Calendar vs. Weeks to Expiration Livestock Basis Forecasts: Which Is Better?

by

Glynn T. Tonsor, James R. Mintert,
and Kevin C. Dhuyvetter

Suggested citation format:

Tonsor, G. T., J. R. Mintert, and Kevin C. Dhuyvetter. 2003. "Calendar vs. Weeks to Expiration Livestock Basis Forecasts: Which Is Better?" Proceedings of the NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management. St. Louis, MO. [http://www.farmdoc.uiuc.edu/nccc134].

Calendar vs. Weeks To Expiration Livestock Basis Forecasts: Which Is Better?

Glynn T. Tonsor, James R. Mintert, and Kevin C. Dhuyvetter

Paper presented at the NCR-134 Conference on Applied Commodity Price

Analysis, Forecasting, and Market Risk Management

St. Louis, Missouri, April 21-22, 2003

* The authors are an USDA National Needs Graduate Fellow, professor, and professor, respectively, Department of Agricultural Economics at Kansas State University.

Calendar vs. Weeks To Expiration Livestock Basis Forecasts: Which Is Better?

ABSTRACT

The ability to accurately forecast basis is crucial to risk management strategies employed by many agribusiness firms. Previous research has examined how to effectively use basis forecasts and what factors affect basis, but literature focusing on forecasting basis is sparse. This research evaluates the impact of adopting a time-to-expiration approach, as compared to the more common calendar approach, when forecasting feeder cattle, live cattle, and hog basis. Furthermore, the optimal number of past year's basis levels to include in making basis predictions is evaluated in an out-of-sample framework. Absolute basis forecasts errors are generated for all three commodities and evaluated to determine the significance of the two issues mentioned above. Results indicate that basis forecasters should consider using three-year historical averages for feeder cattle and four-year historical averages for live cattle and lean hogs when making basis forecasts. Furthermore, the use of a time-to-expiration method of calculating historical average basis results in very little improvement in basis prediction accuracy compared to the calendar approach.

Keywords: livestock prices, basis, hedging, basis forecasts

INTRODUCTION

The profitability of an agribusiness can be heavily influenced by the timing of when it chooses to market its livestock, or alternatively to cover its future livestock purchases. Research suggests that managers who use the futures market to hedge their respective sales and purchases of livestock are typically regarded as good marketers (Schroeder et al.). The difference between the futures market price and the cash market price is known as the "basis" (cash – futures). Successful hedging requires that hedgers be able to accurately project basis at the outset of a hedge. That is, at the time a hedge is initiated hedgers need to predict what basis will be when the cash sale or purchase is made and the futures position is offset.

Cash prices and futures prices should converge on the expiration date at the delivery point specified in a given contract (Tomek). Hedgers are often interested in forecasting basis prior to delivery at locations other than delivery points specified in the futures contract. A typical approach for forecasting basis is to average historic basis levels, across years, on a stated calendar date. But this technique fails to account for changes in the days to contract expiration from this date, across years, masking convergence and potentially reducing forecast accuracy. In order to capture the convergence effect when averaging historic basis, it may be important to properly account for the days remaining until contract expiration. For a better understanding, consider the common practice, which is to state that: "lean hog basis for the week ending July 12th is expected to be -$3.00/cwt.", where the forecast is based on a multi-year average for a recent time period. In fact, the number of days between "the week of July 12th" and the expiration date of the July contract varies from year to year. Therefore, it may be more reasonable to make basis predictions, when using historical multi-year averages, relying on a time-to-expiration technique.

Differences in the time-to-expiration and calendar techniques may also arise because, across years, calendar technique basis forecasts are sometimes generated using basis calculations from different futures contracts. In contrast, a weeks-to-expiration technique, by definition always uses the same futures contract to compute basis. Thus, eliminating this potential source of error could potentially improve basis forecast accuracy.

The use of multi-year averages in creating basis forecasts is a common practice and is generally supported by a considerable amount of research (see Jiang and Hayenga; Dhuyvetter and Kastens; Mintert et al.). To evaluate the forecast accuracy of the calendar versus the time-to-expiration techniques, the optimal number of years to include when making basis forecasts needs to be determined.

