The Journal of Extension

Volume 46 | Number 1 Article 16

2-1-2008

Understanding Basis Risk Associated with Fed Cattle Livestock Risk Protection Insurance

Andrei R. Coelho
University of Nebraska- Lincoln, andrei_coelho@yahoo.com

Darrell R. Mark
University of Nebraska- Lincoln, dmark2@unl.edu

Azzeddine Azzam
University of Nebraska- Lincoln, Aazzam1@unl.edu

Recommended Citation

Coelho, A. R., Mark, D. R., & Azzam, A. (2008). Understanding Basis Risk Associated with Fed Cattle Livestock Risk Protection Insurance. *The Journal of Extension, 46*(1), Article 16.
https://tigerprints.clemson.edu/joe/vol46/iss1/16

This Research in Brief is brought to you for free and open access by the Conferences at TigerPrints. It has been accepted for inclusion in The Journal of Extension by an authorized editor of TigerPrints. For more information, please contact kokeefe@clemson.edu.

February 2008 // Volume 46 // Number 1 // Research in Brief // 1RIB6

Understanding Basis Risk Associated with Fed Cattle Livestock Risk Protection Insurance

Abstract
The research reported here identified factors explaining variability in weekly fed cattle Livestock Protection Insurance (LRP) basis for five cattle feeding regions in the United States. A Seemingly Unrelated Regressions (SUR) system of five futures and five LRP basis equations was estimated using weekly data from 1995 to 2004. Results indicated that market fundamentals, including the Choice-to-Select spread, slaughter level, corn price, and cattle imports, were significant determinants of both futures and LRP basis variability. Results have implications for cattle feeders and Extension educators who forecast LRP basis for hedging purposes.

Andrei R. Coelho
Graduate Student
andrei_coelho@yahoo.com

Darrell R. Mark
Assistant Professor and Extension Livestock Marketing Specialist
dmark2@unl.edu

Azzeddine Azzam
Professor
aazzam1@unl.edu

University of Nebraska Lincoln
Lincoln, Nebraska

Introduction

In 2003, USDA's Risk Management Agency (RMA) introduced Livestock Risk Protection Insurance (LRP) for fed cattle. LRP is single-peril price risk insurance that provides an indemnity to insured producers if a regional cash price index falls below some insured coverage price on the end-date of the insurance policy. By providing an indemnity based on a regional cash price index, producers hedging with LRP are exposed to a different type of basis risk than when hedging with traditional futures or options. Rather than being at risk to changes between a local cash selling price and the futures market price (futures basis), producers using LRP insurance are at risk to changes between the local cash selling price and the regional cash price index (LRP basis).

One of the intended goals of LRP for fed cattle was to reduce basis risk for producers by indemnifying local cash selling prices on an index more closely related to the cash price. Still, some level of basis risk is present. More important, understanding what determines changes in LRP basis is important for producers using LRP as they develop LRP basis expectations for future cattle selling dates. Further, it is critically important for Extension Educators to recognize the difference between futures basis and LRP basis.

Typically, Extension provides historical futures basis data for multiple cash market locations to assist producers in forecasting basis at the conclusion of a hedge. This traditional futures basis is not appropriate for forecasting LRP basis for a future date. Therefore, Extension educators should be prepared to not only explain the differences between futures and LRP basis, but also to provide insight on determinants of LRP basis risk. To date, there has not been any empirical research conducted to examine the factors influencing LRP basis risk. The study reported here explored the relationship between several factors and LRP basis.

Research Objectives

LRP insurance for fed cattle is indemnified on the five-area weekly weighted average cash price for 35-65% choice slaughter steers, FOB feedyard on a live weight basis, reported by USDA's Agricultural Marketing Service. Thus, LRP basis for fed cattle is the difference between a producer's local cash selling price and this five-area cash price (or Actual Ending Value as termed in the LRP policy). This LRP basis will vary according to location, but the variation would be expected to be small if the location was one of the five regions reported in the price (Kansas, Nebraska, Texas/Oklahoma, Colorado, and Iowa/Southern Minnesota).

The objective of our research was to develop an understanding of the factors affecting LRP basis and compare those effects to their impacts on futures basis for the five-area region. This information should aid both producers and educators in better understanding LRP basis risk.

