

Trends in Arkansas Cattle Markets: Feeder Cattle Price Seasonality, 2011-2020

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What is Price Seasonality?

Commodity prices exhibit systematic and random variation through time (Tomek and Kaiser, 2014). Three patterns of systematic price behavior include trends, cycles and seasons. Cattle producers can exploit these systematic price patterns to anticipate future price fluctuations and plan accordingly. The price pattern that we will focus on in this fact sheet is price seasonality for Arkansas feeder cattle.

Price seasonality is a systematic pattern that occurs within a year. For livestock, the seasonal pattern begins in January and ends in December. Crop price seasonality follows the crop's marketing year. Within a season, prices will show highs and lows relative to the average price. The idea behind price seasonality is that these seasonal highs and lows will usually occur at the same time each year.

Price seasonality arises from seasonal variability in supply and demand conditions. Agricultural production involves biological lags between the initial production decision and realized output (e.g., growing season or gestation period), which drives seasonal supply variation. In the United States, most calves are spring-born and fall-weaned. Because of this, we observe a large supply of calves in the fall. One source of seasonal demand arises from seasonal changes to consumer eating habits which transmit through the supply chain. For example, peak seasonal beef demand occurs between Memorial Day and Labor Day during grilling season. The tendency

for supply and demand fundamentals to change each year in a repeatable fashion gives rise to cattle price seasonality.

Seasonal Price Indices

One way to examine price seasonality for cattle is to estimate a seasonal price index. Most seasonal price indices are monthly indices. Each value in the price index gives the relationship between average prices for a specified month compared to the annual price average. The index value for a specific month is the percentage change in that month's average price compared to the annual average price. For example, an index value of 106 in August for 700-800 lb. medium and large No. 1 steers in Arkansas means that August prices average $106-100 = 6$ percent higher than the annual average price. Similarly, an index value of 98 for Arkansas in December suggests that December feeder steer prices average 98 percent of the annual average feeder steer price or $98-100 = 2$ percent below the annual average.

Estimating a seasonal price index requires the collection of historical price data. For this article, Arkansas cattle prices are collected from USDA-AMS for the 2011-2020 period¹. These prices reflect averages for the state. It is important to define a specific class of animal for your price index. Different classes of cattle will have different seasonal price patterns. In the previous example, our seasonal price index was defined as 700-800 lb. medium and large #1 Arkansas steers. Region, sex, weight, frame, muscling and class

¹See https://www.ams.usda.gov/mnreports/ams_2056.pdf.

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are important factors to consider. Data collection should reflect a pre-determined class of cattle.

To estimate a seasonal price index, first calculate the monthly average price for January through December. Do this for every year of data. For example, using 2011 data, calculate the monthly average price for each month in 2011. Repeat this process for each year of data. Next, calculate the annual average price for each year of data (2011 average price, 2006 average price, ..., 2020 average price). The results should be an annual average price for each year of data. Finally, divide each month's average price by its corresponding annual average price and multiply by 100. The result is ten seasonal price indices.

To illustrate the process, we can use our earlier example of 700-800 lb. medium and large #1 feeder steers in Arkansas. The first step is to calculate the monthly average price for every month for every year. In 2020, for example, suppose we calculate an average price of \$135.07/cwt for August. The next step is to calculate the annual price for every year of data. Again, in 2020, suppose we estimate an annual average price of \$127.44/cwt. Finally, to calculate the index value for August 2020, divide the August 2020 average price by the 2020 average price and multiply by 100. The result is $(135.07/127.44) \times 100 = 106$. The August 2020 index value tells us that August feeder steer prices averaged 6 percent above the annual price in 2020.

Average Seasonal Price Indices

Calculating annual seasonal price indices is a helpful first step. We are really interested in a historical average price index, which will give us a more reliable estimate. To do this, take an average of the index values across years for a specified month. For example, to obtain the average seasonal price index value for January, average the January index values for 2011-2020. Repeat this process for each month. The result is a 10-year seasonal price index.

Arkansas Seasonal Price Indices

Tables 1 and 2 reports 10-year average seasonal price indices for Arkansas steers and heifers. Each index value is

interpreted as the average percentage deviation from the annual average price. For example, 400-500 lb. steer prices in March average $106-100=6$ percent above the annual average price level (Table 1). In October, 400-500 lb. steers average 4.4 percent below the annual average price.