OBJECTIVES

The objectives of this study are two-fold; the first objective is to compare livestock basis forecasting accuracy using forecasts generated via the historical calendar technique and those generated via a time-to-futures-contract-expiration technique. Furthermore, if there is a difference in forecasting accuracy between the two methods, is the difference significant enough to warrant use of the time-to-expiration methodology? The second objective is to determine the optimal number of years to include in historic multi-year averages when computing livestock basis forecasts. Both objectives will be evaluated for feeder cattle, live cattle, and lean hogs across different historic time periods. All basis forecasts will be for the nearby basis where "nearby" refers to the contract closest to expiration.

We expect to find that basis projections made using a time-to-expiration technique are more accurate in predicting basis levels than projections made using a calendar date technique. This expectation seems logical as the time-to-expiration platform is not sensitive to year-to-year variation in contract expiration dates and is thus more consistent with basis convergence.

PREVIOUS RESEARCH

Research has indicated that "forecasters would do well to provide historical localized basis values directly to producers and businesses and to instruct them to simply add current deferred futures prices" (Kastens, Jones, and Schroeder; p 306). In a 1992 extension bulletin, Dhuyvetter states that "the most common method of forecasting is to simply use a historical average (3-5 years)" (p 3). While research indicates the importance of basis forecasting, comparatively little research focusing on livestock basis forecasting has been conducted. Furthermore, Mintert, et al. note the lack of research on the appropriate historical average to use when forecasting lean hog basis, but speculate that a three- to five-year average will perform well. Dhuyvetter and Kastens evaluated various crop basis forecasting techniques and, based upon out-of-sample forecasts, concluded that multi-year averages were as good as or better than forecasts from more complex techniques. Their conclusions regarding appropriate average length (number of years to include in the historical average) varied depending on the commodity and the futures contract month.

Our work builds upon that of Dhuyvetter and Kastens. We use out-of-sample forecasts to compare models for forecasting livestock basis. Feeder cattle, live cattle, and lean hog basis forecasts are generated using models based on historical average basis levels, which incorporate from one to five years of historic basis data, and for both the calendar and time-to-expiration methods.

DATA

Futures settlement price data were obtained from Bridge Financial Data Center. The data series begin on January 1, 1974, February 28, 1975, and January 5, 1973 for Feeder Cattle, Live Cattle, and Live and Lean Hogs, respectively, and continued through December 31, 2002 for the two cattle series and through December 29, 2000 for hogs. A nearby futures data series was created for each commodity, where "nearby" denotes the contract closest to expiration.

It is very important when calculating basis (i.e., cash minus futures) that the cash and futures prices are for consistent time periods. Therefore, Wednesday's nearby contract settlement futures prices were used to compute feeder cattle basis, given that the cash price series was from the Dodge City, Kansas Wednesday feeder cattle auctions. In contrast, live cattle and lean hog futures settlement prices for a given week were averaged since the respective cash price series were weekly averages.

Cash data were organized uniquely for each commodity studied in an attempt to make the cash data series reflect approximately the same specifications as that of the futures data over the entire time period analyzed. A breakdown of how each contract's specifications have changed since inception was obtained from the Chicago Mercantile Exchange.

As warned by Tomek, we experienced some difficulty in organizing the cash data as it can sometimes be a challenge to find consistent livestock price data. Table 1 provides a breakdown of how each cash series used was aligned to approximately match the corresponding futures specifications of that time period. The feeder cattle cash series is composed of data reported by USDA's Agricultural Marketing Service and provided by the Livestock Marketing Information Center (LMIC) for sales at Dodge City, Kansas beginning on January 4, 1974. From January 4, 1974 to December 27, 1974 the Dodge City 600-700 lb. price series was used because the futures contracts' average target weight was 650 pounds for this time span. Subsequent changes in the cash price series reflected changes in the feeder cattle contract's par weight range. From January 3, 1975 to August 29, 1986 an average of the Dodge City 500-600 lb. and Dodge City 600-700 lb. prices was used; from September 5, 1986 to December 25, 1992 we used an average of the Dodge City 600-700 lb. and Dodge City 700-800 lb. prices; from January 1, 1993 to December 31, 1999 the Dodge City 700-800 lb. price series was used; and finally, from January 7, 2000 to December 31, 2002 we used an average of the Dodge City 700-750 lb., 750-800 lb., and the 800-850 lb. prices.

The live cattle cash price series was also obtained from the LMIC. Specifically, the price series used was the *Western Kansas Direct Slaughter Steers* price series. Since April 1, 2001, with the initiation of mandatory price reporting, this price series changed to the *Kansas Slaughter Steers* price series. This is a weekly average data series, which required the futures' daily settlement prices to be averaged for each week.

