Hedging Effectiveness In A Vertical Marketing Channel For Two Periods

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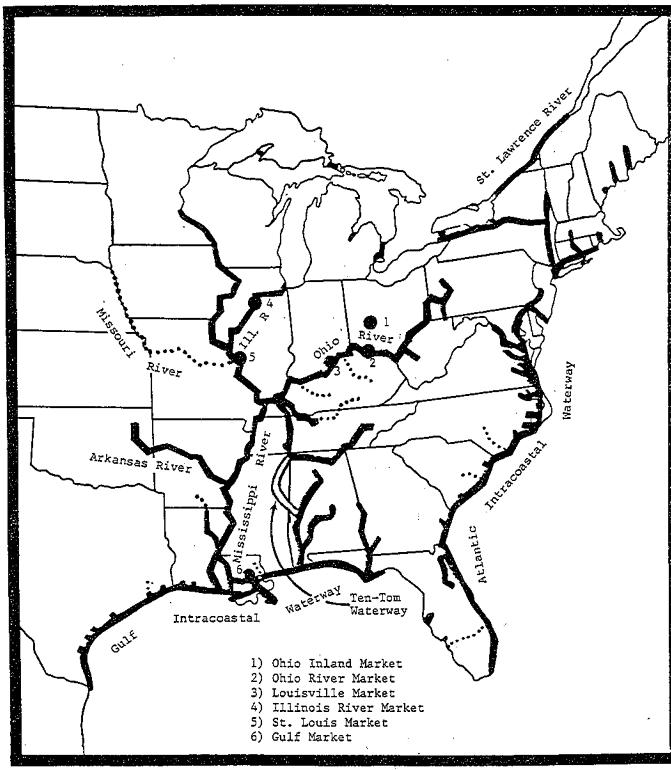
A vertical marketing system is the physical and institutional structure that transfers a commodity from the producer to the final consumer. For the US grain system, the vertical marketing channel includes transportation of grains from the farm level through intermediate handlers to points of export or to feed and grain processors. If the marketing system is competitive, then basis differentials between each market location will equal transportation costs. Thus, short hedges can manage price risk effectively in each market.

Most research on hedging effectiveness has focused on only one market level and one period (Ederington; Gray and Rutledge; Gray; Kahl 1983; Kahl 1986; Nelson and Collins; Tomek and Gray; Wilson). Also not studied is whether agribusinesses can effectively use short hedges to reduce risk, or to hedge grain at all levels within the marketing channel, or in different periods. So, should managers of country elevators hedge the same proportion of grain as managers of river elevators or export houses? Will the hedging practices of the different managers change in response to changes in government policies, transportation routes and rates, international market conditions or weather conditions?

This study examines hedging effectiveness at selected levels in the vertical marketing channel for corn for two specific periods. We compared differences in hedge performance measures for selected hedging periods in the crop year across markets and for two time intervals, 1975-80 and 1980-86. Specifically, we use a portfolio hedging framework to measure hedging effectiveness for six markets in a vertical market channel. These include a Gulf export market, Cincinnati and Louisville on the Ohio River, St. Louis, an aggregation of market locations on the Illinois River, and an inland location in Ohio (Figure 1).

We expect that hedging effectiveness measures may vary within the vertical marketing channel. This is because price bids by the inland elevator

Figure 1:
Selected Locations In a Vertical Marketing System for Corn



reflects both domestic and international demands. In contrast, the prices bid by river elevators reflect the price bids at the Gulf. Also, the export market determines the price bids by the Gulf elevator.

The two periods, 1975 to 1980 and 1981 to 1986, were chosen for comparative purposes. We chose the first period because it represents a relatively free competitive corn market. There was limited government supply intervention, relatively stable carry over from one year to the next, excellent weather conditions, and strong export demand. Hedging decisions were subject to major changes in the supply and demand conditions of the world markets. The second period, 1981 to 1986, represented an almost complete reversal of these characteristics. Therefore, we hypothesize that hedging and marketing decisions were subject to less risk than in the 1975-1980 period. This is because US corn prices were supported above world market levels, export demands were declining, and stocks were building. Although weather conditions were more variable than in the former period, in most years stocks were adequate to offset any decrease in production. Therefore supply was relatively stable. We expected that all firms within the vertical marketing channel could more effectively hedge grain in the latter more stable period.