Methodology

A system of five LRP and five futures basis equations (one for each region) was developed to determine whether market fundamentals explain the variation in weekly LRP and futures basis. These equations took the form:

$$BASIS_{it} = \alpha_1 + \alpha_2 SLBEEF_{it} + \alpha_3 CASHCORN_{it} + \alpha_4 CSSPREAD_t + \alpha_5 COF_{it} + \alpha_6 CANBDR_t + \sum_{j=2}^{12} \alpha_j MON_j + \varepsilon_{it}$$

where *BASIS* is either the futures basis or LRP basis, *i* represents the region, *t* represents the week, and *j* indexes the months from February to December. The explanatory variables representing market fundamentals included in the model are:

- The region's quantity of cattle slaughtered relative to total slaughter in the five regions (SLBEEF),
- The region's cash corn price relative to the five-region average (CASHCORN),
- The national Choice-to-Select spread (CSSPREAD),
- The region's cattle on feed inventory relative to the total cattle on feed inventory for the five regions (COF),
- A binary variable to account for the ban on Canadian cattle imports between May 2003 and July 2005 following Canada's first case of bovine spongiform encephalopathy (CANBDR), and
- Monthly binary variables to capture seasonal effects.

Weekly data from 1995 to 2004, totaling 487 useable observations, were used to estimate the effect of these market fundamental factors on LRP and futures basis (LMIC, 2006; USDA, 2005; USDA, 2006). To account for potential correlation of errors across equations, the system of five LRP and five futures basis equations were estimated using Seemingly Unrelated Regression (SUR). Additionally, the parameter estimates were corrected for first-order autocorrelation.

Empirical Results

Tables 1 and 2 present the estimated coefficients for the futures basis and LRP basis equations, respectively, for the system of 10 equations estimated together using SUR (parameter estimates corresponding to the monthly binary variables were generally insignificant and are available in Coelho, 2006). The parameter estimates measure the change in basis in $/cwt from a one-unit change in the explanatory variable, *ceteris paribus*. Percentage units are used for variables measured as the region's share or total relative to the five-region total (e.g., SLBEEF, CASHCORN, and COF). Positive coefficients represent a strengthening or narrowing basis and negative coefficients indicate a weakening or widening basis. Results indicate that several of the independent variables had a statistically significant relationship with futures and LRP basis.

Table 1.
Futures Basis Parameter Estimates

VARIABLE	KANSAS	NEBRASKA	TX/OK	COLORADO	IA/So.MN
SLBEEF	0.0061	0.0105	-0.0135	-0.0388	0.0274
	0.5620[a]	0.5690	-1.0490	-2.1680	0.7425
CASHCORN	-0.0040	-0.0496***[b]	0.0046	-0.0076	-0.0104
	-0.5472	-3.6650	0.5963	-1.0260	-0.9958
CSSPREAD	0.1324***	0.1933***	0.1242***	0.1485***	0.1937***

	4.6600	5.7250	4.4970	5.1350	5.8070
COF	-0.0022	0.0638	-0.0170	0.0183	-0.1304
	-0.0684	1.3910	-0.8052	0.3038	-1.5070
CANBDR	1.2325***	1.7602***	1.1214***	1.7676***	1.3846**
	2.7910	3.3120	2.6960	3.9250	2.2920
CONSTANT	-0.4671*	0.2071	-0.4239	-0.3192	-0.1872
	-1.8080	0.5781	-1.4610	-1.1270	-0.8275
R-SQUARED	0.0924	0.1220	0.0900	0.1322	0.0948

[a] T-statistics are reported below the parameter estimates.
[b] One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