The Iowa-Southern Minnesota Barrow and Gilt price series from the LMIC was used for our hog cash price series. This price series runs from January 5, 1973 to December 29, 2000. Cash price data for 2001 or 2002 were not included because the Iowa-Southern Minnesota price series did not exist over this time period. As with the live cattle cash data, this is a weekly average data series so the future's daily settlement prices were averaged for each week.

METHODOLOGY

After aligning the cash and futures data series, basis tables were created for each of the three commodities[1]. Out-of-sample absolute basis prediction errors were generated using forecasts based upon one- to five-year averages of prior basis levels as shown by:

$$(1)\ AE_{ijt} = \mathrm{ABS}(BASIS_{ijt} - (\sum_{k=1}^{K} BASIS_{ijt-k})/K)$$

[1] This historical information is not reported here but is available from the authors upon request.

where AE is the absolute basis prediction error, i denotes the commodity, j denotes the year, t denotes the week for the calendar method and the weeks prior to contract expiration for the time-to-expiration method, and K denotes the number of years used in the multi-year average. This process was repeated for every week on the calendar method tables. As for the time-to-expiration method tables, the process was repeated for every week prior to expiration, in which we had five years of data prior to the year being predicted. Sufficient data were available to create absolute basis prediction errors, under both methods, from 1979 to 2002 (23 years) for feeder cattle, from 1981 to 2002 (21 years) for live cattle, and from 1978 to 2000 (22 years) for lean hogs.

For the calendar based approach, week 1 was defined to be the first week of the year including a minimum of three trading days. Thus, if the first trading day in January fell on either a Thursday or Friday, the following week was defined to be week 1. Weeks 2 through 52 were simply the subsequent weeks. As for the basis calculated under the time-to-expiration approach, we identified the expiration week of each contract month for every year and then worked backwards from expiration until reaching the preceding contract. This process was repeated for every contract month and for each commodity. The difference between the two methods can be summarized by the fact that the calendar method defines week 1 of the year and works forward without regard for the contract being used, whereas the time-to-expiration method identifies the actual week of expiration for a specific contract and then works backwards.

We evaluated the accuracy of making basis forecasts under both the calendar and the time-to-expiration methods over a number of different time periods. Given that the futures contracts for feeder cattle and hogs switched to cash settlement in September of 1986 and February 1997, respectively, we considered the entire time spans for which we had data, the Pre-Cash Settlement periods, and the Post-Cash Settlement periods for these two commodities. Furthermore, we looked at the last five years (1998-2002) for feeder cattle to see if forecasting accuracy has changed recently, relative to the longer time periods analyzed. For live cattle we looked at the entire time period (1981-2002) and the last five years (1998-2002). Intermediate time periods were not included since live cattle futures have not undergone a "structural change" similar to cash settlement like feeder cattle and lean hogs.

Once the tables described above were completed, absolute forecast errors (AE) were calculated for each forecasting method according to Equation (1). Paired t-tests were completed to determine the significance of difference in absolute errors for the five different multi-year averages (one- to five-year averages) analyzed within each calculation method. The use of paired t-tests allowed the optimal number of years to include in basis forecasts over a variety of time spans to be determined, however, it left the empirical evaluation of whether a time-to-expiration method is better than the traditional calendar approach yet unfulfilled. To answer this question, the model:

$$(2)\ AE = \beta_0 + \beta_1\, Year + \beta_2\, Technique + \beta_3\, 5YrAvg + \beta_4\, 4YrAvg + \beta_5\, 3YrAvg + \beta_6\, 2YrAvg + \beta_7\, Cash + \beta_8\, TechCash + \varepsilon$$

was estimated for feeder cattle, live cattle, and hogs[2]. *AE* is the absolute forecast error, *Year* is a variable for the calendar year of the forecast, *Technique* is a dummy variable for the technique used (0 if time-to-expiration and 1 if calendar), *5YrAvg*, *4YrAvg*, *3YrAvg*, and *2YrAvg* are binary variables referring to the different number of years included in the forecast (one-year average is the default), *Cash* is a binary variable for the time period forecasted for feeder cattle and hogs (0 denotes physical delivery time periods and 1 denotes cash settlement time periods), *TechCash* is an interaction term between *Technique* and *Cash.* The variables *Cash* and *TechCash* were not included in the live cattle model. Tables 3 and 4 provide additional explanation of these variables.

