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HEDGING ON THE LIVE CATTLE FUTURES CONTRACT

by

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Hedging on the futures market is frequently advocated as being a sound management practice for cattle feeders. Proponents of this view-point assert that hedging reduces the variability associated with "over the feeding period" changes in the price of fat cattle and in addition may lead to profits on the hedging operation itself.[1]

However, for a cattle feeder to make rational economic decisions regarding the use of the cattle futures market requires specific information concerning first, the reduction in price variability and second, the actual price he can expect on a hedged contract.

This paper is concerned with developing measures for selected markets of the change in price variability, hereafter referred to as the "efficiency of the hedge," and monthly measures of the actual price received, hereafter referred to as the "effective hedged price."

RESULTS OF A HEDGE

A hedge involves the cattle feeder making offsetting transactions in the cash and futures market, i.e., at the time feeder cattle are purchased a futures contract is sold and subsequently when the fat cattle are sold, the futures contract is bought back. The time between the two sets of transactions is determined by the length of the feeding period.

Thus, the price results of a hedge can be expressed as:

$$EP = FS - FB + CS - TC \qquad (1.$$

where,

EP = effective price

FS = price contract is sold for

FB = the futures contract buy back price

CS = cash price cattle are sold for

TC = transaction cost of hedging

It is apparent that the above equation defines the effective hedged price.[2] The efficiency of a hedge depends directly upon a comparison of the variability of the effective hedged price with the variability of the cash price and is best defined in relation to the concept of an ideal hedge.

An ideal hedge can be defined in terms of the above definition of the effective price. An ideal hedge is a hedge which results in the effective price received by the feeder for his fat cattle being equal to the net sales price of the futures contract (sales price of the futures contract minus the transaction cost).

The significance of an ideal hedge is directly related to the reduction of variability in the effective price. From the definition of the effective price (equation 1), it is obvious that under the conditions of an ideal hedge the price variability is zero. The price variability is zero since at the time the hedge is placed the only unknowns are the contract buy back price (FB) and the cash price the fat cattle are sold for (CS). Under the ideal hedge, the cash price and the net sales price of the futures contract exactly offset one another and therefore introduce no uncertainty into the effective price.

RESULTS OF A NONIDEAL HEDGE

Very seldom does the theoretical norm appear as an economic reality and the operation of hedging is no exception. There are two major reasons why the ideal hedge is seldom achieved; they are the factors of time and location. The further the sale of the fat cattle is from the closing date for the futures contract, and the further the cattle feeder is from the delivery point, the less are his chances of having an ideal hedge.

The obvious result of a nonideal hedge is that the effective price the feeder receives for his cattle does not equal the net sales price of the futures contract. In terms of equation 1, the effective price becomes:

$$EP = FS + B - TC \qquad (2.$$

B = basis (CS - FB)

In addition, if the basis has as a component random or unpredictable elements, a second result of a nonideal hedge is a degree of risk in the effective price equal to the variability in the basis. The risk is equal to the variability of the basis since all other components of the effective price are known to the feeder at the time he places the hedge.

The rest of this research is concerned with investigating the nature of this basis for five major fat cattle markets: Chicago, Kansas City, Omaha, Denver, and Phoenix.

The hypothesis to be tested is:

Ho: The level and variability of the basis in the cattle futures market differs among areas.

In order to test this hypothesis, a multiple linear regression technique using dummy variables was used.[3] The specific model which was fit to weekly data from five regions was:[4]

$$CS - FB = BI + e$$

where,

CS = cash price in feeding region

FB = the futures contract buy back price

BI = estimate of basis for applicable month

e = random term

Thus, the expected effective price for a hedged contract in a cattle feeding area is equal to the net sales price of the futures contract plus the monthly estimate of the basis BI. Note that this is only an expected effective price, for the basis is influenced by a random component of the basis provides a measure of the efficiency of the hedge. This comparison was presented in terms of a ratio of the variances which may be used directly to test for the reduction in variability through use of the F-test.

RESULTS BY REGIONS

Chicago

As expected, Chicago has the estimated basis closest to zero for most months. In addition, the mean of the basis is closest to zero for the Chicago market, -0.097 \$/cwt (table 1). In terms of seasonal pattern, the basis at Chicago declines from a high in November to a low in December then increases to another high in March. From March, it declines to a low in July and then increases to the November high. Only in June and July does any other region have a more favorable basis for hedgers. The R squared for this regression was 0.135 and the F-test testing the significance of the regression was 2.558. The efficiency of the hedge for the Chicago market was 3.147 (table 1).

Kansas City and Omaha

The basis of these two regions does not differ from one another to any great extent. Kansas City and Omaha have a mean basis of -0.663 \$/cwt and -0.696 \$/cwt, respectively (table 1). The low for the season is in December and January, while the maximum for the markets occurs in the summer. The R squareds were 0.187 and 0.091 with F-tests of 3.763 and 1.630 for Kansas City and Omaha, respectively. The ratio of variances was 3.913 for the Kansas City market and 4.350 for the Omaha market (table 1). These two markets showed the greatest reduction of risk for the period observed.

