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Title: An Alternative Portfolio Estimation Procedure as Applied to Wheat Hedging

Abstract: Previous hedging portfolio estimations have not explicitly tested for the effect of a widening and narrowing basis on the optimal hedge ratios. Evidence was found that winter wheat producers on the northern Great Plains may be able to hedge more effectively on the Minneapolis spring wheat contract.

An Alternative Portfolio Estimation Procedure as Applied to Wheat Hedging

Since 1979, the portfolio approach to hedging has received considerable theoretical and empirical attention (Wilson, Brown, Nelson and Collins, Bond and Thompson). Brown respecified the portfolio model so as to estimate the optimal hedge ratios using returns rather than price levels. His subsequent empirical analysis involved one week hedges for the Chicago Board of Trade's corn, wheat, and soybean contracts. Using Chicago cash prices for the different commodities, Brown found the hedge ratios to be consistent with the traditional hedging approach of assuming a futures market position equal and opposite to the spot market position. Bond and Thompson have recently demonstrated that individual risk preferences affect the size of optimal hedge ratios under specific conditions. Nelson and Collins pointed out that the portfolio approach stresses minimization of risk rather than the hedge's performance in terms of risk and return.

Wilson used the portfolio approach to analyze the hedging effectiveness of the U.S. wheat futures. Commentary by Gray, and Miles were critical of the portfolio approach as applied by Wilson. Subsequent discussion questioned whether the estimated models could properly take into account the nonconsistency of the basis. Also, unlike Brown, a high proportion of the hedge ratios were found to be significantly less than one.

In this paper, the specifications of the regression equation were altered to test the stability of optimal hedge ratios during a widening and narrowing basis. Previous portfolio hedging research used only cash prices at delivery point location (Wilson, Brown). In addition to delivery point cash markets, export and other domestic cash markets were analyzed in this study. The two wheat classes analyzed in the study were hard red winter wheat and hard red spring wheat.

Presented in the first section of this paper is a brief review of the portfolio approach and the standard estimation equation. Subsequent discussion presents arguements for altering the specification of the regression model used to estimate the hedge ratio. After the description of the price data and methodology, the empirical analysis is presented and interpreted.

The Portfolio Approach

The derivation of the optimal hedge ratio under various assumptions concerning risk aversion, storage costs, basis changes, and prices are presented in the literature. Johnson, and Stein derived the risk-minimizing ratio, b*, as being the slope coefficient of an ordinary least squares equation of cash prices on futures prices. The b* represents the proportion of the cash position that should be hedged. Brown reformulated the model in terms of returns and indicated that ,b*, should be formulated in terms of the variances and covariances of spot and futures returns. Hill and Schneeweis used price changes in their analysis. As pointed out by Brown, and Wilson, the important issue is the estimation of b* using something other than price levels. The analysis in this paper used the price change method of estimating the optimal hedge ratio. Previous hedge ratios were calculated using the following equation:

$$\hat{S}_t = a + b\,\hat{F}_t + e_t$$

Where: $\hat{S}_t$ = change in the spot price
$\hat{F}_t$ = change in the futures price
a,b = estimated regression parameters
c_t = error term

This equation can be expanded to included more than one futures market position (Wilson). To determine the optimal hedge ratios for each futures position, the variance of the returns equation is minimized by solving for the partial derivatives for each market. The solutions are equal to the optimal hedge ratios.

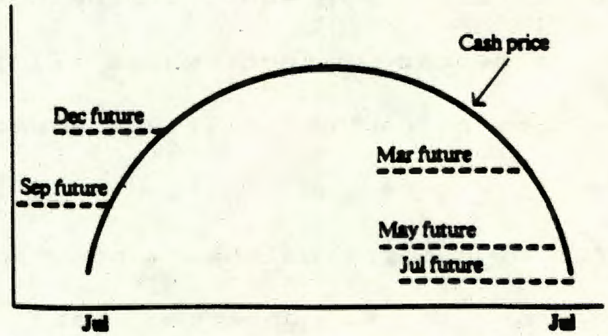
The measure of hedging effectiveness (E) is the percentage decrease in the spot price variability because of the hedged position relative to unhedged position. E is equal to the variance of returns of the optimal hedge position divided by the variance of returns in an unhedged cash position or the coefficient of determination.