RESULTS

Comparison of Calculation Techniques

Table 5 provides the parameter estimates of estimating Equation (2) using ordinary least squares in SAS. The coefficient estimates for the *Technique* variable are small and generally statistically insignificant, suggesting that the technique chosen by a forecaster has had no significant impact on basis forecasting accuracy. For feeder cattle the coefficient is -0.0377 (p-value of 0.3864), for live cattle it is 0.0309 (p-value of 0.1176), and for hogs it is 0.0073 (p-value of 0.8600). Coefficient estimates on the *Cash* variable indicate that the ability to forecast basis has declined with the switch to cash settlement of the futures contracts for feeder cattle and lean hogs. This however is partially offset by the coefficient estimates for the *Year* variable, which is negative, implying that basis is getting easier to predict over time. The coefficients on the *TechCash* variable are rather small and statistically insignificant implying no drastic change in the performance of either the calendar or time-to-expiration method during cash settlement as compared to its performance during physical settlement. Once again, note that because live cattle have not switched to cash settlement like feeder cattle and lean hogs, the *Cash* and *TechCash* variables were not included in the live cattle model.

Feeder Cattle Multi-Year Average Evaluation

Tables 6a and 6b provide the paired t-tests results of comparing the mean absolute errors of the five different multi-year averages for each time period analyzed and the two forecasting techniques for feeder cattle. These tables also provide the relative mean absolute errors from each of the multi-year averages over each time period considered. The three-year average had the lowest mean absolute error (MAE) when using the calendar method over the entire time span (1979-2002) (Table 6a). The three-year average MAE ($1.6642/cwt) was significantly lower than the one-year average forecast and marginally lower than the two- and five-year average forecasts.[3] As for the time-to-expiration method, the three-year average had the lowest MAE ($1.6558/cwt) and was significantly lower than both the one- and five-year averages and marginally better than the two-year average (Table 6b). When looking only at the Pre-Cash Settlement period (1979 to September 1986) under the calendar method, the five-year average MAE was significantly lower than all of the other averages. When considering the time-to-expiration method for this same time period, the results were

[2] Similar results were found when this model included only one of the multi-year average variables.
[3] Here and throughout the rest of the paper the term "significantly" is used based on p-values less than 0.05 and p-values between 0.05 and 0.15 are referred to as being "marginally significant."

similar with the exception of the five-year average not being statistically superior to the four-year average. When considering only the Cash Settlement period (September 1986 to 2002) the rankings changed considerably. Under the calendar method approach, the three-year average had the lowest MAE and was significantly lower than the four- and five-year averages. The time-to-expiration method resulted in the two-year average having the lowest MAE. It is statistically lower than both the four- and five-year averages. Finally, the most recent five years were examined (out-of-sample) to see what multi-year average would have worked best. Under the calendar method, when looking only at 1998-2002 data, the four-year average had the lowest MAE. This MAE was significantly lower than the naïve forecast. Over the same five-year time period, the time-to-expiration method resulted in the three-year average having the lowest MAE, which was significantly lower than the two-year average and naïve forecast.

Live Cattle Multi-Year Average Evaluation

Tables 7a and 7b provide the paired t-tests results of comparing the mean absolute errors of the five different multi-year averages for each time period analyzed and the two forecasting techniques for live cattle. When considering the entire 1981-2002 time period, for live cattle, the four-year average had the lowest MAE ($1.1966/cwt) under the calendar method (Table 7a). It was significantly lower than the one-year forecast and marginally lower than the two- and five-year average forecasts. As for the time-to-expiration method, again the four-year MAE ($1.166/cwt) was the smallest and was significantly lower than the one-year average and marginally lower than the five- and three-year averages (Table 7b). Since there has not been a structural change in the live cattle markets, such as the switch from physical to cash settlement as with feeder cattle, in addition to the entire time period we analyzed the past five year's data (1998-2002). Using the calendar approach, the two-year average had the lowest MAE, but was not statistically better than any of the alternative averages. The same results held for the time-to-expiration approach.