The results from this study will be of interest to farmers and merchants who use short hedges to lessen price risks. Lenders will have an improved understanding of the marketing practices of their clients who operate at different levels within the vertical marketing channel. Policymakers will gain insight into the effects of their actions on the marketing practices of merchants.

Procedures and Data

Theoretical Framework. The theoretical framework for this study is the portfolio model of hedging initially proposed by Johnson and Stein. They based this framework on Modern Portfolio Theory (MPT), originally developed by Markowitz. By maximizing return for a given level of risk, or minimizing risk for a given level of return, MPT is a framework for determining the optimal proportions of assets to include in a portfolio. Key inputs into the framework are the expected returns, risks, and correlations of the individual assets. Using MPT, Johnson and Stein showed that a risk-averse hedger's problem is minimizing the risk of a portfolio of spot and futures positions. Here risk is the variability of returns from the combination of open and hedged positions within the portfolio. The risk-averse hedger's problem is to determine the optimal ratio of futures and spot positions (the hedge ratio), to reduce the combined risk of the futures and spot positions. Since futures and cash price movements are positively correlated, a normal hedge position is assumed. For example, a short hedger will take a long position in the spot market and a short position in the futures market.

With this background, we can formally derive the risk-minimizing hedge ratio. If a spot commodity position is determined in advance, the total risk (variance) of a spot plus hedged futures position is:

$$\mathrm{Var(HP)} = X_s\sigma^2_s + X_f\sigma^2_f + 2X_sX_f\mathrm{Cov}_{sf} \qquad (1)$$

Where:

- $\mathrm{Var(HP)}$ = variance of hedged position returns,
- X_s = units of the spot commodity to be hedged,
- X_f = units of the futures position,
- σ^2_s = variance of spot commodity returns (% change in spot price),
- σ^2_f = variance of the futures commodity returns (% change in futures price), and

Cov_{sf} = covariance of spot and futures commodity returns.

Equation (1) states that the total risk (variance) of hedge position returns is the weighted sum of the risk of spot commodity returns, the risk of futures commodity returns, and the covariance of spot and futures commodity returns. If spot and futures commodity returns are uncorrelated, then the covariance term in (1) will equal zero.

The hedging problem is to choose X_f such that Var (HP) is minimized. To do this, take the derivative of (1) with respect to X_f,

$$\frac{\delta Var\ (HP)}{\delta X_f} = 2X_f\sigma^2 2_f + 2X_s\ Cov_{sf} \qquad (2)$$

and set the derivative equal to zero and solve for X_f/X_s, the risk minimizing hedge ratio,

$$\frac{X_f}{X_s} = - \frac{COV_{sf}}{\sigma^2{}_f} \qquad (3)$$

This result shows that the correlation of cash and futures prices is a critical determinant of the optimal hedge ratio. Specifically, given a level of variability of futures returns, the more correlated are spot and futures returns then the larger will be the optimal hedge ratio.

The negative sign in (3) shows that the futures position should be opposite that in the spot market. Also, we must emphasize that risk-minimizing hedges do not necessarily imply that the number of futures contracts sold equals the total holdings of the cash commodity. This is because spot and futures prices do not necessarily move in tandem (Brown).

Risk minimizing hedge-ratios can be estimated based on the following regression,

$$P_{st} = \alpha + \beta\, P_{ft} + \varepsilon_t \qquad (4)$$

where:

P_{st} = spot commodity return at time t,
P_{ft} = futures commodity return at time t,
ε_t = Standard normal error term at time t.

