ratios, monthly production-to-use ratios, monthly supply-to-use ratios, and weekly export inspections as well as an indicator for seasonality.

INTRODUCTION

Each year wheat producers face the decision of pricing the upcoming year's crop. Whether they choose to hedge using the futures market or sell in the cash market, basis directly affects their final price. Basis can be defined as the relationship between the cash and futures price and is calculated by taking the local cash price minus the nearby futures price in the particular market. As producers attempt to predict a localized cash price, they most often use a historical basis calculation, which is generally a stable number, for the date intended to make the sale. The difference between the figured cash price and the realized cash price can cause the producer to make or lose money. Therefore, the accuracy of the basis number used in the formula directly affects the producer's profitability.

Generally, basis reflects the local supply and demand for a commodity relative to the futures market. In addition to local supply and demand, other factors influencing basis include national and international supply and demand, the quality of the commodity, costs associated with the transportation and storage of the commodity, seasonality, and the geographical location (Dhuyvetter). Basis has its own unique language. When describing the value of basis relative to a previous figure, terms such as stronger or weaker are used. To further explain, the more negative the basis is, it is referred to as "weaker" or "wider." Similarly, the more positive the basis is, it is said to be "stronger" or "narrower." For example, a strengthening or stronger basis may be the result of a slow harvest which allows the grain to be moved with minimal hassle, a small local supply, or a strong local demand. The basis may weaken or widen in the case of a bumper crop, lack of rail line or the unavailability of rail cars, or a wheat crop of low quality. Furthermore, when the basis is stronger than normal, the market is providing a financial incentive to make cash sales, and vice versa (Dhuyvetter).

The primary focus of this study is to help wheat producers more accurately predict the cash price they will receive from their selling point by identifying key fundamental factors which affect basis as well as seasonal patterns over time. To identify these main fundamental factors and their impact, this study will track basis movements from Salina, located in North Central Kansas. In addition, the basis will be calculated using the nearby Kansas City Board of Trade hard red winter wheat futures price.

Through the utilization of four-year monthly moving averages of the basis for Salina, United States monthly stocks-to-use ratios, monthly production-to-use ratios, monthly supply-to-use ratios, weekly export inspections, and a seasonality indicator, this study strives to determine the influence of each variable on the local basis. A simple basis model will be used incorporating each of the previously mentioned variables as independent variables and the nearby basis will be the dependent variable. The results should yield a model which the above mentioned variables can be incorporated into, thus determining the basis reaction for the given fundamental situation.

Salina is an interesting site to study from my prospective because the grain elevator I work for during the summers, located in Tampa, Kansas, ships a majority of its annual wheat crop to The Scoular Company, which resides on the east side of Salina. In addition, I have some interest in managing the elevator which has provided me a summer job for three years. The acquisition of how fundamental factors affect Salina basis may be an item which will be considered in my daily life. Furthermore, many producers around the point of interest chose to truck their grain to Salina. This project can help these individuals to understand fundamental basis fluctuations as well.

LITERATURE REVIEW

This study was developed around a paper by Philip Maass and Mark L. Waller of Texas A&M, entitled, “Factors Affecting Texas Wheat Basis Behavior.” In their project, a similar model was applied to two areas, north of the Canadian River in the Texas Panhandle, and the Houston port. Additionally, Maass’s and Waller’s study was aimed to explain Texas wheat basis behavior, identify seasonal patterns producers may take advantage of, and to develop a better understanding of the factors which influence basis over time. The paper offered a starting point and framework to build a model of Salina’s basis factors.

Another study which offers valuable input is “Forecasting Crop Basis: Practical Alternatives” completed by K-State’s Dhuyvetter and Kastens. According to this paper, producers have a limited amount of information available when making production decisions based on price forecasts. Thus, cash price forecasting should be based on simple basis models.