Problems of Previously Specified Regression Model

Previous discussions of the estimated optimal hedge ratios have largely ignored the implications of the estimated intercept term. In their analysis of price changes between local and destination cash markets, Schmiesing, Blank and Gunn discussed how the intercept term will reflect the time trend in the price relationship between two markets. Stoll has asserted that because the intercept term will reflect any trends in the basis, a the trend in the basis will not bias the hedge ratio analysis (Wilson, p.86).

The expectation is for the basis to converge to essentially zero at delivery points during the delivery month. However, this convergence does not have to be accomplished by an identical time trend for all futures contracts. Consider Working's basic seasonal model of the price relationships between the futures and cash markets at the delivery point (Figure 1). During the narrowing of the basis, the intercept term will be positive for the September and December contracts. For the March, May, and July contracts, the intercept term would be negative.

Figure 1: Hypothetical Expectation of the Movement of Cash Prices Relative to Futures Contract Prices During a Marketing Year for Wheat.



Source: "Commentary," Review of Research in Futures Markets, 3 (1984) P. 87.

Figure 2: Average Gulf Winter Wheat May Basis for Specified Months Prior and During the May Kansas City Futures Contract for July 1, 1980 - June 30, 1985

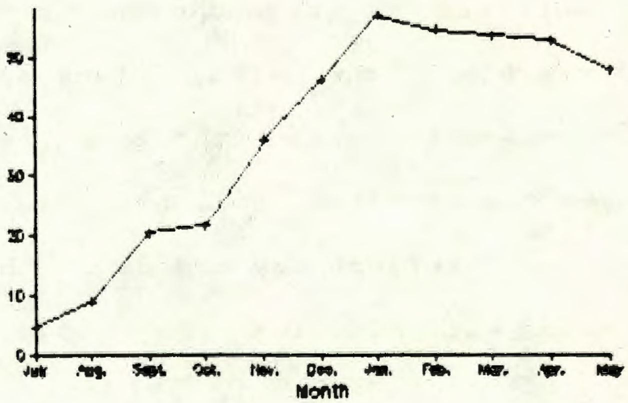
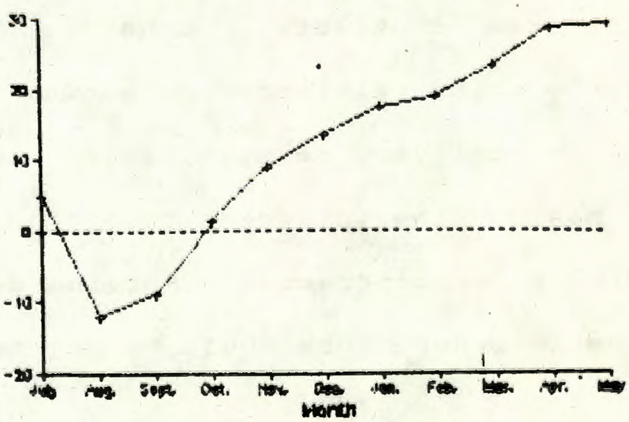


Figure 3: Average Minneapolis Spring Wheat May Basis for Specified Months Prior and During The May Minneapolis Futures Contract for July 1, 1980 - June 30, 1985.



Previous research has not explicitly recognized this fact in their estimations. Instead of segmenting their data sets into periods of narrowing and widening basis, the implicit assumption has been that convergence of the cash and futures market occurred with a single cash price trend in the data set.