Tables 1 and 2 also provide standard deviations, which are in parentheses below each index value. In non-technical terms, the standard deviation measures how precise our estimates are for the seasonal price index. A large standard deviation implies more variability in our estimated index value. Smaller standard deviations indicate a more reliable price index.

Using the standard deviation in Tables 1 and 2, we can construct a statistical range that we expect our seasonal price index to fall within. Specifically, we would expect the price index's average estimate to fall within plus or minus one standard deviation 68 percent of the time. In January, for example, we would expect that 68 percent of the time, the price index for 400-500 lb. steers will fall in the 111.8 ($102+9.8$) to 92.2 ($102-9.8$) range (Table 1).

Table. 1. Arkansas Average Seasonal Price Indices for M/L #1 Steers, 2011-2020

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--------------|-------|--------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|
| 400-500 lbs. | 102.0 | 105.3 | 106.0 | 104.2 | 101.0 | 97.6 | 95.6 | 97.8 | 95.2 | 95.6 | 99.3 | 100.4 |
| | (9.8) | (10.2) | (9.7) | (7.9) | (6.7) | (5.5) | (5.4) | (4.9) | (7.0) | (10.7) | (11.3) | (13.3) |
| 500-600 lbs. | 101.6 | 104.8 | 106.0 | 104.7 | 101.8 | 99.5 | 96.7 | 98.1 | 94.6 | 94.8 | 98.1 | 99.1 |
| | (9.7) | (9.7) | (9.2) | (7.4) | (6.2) | (5.6) | (4.9) | (4.5) | (6.3) | (9.6) | (10.5) | (12.6) |
| 700-800 lbs. | 100.3 | 101.0 | 101.6 | 100.4 | 99.5 | 100.5 | 99.8 | 101.2 | 98.8 | 98.8 | 99.5 | 98.6 |
| | (9.0) | (8.5) | (8.0) | (6.9) | (5.4) | (5.1) | (5.0) | (3.9) | (5.6) | (9.5) | (9.4) | (11.7) |

Note: Standard deviations in parentheses.

Table. 2. Arkansas Average Seasonal Price Indices for M/L #1 Heifers, 2011-2020

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--------------|--------|--------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|
| 400-500 lbs. | 101.0 | 104.6 | 106.2 | 105.2 | 102.6 | 99.9 | 97.6 | 99.3 | 94.9 | 93.9 | 97.0 | 98.0 |
| | (10.3) | (10.3) | (9.6) | (7.6) | (6.5) | (5.8) | (5.2) | (4.8) | (6.8) | (10.5) | (10.9) | (13.6) |
| 500-600 lbs. | 100.0 | 103.2 | 105.3 | 104.2 | 102.5 | 100.8 | 99.2 | 100.4 | 96.1 | 94.7 | 96.8 | 96.9 |
| | (9.7) | (9.6) | (8.9) | (7.4) | (6.1) | (5.4) | (5.0) | (4.4) | (6.3) | (10.2) | (10.3) | (12.8) |
| 700-800 lbs. | 100.8 | 101.8 | 100.6 | 101.3 | 100.3 | 100.3 | 99.5 | 102.4 | 97.3 | 98.2 | 99.5 | 98.0 |
| | (8.8) | (9.2) | (8.4) | (6.5) | (5.8) | (5.1) | (4.2) | (4.1) | (7.9) | (10.2) | (8.5) | (10.9) |

Note: Standard deviations in parentheses.

Figures 1-6 plot the 10-year average price index (red line) and the corresponding range (dotted blue line) that we would expect the average price index to fall within 68 percent of the time.

400-500 lb. Steers and Heifers

Figures 1 and 2 depict a clear seasonal pattern for 400-500 lb. steers and heifers. Steer prices average 6 percent above the annual average in March and remain above the annual average through May before declining during the summer months (Figure 1). Notice that steer prices increase through the fall but remain below the annual average price. The seasonal pattern in Figures 1 and 2 is consistent with prices declining during the fall calf market. Importantly, steer and heifer prices experience a similar seasonal pattern, but there are differences in the value of the index. Take note of the differences between steers and heifers.

