

Using the Futures Market to Predict Prices and Calculate Breakevens for Feeder Cattle

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AEC 2013-09

August 2013

Introduction

Futures markets are used by cattle producers in three ways. First, the futures market is an excellent source of price information. It responds very quickly to information that affects supply and demand in the marketplace and can be used as a rough gauge as to what is going on in these markets. Second, it provides a mechanism to forward contract feeder cattle and manage downside price risk.³ Third, when combined with an understanding of “basis”, it can be a source of price forecasts. It is this third use that is the focus of this publication. The objectives of this publication are:

- 1) Show how basis data can be used to move from a futures price to an actual price forecast for feeder cattle in a given location. The ability to use the futures market to predict local prices for different sized calves will be useful to cow-calf, backgrounding, and stocker operations as they try to anticipate likely sale prices for the cattle they sell.
- 2) Show how those expected local prices can be used to estimate breakeven purchase prices for calves. Breakeven analysis will be useful for backgrounders and stocker operators as they make decisions about placing calves into their programs. However, it will also be useful for cow-calf operations as they decide whether to sell or retain their calves at weaning.

Reading and Understanding Futures Market Reports

Futures price quotes can be obtained from many sources including the internet, newspapers, subscription services, etc. They are an inexpensive, yet valuable, source of market information. Feeder cattle futures prices are generally available twelve months out into the future, and are traded for the months of January, March, April, May, August, September, October, and November. So, in March of a given year, feeder cattle futures quotes would be available for that contract month all the way through to January of the following year.

Futures contracts have very defined contract specifications. Feeder cattle futures prices can be thought of as price expectations for 750 lb Medium / Large Frame #1-2 steers sold in tractor-trailer size lots in the Great Plains⁴.

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³ The following two publications discuss the use of futures markets as a price risk management tool: 1) AEC 2013-01, *Using Futures Markets to Manage Price Risk for Feeder Cattle* and 2) AEC 2013-03, *Using Futures Markets to Manage Price Risk for Feeder Cattle: Advanced Strategies*.

⁴ Futures contracts are cash settled to the CME® Feeder Cattle Index, which is a 7 day weighted average of Medium / Large Frame #1-2 Steers between 650 and 849 lbs in CO, IA, KS, MO, MT, NE, NM, ND, OK, SD, TX, and WY.

Below is a set of futures' market quotes which will be used in the rest of the discussion. For simplicity, they have been rounded to the nearest dollar per cwt.

Contract Month	Current Price (\$ per cwt)
March	\$137
April	\$139
May	\$141
August	\$148
September	\$150
October	\$151
November	\$152
January	\$153

The first observation that should be made when looking at these futures prices is what they suggest about the expected direction of the overall feeder cattle market. In Table 1, futures prices continue to get stronger as we move further out into the year. The overall feeder cattle market was expected to increase by about \$11 per cwt between March and August, and was expected to increase by about \$16 per cwt between March and January of the following year. Obviously, this is important information to know when bidding on calves that are expected to be sold later in the year, or for making marketing decisions.

Understanding Feeder Cattle Basis

In addition to gauging expected market direction, the futures market can be used to make local price forecasts. However, in order to do this, producers must consider the way that prices in their area relate to the futures market. The term used to describe the difference between local price and futures price is basis. Basis is the key concept to understand when using the futures market to make price predictions.

Mathematically, basis equals local price minus futures price, so Kentucky will typically have a negative basis for feeder steers near the futures contract specification of 750 lb. A negative basis simply implies that Kentucky prices for 750 lb feeder steers are selling for less than the futures price (these same steers sold in the Great Plains). Basis is said to get stronger as local prices increase relative to futures and weaker as local prices decrease relative to futures. So, a strengthening basis implies that basis is become less negative (or more positive) while a weakening basis implies that basis is becoming more negative (or less positive). Rather than positive and negative, sometimes basis is discussed in terms of over and under the futures price. For example, if someone indicates that 750 lb feeder steers in Kentucky are \$10 under the board, this means that the Kentucky price is \$10 less than the futures price. This is analogous to saying that basis for 750 lb feeder steers in Kentucky is -\$10.