The slope coefficient in (4) is equal to the following:

$$\beta = \frac{COV_s f}{\sigma^{2f}} \qquad (5)$$

Then, substituting β for the right hand term of (3), β is an estimate of the optimal hedge ratio. We measure the effectiveness of the risk-minimizing hedge by the R^2 of the estimated equation (4). Effectiveness, in this sense, is the proportion of variability in the spot commodity returns explained by the variability in futures commodity returns. Finally, both the hedge ratio and effectiveness measures are only relevant to the period over which the estimation was conducted.

Data and Statistical Tests. In this study, we examined hedge ratios and hedging effectiveness measures for six individual markets across the two periods, 1975-80 and 1981-86. Since the inland Ohio location and the Ohio and Illinois river locations ship grain to the Gulf, these markets form a vertical market system.

For the 1975 to 1986 period, we collected weekly Thursday closing cash price data for all markets except the aggregated river locations in Illinois. Data were not available for an individual river elevator in Illinois. So we obtained the average Thursday's closing prices for four river elevators from the Illinois Livestock and Crop Market News Service. Data were not available for the Ohio inland location for 1975-1978. We obtained Thursday's closing futures prices (December, March, May and July contracts) from the Chicago Board of Trade.

We assumed purchases and sales of corn were made during six hedging periods. In Working's terminology, elevators are merchandizing corn via an operational hedge (Table 1). For example, we assume corn bought in October or November by an elevator in the vertical marketing system is sold by December. This assumption is realistic as an inland elevator fills its storage facility at harvest and routinely merchandises corn through the vertical marketing system. Likewise, river and export elevators do not perform storage functions. Instead, their limited storage space is turned to perform the merchandizing function in an orderly and systematic manner (Larson and Baldwin).

For each hedging period and market, we regressed the weekly percentage change in cash prices at each market on the percentage change in the nearby futures price. We used percentage changes of prices instead of absolute price levels to reduce autocorrelation problems (Brown). We used the Durbin-Watson test to determine if autocorrelation was present in any of the equations. If present, we used a Cochrane-Orcutt procedure to transform the data.

We estimated regressions for two time intervals: 1975-1980 and 1981-1986. We analyzed differences in the magnitude of the hedge ratios across locations for each hedging period, and time period by their respective "t" test statistic for dummy variables (Gujarati; Marmer; Hill, Liro, and Schneeweis). Using dummy variables to test whether sets of coefficients in two linear regressions are equal is identical to the well-known Chow test. However, unlike the Chow test, the dummy variable procedure determines whether observed differences in two regressions are due to the

Table 1.
Corn Hedge Ratios for Selected Locations and Periods, 1975-1980 and 1981-86[a]

Market Locations	Ohio River Cincinnati	Ohio Inland	Ohio River Louisville	Illinois River Locations	Illinois River St. Louis	Gulf
Hedge Periods						
October–December Hedge						
1975-1980	0.8182	1.0290	0.8020	0.8631	0.8322	0.7992
	(8.37)	(9.41)	(9.92)	(5.02)	(9.86)	(16.61)
1981-1986	1.0585	1.1467	1.0712	1.034	0.9961	0.9206
	(24.19)	(27.8)	(17.68)	(20.38)	(21.64)	(22.72)
December-January						
1975-1980	0.8794	1.1036	0.9111	0.9519	0.9540	0.7349
	(13.91)	(21.99)	(21.13)	(16.16)	(13.84)	(16.96)
1981-1986	1.0348	1.1782	1.0523	1.0058	0.9260	0.9343
	(17.79)	(17.58)	(17.34)	(17.89)	(7.61)	(17.41)
January-February						
1975-1980	0.8758	1.1080	0.9084	0.9373	0.8981	0.8400
	(13.29)	(14.53)	(15.11)	(14.78)	(12.44)	(9.29)
1981-1986	1.0561	1.1680	1.1081	0.9907	1.0283	0.9883
	(26.20)	(29.10)	(31.36)	(29.42)	(12.40)	(18.37)
February-March						
1975-1980	0.8078	0.9027	0.7939	0.8393	0.8182	0.6320
	(21.99)	(26.71)	(27.09)	(16.16)	(10.07)	(6.73)
1981-1986	1.0287	1.1983	1.1502	0.9683	0.9357	0.8687
	(30.10)	(33.36)	(40.00)	(24.48)	(27.46)	(21.75)
March-April						
1975-1980	0.9948	0.9536	1.0930	1.2250	0.9759	0.67765
	(9.43)	(21.49)	(11.80)	(13.81)	(11.26)	(6.79)
1981-1986	0.9783	1.0411	1.0080	0.9237	0.8955	0.8818
	(20.37)	(34.83)	(26.37)	(26.94)	(31.61)	(33.45)
May-July						
1975-1980	1.0043	0.9144	0.9552	0.9791	1.0254	1.1985
	(21.48)	(11.81)	(14.44)	(24.98)	(29.26)	(18.68)
1981-1986	0.9760	1.0191	0.9253	0.9863	0.9892	0.9285
	(28.32)	(27.52)	(17.60)	(28.19)	(27.87)	(28.36)