500-600 lb. Steers and Heifers

Figures 3 and 4 plot the seasonal price index for 500-600 lb. steers and heifers. The seasonal patterns are similar to the price behavior for 400-500 lb. steers and

heifers. Average prices are seasonally highest in March, decline through the summer, and remain below the annual average in the fall. Notice for both weight classes the dotted lines are wider in the fall, which means there is more variability in the seasonal index.

One hypothesis is that, even for a well-defined class of cattle, a large supply of calves in the fall is accompanied by significant quality variation, and thus, more price variability (Mitchell, 2020). Another hypothesis is that more frequent non-seasonal factors impact prices in the fall, which leads to a more variable seasonal pattern. Regardless of the cause, producers should acknowledge a less reliable seasonal price index for calves sold in the fall.

700-800 lb. Steers and Heifers

Heavier feeder cattle have a more subtle seasonal pattern (Figures 5 and 6). In Arkansas, feeder steer and heifer prices follow the annual average price more closely. Compared to calves, the standard deviations for feeder cattle are smaller, which indicates less variability in the estimated price index.

Figure 1. Arkansas Seasonal Price Index for 400-500 lb. M/L #1 Steers (2011-2020)

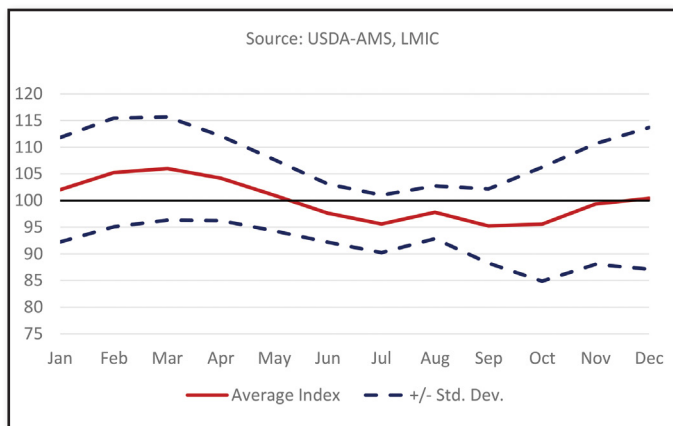


Figure 2. Arkansas Seasonal Price Index for 400-500 lb. M/L #1 Heifers (2011-2020)

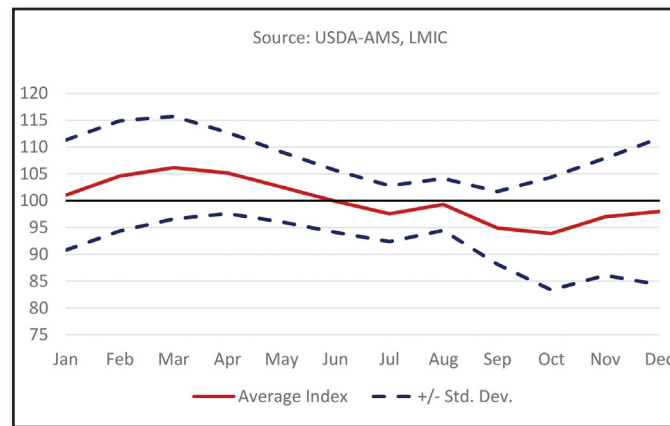


Figure 3. Arkansas Seasonal Price Index for 500-600 lb. M/L #1 Steers (2011-2020)

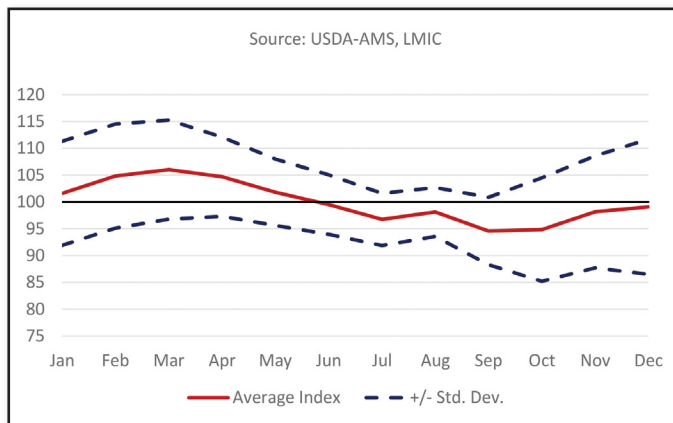


Figure 4. Arkansas Seasonal Price Index for 500-600 lb. M/L #1 Heifers (2011-2020)