Presented in Figures 2 and 3 are examples of how the basis actually converged for hard red winter wheat at the Gulf ports and hard red spring wheat at Minneapolis. The basis presented is the average monthly basis during 1980-1985 at the respective markets for the May futures contracts. The average monthly winter wheat basis at the Gulf narrowed from July to January, and either widened or stayed constant until the maturity of the contract. The average monthly spring basis at Minneapolis narrowed from August until April and stayed constant or widened thereafter. This information as to the trends in the basis has not been incorporated into the models used in previous studies.

Implicitly assumed in the previous analysis is the stability of the hedge ratios across periods of narrowing and widening basis. Strohmaier and Dahl have argued that hedging effectiveness is enhanced with predictable changes in the cash-futures market relationship. By altering the specification of the regression models, the stability of the hedging coefficients can be explicitly tested. If the hedge ratios are not stable, this would imply that risk minimization strategies would have to be altered based on the predictable changes in the cash and futures markets.

Altering the Specification of the Portfolio Model

The regression model was respecified to test explicitly for the existence of divergent time trends in the cash prices, and the stability of the hedge ratio across widening and narrowing basis periods. Binary variables for the intercept and slope were introduced into the regression model (Kmenta).

The following regression model was used to explicitly test the hypothesis discussed:

$$\hat{}S_t = a + b\,\hat{}F_t + y Z_t + S Y_t Z_t + e_t$$

The intercept binary variable (Z_t) was used to test the affect of the narrowing and widening of the basis on the time trend in the cash market. The intercept binary variable was zero, when the basis was estimated to be narrowing and equal to one, when the basis was estimated to be widening.

The slope binary variable ($Y_t Z_t$) was used to determine whether the hedge ratio was stable through periods of a narrowing and widening basis. As with the previous binary variable, the binary variable was equal to zero during the narrowing basis period. During the widening basis period, the binary variable was equal to the change in the futures contract price.

The length of time that the hedge existed would be expected to affect the existance of significant time trends in the intercept terms. Hedges of one week in length, such as those used by Brown, would not be expected to have significant time trends as represented by the regression equation's intercept. However, hedges of longer time periods, like a month, would be more likely to have significant intercepts. Also, the instability of the hedge ratios would be expected to be higher on the hedges of longer duration.

Data and Methodology

Wednesday cash market prices were collected for hard red winter wheat and hard red spring wheat. The protein level for the hard red winter wheat was "ordinary" and the protein level for the hard red spring wheat was 14 percent. The period for which prices were collected was July 1, 1980 to June 30, 1985.

Four cash markets were selected for each class of wheat. One cash market was a delivery point for the inherent futures market. A second cash market was a major export market for the specified class of wheat. The remaining two markets were local cash markets for the specified class of wheat.

The four spring wheat markets were: (1) Minneapolis, Minnesota; (2) Portland, Oregon; (3) Sioux City, Iowa; and (4) Aberdeen, South Dakota. Minneapolis is a delivery point for the Minneapolis Grain Exchange's hard red spring wheat contract. Portland is a major export port for spring wheat. Sioux City and Aberdeen were selected as the local cash markets.

The four winter wheat markets were Kansas City, the Gulf, Sioux City and Aberdeen. Kansas City is the delivery point for the Kansas City Board of Trade hard red winter futures contract. The Gulf is the major export port for this class of wheat. Sioux City and Aberdeen were again selected as the local cash markets.

Analyzed in the empirical analysis were hedges of one week and one month in length. The nearby futures contract price series was created by merging all nearby futures contracts into one price series. The delivery month was excluded from this price series. The series was was first differenced to calculate the weekly hedge ratios and fourth differenced to calculate the monthly hedge ratios. Steps were taken to to eliminate the problem of differencing across contracts. The May futures contract price series was found by differencing each May contract according to the length of the hedge and than merging the contracts together.

The first set of regressions analyzed were the futures and cash price series using futures prices from the nearby futures contracts of the inherent futures market. The regression model estimated was that contained in the previous research. The revised regression model results for the weekly hedges using the nearby contracts are presented in Table 2. Tables 3 and 4 contain the monthly hedge ratio estimates using the nearby futures contracts for inherent hedges and cross-hedges.

The remaining tables present the analysis of inherent and cross-hedges based only on the May futures contracts for each wheat class. Tables 5 and 6 present the weekly hedge ratio analysis, and Tables 7 and 8 present the monthly hedge ratio analysis.

For all the revised regressions estimated, the marketing year was divided into two periods based on the basis trend during specific months. The narrowing basis periods were September through February for the winter wheat and September through April for spring wheat. The remaining months were classified as being the widening basis periods. For cross-hedges, the classification scheme for the futures market was used to determine the binary variables.

Empirical Results

Based on the inherent nearby futures contract, the estimated hedge ratios were significantly less than one for the weekly hedges based on the nearby inherent futures contract (Tables 1 & 2). Although the binary intercepts were all insignificant and therefore indicating a lack of time trend in the cash market price, a number of the binary slope coefficients were significant. During the period of a widening basis, the positive coefficients would indicate the hedge ratio would have to be

Table 1: Ordinary Least Squares Estimate of Weekly Hedge Ratios on Kansas City (KC) and Minneapolis (MPLS) Nearby Futures Contracts for July 1, 1980 to June 30, 1985.

Cash Market	Equation	# of Obs.	F test	DW	R^2
Winter Wheat Cash and Futures Markets a/					
Kansas City	-.11 + .58KC	259	173.7	2.3	.40
	(.41) (.04)*				
Gulf	-.05 + .64KC	259	203.3	2.4	.44
	(.41) (.04)*				
Sioux City	.02 + .59KC	259	102.7	2.2	.28
	(59) (.06)*				
Aberdeen	-.10 + .47KC	259	86.9	2.0	.25
	(.47) (.05)*				
Spring Wheat Cash and Futures Markets a/					
Minneapolis	.01 + .78MPLS	259	283.6	2.2	.51
	(.32) (.04)*				
Portland	-.06 + .77MPLS	259	350.6	1.8	.56
	(.29) (.04)*				
Sioux City	.12 + .78MPLS	259	193.2	2.2	.41
	(.40) (.06)*				
Aberdeen	.01 + .73MPLS	259	288.2	2.2	.51
	(.31) (.04)*				

a/ Standard errors of the coefficients are presented in the parentheses. A "*" indicates that a intercept or binary variable coefficient are significantly different than 0 or the slope is significantly different than 1 at the 95% level.

Table 2: Ordinary Least Squares Estimate of Weekly Hedge Ratios on Kansas City (KC) and Minneapolis (MPLS) Nearby Futures Contracts with Slope and Intercept Binary Variables for July 1, 1980 to June 30, 1985.

Cash Market	Equation a	# of Obs.	F test	DW	R^2
Winter Wheat Cash and Futures Markets b/					
Kansas City	.30 -.74ID+ .48KC+ .28SD	259	63.7	2.2	.43
	(.56) (.81) (.05)* (.09)*				
Gulf	.12 -.21ID+ .50KC+ .38SD	259	78.0	2.2	.48
	(.56) (.80) (.05)* (.09)*				
Sioux City	.23 -.25ID+ .42KC+ .46SD	259	41.2	2.2	.33
	(.73) (1.1) (.07)* (.12)*				
Aberdeen	.19 -.52ID+ .37KC+ .28SD	259	32.2	2.0	.28
	(.65) (.93) (.06)* (.10)*				
Spring Wheat Cash and Futures Markets b/					
Minneapolis	.50 -1.30ID+ .76MPLS+ .03SD	259	96.8	2.2	.52
	(.40) (.69) (.06)* (.09)				
Portland	.25 -.93ID+ .78MPLS -.03SD	259	117.7	1.9	.57
	(.36) (.61) (.05)* (.08)				
Sioux City	.38 -.48ID+ .67MPLS+ .29SD	259	68.1	2.1	.43
	(.49) (.84) (.07)* (.11)*				
Aberdeen	.44 -1.20ID+ .72MPLS+ .03SD	259	97.9	2.1	.52
	(.38) (.65) (.05)* (.09)				