Table 2.
LRP Basis Parameter Estimates

VARIABLE	KANSAS	NEBRASKA	TX/OK	COLORADO	IA/So.MN
SLBEEF	0.0215**[a]	0.0013	-0.0260**	-0.0658***	0.0690***
	2.1830[b]	0.8011	-1.9630	-3.5510	2.6050
CASHCORN	-0.0014	-0.0407***	0.0013	-0.0130**	0.0089
	-0.2315	-3.0860	0.2501	-2.2200	0.7111
CSSPREAD	0.0061	0.0767***	-0.0094	0.0339*	0.0747***
	0.3455	3.3270	-0.5369	1.8950	3.3960
COF	-0.0213	0.0967***	0.0036	0.0575	-0.1578***
	-1.1880	3.4840	0.3050	1.5150	-2.7590
CANBDR	0.0866	0.6918**	-0.0446	0.6344***	0.5059*
	0.3834	2.3390	-0.1983	2.7200	1.7760
CONSTANT	0.0581	0.7589	0.6061	1.0990	-0.6767
	0.0697	0.6850	0.7963	1.2710	-0.7037
R-SQUARED	0.0416	0.0724	0.0318	0.0670	0.0666

[a] One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively.
[b] T-statistics are reported below the parameter estimates.

The Choice-to-Select spread is a statistically significant determinant of live futures basis for all five regions (Table 1). The positive parameter estimates indicate that a $1/cwt increase in the Choice-to-Select spread leads to a $0.12-0.19/cwt increase in futures basis. Wald chi-square tests that tested for equal effects of the Choice-to-Select spread on each region were rejected.

For Nebraska, Colorado, and Iowa/So. Minnesota, the Choice-to-Select spread also had a statistically significant positive effect on LRP basis (Table 2), and this effect was statistically different across the regions. Thus, LRP basis in the northern states (which typically produce more Choice cattle) strengthened (or cash prices increased in the Northern states relative to the five-region average) as the Choice-to-Select spread widened. This suggests that Northern cattle feeding regions that traditionally produce more Choice cattle receive a premium as the demand for higher quality meat increases. Further, producers and Extension educators in those Northern states should be aware that unexpected changes in the Choice-to-Select spread may cause their actual LRP basis to differ from that expected and could slightly alter the outcome of hedges with LRP.

Another factor that tended to affect LRP basis in the Northern feeding areas (Nebraska, Colorado, and Iowa/Southern Minnesota) during the time period of the study was the closure of the Canadian border (Table 2). These states tend to import a larger number of slaughter cattle from Canada, thus cash prices increased more in those areas lacking Canadian supply between 2003 and 2005, which increased LRP basis.

While the impacts of the Canadian border on LRP basis were larger in the Northern regions and statistically different across all regions, it also had a statistically significant positive impact on futures basis in all five regions (Table 1). In general, futures basis strengthened (i.e., cash prices increased) in the five-region market given an overall reduction in slaughter cattle supply for U.S. meat processors and stronger domestic demand at that particular time. However, futures basis

was affected by a larger magnitude in the Northern states that imported larger numbers of slaughter cattle from Canada.

The quantity of cattle slaughtered in one location relative to the five-region total (SLBEEF) had mixed effects on LRP basis in different states (Table 2). Wald chi-square tests for equal effects of SLBEEF on LRP basis across the regions were rejected, confirming these mixed effects. LRP basis in Kansas and Iowa/So. Minnesota increased with SLBEEF, while in Texas/Oklahoma and Colorado, LRP basis weakened as the relative quantity of cattle slaughtered increased.

These mixed results could be due to the relative cost of procurement of cattle locally vs. that in other regions. If processors in a particular region procure cattle outside of their region due to prices being higher in their region, it is possible to increase SLBEEF in the region and have higher cash prices (LRP basis) simultaneously. This may have occurred in Kansas and Iowa/Southern Minnesota. Regardless, producers in various regions should adjust LRP basis forecasts accordingly for slaughter in their respective regions.

Previous studies have shown that corn price is an important factor affecting live cattle futures basis (Parcell, Schroeder, & Dhuyvetter, 2000). In this case, however, cash corn prices had a statistically significant negative impact on live cattle futures basis only in Nebraska. Corn prices had a negative impact (statistically significant at the .01 level) on LRP basis in both Nebraska and Colorado, indicating that an increase in local cash corn prices relative to the five-region average corn price weakens LRP basis in those two states.

Again, Wald chi-square tests rejected the cash corn price effect being the same across the regions for both futures and LRP basis. Results here suggest that Nebraska and Colorado cattle feeders hedging with LRP should adjust their LRP basis forecasts downward as their corn price increases relative to the five-region average.