Basis is important as it allows producers to convert futures prices to Kentucky price expectations. For example, with the October futures price of \$151 per cwt shown in table 1, and an estimated basis for 750 lb feeder steers sold in Kentucky at this time of -\$10, producers would expect a price of \$141 at the local level. Although understanding the concept of basis is not that difficult, being able to predict basis with accuracy can be.

⁵ These were actual CME© futures market quotes from March 15, 2013 rounded to the nearest dollar per cwt.

There are several factors that will determine how feeder cattle in a given Kentucky location will sell as compared to the futures price on a given day. The most obvious factor is transportation costs as most all of Kentucky's feeder cattle will move to the west for finishing. As factors that would affect transportation cost change, so will the Kentucky basis. For example, if fuel prices rise, we would expect Kentucky basis to weaken as the cost of transporting those cattle increases.

Another local factor that affects Kentucky basis is the demand for calves to place on local pastures. Because Kentucky has a strong forage base, a large number of grazers run stocker cattle through the growing season. This creates a strong local demand for light calves in the spring. This increased spring demand tends to result in significant price increases in 400 to 625 lb calves in Kentucky. So, basis for Kentucky calves tends to strengthen considerably in the spring and early summer.

Changes in feed costs will also affect basis. Rising corn prices will negatively affect the prices of heavy feeder cattle (675 lbs and above) in Kentucky and the Great Plains about the same. Thus when feed costs increase, the future's price and Kentucky cash price would be expected to decrease, but Kentucky basis should not change. However, the effect that rising or falling feed prices have on lighter calves will vary depending on the season. During the fall and winter, rising feed prices should weaken the basis (lightweight calf prices drop more than the CME feeder index for 750 lb steers). This is because it takes more feed to finish smaller calves, and a rise in feed prices will have more impact on the value of these light calves. Conversely, in the spring and early summer, these smaller calves in Kentucky will be much less affected by changes in feed prices as their prices will primarily be driven by grass demand. Therefore, basis for calves may actually get stronger in the spring time as feed prices increase.⁶ It is important for feeder cattle producers to be aware of how feed prices and grazing conditions affect the value of the cattle they market.

Other local supply and demand conditions will also impact basis. While many factors such as feed prices and deferred live cattle futures will tend to impact Kentucky prices and the futures market similarly, there will be factors that will affect one market but not the other. For example, a localized drought in Kentucky might force producers to sell off calves in mid-summer and put downward pressure on Kentucky prices, but have little effect on feeder cattle prices in the large cattle feeding areas. The result would be weaker Kentucky basis.

In order to create historical basis information for Kentucky, monthly weighted average price data from the USDA Agricultural Marketing Service⁷ were analyzed. Weighted average prices by 50 lb increments were provided and adjusted to estimate weighted average prices for cattle at 550, 750, and 850 lbs. Charts showing historical basis data are included for steers and heifers in figures 2-6 at the end of this publication. Basis data were not included for 850 lb heifers as price data was very limited in several months during the past 3-5 years. These data include a wide range of cattle in various lot sizes. It also includes both in-weigh and out-weigh sale conditions. While highly variable by month, it is likely that 10-15% of the cattle in this dataset come from in-weigh markets, which will generally be associated with lower prices (weaker basis). So,