MODEL

Basis for Salina can be explained by the following variables: four-year monthly moving average of Salina basis; monthly US stocks-to-use ratios, monthly supply-to-use ratios, and monthly production-to-use ratios; monthly export inspections; and a dummy variable to account for seasonal tendencies . The conceptual model is as follows:

Nearby basis = $f(4 \text{ Yr. Ave.}, \text{US Stks/Use}, \text{US Sup/Use}, \text{US Prod/Use}, \text{Exp. Insp.}, \text{Monthly})$

The four-year monthly moving average of the basis for Salina should have a positive relationship to the nearby basis. As the moving average shifts, the nearby basis should move accordingly, in the same direction. The United States stocks-to-use ratio should have a negative relationship to the dependent variable. This occurrence should result from an increased supply, thus weakening the basis. The US supply-to-use ratio should also have an indirect relationship to the nearby basis. As the domestic supply increases, the basis will widen as a result. In addition, the US production-to-use ratio should have a negative relationship as well. When the production rises, the basis should weaken to help accommodate for the increased costs to transport and store the supply. Wheat export inspections should have a direct relationship to the nearby basis. As wheat is exported from the United States, the declining domestic supply should help to narrow the basis.

To ensure significance of the monthly dummy variable, an F-Test was conducted. The test was performed with the above mentioned conceptual model and the same model excluding the monthly dummy variable. Upon completion of the test, it was found the full model is better than the reduced model at a 95% confidence level.

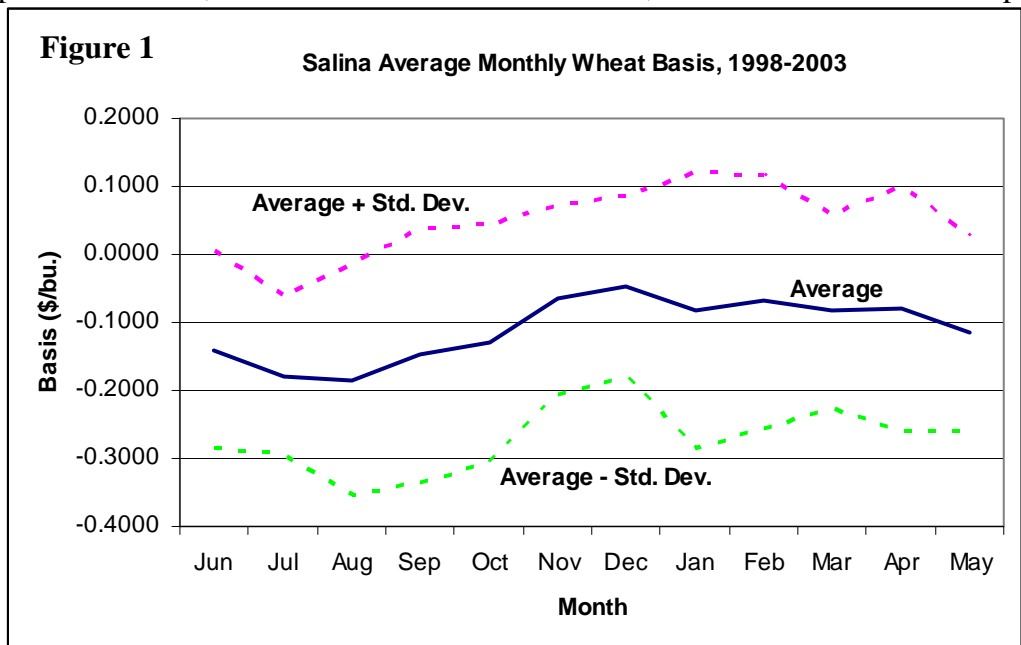
DATA

Various sources were utilized to obtain the necessary data to conduct this study. First, all pieces of information were compiled to form monthly observations. The calculation of moving averages for necessary variables followed. The majority of the fundamental data was taken from the World Agricultural Supply and Demand Report published by the Economic Research Service. Monthly values used to calculate the US stocks-to-use ratios, supply-to-use ratios, and production-to-use ratios originated in the World Wheat Supply and Use Table and are

stated in million metric tons. Another variable, export inspections, which monitors the shipment pace, was taken from the weekly bulletin, Grains Inspected and/or Weight for Export, posted by the Agricultural Marketing Service and is listed in thousands of bushels. The weekly data was then converted to a monthly average. Old crop cash wheat prices for Salina as well as nearby futures prices from the Kansas City Board of Trade were obtained from the *Wichita Eagle* on each Wednesday throughout the duration of the data set. Both the cash and futures prices, figured in dollars per bushel, contributed to the calculation of weekly, and then monthly basis.