Lean Hogs Multi-Year Average Evaluation

Tables 8a and 8b provide the paired t-tests results of comparing the mean absolute errors of the five different multi-year averages for each time period analyzed and the two forecasting techniques for lean hogs. We should note that our "lean hog" data were actually "live hog" data until 1996. When evaluating the entire time period (1978-2000), using the calendar method for lean hogs, the five-year average had the lowest MAE ($2.5995/cwt) (Table 8a). It was significantly lower than the MAE of the naïve forecast and two-year average. For the time-to-expiration method, the four-year MAE ($2.5725/cwt) was the smallest and significantly lower than the three-, two- and one-year averages (Table 8b). When looking only at the Pre-Cash Settlement period (1978 to February 1997), the four-year average MAE was lowest using the calendar method. Its MAE was significantly lower than the two- and one-year MAEs. Analyzing the same time period under the time-to-expiration method yielded basically the same results. Finally, when considering only the Cash Settlement period (February 1997 to 2000) using the calendar method approach, the five-year average possessed the lowest MAE and was statistically lower than the two-year average. Once again, the results under the time-to-expiration method were more or less the same as that of the calendar method. The five-year average remained statistically lower than the two-year average and marginally lower than the three-year average.

CONCLUSION

Possessing a sound understanding of basis and being able to make accurate forecasts is vital to the management of risk and therefore the viability of agribusiness firms. Much research has been done evaluating the use of price and basis forecasts and how accurate they may be, but little research has specifically looked at the procedures of making basis forecasts. This study used absolute forecasting errors in an out-of-sample framework to evaluate whether or not the use of a time-to-expiration method, compared to a calendar-based method, would improve forecasters' ability to make accurate livestock basis projections. Furthermore, the optimal number of years to include in forecasting livestock basis was evaluated. The optimal number of years to include in an historical average depends on the particular time period analyzed. However, as a general rule the results of this research indicate that basis forecasters should consider using three-year averages of historic basis data for feeder cattle and four-year averages for live cattle and lean hogs. The use of a time-to-expiration method, compared to the calendar method, had little to no effect on the accuracy of basis projections over the time periods studied. Furthermore, while our results indicate that hog basis has been considerably harder to predict than both feeder cattle and live cattle, absolute basis forecasting errors have been declining over time for all three commodities. Further research should be conducted to evaluate the effect on basis accuracy of including current market information in making future forecasts.

REFERENCES

Bridge Financial Data Center (CD-ROM). Bridge Financial, 20 South Wacker Drive, Suite 1810, Chicago, Illinois.

Chicago Mercantile Exchange, (CME). Chicago, Illinois.

Dhuyvetter, K.C. 1992. "Basis: The Cash/Futures Price Relationship." Kansas State University Cooperative Extension Service. (Bulletin MF-1003).

Dhuyvetter, K.C. and T.L. Kastens. (1998): "Forecasting Crop Basis: Practical Alternatives." *NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management.* Proceedings of the NCR-134 Conference, pp. 49-67.

Garcia, P. and D.L. Good. "An Analysis of the Factors Influencing the Illinois Corn Basis, 1971-1981." *NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management*, Ed. M. Hayenga, Ames, Iowa: Iowa State University, Department of Agricultural Economics, 1983, pp. 306-326.

Garcia, P., R. Hauser, and A. Tumblin. "Corn and Soybean Basis Behavior: An Intertemporal, Cross-Sectional Analysis." *NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management*, Ed. M. Hayenga, Ames, Iowa: Iowa State University, Department of Agricultural Economics, 1986, pp. 128-142.

Hauser, R.J., P. Garcia., and A.D. Tumblin. "Basis Expectations and Soybean Hedging Effectiveness." *North Central Journal of Agricultural Economics*, Vol. 12, No.1, January 1990. pp. 125-136.

Jiang, B. and M. Hayenga. "Corn and Soybean Basis Behavior and Forecasting: Fundamental and Alternative Approaches." *NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management,* Ed. B.W. Brorsen, Stillwater, Oklahoma: Oklahoma State University, Department of Agricultural Economics, 1997, pp. 125-140.

Kastens, T.L., R. Jones, and T.C. Schroeder. "Futures-Based Price Forecasts for Agricultural Producers and Businesses." *Journal of Agricultural and Resource Economics*, 23:1(1998):294-307.

Livestock Marketing Information Center, (LMIC). Englewood, Colorado.

Mintert, J., E.E. Davis, K. Dhuyvetter, and S. Bevers. 1999. "Livestock Basis." Texas Agricultural Extension Service. (Bulletin RM2-4.0).