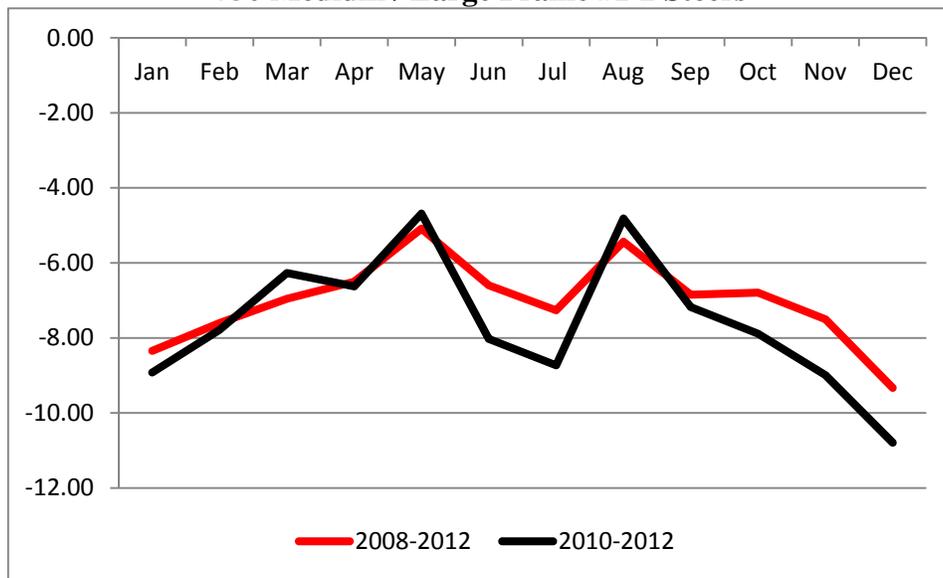
⁶ This is because the prices for lightweight calves should not change much, while the price for heavier feeder calves will decrease.

⁷ These data are collected by state market reporters from the Kentucky Department of Agriculture.

producers should bear this in mind and use these estimates as a starting point for individual basis forecasts for cattle they plan to sell.

While CME® feeder cattle futures are for feeder steers that average 750 lbs sold in tractor-trailer sized lots, basis can be estimated for any weight, lot size, and type of cattle by comparing their local (cash) prices to the futures price. Basis adjustments for weight can be made by incorporating typical price slides for heavier weight calves (above 675 lbs). For example, if you are trying to estimate the basis for 800 lb feeder steers, you would start with the 750 lb basis chart provided in Figure 1 below and decrease the basis estimate appropriately for the additional 50 lbs. Typical price slides for calves 700 lbs and above are \$3-6 per hundredweight. If you thought a price slide of \$4 per hundredweight was most representative, then you would subtract \$2 from the basis for 750 lb steers.⁸ Another logical approach for estimating basis on an 800 lb steer would be to average the basis from the 750# chart and the 850# chart. However, if the weight of cattle for which basis is being estimated falls outside the range of estimates provided, the price slide approach would have to be used.

**Figure 1: Monthly Kentucky Basis Estimates
750 Medium / Large Frame #1-2 Steers**



Lot size will have a major effect on overall local cash price, and thus basis. Recall that the CME feeder cattle futures prices assume a 50,000 lb lot size. Selling in lots less than this will generally result in lower prices, and thus a weakened basis compared to the CME index. As previously discussed, data used to generate basis figures in this publication included many sale locations and many different lot sizes. The average lot size within the data used to generate these figures was likely in the 10-20 head range. Thus for lot sizes less than 10-20 head, you should use a weaker (more negative) basis estimate and for lot sizes greater than 10-20 head, you should use a stronger (less negative) basis. Table 2 is provided as a way to adjust basis by lot size.

⁸ Going from 750 to 800 lbs is 50 lbs or half of a hundredweight. Thus we would use half of the price slide of \$4, or \$2 to subtract from the 750 lb basis. So a -\$6.50 basis becomes -\$8.50 for example.

While it provides a realistic estimate, it is based solely on recent feeder cattle price research and on the best estimates of the authors. Many other factors such as breed, quality, location, etc will affect basis and should also be considered. Suggested adjustments to figures 1-6 for lot size are reported in Table 2.