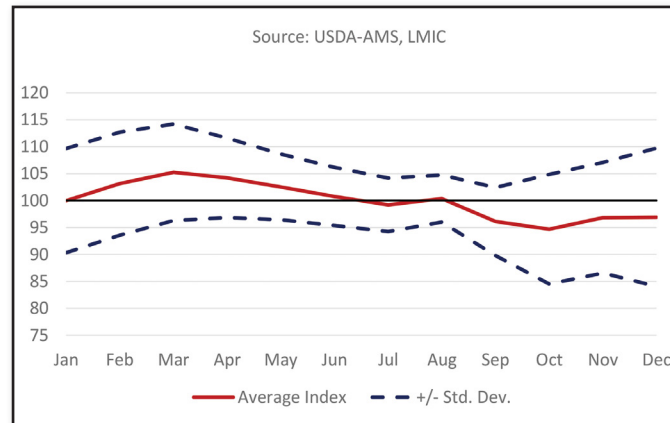


Figure 5. Arkansas Seasonal Price Index for 700-800 lb. M/L #1 Steers (2011-2020)

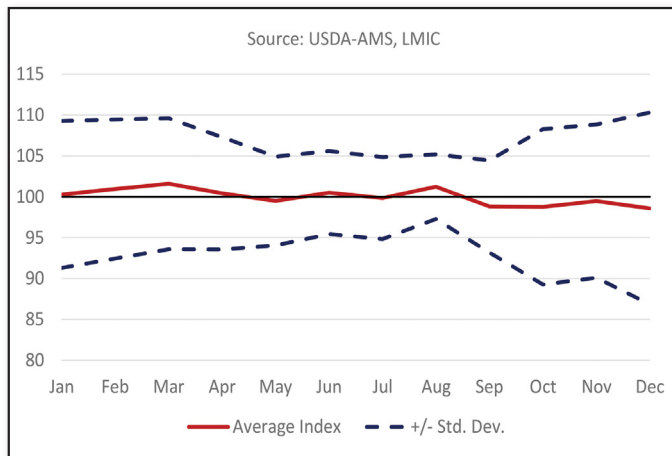
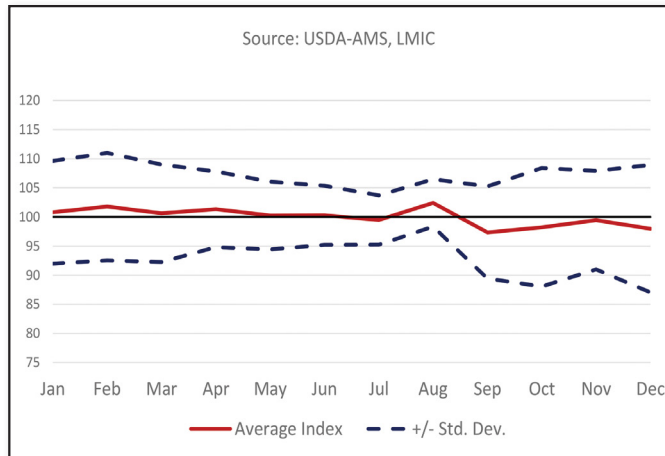


Figure 6. Arkansas Seasonal Price Index for 700-800 lb. M/L #1 Heifers (2011-2020)



Forecasting with Price Indices

Seasonal price indices provide a practical way of forecasting future prices. Given a historical price index and current prices, we can anticipate future price behavior and predict prices with this knowledge. For example, in Arkansas, July 2021 prices averaged \$165.90/cwt for 400-500 lb. steers. What if we want to forecast November 2021 prices? We can use the seasonal relationship between July and November to forecast prices. All we need is the July average price (\$165.90/cwt), July index value (95.6), and November index value (99.3). The November 2021 forecast for Arkansas steer calves is $165.90 \times (99.3/95.6) = \$172.36/\text{cwt}$.

References

- Mitchell, J.L. 2020. "Trends in Arkansas Cattle Markets: Estimates of the Premium for Preconditioned Cattle." University of Arkansas, Cooperative Extension Service. Publication FSA3153. Available at: <https://www.uaex.uada.edu/publications/pdf/FSA3153.pdf>.
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