Schroeder, T.C., J.L. Parcel, T.L. Kastens, and K.C. Dhuyvetter. "Perceptions of Marketing Strategies: Producers vs. Extension Economists." *Journal of Agricultural and Resource Economics*, 23:1(1998):279-293.

Tomek, W.G. "Commodity Futures Prices as Forecasts." *Review of Agricultural Economics*, 19:1(1997):23-44.

Table 1. Explanation of Cash Price Series Used and Futures Contract Target Weight.

Commodity	Time Period	Cash Price Series Used	Futures Market's Par Weight Range
Feeder Cattle			
Jan. 4, 1974 - Dec. 27, 1974		Dodge City 600-700 cwt.	650 lbs
Jan. 3, 1975 - Aug.29, 1986		Average of Dodge City 500-600 cwt. and 600-700 cwt.	550 - 650 lbs
Sept. 5, 1986 - Dec. 25, 1992		Average of Dodge City 600-700 cwt. and 700-800 cwt.	600 - 800 lbs
Jan. 1, 1993 - Dec. 31, 1999		Dodge City 700-800 cwt.	700 - 800 lbs
Jan. 7, 2000 - Dec. 31, 2002		Average of Dodge City 700-750 cwt., 750-800 cwt.,and 800-850 cwt.	700 - 850 lbs
Live Cattle			
Feb. 28, 1975 - Apr. 2001		Western Kansas Direct Slaughter Steers	With 62% yield, 1,050 - 1,250 lbs With 63% yield 1,100 - 1,300 lbs
Apr. 2001 - Dec. 2002		Kansas Slaughter Steers	With 63% yield 1,100 - 1,300 lbs
Hogs			
Jan. 5, 1973 - Dec. 29, 2000		Iowa - Southern Minnesota Barrow and Gilt Price Series	Target weights not known specifically

Table 2. Time Table of Futures Contracts' Switch to Cash Settlement.

Contract[a]	Time Period	Description of Structural Change
Feeder Cattle	September 1986 Contract	Contract switched from physical to cash settlement
Hogs	February 1997 Contract	Contract switched from physical to cash settlement

[a] The live cattle contract is still under physical settlement.

Table 3. Definition of Methods for Forecasting Basis.

Method	Description of Forecast at time *t*
5YrAvg	Equals the average of the last 5 years' basis at time *t*
4YrAvg	Equals the average of the last 4 years' basis at time *t*
3YrAvg	Equals the average of the last 3 years' basis at time *t*
2YrAvg	Equals the average of the last 2 years' basis at time *t*
1YrAvg	Equals last year's basis at time *t (is default multi-year avg.)*

Table 4. Definition of Other Explanatory Dummy Variables.

Dummy Variable	Description
Year	Indicates the calendar year of the basis forecasts
Technique	Indicates the time to expiration method (0) or calendar method (1)
Cash[a]	Indicates physical settlement (0) or cash settlement (1)
TechniqueCash[a]	Interaction term between variables *Technique* and *Cash*

[a]These variables were not included in the live cattle model.

Table 5. Parameter Estimates for Determinants of Absolute Errors In Forecasting Basis for Feeder Cattle, Live Cattle, and Hogs.[a]

Estimate	Feeder Cattle	Live Cattle	Hogs
Intercept	2.325*	1.3601*	3.1808*
	(<.0001)	(<.0001)	(<.0001)
Forecasting methods: default is one-year average			
5YrAvg	-0.0656	-0.1257*	-0.4566*
	(0.0924)	(<.0001)	(<.0001)
4YrAvg	-0.0977**	-0.1414*	-0.4595*
	(0.0122)	(<.0001)	(<.0001)
3YrAvg	-0.1056*	-0.1242*	-0.4168*
	(0.0068)	(<.0001)	(<.0001)
2YrAvg	-0.0739	-0.109*	-0.1726*
	(0.0580)	(0.0005)	(0.0038)
Other explanatory variables:			
Year	-0.0789*	-0.0059	-0.0331*
	(<.0001)	(0.0576)	(<.0001)
Technique	-0.0377	0.0366	0.0073
	(0.3864)	(0.2130)	(0.8600)
Cash	0.6261*		1.4707*
	(<.0001)		(<.0001)
TechCash	0.0637		0.0425
	(0.2272)		(0.6695)

[a]Significance at the 0.01 and 0.05 level denoted by * and **, respectively.
P-values are in parentheses. Number of observations was 12,000; 11,000; and 11,500 for feeder cattle, live cattle, and hogs, respectively.