Table 2: Estimated Basis Adjustment for Lot Size Variation to Figures 1-6	
Lot Size Range	Expected Adjustment (\$/cwt)
0-5 head	-\$10
5-10	-\$5
10-20 head	\$0
20-30 head	\$1
30-50 head	\$2
50 head to full lot	\$3
Full lot	\$4
<i>Note: These estimated basis adjustments are made assuming average weight exceed 700 lbs.</i>	

Price Forecasts

There are multiple ways to use historical basis to make price forecasts. However this publication will discuss two that are simple to employ: 1) Historical monthly average, and 2) Current basis adjusted for historical seasonality. With either method, it is important to remember that basis estimates will not be 100% accurate so producers should expect some error in their price forecasts.

Historical Monthly Average Approach:

The historical monthly average approach to basis is very simple. Basis forecasts are determined by average basis for the month in which the price forecast is being made. For example, let's say that in March you want to estimate likely sale price for a group of 750 lb feeder steers to be sold in October. The October futures price from Table 1 is \$151 per cwt, which becomes the starting place for this approach. Next, we adjust that price from historical October basis. Both 3 year and 5 year averages are often used as this basis forecast.

Figure 1 charts historical basis for 750 lb feeder steers in KY over the last 3 and 5 years. Based on this figure, it appears that the 3 year and 5 year basis is around \$8 and \$7 under the October board respectively. If you were most comfortable with a 3 year average basis, then the estimated sale price for 750 lb feeder steers would be \$143 (\$151 futures price minus \$8 basis). Similarly, a 5 year basis estimate of (-\$7) would suggest a sale price of \$144. The advantage of using a longer historical period is that individual years have less impact on the estimate. However, shorter time frames will be most similar to current market conditions in times when market conditions are changing. In either case, this should be considered only as the starting point and other factors that impact basis (above) should also be accounted for.

Current Basis Adjusted for Historical Seasonality:

Another approach to estimating basis would start with current basis and adjust for historical seasonal tendencies. This approach offers the advantage of better incorporating current conditions into the forecast. While there is always the possibility that seasonal tendencies will not hold in a given year, that possibility exists with most any method.

The first step in using this approach is to estimate current basis for the relevant cattle type. If it is currently March, then March will also likely be the most current futures contract. The only time that this would not be the case would be if it was very late in a month and the futures contract had already cash settled or if it was very close to the settlement⁹ of the futures contract and the producer felt that the current contract was not indicative of the current feeder cattle market¹⁰.

In Table 1, the March feeder cattle futures contract was trading at \$137 per cwt. Using this approach, if you want to estimate a sale price for 750# feeder steers in October, you would start by comparing the current futures price to the current price of 750# feeder steers in Kentucky. If 750# steers at the local market are selling for \$126, then current basis for these steers is \$11 under the board. You would then use the seasonal chart in Figure 1 to consider typical basis trends on these steers between March and October (the difference between the two basis numbers). The 5 year basis plot would suggest that basis in the two months is very similar, but the 3 year basis plot would suggest that basis tends to weaken by \$1 to \$2 per cwt. If you wanted to take a more conservative approach and use the 3 year trend, then adjust the current basis of -\$11 downward by \$2 and estimate October basis for the current year at -\$13. Since the October feeder cattle futures price reported in Table 1 was \$151 per cwt, this method would suggest a price forecast of \$138. Note that the *current basis adjusted for historical seasonality* approach yielded a lower price forecast than the historical monthly average approach because it incorporated the fact that current basis is weaker than historical basis charts would have predicted for March.

Price Forecast Example:

Assume you plan to sell 55 feeder steers in mid-August and estimate they will weigh approximately 900 lbs at that time (49,500 lbs total or a full tractor-trailer load of cattle). You must first determine the relevant futures price. Since you plan to sell the steers in mid-August, use the August futures price reported in Table 1 of \$148 per cwt. Also assume that you decided to use the historical monthly average approach described previously. Since these cattle are expected to weigh 900 lbs, go to figure 4 (850 lb steers) in the back of this publication. Examining this figure, it appears that the basis in August is usually about -\$9 for 850 lb steers.