[a]The analysis for Ohio Inland market; first period covers 1978–1980.
Number in parentheses represents the "t" statistics.

intercept, the slope, or both (Gujarati). The ability to isolate the source of the difference between the intercept and slope is important for this analysis since the slope coefficient is the hedge ratio.

The dummy variable model is of the form,

$$C_t = \alpha_0 + \alpha_1 D + \alpha_2 F_t + \alpha_3 (DF_t) + e_t$$

where:

D = the dummy variable equals (1) if the observation is in the 1975-80 period and (0) if the observation lies in the 1981-86 period,

C_t and F_t = cash and futures percentage price change, respectively,
e_t = error term and, α_0, α_1, α_2, and α_3 = parameters to be estimated.

The coefficient α_1 is the differential intercept in the additive form and the α_3 coefficient is the differential slope coefficient in the multiplicative form (Gujarati). Following the procedures developed by Gujarati, Marmer, and Hill (et al.), the hedge ratios for the two intervals are dissimilar when the differential slope coefficient α_3 is statistically significant as shown by the dummy test.

To determine if the hedging effectiveness coefficients differed across markets and periods, we applied a confidence interval test (Neter, Wasserman, and Kutner). We consider hedging effectiveness measures (R^2 values) to be statistically different if their confidence regions do not overlap. The test involves the transformation of the sample correlation coefficient (the square root of the coefficient of determination) to a parameter Z' by,

$$Z' = \tfrac{1}{2} \log_e(1 + r/1 - r).$$

As noted by Neter (et al.), when $n \geq 25$ the distribution of Z' is approximately normal with variance:

$$\sigma^2(Z') = (1/n - 3)$$

and the confidence limits are determined by

$$[Z' \pm Z(1 - \alpha/2)\sigma\ (Z')]^2.$$

where $Z(1 - \alpha/2)$ is the $[(1 - \alpha/2)\ 100]$ percentile of the standard normal distribution. We compare the hedging effectiveness measures for each location individually and between locations for the two periods.

Results

Hedge Ratios: Market Location Evaluations. In the vertical marketing chain, the magnitude of most hedge ratios declined as corn moved from the inland market via river markets to the Gulf market (Table 1). For the 1975-1980 October to December hedge period, the hedge ratio equaled 1.029 for the Ohio Inland market. It ranged between 0.8631 and 0.802 for the river markets, and equaled 0.7992 for the Gulf market. The decrease in the hedge ratios suggests that the volume hedged as a percent of total volume handled should decline as grain moves down the vertical marketing chain from the Ohio Inland market to the Gulf market.

Examining the hedge ratios for all hedging periods for 1975-80, we see that half of the inland market hedge ratios were not statistically different from 1:00, (Table 1). Therefore, 50 percent of the time the elevator manager in the inland market should hedge all grain merchandized through the firm.

Except the March–April and May-July hedging periods, the hedge ratios for both river and Gulf markets were statistically less than one (Table 1).

For example, the Ohio River Cincinnati market hedge ratio is 0.8182 for the October–December hedging period. Since hedging ratios for most hedging periods are less than one for all river and Gulf markets, the volume of corn hedged by river and Gulf elevator managers is less than that hedged in the inland market. So, the river and Gulf elevators may chose to hold a larger volume of long cash positions than should the manager of the inland elevator. These findings suggest that inland market prices were more effectively tracking futures prices than were prices from the river and Gulf markets.

During the 1981-86 period, the hedge rations ranged from 1.0192 (May–July) to 1.0192 (February-March) for the inland market (Table 1). Since the hedge ratios were not statistically different from one for all hedging periods, the elevator manager should maintain a perfect hedge. More often than not, the river hedge ratios were also not statistically different from one. Thus, the river markets should also maintain a perfect hedge position for most hedging periods.

In contrast, the Gulf market hedge ratios were all statistically less than one for this period. These findings suggest that inland market and river prices were more effectively tracking futures prices than were prices from the Gulf market. They also suggest that hedging strategies adopted by elevator managers at different levels within the vertical marketing system should vary from a perfect hedge at the inland market to some open cash positions at the Gulf market.

Hedge Ratios: 1975-80 and 1981-86. Since the government controlled the supply of corn from 1981 to 1986, hedging and marketing decisions may have been subject to less price risk than for 1975-80. Thus, hedging ratios for all but the late spring and summer periods increased for all markets in the vertical marketing chain (Table 1). For example, the Ohio River (Louisville) October-December hedge ratio increase from 0.8020 in 1975-1980 to 1.0712 in 1981-1986.

These larger hedge ratios suggest that the 1981-1986 prices for all markets may be more effectively tracking futures prices than were prices for the more unstable 1976-1980 period. The decreases in the ratios for late spring and early summer hedging periods may be the result of lulls in the cash markets. Since less grain moves through the vertical marketing channel, elevator managers may be more inattentive to corresponding price changes in the futures market.

To test whether the changes in the hedge ratios are different, we examined the differential slope coefficient using the dummy test. Based on the differential slope coefficient for the respective dummy variables, the increase in the hedge ratios was statistically significant at the 10 percent level for the Gulf market. Thus, we rejected the hypothesis that the optimal hedge ratios did not change between the two periods (Table 2). Except the spring and summer hedging periods, prices in the Gulf market were more effectively tracking futures prices during the 1980s than in the 1970s.

We accept the hypothesis for the two Ohio River locations for five of the six hedging periods at the 10 percent level (Table 2). Except the May–July hedging period, we reject the hypothesis that the optimal hedge ratios did not change between the two periods. For the markets on the Illinois River, we reject the hypothesis for only four of 12 hedging periods. For the Ohio Inland location, we accept the hypothesis 50 percent of the time at the 10 percent level.

These results suggest that governmental policies in the 1980s may have had a stabilizing effect on both futures and cash prices for some markets and hedging periods. As export demand decreased, government intervention in the markets increased. Also, carry-over stocks increased and there was stability in price relationships between cash and futures markets. Improving multiple correlation coefficients (R^2s, the explained relationship between the futures price and a respective cash price) supports this argument. For example in the 1970s, futures price movements explained 74.68 percent of the movements in Ohio Inland cash prices (Table 3). In the 1980s, we can explain 92.7 percent of the cash price movement. The improved multiple correlation coefficients reported in Table 3 show that the respective cash prices for the 1980s were in fact moving more in tandem with futures prices than in the 1970s. The results also show that the changes in policy and economic conditions in the 1980s had more effect on the

Table 2.
Statistical Difference in Hedge Ratios Between 1975–1980 and 1981–1986 for Selected Hedging Periods[a]

Market Location	Ohio[b] River Cincinnati	Ohio Inland	Ohio River Louisville	Illinois River Locations	Illinois River St. Louis	Gulf
Hedge Periods						
Oct.–Dec.	Sig.	Sig.	Sig.	Insig.	Sig.	Sig.
Dec.–Jan.	Sig.	Insig.	Sig.	Insig.	Insig.	Sig.
Jan.–Feb.	Sig.	Insig.	Sig.	Sig.	Sig.	Sig.
Feb.–Mar.	Sig.	Sig.	Sig.	Insig.	Insig.	Sig.
Mar.–April	Sig.	Insig.	Sig.	Insig.	Insig.	Sig.
May–July	Insig.	Sig.	Insig.	Sig.	Insig.	Sig.

[a]Sig. = Difference in Hedge Ratios is statistically significant.
Insig. = Difference in Hedge Ratios is statistically insignificant.
[b]For all market locations, $\alpha = 10\%$.

Table 3.
Hedging Effectiveness Measures for Hedging Periods and for Selected Locations, 1975–1980 and 1981–1986

Market Locations	Ohio River Cincinnati	Ohio[a] Inland	Ohio River Louisville	Illinois River Locations	Illinois River St. Louis	Gulf
Hedge Periods						
October–December						
1975–1980	0.5343	0.7468	0.6171	0.3503	0.6143	0.8188
1981–1986	0.9055	0.9271	0.9083	0.5664	0.8847	0.8943
December–January						
1975–1980	0.8736	0.9738	0.9409	0.9031	0.8673	0.9113
1981–1986	0.9134	0.9115	0.9092	0.9143	0.6586	0.9099
January–February						
1975–1980	0.8548	0.9378	0.8838	0.8792	0.8376	0.7422
1981–1986	0.9581	0.9657	0.9704	0.9665	0.8400	0.9183
February–March						
1975–1980	0.9470	0.9834	0.9645	0.9063	0.7898	0.6264
1981–1986	0.9711	0.9763	0.9834	0.9568	0.9654	0.9460
March–April						
1975–1980	0.6448	0.9525	0.7395	0.7954	0.7214	0.4847
1981–1986	0.8944	0.9611	0.9341	0.9367	0.9532	0.9580
May–July						
1975–1980	0.8815	0.8279	0.7707	0.9096	0.9324	0.8491
1981–1986	0.9293	0.9254	0.8354	0.9287	0.9272	0.9294

[a]The analysis for Ohio Inland Market; first period covers 1978–1980.

Gulf market than on the river and inland markets. This may reflect the specialized nature of the export Gulf market. Finally, it is inconclusive whether the changes of the 1980s have had more effect on the river locations than on the inland location. The findings for the Ohio River locations vis-a-vis the inland market suggest a relatively larger impact for the river markets. We cannot substantiate this by comparing the findings for the Illinois River to that of the inland location.

Hedging Effectiveness: Locations. Hedging effectiveness measures (R^2s) are mostly larger for the Ohio inland location than for the other market locations (Table 3). For the 1980s, the multiple correlation coefficient for the Ohio Inland market was 92.71 percent. This finding implies we can explain 92.71 percent of the change in the Ohio Inland cash price by the corresponding change in futures price. Thus, the two price series are changing in tandem. In contrast, for the Illinois River locations changes in futures prices explain only 56.64 percent of the changes in the cash market price.

To determine if the hedging effectiveness measures or multiple correlation coefficients differ across markets, we applied a confidence interval test. For most hedging periods, we cannot reject the hypothesis that the hedging effectiveness measures are similar across locations (Table 4). These findings suggest that the markets were equally effective in their capability to offset cash price variance by selecting different hedging strategies. There is no evidence that one market is more effective than another within this vertical marketing channel.

Hedging Effectiveness: 1979–80 and 1981–86. The hedging effectiveness measures appear to have increased for all markets and for nearly all hedging periods in the 1980s (Table 3). For example, the Ohio River Louisville market effectiveness measure increased from 61.71 percent for the 1970s to 90.83 percent for the 1980s. On the surface, cash prices were more effectively tracking futures prices in the 1980s than in the 1970s.

To determine if there was more correlation between movements in futures and cash prices in the 1980s than in the 1970s, we applied a confidence interval test to the hedging effectiveness measure — the multiple correlation coefficient. We accept the hypothesis that the hedging effectiveness measure is not statistically different between 1975–80 and 1981–86 for five of the six hedging periods (83 percent of the time) for the inland market (Table 5). For the river markets and the Gulf, the hypothesis is accepted for 72 percent and 50 percent of the hedging periods, respectively.

Table 4.
Hedging Effectiveness (R^2) Confidence Interval Evaluations Across Markets in the Vertical Marketing Channel for the October to December Hedge Period,[a] 1975–80 and 1981–86[b]

Location	Ohio Inland	Louisville	Illinois River	St. Louis	Gulf
Ohio River					
1975–1980	A	A	A	A	R
1981–1986	A	A	R	A	A
Ohio Inland					
1978–1980		A	R	A	A
1981–1986		A	R	A	A
Louisville					
1975–1980			A	R	A
1981–1986			R	A	A
Illinois River					
1975–1980				A	R
1981–1986				R	R
St. Louis					
1975–1980					A
1981-1986					A

[a] Findings for the October-December hedging period are representative of the findings for the remaining five hedging periods.
[b] H_0 = Hedging effectiveness is not different between market locations at = α5 percent (A = Accept and R = Reject).

Table 5.
The Statistical Test for Hedging Effectiveness (R^2) Comparisons Between the 1975–1980 and 1981–1986 Time Periods for Different Locations in the Marketing Channel[a]

Market Locations	Ohio River Cincinnati	Ohio Ohio Inland	Illinois River Louisville	Illinois River Locations	River St. Louis	Gulf
Hedge Periods						
October–December	R	R	R	A	R	A
December–January	A	A	A	A	R	A
January–February	A	A	R	R	A	R
February–March	A	A	A	A	R	R
March–April	A	A	R	R	R	R
May–July	A	A	A	A	A	A

[a] H_o: The hedging effectiveness measure is not different ($\alpha = 5$ percent) for 1975–1980 and 1981–1986 (A = Accept and R = Reject).

Statistically, these tests show that cash prices in the Ohio Inland market were equally effective in tracking futures prices for both periods for five of the six hedging periods. A reexamination of Table 3 shows that for most hedging periods, we can explain more than 90 percent of the change in the Ohio Inland cash prices by the corresponding change in futures prices. Statistically, these tests further show that hedging effectiveness improves across the two periods as one moves down the vertical marketing channel.

We can explain the apparent direct correlation between the improvement in the 1980s hedging effectiveness measure and movement down the vertical marketing system by three factors. First, the political and economic changes of the 1980s may have had a more stabilizing effect on river markets and the Gulf than on the inland market. Second, statistically, the hedging effectiveness measure improved for the Gulf and mostly for the river markets during the winter months when the river system freezes. Thus, this test may be capturing the effects of changing weather patterns and the potential increase in the instability of the export demand of the 1970s. The extreme cold weather of the 1970s caused the river system to remain frozen for long periods relative to what occurred in the 1980s. Therefore, the Gulf and river markets may have had difficulty meeting prior sale commitments during the 1970s. They then had to bid aggressively to move grain into the Gulf by other transportation modes, or through firms located on other rivers or transportation routes. Finally, we have not ruled out the likelihood that location, or the size of the data base, may influence these findings. There is only one inland market in the database. The statistical findings for the Cincinnati Ohio River location are the same as the findings for the Ohio inland market. Repeating the experiment for many markets would shed more light on this issue.

Conclusions and Implications

Findings from this study indicate that the size of the estimated hedge ratios were directly related to the flow of grain in the marketing channel being the largest at the inland location and the smallest at the Gulf port. This implies that prices in the inland market were more effectively tracking futures than were corresponding prices at the other locations. Thus, elevator managers who are merchandising grain at different locations in the vertical marketing channel will not hedge the same volume of grain. The inland elevator manager should maintain a perfect hedged position, while at the Gulf the manager should hold a small long cash position. Holding different hedged positions ensures that elevator managers or merchandisers are equally efficient in reducing price variance. Finally, different policy decisions, economic trends or weather patterns may have different effects on elevator managers, depending upon their location within the vertical marketing system.

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