Cost of Forward Contracting Hard Red Winter Wheat

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Abstract

Two methods were used to determine the cost of forward contracting hard red winter wheat. One hundred days before delivery, the parametric method estimated the cost of forward contracting at four cents and the nonparametric estimated costs at 10 cents.

Producers have been encouraged by academians, lenders, and extension professionals to reduce price risk using futures or forward contracting. A key assumption of those advocating these methods of risk protection is that the benefits outweigh the costs. The costs of such protection however, have been omitted or assumed to be zero for most of these discussions. Lence has shown that considering hedging costs can lead to quite different hedging recommendations than assuming zero transaction costs. Brorsen and Anderson found that none of the 24 extension marketing economists surveyed agreed that farmers who forward contract production will receive a lower average price than those who do not. They also found only one extension marketing economist who disagreed with the statement that pre-harvest hedging strategies are available which allow a producer to, on average, receive a higher price than always selling at harvest. Given that the views of extension economists contrast strongly with the limited empirical research available, there appears to be a need for further research on this issue.

While some of the costs of hedging are widely acknowledged, the exception being liquidity costs, the costs of forward contracting are not so obvious. The purpose of this paper will be to determine the average costs associated with forward contracting hard red winter wheat at an Oklahoma terminal elevator. Brorsen, Coombs, and Anderson determined the costs of forward contracting wheat based on Gulf elevator basis bids. This article expands on that idea by using Arkansas River terminal elevator prices. Gulf bids may underestimate the costs of forward contracting at a local elevator.

Forward contracting and hedging are services offered to producers to reduce price risk. Like many services, there is a cost to using this service. In hedging, the cost consists of margins, liquidity costs, brokerage fees, and paperwork. Barkley and Schroeder argue forward contracting also contains these fees built into the basis bid offered by the elevator since the elevator is now assuming the price risk from the producer. Since forward contracts lack the margin requirements and the marking to market feature of futures contracts, forward contracts have greater default risk and collection costs. Elam and Woodworth found that forward contracting has costs for producers and that the net price received for forward contracts ranged from 18 cents less than the net price from hedging 10 months to delivery to 2 cents less than the net price from hedging 1 month from delivery.

Two analysis techniques were chosen. The parametric determined forward contract price as a linear and quadratic function of year dummy variables and number of days to delivery with the nonparametric, a seven day moving average of daily basis (cash price - futures price) was used to estimate the weekly average of basis.

Forward Contracting of Wheat

An elevator may forward contract the wheat supplied by the producer to another user, a mill, a grain exporter, or even a feed mill. The end user may choose to sell the equivalent amount of grain in the futures market to protect against a drop in prices. Elevators also may hedge the grain for sale at a later date. In both cases the elevator forward contracts grain to protect against two things, an increase in grain prices and grain shortages. Although this protection depends on the ability of the producer to deliver against the contract. The formula for forward contract price received by the farmer is

forward contract price = Kansas City wheat July futures prices + Arkansas River basis bid

Adding the Arkansas River basis bid to the July futures price yields the forward contract price. Brorsen, Coombs, and Anderson, argued that elevator managers may include an extra cushion in the forward contract bid to compensate for possible increased transportation costs. The Gulf bids reflect contracts between elevators while our data reflect contracts between and elevator and a farmer. The elevators may be less likely to default on the contract than a farmer. Thus, the forward contracting costs found here for Arkansas River prices are expected to be higher than Gulf prices used by Brorsen, Coombs, and Anderson.

Data

Data are Arkansas River (Catoosa, Oklahoma) forward contract bids for hard red winter wheat from 1986-1994. The data are available for every day a bid was offered by the elevator to the last delivery day. On many days, there was no interest in forward contracting and so no bids were offered. Prices were freight on buyer (FOB) Arkansas River for delivery in the last half of June. In addition to the terminal elevator's bids the data also include Kansas City July hard red winter wheat futures. The basis was defined as (*forward contract price - Kansas City futures).* One observation was removed, June 15, 1988, due to the forward contract bid's failure to adjust to a large increase in both the

Gulf forward contract price and Kansas City futures price. The next day the Arkansas River price had adjusted. The first bids recorded in each year varied in time from 180 days to delivery to 276 days before delivery, as illustrated in figure 1.