a/ ID is an intercept dummy and SD is a slope dummy. The two marketing year periods for spring wheat were September to May and May to September and for winter wheat, September to March and March to September.
b/ Standard errors of the coefficients are presented in the parentheses. A "*" indicates that a intercept or binary variable coefficient is significantly different than 0 or the slope is significantly different than 1 at the 95% level.

Table 3: OLS Estimate of Monthly Hedge Ratios on Kansas City (KC) and Minneapolis (MPLS) Nearby Futures Contracts with Slope and Intercept Binary Variables for July 1, 1980 to June 30, 1985.

Cash Market	Equation a	# of Obs.	F Test	DW	R^2
Winter Wheat Cash and Futures Markets b/					
Kansas City	1.53 -3.3ID+ .71KC -.04SD	256	95.1	.79	.53
	(.90) (1.3)* (.05)* (.08)				
Gulf	1.55 -3.3ID+ .73KC+ .02SD	256	108.9	.90	.57
	(.90) (1.3)* (.05)* (.09)				
Sioux City	1.75 -2.9ID+ .57KC+ .26SD	256	50.5	.71	.38
	(1.20) (1.7) (.07)* (.11)*				
Aberdeen	.81 -2.5ID+ .33KC+ .02SD	256	13.2	.57	.14
	(1.20) (1.8) (.07)* (.11)				
Spring Wheat Cash and Futures Markets b/					
Minneapolis	1.83 -5.8ID+ .94MPLS -.36SD	256	128.8	.81	.60
	(.63)* (1.1)* (.06) (.09)*				
Portland	1.44 -5.9ID+ .90MPLS -.29SD	256	110.1	.65	.55
	(.66)* (1.2)* (.06) (.10)*				
Sioux City	1.24 -2.1ID+ .91MPLS -.06SD	256	69.4	.63	.69
	(.87) (1.5) (.07) (.13)				
Aberdeen	1.89 -5.7ID+ .93MPLS -.38SD	256	138.9	.84	.61
	(.59)* (1.0)* (.05) (.09)*				

a/ ID is an intercept dummy and SD is a slope dummy. The two marketing year periods for spring wheat were September to May and May to September and for winter wheat, September to March and March to September.
b/ Standard errors of the coefficients are presented in the parentheses. A "*" indicates that a intercept or binary variable coefficient is significantly different than 0 or the slope is significantly different than 1 at the 95% level.

Table 4: OLS Estimate of Monthly Cross-Hedge Ratios on Kansas City (KC) and Minneapolis (MPLS) Nearby Futures Contracts with Slope and Intercept Binary Variables for July 1, 1980 to June 30, 1985.

Cash Market	Equation a	# of Obs.	F Test	DW	R^2
Winter Wheat Cash and Spring Wheat Futures Markets b/					
Kansas City	1.30 -5.1ID+ .91MPLS -.35SD	256	65.7	.60	.42
	(.84) (1.5)* (.07) (.13)*				
Gulf	.76 -3.4ID+ .88MPLS -.28SD	256	53.5	.62	.37
	(.90) (1.6)* (.08) (.14)*				
Sioux City	1.75 -4.3ID+ .91MPLS -.09SD	256	54.0	.80	.38
	(1.0) (1.8)* (.09) (.15)*				
Aberdeen	2.76 -8.5ID+ .86MPLS -.28SD	256	75.7	.67	.46
	(.82) (1.4)* (.07) (.12)*				
Spring Wheat Cash and Winter Wheat Futures Markets b/					
Minneapolis	-.90 + .76ID+ .35KC -.05SD	256	14.7	.60	.15
	(1.10) (1.6) (.06)* (.10)				
Portland	-.94 -.08ID+ .43KC -.14SD	256	20.3	.54	.20
	(1.10) (1.5) (.06)* (.10)				
Sioux City	.52 -1.1ID+ .36KC .09SD	256	15.2	.59	.15
	(1.30) (1.8) (.07)* (.12)				
Aberdeen	-.46 + .12ID+ .38KC -.09SD	256	17.5	.60	.17
	(1.00) (1.5) (.06)* (.09)				

