Managing for Today's Cattle Market and Beyond

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Factors Affecting the Basis for Feeder Cattle

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Introduction

Basis is one of the most useful concepts in developing marketing strategies for agricultural commodity markets. Basis information is a critical part of forward pricing and spot market decisions and forecasting basis is an essential element when one is making these types of decisions. For example, the relative success of parties involved in contracts depends, in large part, on the ability to accurately predict the basis.

Basis has a geographical aspect because it is usually defined as local cash price minus the futures contract price. Basis indicates the relative strength or weakness of prices in one geographic location relative to a broad, general market like the futures market. The basis is different in different locations because local prices are not the same for a number of reasons including differences in transportation costs to principal feeding and processing locations and differences in local supply and demand conditions.

The relative variability of basis in different locations can also vary and may affect the ability of producers at any particular geographic location to effectively contract using basis information. For example, hedgers typically view hedging as a risk management method since they want to reduce the variability of the prices they receive.

The expected forward price of a hedge is the following equation:

(1) $FP_{t+n} = F_t + BASIS_{t+n}$,

where FP_{t+n} is the expected forward price to be received n days after a hedge is placed (say the day cattle are to be sold), F_t is the futures price the day the hedge is placed and $BASIS_{t+n}$ is the local basis the day the hedged cattle are sold and the futures position is closed. As implied in equation (1), hedgers are trading cash market risk for basis risk. Hedgers will only reduce price variability if basis variability is less than cash price variability.

This article examines the level of basis and the influence of different market conditions on the level of basis. The relative variability of cash prices and basis in four feeder cattle markets for two different weights of feeder steers is also examined to determine if hedging at these locations can routinely reduce the variability of prices received by hedgers.

Data for this analysis were provided by the Livestock Marketing Information Center in Denver, Colorado. The data covered the period from January 1, 1990 to October 7, 2000, were measured weekly at each location, and included local cash prices, futures prices, and basis information. The markets included in the analysis are Oklahoma City, OK (OK City); Billings, MT; a composite price for Washington, Oregon, and Idaho (WA); and Alabama (AL). The markets were selected to represent

different parts of the United States as well as markets with different types of cattle, different types of feeding opportunities (winter grazing vs. feeding hay), and different levels of market activity. For example, Oklahoma City is one of the most active feeder cattle markets in the country in terms of volume across the year while volume in the other markets tends to be more seasonal. The steer weights selected were 500-600 lbs. and 700-800 lbs. and represent basically calves and yearlings.

Level of Basis

Average basis for 500-600 lb. and 700-800 lb. steers in the four markets is presented in Figures 1 and 2, respectively. Seasonality plays a big role in 500-600 lb. steer basis levels since the basis tended to be much stronger during the spring months and weaker in the fall months coinciding with the availability of pasture grazing and the fall calf run, respectively (Figure 1). Seasonality in the basis existed but was less pronounced for 700-800 lb. steers than for 500-600 lb. steers (Figure 1 compared to Figure 2).

The OK City basis was the strongest of the four markets throughout the year for both 500-600 lb. and 700-800 lb. steers (Figures 1 and 2). The Billings basis for 500-600 lb. steers was almost as strong as the OK City basis except during the summer months. This may be because few calves are sold in Billings during the summer or that the calves being sold in Billings during the summer months are lower than average quality. The AL basis was consistently the weakest for both 500-600 lb. and 700-800 lb. steers except in the late winter and early spring when it about equals the WA basis. Pasture grazing is more available in AL during these months than in the other locations and may account for why AL was relatively strong during that part of the year.

Basis Variability

How strong or week a local basis is at any given location depends on local supply and demand conditions. However, the same set of factors may affect local supply and demand differently across the country. The factors assumed in this article to affect local basis are defined as the following:

(2) $BASIS_i = f(HISTORY, PROFIT, TREND, CYCLE, SEASON, SPECS, BASIS_{t-1})$.

Equation (2) states that the basis at location *i* (where *i* = OK City, Billings, WA, and AL) is a function of the past history of the basis in that location (*HISTORY*), the expected profitability of cattle feeding (*PROFIT*), trends in the basis (*TREND*), the location of the cattle cycle (*CYCLE*), seasonality *(SEASON*) and changes in the weight specifications for the Chicago Mercantile Exchange feeder cattle futures contract (*SPECS*) (Parcell, Schroeder, and Dhuyvetter).