Changes in cattle on feed relative to the five-region cattle on feed had no impact on live cattle futures basis in all five regions. Wald chi-square tests confirmed that COF effects on LRP basis differed across regions. LRP basis for Iowa/Southern Minnesota was negatively correlated with cattle on feed while an increase in cattle on feed in Nebraska relative to the five-region total had a statistically significant positive impact on LRP basis for the state. Again, this might be explained by the relative cost of local procurement of cattle. Results indicate that Nebraska and Colorado producers hedging fed cattle with LRP should account for relative cattle on feed inventories and adjust LRP basis forecasts up and down, respectively.

The model results in Table 2 indicate that only the number of cattle slaughtered in Texas/Oklahoma and Kansas relative to the five-region total was significant in explaining LRP basis variability in those states. The magnitude and variability of LRP basis in these Southern plains feeding states was not significantly different from LRP basis in the Northern states. Thus, the model results do not imply that LRP basis is more risky in those states, but that factors other than those included in the model caused the differences in local fed cattle prices relative to the five-region average. One such variable might be the proportion of cattle of *bos indicus* breeding that might receive quality discounts relative to cattle of predominantly *bos taurus* breeding being fed in the north. Further, the impact of the relative corn price variable might have affected LRP basis more in Southern states after the time period analyzed in the study when corn prices rose rapidly, particularly in those states.

Concluding Remarks

Previous research has confirmed that differences between futures basis and LRP basis exist (Mark, Prosch, & Smith, 2005). Generally, fed cattle LRP basis was found to be smaller and less variable than futures basis. While this serves as an advantage for producers hedging with LRP, it presents a new challenge in understanding the determinants of this "new" basis. Rather than using historical differences between local cash selling prices and futures prices for basis forecasts, LRP users need to focus on differences between local cash selling prices and the USDA Agricultural Marketing Service 5-Area reported fed cattle price.

Knowing the historical and seasonal trends in LRP basis can be useful for producers in generating expected LRP basis forecasts. Mark (2004) provides background on these seasonal trends and historical patterns. The research reported here complements that information by providing additional insight for producers and Extension Educators in understanding the drivers of changes in LRP basis.

The most important finding of the study is that market fundamentals affect LRP basis. This has important implications for cattle producers and Extension educators. Changes in LRP basis are determined partly by market fundamentals such as the Choice-to-Select spread, cash corn price, Canadian cattle import situation, and slaughter levels. Some of these factors tend to have more influence in some states (particularly northern feeding regions) than others. As a result, cattle feeders hedging with LRP should consider these LRP basis drivers when forecasting basis at the conclusion of their hedges.

Further, Extension educators providing educational programs and/or historical basis data on LRP need to be able to explain the differences between futures and LRP basis. Understanding some of the market factors that most influence LRP basis and futures basis is critical to doing so. While the

results of the study can enhance this understanding, they do not provide a model to forecast LRP basis with accuracy.

References

Coelho, A. R. (2006). *Empirical determinants of fed cattle livestock risk protection insurance basis*. Unpublished master's thesis, University of Nebraska-Lincoln.

LMIC (Livestock Marketing Information Center). (2006). *Livestock spreadsheets.* Retrieved May 10, 2006 from: http://www.lmic.info

Mark, D. R. (2004). Hedging and basis considerations for fed cattle livestock risk protection insurance. *Extension Circular EC04-834.* Lincoln, NE: Department of Agricultural Economics, University of Nebraska-Lincoln Extension.

Mark, D. R., Prosch, A. L., & Smith, R. R. (2005). Livestock protection insurance: a self-study guide. *Extension Circular EC 05-839.* Lincoln, NE: Department of Agricultural Economics, University of Nebraska-Lincoln Extension.

Parcell, J. L., Schroeder, T. C., & Dhuyvetter, K. C. (2000). Factors affecting live cattle basis. *Journal of Agricultural and Applied Economics, 32*, 531-541.

USDA (United States Department of Agriculture). (2005). *Statistics of cattle, hogs, and sheep*. National Agricultural Statistics Service. Retrieved May 10, 2006: http://www.usda.gov/nass/pubs/agr05/05_ch7.PDF

USDA (United States Department of Agriculture). (2006). *Agricultural statistics database*. National Agricultural Statistics Service. Retrieved May 10, 2006: http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp