Average Local Bases For An Aggregation of Cattle Markets in Ohio

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Introduction

Futures markets are a releatively new development in the livestock industry. They began in 1964 when the Chicago Mercantile Exchange (CME) initiated trading of contracts for live steers. Future markets allow farmers to hedge their production. In order for farmers to be successful in hedging they need to calculate a local basis. Since future markets are relatively new, it is the purpose of this article to define an ending local basis, explain the importance of the basis and how to use the concept, illustrate how to calculate the ending basis, and report a local slaughter steer ending basis for an aggregation of markets in Ohio.

Local Ending Basis

To hedge cattle, a farmer fills a feed lot with calves (buys calves or produces them) and sells a futures contract. The contract specifies that 40,000 pounds of live beef grading USDA choice will be delivered to Peoria, Illinois or Sioux City, Iowa. At the time the hedge is initiated, the feeder cattle do not meet the contract's specifications. Upon completion of the feeding period the fed cattle meet the contract's specifications and the hedge is terminated by selling the cattle and by buying back the futures contract.

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The price received by the farmer from this transaction depends upon the basis, the difference between the futures price and the cash price. Since the cattle in this analysis are to be sold at the end of the feeding period when the futures contract terminates, the price received by the farmer depends upon the ending basis.

The local ending basis is the difference between the futures price and the local cash price when the futures contract terminates and the live cattle are sold. The December contract ending basis, for example, would be the difference between the December futures price and the local cash price for December 1-20; the 20-day period when "shorts" (a term for those who have sold a live cattle contract) may deliver cattle to Peoria or Sioux City.

To predict the ending basis and the expected price for live cattle that are hedged, farmers need historic cash and futures price data. Since historic live cattle cash price data are not readily available for a specific market, this task may be difficult and time consuming. The bases presented in the table may be used by farmers in Ohio to estimate prices; however, farmers who are planning to hedge, should record cash price data for their respective markets.[1]

Procedures

The procedure used in this article to predict the local ending basis is the average value technique along with the standard deviation about the average. The standard deviation is the statistical term used to measure the distribution of actual observations around the average. The smaller the standard deviation, the greater the chance that the actual ending

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[1]Forms for secondary cash price data and the basis are available through the respective County Extension Office, The Ohio Cooperative Extension Office.

basis will be close to the average ending basis and the more accurately the farmer can predict the price he will receive for his cattle.

The following specific procedures illustrate a method for determining a local ending basis.

1. Obtain at least five years of daily or weekly cash price quotes from a local market, such as an auction, stock yard, order buyer, dealer, or packer. Do this for the first twenty days of the month in which the futures contract comes due. This constitutes a minimum of ten observations per month. Daily price quotes are better than weekly because a greater number of observations increases the accuracy of results.

   Weekly price data may be obtained from the Ohio Federal-State Marketing Service or Statistical Reporting Service. Data from these two sources are averages from different markets in the state. The prices they report do not necessarily reflect prices bid to an individual farmer who is selling cattle in a specific market. If the farmer cannot acquire historic price data from his market, the averages as reported by the Ohio Federal Marketing Service are good substitutes. If you use local market data, then you will be calculating a local basis; if you use state averages, then you will be calculating an average state basis.

2. Gather five years of "closing" futures prices for each of the first twenty days of the month when the contract comes due. These data are available from the following sources: The Wall Street Journal, local newspapers, or Statistical Annuals of the CME. These publications are stored in libraries on microfilm.

3. Select a "closing" futures price and a corresponding cash price for the same day of the year. Subtract the cash price from the "closing" futures price and the difference is the ending basis for that day.

4. Group the ending daily basis by contract month. For each contract month, determine the average ending basis. Each average ending basis is equal to the sum of daily bases for that month divided by the number of days.

5. Calculate the standard deviation for each contract month's average ending basis. The standard deviation for each contract month is obtained by using the following formula:

$$S = \sqrt{\sum_{i=1}^{n} \frac{(\text{daily basis} - \text{average ending monthly basis})^2}{\text{number of daily basis} - 1}}$$

To solve the formula, take the average ending basis for a contract month (Procedure 4) and subtract it from each daily bases of that month. These differences are squared and then summed. This sum is then divided by the number of daily bases minus one. The square root of this quotient is the standard deviation.

Determining An Average Ending Basis: An Example

Suppose we want to find the average basis and its standard deviation for a contract month, say June. Assume we collected data for a five year period (Procedures 1 and 2). For this example, we will assume 10 days of data.[2]

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[2]For the five year period, one would have 50 to 100 daily bases; 10 to 20 trading days per year times five years. To have an accurate estimate of the average ending basis and the variation about that average, one must have at least 20 data points.

In Table 1, the futures prices are specified in column 2 and the cash prices in column 3. The daily bases (column 4) are found by subtracting each day's cash price from the futures price (column 2 - column 3), Procedure 3. The daily bases in column 4 are summed. This total (total A) is then divided by the number of days in column 1, Procedure 4. The resulting quotient is the average basis and is placed in column 5. To solve the formula in Procedure 5, the following steps are executed and the results are secured in six and seven. Data in column 5 is subtracted from the data in column 4 and the results are placed in column 6; data in column 6 is squared and the results placed in column 7. Data in column 7 is summed and the total (total B) is then divided by one less than the number of days (number X). The square root of the resulting quotient (number Y) is then calculated which gives the standard deviation.

The standard deviation estimates the variation of the daily bases observations around the average ending monthly basis. In the above example, sixty-seven percent of the time, the basis will range from $.27 ($2 - $1.73) to $3.73 ($2 + $1.73); ninety-five percent of the time, the basis will range from $-1.46 ($2 - 2($1.73)) to $5.46 ($2 + 2(1.73). These estimates represent likely intervals in which the basis will fall. This can be used to determine the interval for the price received by the farmer, not including marketing and transaction costs. If, for example, the June's futures price is $40/cwt at the time of the hedge, then sixty-seven percent of the time the farmer will receive a price, that falls in the interval of $36.27 ($40 - $3.73) to $39.73 ($40 - $.27) and ninety-five percent of the time the price will fall in between the $34.54 ($40 - $5.46) to $41.46 ($40 - ($-1.46)) interval.

Since accurate production costs may be acquired from production records, profit ranges may also be estimated. Assuming a production cost

TABLE 1. A Report of Daily Bases and An Ending Average Basis for June: Hypothetical Data

Trading Days (Col. 1)	Futures Price (Col. 2) ($/cwt)	Cash Price (Col. 3) ($/cwt)	Daily Basis (Col. 4) ($/cwt)	Average Basis (Col. 5) ($/cwt)	Daily Basis - Avg. Basis (Col. 6)	Column 6 Squared (Col. 7)
1	38	36	2	2	0	0
2	39	36	3	2	1	1
3	41	40	1	2	-1	1
4	37	38	-1[1]	2	-3	9
5	35	35	0	2	-2	4
6	40	37	3	2	1	1
7	42	40	2	2	0	0
8	39	38	1	2	-1	1
9	38	35	3	2	1	1
10	40	35	5	2	3	9
		TOTAL A	20		TOTAL B	27

TOTAL A 20 ÷ # of days 10 = 2 Ending Average Basis

Number of day 10 -1 = 9 Number X

TOTAL B 27 ÷ Number X 9 = 3 Number Y

Square Root of Number Y 3 = $1.73/cwt Standard Deviation

[1]The negative sign indicates that the cash price is larger than the futures price for that day.

of $34/cwt, 95% of the time a farmer would earn a profit ranging from $.54/cwt ($34.54 - $34) to $7.46/cwt ($41.46 - $34).

Average Ending Basis for Live Cattle Markets in Ohio

Historic daily cash price data[3] were entered into the formula to calculate six ending basis, one for each contract month, for the Ohio slaughter steer markets (Table 2). Cash price data were prices reported by the Ohio Federal-State Marketing Service. These prices are an average of several weekly auction markets and do not represent a specific basis for any one market in Ohio.[4] Slaughter steer "closing" futures prices were obtained from the Chicago Mercantile Exchange.

The average monthly bases ranges from a negative $1.32 in February to $1.01/cwt in June. The smallest standard deviation, $1.71, occurred in February while the largest, $2.43, occurred in April.

The results in Table 2 are somewhat surprising. Theory tells us the basis should be positive, as it reflects the cost of transportation from a producing area to a delivery point. Only 52% (15 out of 29 times) of the time is this true. Other market conditions can be responsible for this. Since live beef does not move west into Illinois and Iowa, delivery from Ohio to Peoria and Sioux City are not economically feasible. Thus, arbitrators are unable to equalize prices between the futures market and the Ohio cash market. When the futures contracts terminates, economic conditions in Ohio may cause prices to be higher than those in Peoria.

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[3]Historic daily price data were not available for specific markets. These data are currently being collected from several marketing points in the state.

[4]Ibid.

TABLE 2. The Average and Monthly Ending Bases for an Aggregation of Ohio Cattle Markets, 1973-1978 ($/cwt)

Year	Delivery Month					
	February	April	June	August	October	December
1973	NA[2]	$-1.51[1]	$ 1.01	$- .86[1]	$-2.84[1]	$-3.03[1]
1974	$-3.25[1]	-1.53[1]	-2.08[1]	2.43	-1.76[1]	- .64[1]
1975	- .62[1]	1.00	3.27	- .33[1]	NA[2]	.90
1976	-1.68[1]	3.35	2.10	1.24	1.02	1.12
1977	- .31[1]	3.19	1.26	1.96	1.23	1.00
1978	- .07[1]	NA[2]	NA[2]	NA[2]	NA[2]	NA[2]
Normalized (Avg. Basis)	$-1.32[1]	$ .90	$ 1.01	$ .82	$-1.28	$- .26
Standard Deviation (Variation Around the Avg. Basis)	$ 1.71	$ 2.43	$ 2.07	$ 1.73	$ 2.14	$ 2.11
Normalized Basis Range, 67% Confidence Limits	$-3.03 to $ .39	$-1.53 to $ 3.33	$-1.06 to $3.08	$- .91 to $2.55	$-3.42 to $ .86	$-3.37 to $1.85

[1]The negative signs indicate that the cash price in the local cash market is greater than the futures prices. In all other instances, the futures price is greater than the cash price.

[2]Data Not Available.

It should be pointed out that the basis for one contract month is not the same as another contract month, due to seasonal trends. Thus, each contract month has its own basis. Also, a contract month's basis cannot be used for a non-contract month. Finally, the basis can change over the years, thus, it is in the best interest of an individual to continually update all bases.

Implication for Marketing Cattle Which Are Hedged

The selection of which day to market cattle determines the final prices and profit levels, even though the cattleman has hedged his cattle and has estimated the ending basis. The final price and the profit levels vary daily with changes in the ending basis. Referring to our initial example, the ten daily bases for June were $2.00, $3.00, $1.00, -$1.00, $0, $3.00, $2.00, $1.00, $3.00, and $5.00/cwt. Since the price received is equal to the futures price minus basis minus marketing costs, different daily bases will result in different prices and profit levels.

The importance of the basis to profit-loss statements is best illustrated with actual data. Assume in January, 1977, a cattle producer hedges cattle for June delivery at $40/cwt. In June, the producer estimates that the basis will average $1.01/cwt and will range between -$1.06/cwt to $3.08, 67 percent of the time (Table 2). The producer should lift his hedge when the basis is equal to or less than $1.01/cwt.

During the June delivery period (first 20 days of June), the bases in 1977 ranged from $.22/cwt on June 13 to a high of $2.84/cwt on June 1. Observe that these data are in the anticipated basis ranged (-$1.06 to $3.08). Assuming his cattle were at the appropriate market weight and grade on June 1, the farmer should not market cattle because the daily basis, $2.84, is greater than the anticipated average ending basis, $1.01.

If he did market on June 1, his price would be $37.17 ($40 - $2.84). By delaying marketing until June 6, the basis declines to $.93 which is below the anticipated average basis of $1.01/cwt; he received a sum of $39.07/cwt ($0 - .93). By delaying marketing and evaluating the ending basis, this farmer increased his price by $1.90/cwt ($39.07 - $37.17). On a 1000 pound steer, this price differential adds $19 to gross receipts.

Obviously, the decision to market cattle when the basis is narrow or negatives, can mean extra profits for the cattleman who is hedging.