a/ ID is an intercept dummy and SD is a slope dummy. The two marketing year periods for spring wheat were September to May and May to September and for winter wheat, September to March and March to September.
b/ Standard errors of the coefficients are presented in the parentheses. A "*" indicates that a intercept or binary variable coefficient are significantly different than 0 or the slope is significantly different than 1 at the 95% level.

Table 5: OLS Estimate of Weekly Hedge Ratios on Kansas City (KC) and Minneapolis (MPLS) May Futures Contracts with Slope and Intercept Binary Variables for July 1, 1980 to June 30, 1985.

Cash Market	Equation a	# of Obs.	F Test	DW	R^2
Winter Wheat Cash and Futures Markets b/					
Kansas City	1.30 -2.11D+ .78KC -.06SD	256	87.7	2.1	.53
	(.51)* (.75)* (.06)* (.09)				
Gulf	1.10 -1.31D+ .75KC -.06SD	256	61.7	2.1	.44
	(.58) (.86) (.07)* (.11)				
Sioux City	1.10 -1.81D+ .70KC -.03SD	256	35.2	2.1	.31
	(.74) (1.1) (.09)* (.13)				
Aberdeen	.91 -1.61D+ .55KC -.04SD	256	26.8	1.8	.26
	(.66) (.97) (.08)* (.12)				
Spring Wheat Cash and Futures Markets b/					
Minneapolis	1.10 -3.70ID+ .77MPLS -.37SD	256	55.7	2.3	.42
	(.45)* (.90)* (.06)* (.11)*				
Portland	.83 -2.70ID+ .76MPLS -.57SD	256	54.7	2.1	.42
	(.41)* (.82)* (.06)* (.11)*				
Sioux City	.90 -2.9ID+ .75MPLS -.24SD	256	38.5	2.1	.34
	(.54) (1.1)* (.08)* (.14)*				
Aberdeen	.96 3.40ID+ .74MPLS -.26SD	256	60.1	2.2	.43
	(.42)* (.84)* (.06)* (.11)*				

a/ ID is an intercept dummy and SD is a slope dummy. The two marketing year periods for spring wheat were September to May and May to September and for winter wheat, September to March and March to September.
b/ Standard errors of the coefficients are presented in the parentheses. A "*" indicates that a intercept or binary variable coefficient is significantly different than 0 or the slope is significantly different than 1 at the 95% level.

Table 6: OLS Estimate of Weekly Cross-Hedge Ratios on Kansas City (KC) and Minneapolis (MPLS) May Futures Contracts with Slope and Intercept Binary Variables for July 1, 1980 to June 30, 1985.

Cash Market	Equation a	# of Obs.	F Test	DW	R^2
Winter Wheat Cash and Spring Wheat Futures Markets b/					
Kansas City	.63 -2.10ID+ .91MPLS -.61SD	256	61.4	1.9	.44
	(.47) (.93)* (.07) (.12)*				
Gulf	.50 -1.21D+ .89MPLS -.68SD	256	41.1	1.9	.37
	(.53) (1.1) (.08) (.13)*				
Sioux City	.81 -2.81D+ .88MPLS -.49SD	256	34.2	2.1	.31
	(.63) (1.2)* (.09) (.15)*				
Aberdeen	1.20 -.44ID+ .76MPLS -.22SD	256	48.6	2.0	.39
	(.51)* (1.00) (.07)* (.13)				
Spring Wheat Cash and Winter Wheat Futures Markets b/					
Minneapolis	.51 -.61ID+ .50KC -.15SD	256	20.3	2.2	.21
	(.63) (.92) (.07)* (.11)				
Portland	.41 -.33ID+ .52KC -.16SD	256	27.7	2.0	.27
	(.55) (.81) (.06)* (.10)				
Sioux City	.93 -1.5ID+ .54KC -.01SD	256	26.9	2.0	.26
	(.67) (.99) (.08)* (.12)				
Aberdeen	.62 -.90ID+ .57KC -.20SD	256	30.5	2.0	.29
	(.56) (.83) (.07)* (.10)*				