Denver

Denver had the lowest average basis, -0.976 \$/cwt. Consistent with this, Denver had the lowest expected basis for 5 months. The general seasonal pattern is a high in July decreasing to a low in March then an increase to the July high. The R squared for this regression was 0.298 with a corresponding F-test of 6.938.

The ratio of the variances was 3.580 for the Denver market (table 1).

Phoenix

Although Phoenix is the market furthest from Chicago studied in this research, the average for the basis was not the highest observed. At -0.670 \$/cwt it was lower than Denver and Omaha and only slightly higher than Kansas City. This is directly related to the fact that Phoenix had the most favorable basis of any market for 2 months--June and July, and the second most favorable basis for 6 months--December, January, February, March. April, and May. To offset these favorable months, Phoenix had the worst basis for 4 months--August, September, October, and November. For this market especially, the monthly estimates of basis are critical to the decision process in determining whether to hedge or not. The R squared and F-test were highest of the regressions, 0.376 and 9.855, respectively.

The possibilities for reduction of risk were lowest for the Phoenix market. Even so, the ratio of the variances was 3.061 and, thus, hedging by cattle feeders in this area can still lead to a substantial reduction in risk.

CONCLUSIONS

In general, the R squares for the regressions predicting basis by months were low (0.097 to 0.376), but all regressions, except Omaha, had a significant F statistic for rejection of the hypothesis that all of the regression coefficients were zero (table 1). The standard errors for the estimates of the basis are high, but the T-tests indicate that there are significant seasonal differences among months in each region. Further, the estimates of the efficiency of the hedge indicate that there is a significant reduction in variability for every market (F-test at 95% level). Thus, the results can be considered as significant in their present form; however, room is left for improvement in the method and model.

Table 1. Estimates of Monthly Basis

	Region				
Month	Chicago	Kansas City	Omaha	Denver	Phoenix
January	0.065	-0.968	-0.742	-0.957	-0.718
February	- .024	- .811	- .848	-1.537[a]	- .585
March	.345[a]	- .755	- .615[a]	-1.645[a]	- .139[a]
April	- .039	- .874	- .891	-1.546[a]	- .217[a]
May	- .059	- .598[a]	- .771	-1.138	- .425[a]
June	- .416	- .398[a]	- .684	- .767	.192[a]
July	- .498	- .364[a]	- .560[a]	- .489[a]	- .156[a]
August	- .345	- .466[a]	- .426[a]	- .551[a]	- .784
September	- .163	- .391[a]	- .441[a]	- .582[a]	- .947
October	.028	- .595[a]	- .763	-1.117	-1.649
November	.384[a]	- .641[a]	- .709	- .933	-1.450[a]
December	- .218	-1.008	- .973	- .930	- .941
Mean of Basis	- .097	- .663	- .696	- .976	- .670
R Squared	.135	.187	.091	.298	.376
F Statistic	2.558[b]	3.763[b]	1.630	6.938[b]	9.855[b]
Standard Error	.690	.552	.537	.584	.715
Standard Deviation of Cash Price	1.224	1.092	1.120	1.105	1.251
Efficiency of the Hedge (ratio of variances)	3.147[c]	3.913[c]	4.350[c]	3.580[c]	3.061[c]

[a]Indicates monthly basis estimates which were significantly different than the December estimate at the 95% level.

[b]Indicates the hypothesis that all regression coefficients equal zero was rejected at the 95% level.

[c]Indicates that the variances were significantly different at the 95% level.

FOOTNOTES

1. For a general discussion of this topic, see Geoffrey S. Shepherd, *Agricultural Price Analysis,* Chapter 15 or; Frederick L. Thomsen and Richard J. Foote, *Agricultural Prices,* pp. 140-164.

2. This applies to a commodity which is not storable. For the corresponding definition of effective hedged price for storable commodities, see Jerome L. Stein, "The Simultaneous Determination of Spot and Futures Prices," *American Economic Review,* Vol. 51, pp. 1012-25, December 1961.

3. For a discussion of "dummy variable" regression, see Arthur S. Goldberger, *Econometric Theory,* pp. 218-224.

4. The data for fat cattle prices relate to 900-1,100-pound choice steers. Data were obtained for the markets of Chicago, Kansas City, Omaha, and Denver from the "Livestock, Meat, Wool Market News, Weekly Summary and Statistics." For the Phoenix Market, the data were obtained from the weekly market reports of the Phoenix office of the Livestock Division, Consumer and Marketing Service, United States Department of Agriculture.

The futures prices used were the weekly closing prices as reported by the Chicago Mercantile Exchange for the contract with the nearest closing date. The data used cover the period from the first week of May 1965 through the last week of December 1968.