Next, adjust this basis estimate for the price slide as discussed in the “Understanding Feeder Cattle Basis” section. Since figure 4 is based on an 850 lb steers, you must slide the additional

⁹ The cash settlement process for feeder cattle futures contracts was discussed in AEC 2013-01.

¹⁰ Since feeder cattle futures contracts are cash settled using a 7-day weighted average of the CME Feeder Cattle Index, as time moves closer to expiration, price movement can be limited by the remaining days in the settlement process.

50 lbs that the steers are expected to weigh. Using a \$4 per cwt price slide, you would slide one-half of this, or -\$2 per cwt. This weakens the basis estimate from -\$9 to -\$11.

Finally, you need to make an adjustment for lot size. Since you plan to sell 55 head (49,500 lbs), adjust the basis estimate to account for the fact that the data used to generate figure 4 was from smaller lot sizes. Using table 2 for this purpose you would strengthen your basis estimate by \$4 to account for having a full load of cattle. This changes your basis estimate from -\$11 to -\$7. Finally, you would then take the base August price of \$148 and add the combined -\$7 basis and arrive at a price estimate of \$141. Again, it is important to realize that this is only an estimate and that additional factors such as breed, quality, location, etc should also be considered.

Incorporating Futures-based Price Forecasts in Calf Purchasing Decisions

Price forecasts can also be a useful tool for backgrounders and stocker operators as they decide how much they can afford to pay for calves. This section will show a four-step process by which you can work from an expected sale price for feeder cattle to determine what price can be paid for calves. The same process can also be used to determine whether the current calf market justifies cow-calf operators keeping calves past weaning.

Step 1: Estimate Expected Revenue per Head - Begin by estimating the basis and using that to estimate the sale price for the weight of cattle that you plan to sell. Assume you are looking at purchasing 500 lb steers in the spring, and selling them at 750 lbs in October. Assume also that you will use the *current basis adjusted for historical seasonality* approach and estimate a likely sale price of \$138 per cwt. To estimate the expected sale revenue per head, multiply the expected sale price by the expected weight in October, or 750 lbs x \$1.38/lb = \$1,035.

Table 3: Example of Variable Costs for Typical Stocker Operation (2013)	
Contract Month	Current Price (\$ per cwt)
Pasture Charge	\$30
Vet	\$20
Interest	\$17
Death Loss	\$18
Commission	\$16
Haul	\$15
Mineral	\$10
Other (water, etc)	<u>\$15</u>
<i>Total Variable Costs</i>	\$141
<i>Note: These are used for illustrative purposes only and will vary by operation and year</i>	

Step 2: Estimate Expenses for Program – The next step involves estimating the total expenses for calves from purchase to sale. Likely costs include pasture cost, veterinary and health expenses, hauling, commission, etc. Table 3 shows an example of these estimated costs for a typical summer stocker program. This is only an example, so you should estimate your own costs as they will vary considerably across operations.

Note that some costs such as pasture, mineral, hauling, death loss, and interest are likely to be higher for larger / more expensive calves. Costs such as death loss and vet / medicine expenses will be highly dependent on the type of calves that are purchased. Finally, sale expenses (commission) will largely depend on the number of feeders that are sold. Table 3 assumes that feeders are sold in lots of 40+, but this cost will be considerably higher for smaller operations. This same process can be used by winter backgrounders who purchase calves in the fall. Costs estimates for winter programs would likely

rely more on purchased feeds and less on pasture. Regardless, in order to breakeven, you must cover the cost of the purchased calf, plus all expenses associated with taking that calf to market weight.

Step 3: Add target profit per head – In addition to estimating expenses, you should have an idea of what level of profit you will need for incurring this risk and justifying your labor and capital. This target profit level can be thought of as a suitable return to labor, management, and capital as none of those items were included in Table 3. This target profit should then be added to estimated expenses. Assume that you targeted at profit level of \$75 per head.