Table 6a. Paired T-Tests Matrices for Feeder Cattle (Calendar). [a]

Entire Time Period: 1979-2002

	5-year	4-year	3-year	2-year	1-year
MAE [b]	1.6972	1.6665	1.6642	1.6990	1.7782
5-year	-------	0.0085	0.1019	0.9507	0.0438
4-year		-------	0.8682	0.1974	0.0033
3-year			-------	0.0636	0.0011
2-year				-------	0.0057
1-year					-------

Pre-Cash Settlement Period: 1979-Sept.1986

	5-year	4-year	3-year	2-year	1-year
MAE [b]	1.7018	1.7562	1.8560	1.9345	2.1261
5-year	-------	0.0057	0.0000	0.0000	0.0000
4-year		-------	0.0001	0.0001	0.0000
3-year			-------	0.0273	0.0001
2-year				-------	0.0008
1-year					-------

Cash Settlement Period: Sept.1986-2002

	5-year	4-year	3-year	2-year	1-year
MAE [b]	1.6951	1.6244	1.5740	1.5883	1.6148
5-year	-------	0.0000	0.0000	0.0022	0.0892
4-year		-------	0.0033	0.2320	0.8271
3-year			-------	0.5153	0.3152
2-year				-------	0.4141
1-year					-------

Last Five Years: 1998-2002

	5-year	4-year	3-year	2-year	1-year
MAE [b]	1.2811	1.2776	1.2896	1.3583	1.5494
5-year	-------	0.8488	0.7881	0.0862	0.0001
4-year		-------	0.6025	0.0527	0.0000
3-year			-------	0.0333	0.0000
2-year				-------	0.0002
1-year					-------

[a]P-values associated with the null hypothesis that there is no difference in the MAE of two different multi-year averages.
[b]Unit for MAE is $/cwt.

Table 6b. Paired T-Tests Matrices for Feeder Cattle (Time-to-expiration). [a]

Entire Time Period: 1979-2002

	5-year	4-year	3-year	2-year	1-year
MAE [b]	1.7035	1.6696	1.6558	1.6835	1.7514
5-year	-------	0.0153	0.0396	0.5180	0.2557
4-year		-------	0.4148	0.6045	0.0407
3-year			-------	0.1561	0.0091
2-year				-------	0.0204
1-year					-------

Pre-Cash Settlement Period: 1979-Sept.1986

	5-year	4-year	3-year	2-year	1-year
MAE [b]	1.7639	1.7880	1.8806	1.9816	2.1308
5-year	-------	0.4049	0.0057	0.0001	0.0000
4-year		-------	0.0095	0.0003	0.0000
3-year			-------	0.0092	0.0006
2-year				-------	0.0101
1-year					-------

Cash Settlement Period: Sept.1986-2002

	5-year	4-year	3-year	2-year	1-year
MAE [b]	1.6745	1.6128	1.5482	1.5408	1.5698
5-year	-------	0.0001	0.0000	0.0002	0.0311
4-year		-------	0.0003	0.0183	0.3375
3-year			-------	0.7378	0.6039
2-year				-------	0.3831
1-year					-------

Last Five Years: 1998-2002

	5-year	4-year	3-year	2-year	1-year
MAE [b]	1.2434	1.2419	1.2298	1.3024	1.492
5-year	-------	0.9392	0.6691	0.1859	0.0003
4-year		-------	0.5982	0.1469	0.0003
3-year			-------	0.0251	0.0001
2-year				-------	0.0004
1-year					-------

[a] P-values associated with the null hypothesis that there is no difference in the MAE of two different multi-year averages.
[b] Unit for MAE is $/cwt.