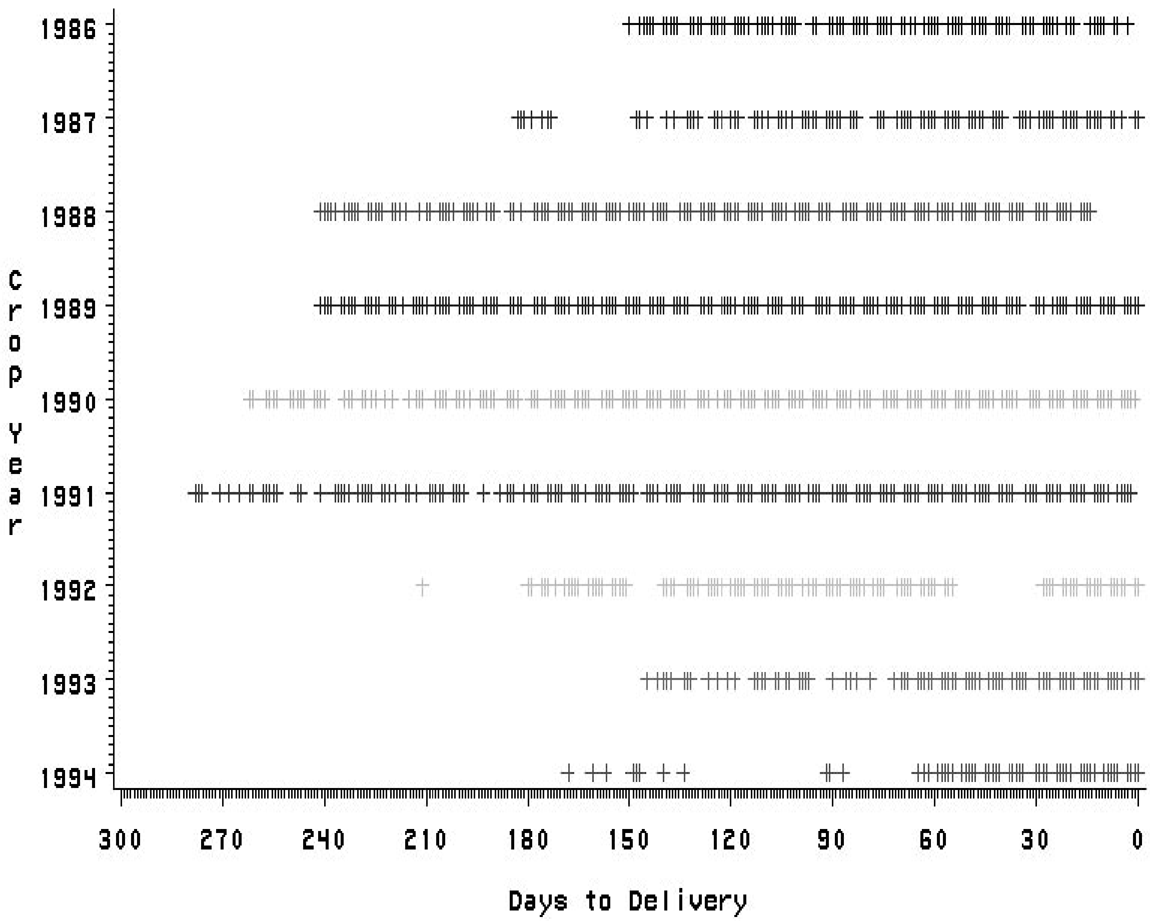

Figure 1. The days when an Arkansas River forward contract wheat price was quoted vs. Days to delivery.

Much theoretical work and applied work on "optimal" marketing strategies assumes hedging or forward contracting is done at harvest. Only during 1991 were prices even quoted at planting so the data in figure 1 do not support this assumption. Since seed beds must be prepared and fertilizer is usually applied before planting, the decision to plant wheat was made even earlier.

The data for the parametric method includes all available bids. Many of these early bids were isolated with few or no bids following for long periods of time. For the nonparametric method, missing values needed to be eliminated. Bids were considered too isolated to be used if less than 50% of the days over a period of time contain an observation. After the missing river data points were deleted, the existing Arkansas River bids were regressed against the Gulf bids and days to delivery to obtain predicted Arkansas River bids where the gulf prices were present in the data set. From the remainder of the data set, 210 observations had the necessary information from the day of the observation to allow a river price to be estimated using regression. The Gulf prices should differ from the Arkansas River prices by the cost of transportation between the two points. Therefore, if the cost of transportation could be estimated, then viable estimates of the Arkansas bids could be determined. The data points available from the Arkansas River were regressed against several variables using ordinary least squares (OLS), the formula is:

(1) $$ARFCP_{it} = \alpha_0 + \alpha_1 GFCP_{it} + \alpha_2 KCFUT_{it} + \alpha_3 DEL_{it} + \sum_{j=4}^{10} \alpha_j D_{ji}$$

where $ARFCP_{it}$ is the Arkansas River price of forward contracts, $GFCP_{it}$ is the Gulf forward contract price, $KCFUT_{it}$ is the July Kansas City futures prices, and D_{ji} are crop year dummy variables. DEL_{it} is the number of days to delivery. The samples where the river price, gulf price, and futures price were present were used in the regression to calculate the coefficients used to estimate the missing river prices. The predicted values were substituted into the data set to fill in missing values and give values of Arkansas River bids. These predicted values were filled in to avoid large data gaps, empty spaces, and to allow the 7 day moving average to be calculated without any missing values in the plots. Therefore, 210 observations were filled in.

Procedure

Both parametric and nonparametric methods are used to estimate the cost. The nonparametric method has the advantage of no functional form, while the stricter restrictions and functional form of the parametric model yields more precise estimates. The general function of the nonparametric model is

forward contract price = f(time to delivery)

The nonparametric model calculated a seven-day moving average for the forward contract bids across all the years of the data set to yield a seven day moving average across years for the contract bids.

The parametric model was estimated using a maximum likelihood estimator (MLE) in SHAZAM. The general model is:

(2) $$ARFCP_{it} = \alpha_0 + \alpha_1 DEL_{it} + \alpha_2 DEL_{it}^2 + \sum_{j=4}^{10} \alpha_j D_{ji}$$

where $ARFCP_{it}$ is the forward contract price in year *i*, *t* days from delivery, D_{ji} is a dummy variable, the value is one if the year equals *i*, zero otherwise, DEL_{it} is number of calendar days to delivery, and DEL_{it}^2 is the number of days to delivery squared. The Breusch-Pagan test statistic indicated that heteroskedasticity was present in the model. The HET command using MODEL=MULT specifying multiplicative heteroskedasticity was used in SHAZAM to correct for the heteroskedasticity. Therefore, OLS could not be used without losing efficiency, so a maximum likelihood estimator assuming multiplicative heteroskedasticity was used.

Results

The results from the regression analysis of the basis are presented in Table 1. In interpreting the results, we can imply that the basis is approximated by:

$$-.02815 * days\ delivery - .0001236 * days\ delivery^2$$

where days to delivery is 100, then (-.02815)100 - (.0001236)$(100)^2$= 4.051 cents per bushel. The cost of forward contracting as calculated at 100 days, which for this paper's purposes will be defined as the point at which producers seriously start to forward contract their grain, is approximately 4 cents.

The non-parametric analysis is plotted in Figure 2 and shows the basis varying over a wide range over the entire range of days to delivery. It could be argued that the range of the basis exceeds 30 cents per bushel. Although as the days to delivery decreases to the range (<120 days) where most forward contracting occurs, the range of the basis values decreases, but still has a range of 10 cents. Arguably, still a large value. It is reasonable to argue that even if only 1/3 of the overall range of the basis is the true value, 10 cents is still a large per bushel cost for forward contracting. Elam and Woodworth also found similarly large costs associated with forward contracting soybeans. Elam and Woodworth found a cost of forward contracting soybeans at 300 days to be 18 cents and at 100 days approximately 4 cents. Brorsen, Coombs, and Anderson found at 100 days the nonparametric form yielded a cost of 4 cents/bu. and the parametric form yielded a cost of 3 cents per bushel. The costs here are higher.

Table 1. Regression Coefficients for basis values as a function of days to delivery, days to delivery squared, and year dummy variables

Variable	basis cash-futures (w/o DEL^2)	T stat.	basis cash-futures (w/ DEL^2)	T stat.
Constant	8.0326*	47.55	7.1296*	29.18
	(0.1689)[a]		(0.2443)	
Time to delivery:				
Days to delivery (DEL)[b]	-0.056203*	-38.57	-0.028153*	-5.956
	(0.0014)		(0.004727)	
Days to delivery^2 (DEL^2)	N/A	N/A	-1.236E-04*	-5.383
			(0.0000229)	
Dummy variables:				
1987	-1.4969*	-4.823	-1.9006*	-6.628
	(0.3103)		(0.2867)	
1988	-5.5898*	-13.33	-5.5136*	-13.49
	(0.4194)		(0.4088)	
1989	-11.66*	-34.85	-12.848*	-45.48
	(0.3346)		(0.2825)	
1990	-8.3845*	-35.21	-8.8636*	-42.99
	(0.2381)		(0.2062)	
1991	-0.4288	-0.924	-0.93258*	-2.395
	(0.464)		(0.3894)	
1992	8.6753*	29.03	8.5198*	32.80
	(0.2988)		(0.2598)	
1993	0.5385*	1.762	1.2101*	4.923
	(0.3057)		(0.2458)	
1994	8.4416*	33.18	8.4080*	31.62
	(0.2544)		(0.2659)	

[a]Parentheses denote standard errors
[b]This variable is defined as the number of days remaining to delivery date where the delivery date is defined as July 1
*Indicates significance at 5%