Step 4: Calculate target purchase price – This final step starts by combining steps 1 through 3. To reach your targeted profit level, you must cover the cost of the purchased calf, all expenses associated with taking the calf to market weight, plus your targeted profit level. Once these costs and profit have been added together, they can be divided by the target placement weight of the calves, which was 500 lbs in this scenario. This will yield the target calf purchase price needed to reach the target profit level of \$75. Table 4 walks through this process and reports breakeven purchase price for a 500 lb steer calf based on the expected value of feeder steers in October, expected stocker expenses from Table 3, and a target profit of \$75 per head.

Table 4: Breakeven Purchase Price Calculation 500 lb steer calf		
Expected Revenue	750 lb feeder x \$1.38	\$1,035
Less Variable Costs		-\$141
Less Targeted Profit per Head		<u>-\$75</u>
Breakeven Purchase Price (per head)		\$819
Breakeven Purchase Price (per pound)	\$819/500 lbs	\$1.64

Based on the expected fall sale price and anticipated expenses for the stocker program, you would need to purchase 500 lb steer calves for \$1.64 per lb or less to reach the target profit level of \$75 per head. Any purchase price lower than \$1.64 will result in increased profit per head, while any purchase price above \$1.64 will result in decreased profit. While this is a useful price target, the market will ultimately dictate whether calves can be purchased for that price. So, it is worthwhile to evaluate a range of target profit levels and target purchase prices. Obviously, as target profit level increases (or decreases), target purchase price will decrease (or increase). Table 5 shows target purchase prices for 500 lb calves as target profit varies from \$50 per head to \$150 per head. This type of sensitivity analysis will help producers determine at what price levels they are no longer interested in purchasing calves (i.e. when gross profit reaches unacceptable levels).

Table 5: Target Purchase Prices For Various Gross Profits – 500 lb Steer Calf	
Gross Profit	Target Purchase Price
\$50	\$1.69
\$75	\$1.64
\$100	\$1.59
\$125	\$1.54
\$150	\$1.49
<i>Notes: Based on costs in Tables 3 and 4 and a sale price of \$138 for 750 lb sales weight for 500 lb purchased steer calves.</i>	

Summary and Conclusions

The purpose of this publication was to show beef cattle producers how the feeder cattle futures market can be used to predict sale prices for cattle sold at a later date, and how those prices could be used to estimate what can be paid for calves placed into stocker and backgrounding programs. By using the futures market as a way to forecast prices, and by carefully considering expenses, a target purchase price can be estimated for calves placed into these programs. While there are many unknowns that producers must manage such as prices, gains, health challenges, death loss, etc, this type of breakeven analysis is crucial for anyone placing calves in today's market environment.

Equally important to the breakeven analysis are price risk management considerations for the calves. While the targeted purchase price calculation described in this publication is very useful, it is important to remember that they will be based on current futures contract prices that are subject to change over time. Reaching the target profit level assumes selling the calves on that expected futures market price level. So producers should also consider price risk management strategies in order to protect their expected profit levels. Information on these opportunities can be found in the Additional Resources section that follows.

Additional Resources

CME Group© - *Strategies for CME Livestock Futures and Options and other publications on futures and options quotes, publications, resources, self study guides, etc.*

www.cmegroup.com

Using Futures Markets to Manage Price Risk for Feeder Cattle. AEC 2013-01, Kenny Burdine.
<http://www.ca.uky.edu/cmsspubsclass/files/kburdine/Using%20Futures%20Markets%20to%20Manage%20Price%20Risk%20in%20Feeder%20Cattle.pdf>

Using Futures Markets to Manage Price Risk for Feeder Cattle: Advanced Strategies. AEC 2013-03, Kenny Burdine.
<http://www.ca.uky.edu/cmsspubsclass/files/kburdine/Using%20Futures%20Markets%20to%20Manage%20Price%20Risk%20in%20Feeder%20Cattle%20Advanced%20Strategies.pdf>