a/ ID is an intercept dummy and SD is a slope dummy. The two marketing year periods for spring wheat were September to May and May to September and for winter wheat, September to March and March to September.
b/ Standard errors of the coefficients are presented in the parentheses. A "*" indicates that a intercept or binary variable coefficient is significantly different than 0 or the slope is significantly different than 1 at the 95% level.

Table 7: OLS Estimate of Monthly Hedge Ratios on Kansas City (KC) and Minneapolis (MPLS) May Futures Contracts with Slope and Intercept Binary Variables for July 1, 1980 to June 30, 1985.

Cash Market	Equation a	# of Obs.	F Test	DW	R^2
Winter Wheat Cash and Futures Markets b/					
Kansas City	5.0 -6.71D+ .68KC -.04SD	220	88.1	.68	.55
	(.94)* (1.4)* (.05)* (.09)				
Gulf	4.7 -5.6ID+ .63KC -.01SD	220	67.1	.70	.47
	(1.1)* (1.6)* (.05)* (.09)				
Sioux City	5.0 -9.6ID+ .62KC -.08SD	220	38.4	.61	.35
	(1.3)* (1.9)* (.06)* (.12)				
Aberdeen	2.4 -3.6ID+ .31KC -.01SD	220	10.3	.62	.13
	(1.3) (2.0) (.07)* (.13)				
Spring Wheat Cash and Futures Markets b/					
Minneapolis	3.70 -11.3ID+ .68MPLS -.40SD	220	68.1	.82	.49
	(.78)* (1.6)* (.06)* (.10)*				
Portland	3.40 -10.1ID+ .69MPLS -.32SD	220	83.9	.86	.54
	(.70)* (1.5)* (.05)* (.09)*				
Sioux City	3.40 -11.3ID+ .73MPLS -.18SD	220	54.0	.66	.43
	(.97)* (2.1)* (.07)* (.13)				
Aberdeen	3.80 -12.4ID+ .65MPLS -.38SD	220	84.7	.86	.54
	(.69)* (1.5)* (.05)* (.09)*				

a/ ID is an intercept dummy and SD is a slope dummy. The two marketing year periods for spring wheat were September to May and May to September and for winter wheat, September to March and March to September.
b/ Standard errors of the coefficients are presented in the parentheses. A "*" indicates that a intercept or binary variable coefficient is significantly different than 0 or the slope is significantly different than 1 at the 95% level.

Table 8: OLS Estimate of Monthly Cross-Hedge Ratios on Kansas City (KC) and Minneapolis (MPLS) May Futures Contracts with Slope and Intercept Binary Variables for July 1, 1980 to June 30, 1985.