As a recommendation from the dynamic research completed by Dhuyvetter and Kastens, a four-year moving average was utilized to calculate Salina's basis in the model. In addition to the moving average, the variable was also lagged two months to take into account the unavailability of information at a particular point in time. Furthermore, all other variables have a two-month lag for the same reasoning.

When analyzing wheat basis, it becomes evident the variable typically follows a seasonal pattern. In June, as the wheat harvest moves north, the basis weakens in anticipation of the new



crop. Once harvest begins in late June and early July, the basis quickly widens and remains at a similar value until mid

September when it starts to narrow through January. From January to April, the basis widens slowly, and then strengthens until late May/early June. In summary, grain basis will usually be the widest during harvest when supplies are plentiful, and then narrow as the crop marketing year progresses and supplies dwindle. Please refer to Figure 1 to view a graph of Salina's basis pattern. Furthermore, Table 1 lists the average and standard deviation values for each month included in Figure 1.

Table 1, Salina Average Monthly Wheat Basis, 1998-2003							
Crop Yr	Jun	Jul	Aug	Sep	Oct	Nov	
Average	-0.1400	-0.1780	-0.1846	-0.1480	-0.1306	-0.0657	
Std. Dev	0.1466	0.1171	0.1697	0.1860	0.1761	0.1388	
Avg + Std. Dev.	0.0066	-0.0610	-0.0149	0.0379	0.0455	0.0731	
Avg. - Std. Dev.	-0.2865	-0.2951	-0.3543	-0.3340	-0.3067	-0.2045	
Crop Yr	Dec	Jan	Feb	Mar	Apr	May	
Average	-0.0473	-0.0821	-0.0686	-0.0832	-0.0791	-0.1153	
Std. Dev	0.1334	0.2024	0.1862	0.1425	0.1804	0.1430	
Avg + Std. Dev.	0.0861	0.1203	0.1176	0.0593	0.1013	0.0277	
Avg. - Std. Dev.	-0.1806	-0.2846	-0.2549	-0.2257	-0.2595	-0.2582	

Looking at the Salina monthly basis summary statistics, the average basis for the period of June 1998 through May 2004 is \$-0.1102/bu. Basically, on average, it would be expected to find the basis falling 11 cents below the futures price. The prices had a standard deviation of

Table 2, Salina Monthly Basis Summary Statistics, 1998-2003	
Average	-0.1102
Std. Dev.	0.1555
Min	-0.4525
Max	0.2060
Mode	0.0500

\$0.1555/bu through this timeframe. Taking this into account, the average basis range is between \$-.2657 and \$0.0453. In August 1999, the basis was the widest hitting the value of \$-0.4525 and in January 2003, the basis was the narrowest at \$0.2060/bu. Finally, the basis value

which most frequently occurred throughout the data set was \$0.05/bu. For a quick view of these statistics, please refer to Table 2.

Data included in this model begins with the 1998 crop year and finishes with the 2003 crop year. The crop year or crop marketing year is defined as June 1st through May 31st. This decision was made partially because of the availability of certain data and partially to exclude the time prior to the 1996 Farm Bill.

RESULTS

A regression was conducted to model the data acquired. The test was run with Salina monthly wheat basis as the dependent variable. Independent variables in the model were four-year monthly moving average of the basis for Salina; monthly US stocks-to-use ratios, monthly

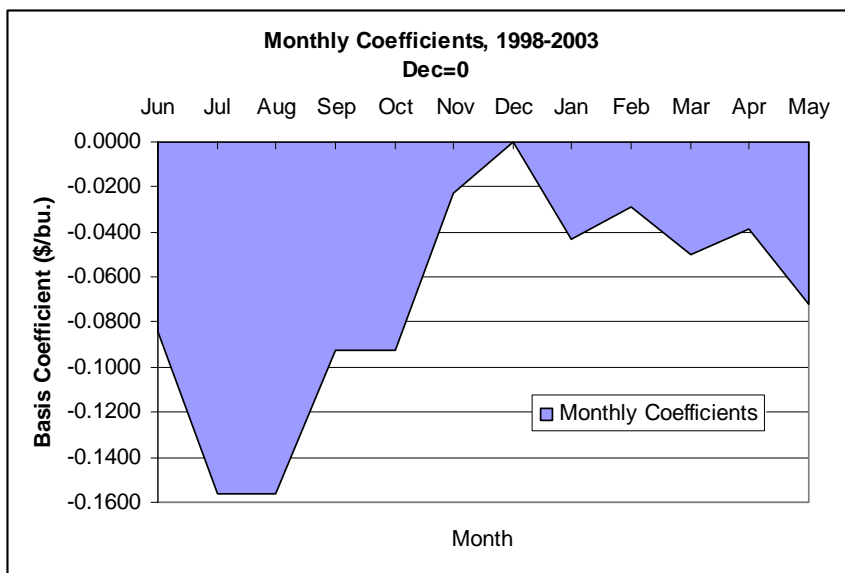
supply-to-use ratios, and monthly production-to-use ratios; monthly export inspections, and the monthly dummy variables.

Table 3. Salina P-Values and t-Statistics		
Variable	P-value	t Stat
Intercept	0.0530	1.9775
Sal.Mov Avg	0.0000	-6.2840
US Stks/Use	0.0671	-1.8680
US Sup/Use	0.0835	-1.7626
US Prod/Use	0.0269	2.2744
Exp. Insp.	0.9445	0.0699
Jan	0.3303	-0.9822
Feb	0.4980	-0.6822
Mar	0.2749	-1.1028
Apr	0.3912	-0.8642
May	0.0947	-1.7003
Jun	0.0631	-1.8969
Jul	0.0006	-3.6203
Aug	0.0014	-3.3696
Sep	0.0383	-2.1228
Oct	0.0676	-1.8641
Nov	0.5955	-0.5340

The regression provided a good fit of the data. The model had an Adjusted R Square of 0.78. This number suggests a good model which may still need improvement, 1.00 being perfect. However, fundamental basis factors can be tough to represent and a model which describes close to 78% of the variation in the fluctuation of wheat basis for Salina is significant. Furthermore, the standard error provided was less than ten cents. Salina's standard error was

\$0.0733 per bushel. The regression contained 72 observations from the span of June 1998 until May 2004. These 72 observations represented six crop years broken into monthly representations.

Analyzing the Salina regression output, it can be noted certain variables are more significant than others. At a 95% confidence level, the monthly basis moving average variable was the most significant in the model. It produced a p-value of nearly zero. Such a representation could be expected as it is directly related to the dependent variable. Furthermore, the moving average was calculated from the data included in the dependent variable. The July and August dummy variables followed closely behind having p-values of 0.0006 and 0.0014, respectively. These variables have an important role in basis determination and greatly affect buyers and sellers as the 1999-2002 five-year average monthly marketings of Kansas wheat in July and August are 27% and 11%, respectively. Please view Table 3 for a detailed listing of all variables and their corresponding p-values and t-statistics. Export inspections was the least significant variable in the model, having a p-value of 0.9445. This occurrence may have resulted because this variable is the summation of all varieties of wheat, not just hard red winter wheat,



which is what is marketed in Salina.

The addition of the monthly dummy variable aided in the specification of periods with strengths and weakness throughout the year. This variable was

broken down into 12 months. The December variable was dropped when the analysis was run. From the output, it can be concluded basis is the narrowest during November, December, and January. The outcome of basis being the narrowest during these months not only reaffirms the conceptual model, but also historical data. To view a graphical depiction of the coefficients, please refer to Figure 2.

All but one coefficient produced a satisfactory product. The US production-to-use ratio resulted with a positive coefficient contrary to the expected result of a negative relationship.

This may be the outcome of the data utilized. The United States’

production may represent a vague picture of the production taking place in the Salina area, thus not having a negative relationship to the basis. Another variable with a questionable coefficient was the four-year monthly moving average of the basis for Salina. This variable also produced a negative coefficient. The outcome may be the result of the majority of the observations in the moving average widening through time more than they narrow, therefore, causing the relationship to be negative. To view a complete listing of all variables and their corresponding coefficients, please refer to Table 4.

More factors affecting Salina basis could be better determined if additional historical site-specific data was available. The most challenging aspect of finding data revolved around locating monthly data. Pertinent data was found, however, it could only be obtained in a yearly output. Monthly stocks-to-use, supply-to-use, and production-to-use ratios for Kansas may help explain more variability

Variable	Coefficients
Intercept	0.7302
Sal.Mov Avg	-1.1455
US Stks/Use	-0.4513
US Sup/Use	-0.4281
US Prod/Use	0.2297
Exp. Insp.	6.16E-08
Jan	-0.0429
Feb	-0.0292
Mar	-0.0499
Apr	-0.0384
May	-0.0723
Jun	-0.0843
Jul	-0.1563
Aug	-0.1561
Sep	-0.0927
Oct	-0.0929
Nov	-0.0227

in the data. Furthermore, monthly wheat quality statistics may have benefited the study as well. Another angle to approach when analyzing the unexplained variation is factors which are not considered fundamental. For example, the price of fuel, rail rates, and labor costs also play a role in determining basis for any location. Finally, an increased frequency of observations should have increased the Adjusted R Square value. Additional data may have been obtained by switching from monthly to weekly observations. These factors, amongst others, may account for part of the 12% unexplained variation in the regression.

SUMMARY

Following the completion of this study, no distinct fundamental factors were identified, however, the most significant finding centers on the monthly dummy variable. The coefficients produced from the regression offer support for the seasonal behavior of basis. Additionally, they provide a sound estimate of how the basis will differ from month to month. To help fulfill the primary focus of this study, helping producers predict the cash price, it has become evident the months of July and August stand out as a significant marketing period. Furthermore, this coincides with historical observations in designating July and August as months with the widest basis. If producers notice the basis stronger than usual during this timeframe, they should consider taking advantage of the opportunity. Moreover, it would be recommended producers capitalize on the weaker basis before or after the months of July and August.

Another implication resulting from this study is the reliability of historical basis data. The significance of the monthly basis moving average variable indicates using previous prices to predict a future value will result in a dependable basis calculation. Thus, producers should utilize basis tables when forecasting a localized cash price.

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Regression Output

Salina Crop Yrs 1998-2003

<i>Regression Statistics</i>	
Multiple R	0.9100
R Square	0.8280
Adjusted R Square	0.7780
Standard Error	0.0733
Observations	72

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	16	1.4211	0.0888	16.5526	1.60E-15
Residual	55	0.2951	0.0054		
Total	71	1.7163			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0.7302	0.3692	1.9775	0.0530	-0.0098	1.4701
S Mov Avg	-1.1455	0.1823	-6.2840	0.0000	-1.5108	-0.7802
US Stks/Use	-0.4513	0.2416	-1.8680	0.0671	-0.9356	0.0329
US Sup/Use	-0.4281	0.2429	-1.7626	0.0835	-0.9150	0.0587
US Prod/Use	0.2297	0.1010	2.2744	0.0269	0.0273	0.4320
Inspections	6.16E-08	8.81E-07	0.0699	0.9445	-1.70E-06	1.83E-06
Jan	-0.0429	0.0437	-0.9822	0.3303	-0.1306	0.0447
Feb	-0.0292	0.0427	-0.6822	0.4980	-0.1148	0.0565
Mar	-0.0499	0.0452	-1.1028	0.2749	-0.1406	0.0408
Apr	-0.0384	0.0444	-0.8642	0.3912	-0.1273	0.0506
May	-0.0723	0.0425	-1.7003	0.0947	-0.1575	0.0129
Jun	-0.0843	0.0444	-1.8969	0.0631	-0.1733	0.0048
Jul	-0.1563	0.0432	-3.6203	0.0006	-0.2427	-0.0698
Aug	-0.1561	0.0463	-3.3696	0.0014	-0.2489	-0.0632
Sep	-0.0927	0.0437	-2.1228	0.0383	-0.1801	-0.0052
Oct	-0.0929	0.0498	-1.8641	0.0676	-0.1927	0.0070
Nov	-0.0227	0.0425	-0.5340	0.5955	-0.1080	0.0626