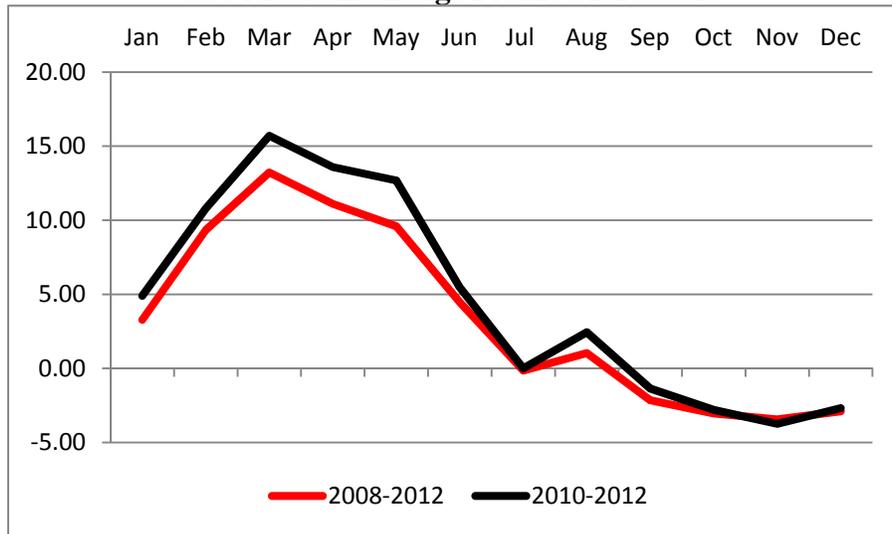
Managing for Today's Cattle Market and Beyond: Hedging Using Livestock Futures, James D. Sartwelle and James Mintert.

<http://www.lmic.info/memberspublic/pubframes.html>

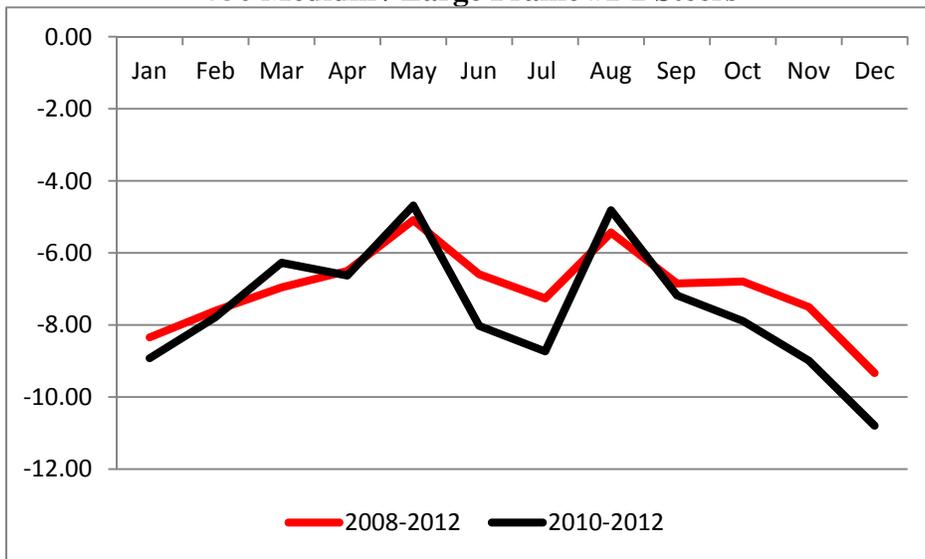
Managing for Today's Cattle Market and Beyond: Commodity Options as Price Insurance for Cattlemen, John C. Mckissick.