Table 7a. Paired T-Tests Matrices for Live Cattle (Calendar). [a]

Entire Time Period: 1981-2002

	5-year	4-year	3-year	2-year	1-year
MAE [b]	1.2109	1.1966	1.2113	1.2326	1.3390
5-year	-------	0.1065	0.9774	0.3174	0.0000
4-year		-------	0.1877	0.0613	0.0000
3-year			-------	0.1452	0.0000
2-year				-------	0.0000
1-year					-------

Last Five Years: 1998-2002

	5-year	4-year	3-year	2-year	1-year
MAE [b]	1.2316	1.2177	1.2236	1.1960	1.2175
5-year	-------	0.4315	0.7842	0.4375	0.8139
4-year		-------	0.7996	0.5811	0.9965
3-year			-------	0.3650	0.9066
2-year				-------	0.6467
1-year					-------

[a] P-values associated with the null hypothesis that there is no difference in the MAE of two different multi-year averages.
[b] Unit for MAE is $/cwt.

Table 7b. Paired T-Tests Matrices for Live Cattle (Time-to-expiration). [a]

Entire Time Period: 1981-2002

	5-year	4-year	3-year	2-year	1-year
MAE [b]	1.1833	1.1660	1.1857	1.1942	1.3062
5-year	-------	0.0559	0.8742	0.6197	0.0001
4-year		-------	0.0844	0.1502	0.0000
3-year			-------	0.5705	0.0000
2-year				-------	0.0000
1-year					-------

Last Five Years: 1998-2002

	5-year	4-year	3-year	2-year	1-year
MAE [b]	1.1660	1.1691	1.1960	1.1551	1.2007
5-year	-------	0.8642	0.3029	0.8136	0.5693
4-year		-------	0.2505	0.7220	0.5909
3-year			-------	0.1896	0.9265
2-year				-------	0.3290
1-year					-------

[a]P-values associated with the null hypothesis that there is no difference in the MAE of two different multi-year averages.
[b]Unit for MAE is $/cwt.

Table 8a. Paired T-Tests Matrices for Lean Hogs (Calendar).[a]

Entire Time Period: 1978-2000

	5-year	4-year	3-year	2-year	1-year
MAE[b]	2.5995	2.6011	2.6396	2.8723	3.0516
5-year	-------	0.9252	0.1572	0.0000	0.0000
4-year		-------	0.0891	0.0000	0.0000
3-year			-------	0.0000	0.0000
2-year				-------	0.0003
1-year					-------

Pre-Cash Settlement Period: 1978-1996

	5-year	4-year	3-year	2-year	1-year
MAE[b]	2.3934	2.3896	2.4177	2.6438	2.9351
5-year	-------	0.8442	0.4230	0.0000	0.0000
4-year		-------	0.2424	0.0000	0.0000
3-year			-------	0.0000	0.0000
2-year				-------	0.0000
1-year					-------

Cash Settlement Period: 1997-2000

	5-year	4-year	3-year	2-year	1-year
MAE[b]	3.5787	3.6060	3.6939	3.9580	3.6051
5-year	-------	0.4952	0.1317	0.0049	0.8972
4-year		-------	0.1610	0.0071	0.9964
3-year			-------	0.0168	0.6545
2-year				-------	0.0228
1-year					-------

[a]P-values associated with the null hypothesis that there is no difference in the MAE of two different multi-year averages.
[b]Unit for MAE is $/cwt.

Table 8b. Paired T-Tests Matrices for Lean Hogs (Time-to-expiration). [a]

Entire Time Period: 1978-2000

	5-year	4-year	3-year	2-year	1-year
MAE [b]	2.5802	2.5725	2.6198	2.8761	3.0418
5-year	-------	0.6634	0.1678	0.0000	0.0000
4-year		-------	0.0418	0.0000	0.0000
3-year			-------	0.0000	0.0000
2-year				-------	0.0010
1-year					-------

Pre-Cash Settlement Period: 1978-1996

	5-year	4-year	3-year	2-year	1-year
MAE [b]	2.3855	2.3713	2.4032	2.6409	2.9416
5-year	-------	0.4709	0.5644	0.0000	0.0000
4-year		-------	0.1922	0.0000	0.0000
3-year			-------	0.0000	0.0000
2-year				-------	0.0000
1-year					-------

Cash Settlement Period: 1997-2000

	5-year	4-year	3-year	2-year	1-year
MAE [b]	3.5047	3.5281	3.6485	3.9935	3.5176
5-year	-------	0.5498	0.0637	0.0002	0.9497
4-year		-------	0.0682	0.0002	0.9568
3-year			-------	0.0020	0.5166
2-year				-------	0.0018
1-year					-------

[a]P-values associated with the null hypothesis that there is no difference in the MAE of two different multi-year averages.
[b]Unit for MAE is $/cwt.