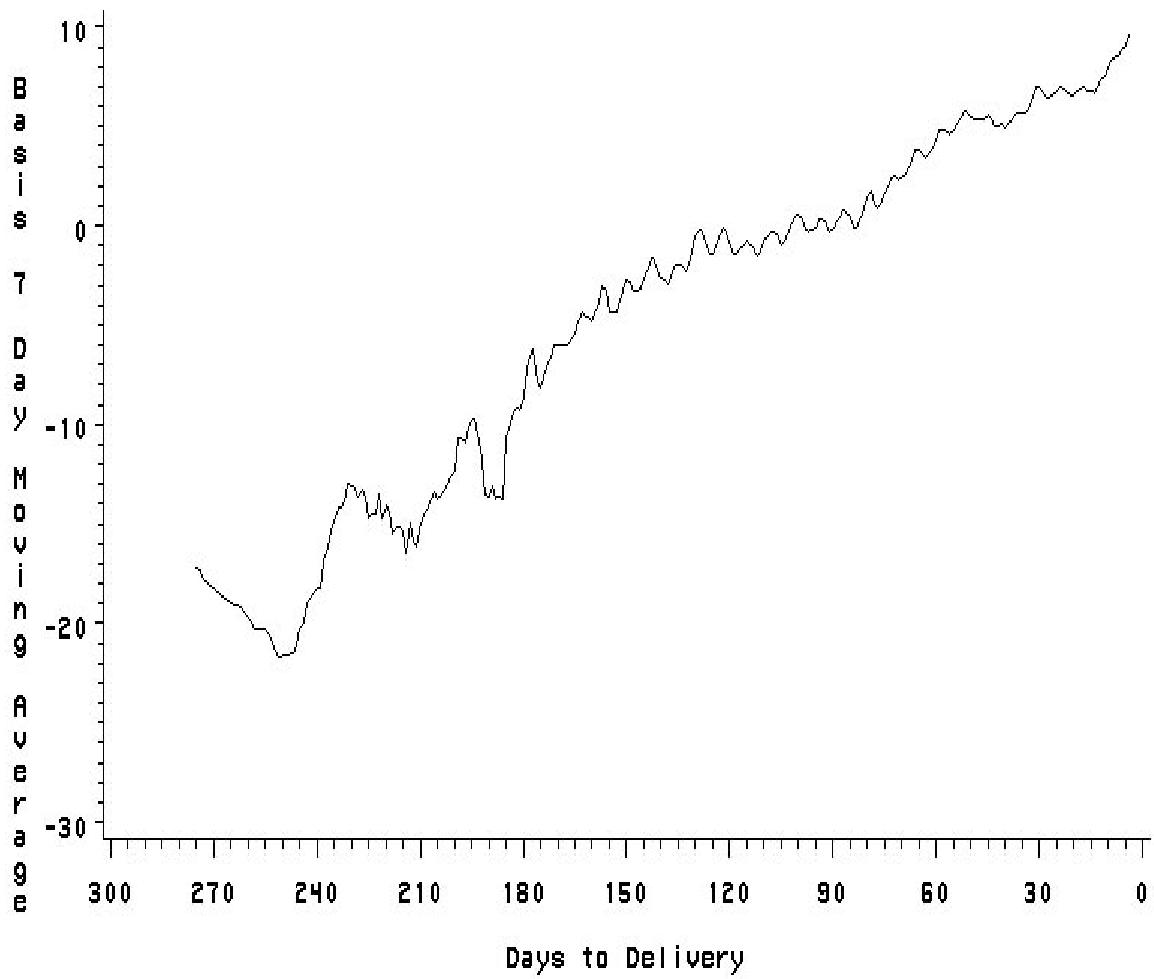

Figure 2. Basis 7 day moving average vs. days remaining until delivery

Conclusions

While the costs of hedging are well documented, the costs of forward contracting are less researched because of the lack of data on forward contract prices. Five studies have now determined that the costs of forward contracting are substantially larger than the cost of hedging. The large costs of forward contracting may indicate an extreme level of risk aversion of the part of the elevator or that the elevator has a monopoly on the forward contract market in the area. It may also mean that default risk and collection risks are high for forward contracts. Perhaps this should not be a surprise. Williams argues that futures markets exist partly because of having lower transaction costs than cash markets. The assumption that producers make forward contracting decisions at planting appears to be incorrect, as indicated by the scarce number of bids offered earlier than 180 days to delivery, well after planting.

These findings also have important implications for extension programs and extension professionals. As Brorsen and Anderson found, most extension professionals believe that producers who use price risk management tools, hedging or forward contracting do not receive lower average prices for their commodities than those who do not. This belief contrasts strongly with the empirical evidence. This suggests extension professionals should reevaluate the marketing advice they give producers. Forward contracting is more costly than many people realize.

References

Barkley, Andrew P. and Ted C. Schroeder. "Forward Contracts and Risk Mitigation in Fed Cattle Markets." Selected paper, American Agricultural Economics Association annual meetings, Manhattan, KS, August 1991.

Brorsen, B. Wade, J. Coombs, and K. Anderson. "The Cost of Forward Contracting Wheat." *Agribusiness* 11(July/August 1995):349-354.

Brorsen, B. Wade, and Kim Anderson. "What Do Extension Marketing Economists Teach?" unpub. manuscript, Dep. Agr. Econ., Okla. State Univ., 1997.

Elam, Emmett and John Woodworth. "Forward Selling Soybeans with Cash Forward Contracts, Futures Contracts, and Options." *Arkansas Business and Economic Review* 22(Summer 1989):10-20.

Lence, Sergio H. "Relaxing the Assumptions of Minimum-Variance Hedging." *Journal of Agricultural and Resource Economics* 21(July 1996):39-55.

White, Kenneth J. *SHAZAM User's Reference Manual Version 7.0*. Vancouver: Mcgraw-Hill, 1993.

Williams, J. "Futures Markets: A Consequence of Risk Aversion or Transaction Costs?" *Journal of Political Economy* 95(October 1987):1000-23.