<http://www.lmic.info/memberspublic/pubframes.html>

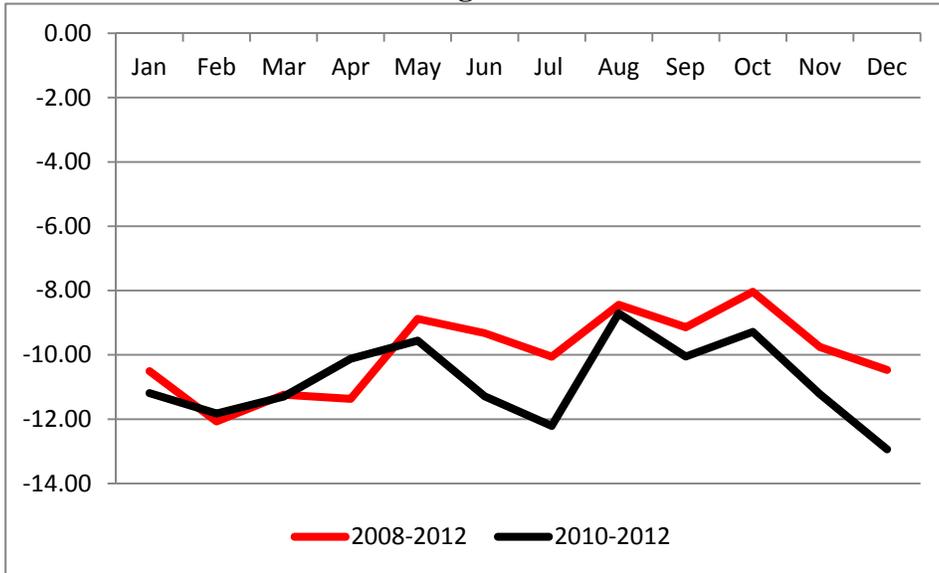
**Figure 2: Monthly Kentucky Basis Estimates
550 Medium / Large Frame #1-2 Steers**



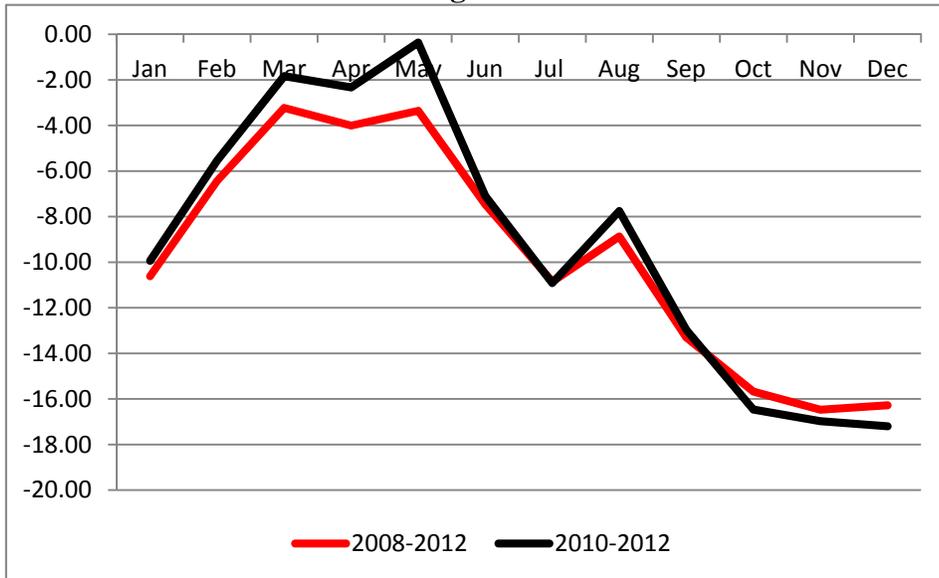
**Figure 3: Monthly Kentucky Basis Estimates
750 Medium / Large Frame #1-2 Steers**



**Figure 4: Monthly Kentucky Basis Estimates
850 Medium / Large Frame #1-2 Steers**



**Figure 5: Monthly Kentucky Basis Estimates
550 Medium / Large Frame #1-2 Heifers**



**Figure 6: Monthly Kentucky Basis Estimates
750 Medium / Large Frame #1-2 Heifers**