Cash Market	Equation a	# of Obs.	F Test	DW	R^2
Winter Wheat Cash and Spring Wheat Futures Markets b/					
Kansas City	3.70 -8.2ID+ .75MPLS -.50SD	220	59.3	.65	.45
	(.87)* (1.9)* (.06)* (.12)*				
Gulf	3.20 -4.5ID+ .70MPLS -.64SD	220	39.7	.64	.35
	(.96)* (2.1)* (.64)* (.13)*				
Sioux City	4.1 -14.9ID+ .76MPLS -.43SD	220	52.7	.67	.43
	(1.1)* (2.2)* (.07)* (.14)*				
Aberdeen	4.50 -15.1ID+ .60MPLS -.42SD	220	46.7	.80	.40
	(.92)* (1.9)* (.06)* (.12)*				
Spring Wheat Cash and Winter Wheat Futures Markets b/					
Minneapolis	1.1 -.19ID+ .39KC -.11SD	220	15.8	.65	.18
	(1.1) (1.80) (.06)* (.11)				
Portland	1.5 -.41ID+ .48KC -.24SD	220	28.0	.68	.28
	(1.1) (1.60) (.06)* (.10)*				
Sioux City	3.2 -5.3ID+ .49KC -.04SD	220	22.2	.58	.24
	(1.3)* (2.1)* (.07)* (.12)				
Aberdeen	1.5 -1.3ID+ .39KC -.08SD	220	19.4	.64	.22
	(1.1) (1.6) (.05)* (.10)				

a/ ID is an intercept dummy and SD is a slope dummy. The two marketing year periods for spring wheat were September to May and May to September and for winter wheat, September to March and March to September.
b/ Standard errors of the coefficients are presented in the parentheses. A "*" indicates that a intercept or binary variable coefficient is significantly different than 0 or the slope is significantly different than 1 at the 95% level.

increased during this period.

The hedge ratios being different from one at all the markets is consistent with the previous research conducted by Wilson. However, the low hedge ratios for winter wheat were of concern to the authors. An analysis of daily price changes between daily delivery point cash prices and nearby futures prices revealed the correlation between the cash prices and nearby Kansas City Board of Trade futures contracts to be lower and more unstable than the correlation associated with the Minneapolis futures contract. Additional efforts are currently being directed towards analyzing this result.

For the estimates involving the monthly hedges of nearby contracts, a major divergence was found between the spring wheat and winter wheat analysis. The Minneapolis futures contract had a hedge ratio that was equal to one during the narrowing basis period in the inherent and cross hedges. The winter wheat futures contracts had low hedge ratios and this was particularily true the farther geographically north the winter wheat market.

However, this result was consistent with actual industry practice. The Aberdeen market's hedge ratio was .33 for an inherent hedge for winter wheat and .86 for a crosshedge on the Minneapolis market. Traditionally, the arguement has been that a wheat class should be hedged on the inherent futures market. Because of the contradictory results with the traditional wisdom, the authors contacted the grain merchandizer for the Aberdeen market. The merchandiser indicated that the elevator was using the Minneapolis futures contract instead of the Kansas City contract. He indicated that the local spatial market for winter wheat was dominated by the pricing structure for spring wheat (Hainy).

The remaining analysis conducted a hedge ratio analysis associated only with the May futures contracts. The analysis again confirmed the strong time trends in the cash markets, plus instability in the spring wheat hedge ratios during the widening basis period. This instability in the hedge ratios during a widening basis could be caused by the large magnitude of the basis change in a short period of time.

Conclusion

The traditional regression model used to estimate hedge ratios does not explicitly test two major hypothesis. The first hypothesis involves the recognition of potentially significantly time trends in the cash market during the narrowing and widening of the basis. The second hypothesis involves the implicit assumption that hedge ratios are stable throughout the marketing year independent of the trends in the basis.

By using intercept and slope binary variables, the existance of trend variables in the basis and stability in the hedge ratio can be explicitly tested. An analysis of the hard red spring wheat and hard red winter wheat revealed the existance of signficantly different time trends in the cash market during the narrowing basis period versus a widening basis period. Also, hedge ratios were found to be more unstable the longer the hedge. Spring wheat hedge ratios were found to be the most unstable during the basis widening period.

In addition, evidence was found that producers of winter wheat in the northern Great Plains may be able to hedge more effectively on the Minneapolis spring wheat contract. Further analysis of the winter wheat market is needed before a specific recommendation could be made to northern winter wheat producers.

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