Regression analysis can be used to identify factors that cause the basis to vary. Equation (2) provided the foundation for this part of the analysis and the regression results for the four markets and two steer weights are reported in Table 1.

Hedgers are sometimes encouraged to use historical basis information when making hedging decisions (e.g. Purcell and Koontz). In this article the history of the basis (*HISTORY*) was measured as the average basis for the preceding three years for a particular week. The effect expected cattle feeding profitability (PROFIT) had on the current basis was measured by the current corn price in Omaha and by current or expected slaughter cattle prices. In the case of 500-600 lb. steers, the current live cattle futures price for the live cattle futures contract closest to, but not preceding, the time the steers would be expected to be ready for slaughter[1] was used for slaughter cattle prices. For 700-800 lb. steers the current fed cattle price was used. Trends in the local basis (*TREND*) were measured as a simple linear trend and were meant to capture the affect of changes in transportation costs, increases in cattle production efficiency, etc. Cattle cycles are expected to influence local basis since buyers extend their procurement areas during times of tight feeder cattle supplies. The effect of the cycle on local basis (CYCLE) was measured by de-trended beef cow inventories in the United States.[2] Seasonality (SEASON) was measured using monthly variables (technically dummy variables) in the regression equation with December as the base month. The effect that changes in the weight specifications for the feeder cattle futures contract have had on local basis is measured in the regression equations by dummy variables.[3] Current conditions probably reflect conditions that also existed in the recent past. In other words, if basis levels have been strong

(weak) in the recent past (one week ago) they may also be strong (weak) during the current week. To measure this, the basis from the previous week ($BASIS_{t-1}$) was included in the regression equations.[4]

As expected, seasonal variations in basis explain a large part of it variation as evidenced by the many monthly dummy variables in all eight models that have coefficients significantly different than zero (Table 1). Current cattle feeding profitability seemed to have a more consistent effect on the basis for 500-600 lb steers than it did for 700-800 lb. steers. However, current fed cattle prices did have a significant impact on the current basis for 700-800 lb. steers in the OK City and AL markets. Widening the range for the feeder cattle price index used to cash settle the feeder cattle futures contract appears to have improved the basis for 700-800 lb. steers in all four markets.[5]

Surprisingly, the only market where the average basis for the previous three years was a significant determinant of the current basis was in the OK City market for 700-800 lb. steers (*HISTORY* in Table 1). This does not suggest that historical basis information is not valuable, but indicates that the center of the distribution for historical basis in these markets (the average historical basis) may be an inadequate forecast of the current basis. Forecasts of basis need to account for the location within the historical basis distribution rather than using just the average or the center of the distribution.

Lagged basis (*BASISt*-1) was a significant determinant of the current basis level since its parameter estimate was positive and significantly different than zero (Table 1). This suggests that when basis is strong (weak) it will tend to remain strong (weak). Consequently, when current basis is in the upper (lower) part of the historical distribution it will tend to remain strong (weak).

Over time (*TREND* in Table 1), there has been a slight improvement in the basis for 500-600 lb. steers in Billings and WA and for 700-800 lb. steers in Ok City and AL. Possible reasons for this could include relatively low energy cost that existed during most of the 1990s or increases in feeding efficiency.

Cattle cycles tend to improve the basis for the more remote markets when beef cow numbers are low, especially for calves (see *CYCLE* for Billings and WA in Table 1). This is probably because feeder cattle buyers tend to extend their procurement areas when feeder cattle supplies are tight. As a result, buyers not usually in the Billings or WA market may enter those markets when cattle inventories are low and increase the level of competition for cattle there.

Since the 700-800 lb. steer models have only a few parameters that are significantly different than zero, and also have lower adjusted R^2s than the 500-600 lb. steer models, one can conclude that variability in the heavier steer basis is more random than the lighter steer basis. Or at least, that the basis for 700-800 lb. steers are not as strongly affected by the variables included in the regression models as the 500-600 lb. steer basis. An out-of sample forecast of the basis in each of the four markets and for both weights was conducted for the first 41 weeks of 2000. The root mean squared prediction error shows that the forecasts generated for the 500-600 lb. steers were more accurate on a percentage basis than for the 700-800 lb. steers.

Figures 3 and 4 report the relative variability of the local basis compared to variability for local cash prices for 500-600 lb. and 700-800 lb. steers, respectively. The percentages reported in Figures 3 and 4 were obtained by dividing the standard deviation for the local basis for each week of the year by the standard deviation of local cash prices during that same week.[6] The relative variability of the basis is less than the variability of local cash prices for all markets and for both weights (Figures 3 and 4). This indicates that hedgers can reduce their price variability in these four markets. However, relative basis variability is greater for 500-600 lb. steers than for 700-800 lb. steers. OK City had consistently less relative variability in its basis for 700-800 lb. steers than the other three markets and also had one of the lowest relative basis variability levels for 500-600 lb. steers.

Conclusions

These results suggest that contracting to reduce price variability has tended to be more successful for 700-800 lb. steers than for 500-600 lb. steers. Based on the parameter estimates and adjusted R^2 reported in Table 1 and the analysis presented in Figures 3 and 4, the basis for 700-800 lb. steers is more stable than for 500-600 lb. steers, but variability in the basis for the heavier steers is more random than for the lighter steers. The OK City market of 700-800 lb. steers appears to have the most stable basis of all

of the markets analyzed. Variability in the light steer basis is affected by current profitability in cattle feeding, seasonality, and lagged basis. The heavier steer basis seems to be mostly driven by seasonality and changes in the cash settlement price index.

This exercise demonstrates that forecasting basis is not a simple exercise. Using average historical basis as a forecast of the current basis does not appear to be a good predictor except in the case of the OK City market for 700-800 lb. steers. If feeding cattle is profitable during down swings in beef cow numbers, basis will tend to be stronger for 500-600 lb. steers than when beef cattle numbers are relatively large and cattle feeding is not profitable. Since basis is difficult to forecast, producers should exercise caution when forecasting the basis. To forecast basis, it may be more advantageous to consider ranges in the basis, such as a best and a worse case scenario, so that a range of risk is considered rather than relying on a single number.

Table 1. Parameter Estimates for Basis Models for Four Locations 500-600 lb. and 700-800 lb. Steers.

	Market and Steer Weight in Cwts.							
Independent Variable	**OK 5-6**	**Billings 5-6**	**WA 5-6**	**AL 5-6**	**OK 7-8**	**Billings 7-8**	**WA 7-8**	**AL 7-8**
Intercept	-6.260	-4.554	-16.130**	-11.397**	-2.445	3.240	2.560	-12.567**
HISTORY:	-0.050	0.000	0.012	0.076	0.252**	-0.031	0.096	-0.033
PROFIT:								
Corn price	-1.165**	-0.520	-0.658*	-0.783**	0.042	-0.102	0.351	-0.179
Futures price	0.226**	0.125*	0.284**	0.200**				
Fed price					0.066**	-0.044	-0.058	0.121**
TREND:	-0.002	0.004*	0.006**	0.006**	-0.003*	-0.001	-0.003	0.005*
CYCLE:	-0.001	-0.001*	-0.002*	0.000	0.000	0.000	-0.001*	0.000
SEASON:								
January	-0.297	1.492*	1.064	0.022	-0.619	0.049	0.691	0.115
February	2.030**	2.733**	2.369*	0.325	-0.629	0.434	1.398*	0.064
March	3.612**	3.160**	4.242**	0.826	-0.989**	0.506	2.117**	-0.114
April	2.735**	2.308**	4.196**	-0.276	-0.865*	0.703	2.191**	-1.085
May	1.986*	1.971**	2.900*	-1.308*	-0.683	0.901	2.041**	-0.742
June	0.048	0.635	1.739	-1.206*	-0.791*	0.232	1.006	-0.104
July	-3.675**	-5.206**	-4.994**	-2.253**	0.461	-0.611	-1.130*	-0.732
August	-0.910	-1.455	-1.547	-2.573**	-0.538	-0.278	0.278	-0.054
September	-2.365**	-2.333**	-2.697**	-2.598**	-0.374	0.390	-0.890	-0.414
October	-2.209**	-0.830	-1.370	-2.332**	-0.617	0.504	0.249	-1.259*
November	-4.841**	-4.738**	-6.252**	-2.625**	0.036	-1.222*	-2.834**	-0.447
SPECS:	0.336	0.132	0.014	-0.890	1.189**	1.096**	1.514**	-1.178*
$BASIS_{t-1}$:	0.564**	0.641**	0.482**	0.684**	0.303**	0.341**	0.284**	0.234**
Adjusted R^2	0.873	0.878	0.843	0.928	0.359	0.208	0.474	0.133
Observations	319	319	319	319	319	319	319	319
Durbin-Watson	2.190	2.292	2.140	1.994	1.931	2.066	2.053	2.054
Out-of Sample RMSPE	1.189	1.268	1.459	1.905	26.746	57.155	20.561	12.070

* indicates statistically different than zero at the 10% level of confidence.
** indicates statistically different than zero at the 5% level of confidence.

Figure 1. Average Weekly Basis for 500-600 lb. Steers, 1990-2000.

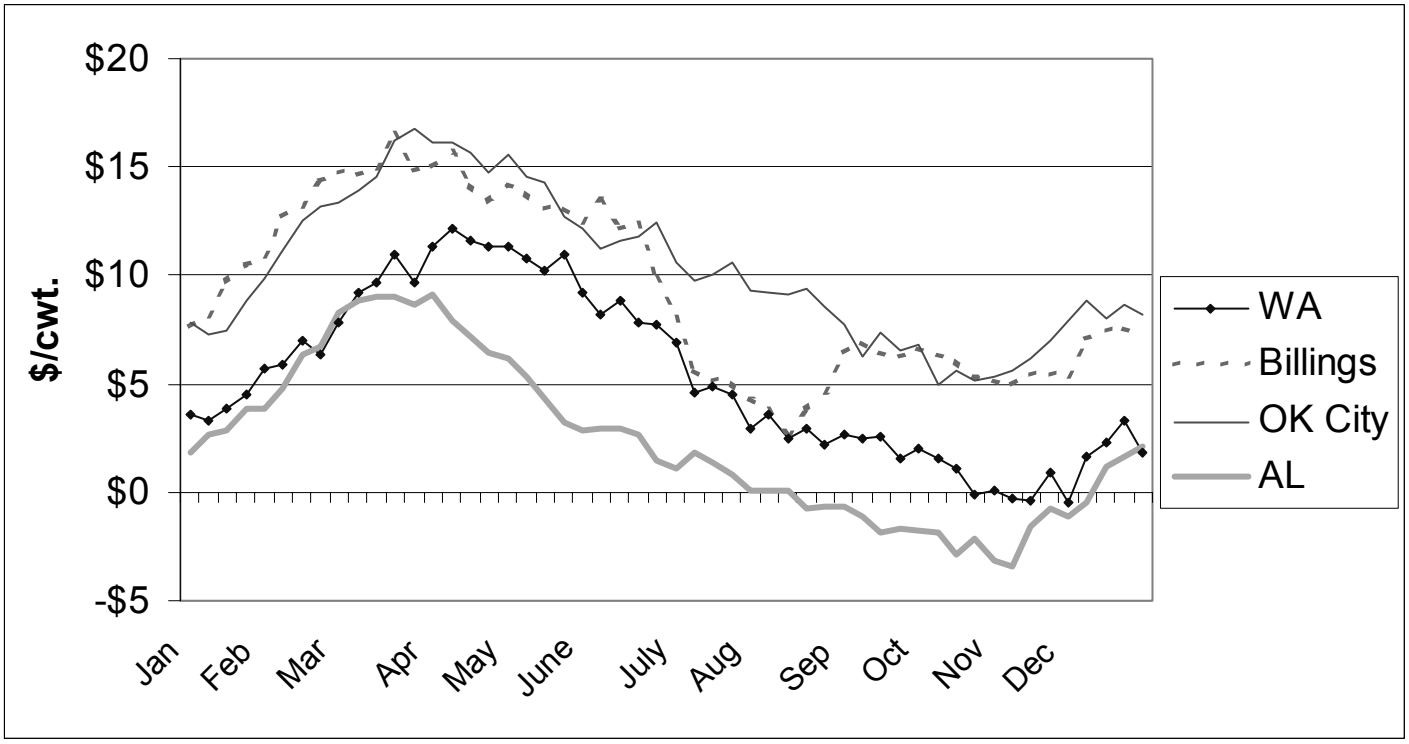


Figure 2. Average Weekly Basis for 700-800 lb. Steers, 1990-2000.

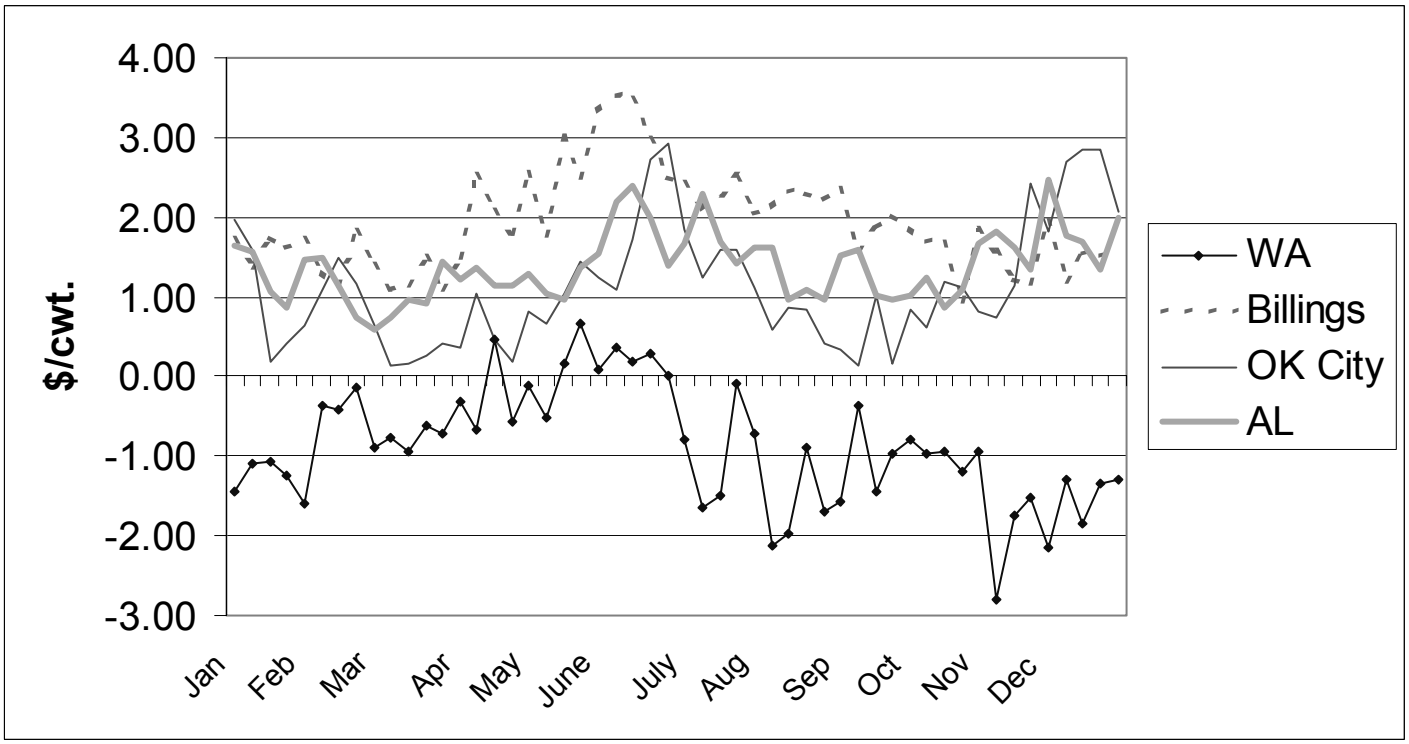


Figure 3. Relative Variability in Local Basis and Cash Prices for 500-600 lb. Steers, 1990-2000.

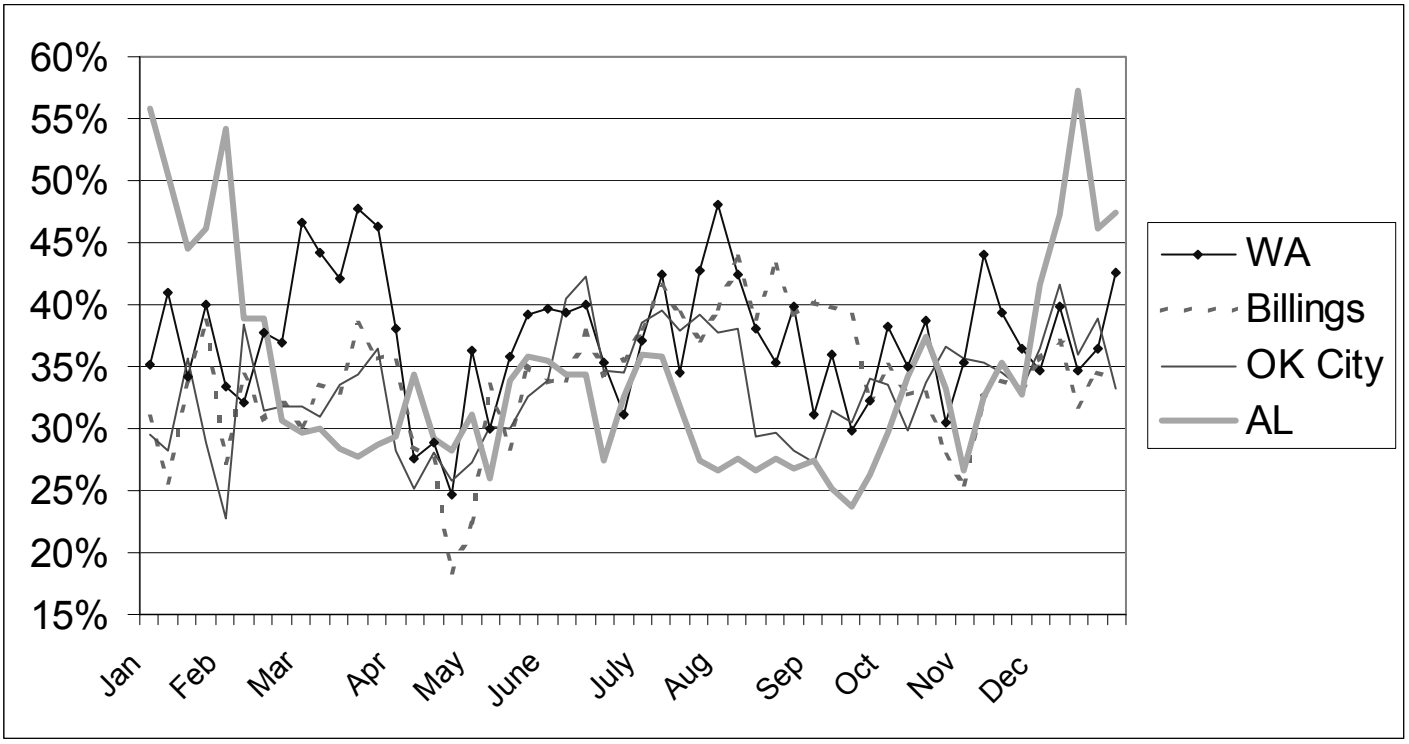
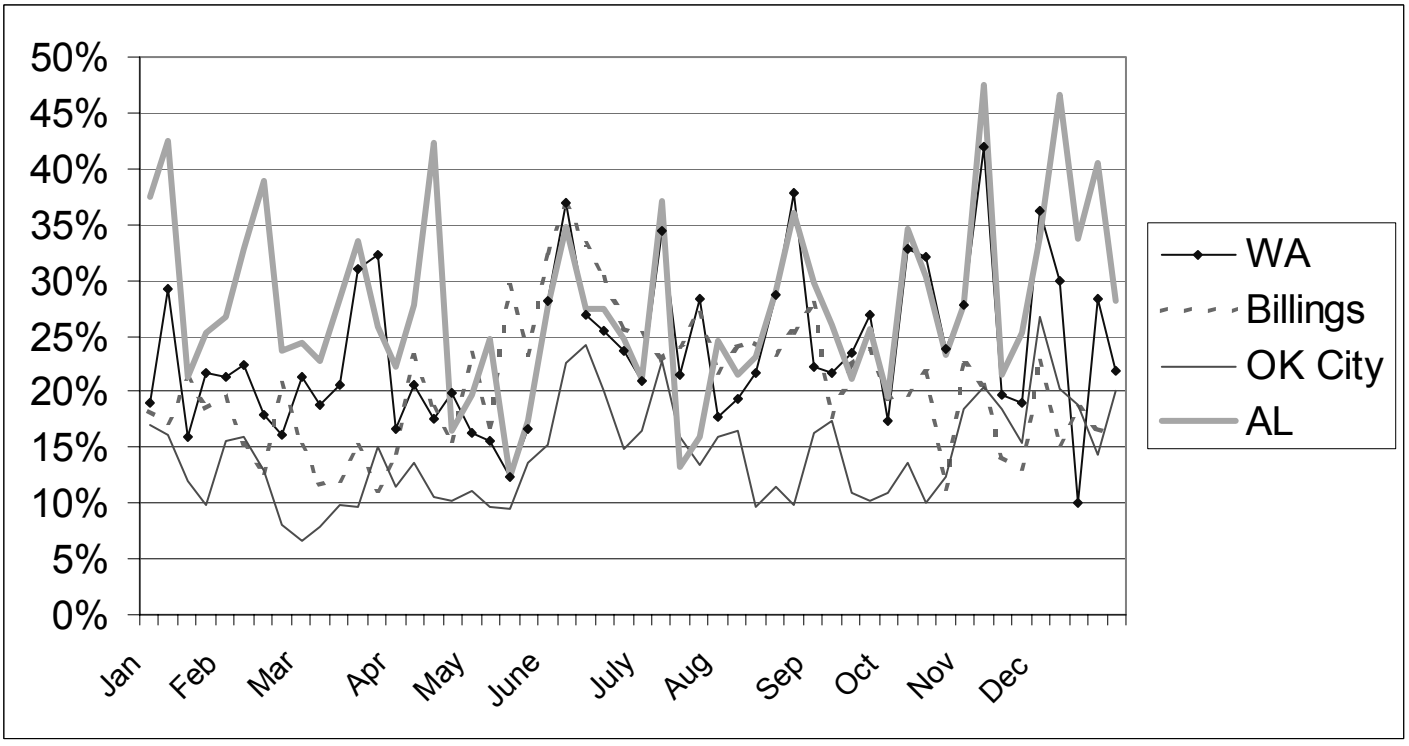


Figure 4. Relative Variability in Local Basis and Cash Prices for 700-800 lb. Steers, 1990-2000.



References

Parcell, Joe L., Ted C. Schroeder, and Kevin C. Dhuyvetter. "Factors Affecting Live Cattle Basis." ***Journal of Agricultural and Applied Economics***, 32(December 2000):531-541.

Purcell, Wayne D., and Stephen R. Koontz. ***Agricultural Futures and Options: Principles and Strategies***. 2nd edition, Prentice-Hall: Upper Saddle River, New Jersey. 1999.

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[1] We estimated that 500-600 lb. steers would be ready for slaughter in seven months if placed directly in a feedlot. Pre-testing showed that current fed cattle prices had a stronger relationship with current basis than current live cattle futures prices for the month when the cattle were expected to be ready for slaughter (about 5 months hence).

[2] De-trended beef cow numbers were the residuals for the years 1990-2000 obtained from regressing annual US beef cow inventories on a linear trend between 1940-2000. A quadratic trend coupled with the linear trend was also analyzed but found to have a coefficient not significantly different than zero, so the linear trend model was used.

[3] Prior to January 1993, the CME feeder cattle contract was cash settled using a price index for 600-799 lb. steers. Between January 1993 and November 1999, feeder cattle contracts were cash settled using a price index for 700-799 lb. steers, and since November 1999 the contracts have been cash settled using a weight range of 700-849 lbs.

[4] Including a lagged basis also eliminated autocorrelation in the regression equations since the basis appears to follow an AR(1) process

[5] This is not surprising since expanding the weight range for the cash settlement index from 700-799 lbs. to 700-849 lbs. should tend to decrease futures contract prices and hence improve basis.

[6] Standard deviations were calculated for each week of the year based on data over the 11-year period (1990-2000).