Seasonal Variation in Prices of Live Cattle Negotiated in Brazil’s Futures and Spot Markets

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Abstract.

Considering the importance of the agricultural hedge and of the futures market as tools to facilitate the decision making concerning live cattle commercialization, our aim in this research was to analyze the seasonal variation in the prices of live cattle futures negotiated in the Brazilian Mercantile and Futures Exchange (BM&FBOVESPA), as well as to compare it with two other commercialization places of the spot market. To calculate the Seasonal Index and the Deseasonalized Index we used the methodology of the 12-month Centralized Mobile Geometric Average. The results have shown a similar and regular pattern of seasonal variation throughout the past few years among the markets. The Seasonal Index has indicated two well-defined periods, signaling the first semester as the period with the largest offer and the second as period with the smallest offer. The month of November consisted in the summit of the upward movement of prices.
1. Introduction

When we analyze a time series, our objectives can be the investigation of the mechanism which generated the time series, the prediction of the serie’s futures economic values, the simple description of the series’ behavior or the identification of relevant periodicities in the data (MORETTIN and TOLOI 2004).

For the spot and futures markets of live cattle, the construction of a time series for the observation of the seasonal variation could turn out to be an important tool for the reaching of the objectives described above, which can reveal a standardized behavior of prices.

Cattle raising is one of the main activities of the sector of animal husbandry and agriculture in Brazil. According to the United States Department of Agriculture – USDA (2014), Brazil is recognized to be the greatest world producer of beef, with 9.6 million carcass weight equivalent tons sold, and was, up to 2011, the world’s exportation leader. In 2013, the country still owned a herd composed of more than 203 million bovines, which corresponded to the second largest cattle herd in the world. Graph 1: World Leaders in Beef Exportation.

The Food and Agriculture Organization of the United Nations – FAO (2003) foresees an on-going increase in the demand for animal protein until 2020, specially in Asia, which can become responsible for the demand for half of the world’s meat production. This is a positive scenario for Brazil, since Asiatic countries such as Russia, Iran and Hong Kong are three out of the four greatest importers of Brazilian in natura meat.

There is a positive relationship between meat consumption and per capita income. Thus, Brazil has been presenting a growth in beef consumption in the last few years. It is important to highlight that the exportations represent just a small slice of the productive chain, since the internal market has consumed 82.7% of the total production of 2011 (ANUALPEC 2012).

Due to the annual oscillation of the production, the prices of the products originating from animal husbandry and agriculture present a much larger variation than the prices of industrial goods, for example. These variations may have many causes according to the duration of the period to be considered (HOFFMAN 2002).

To raise live cattle to produce beef, one should be concerned specially with the quality and the availability of pasture, for those seem to constitute the main biological factors that might limit production. The Brazilian production is mainly concentrated in the central region of the territory, where two well-defined seasons occur, being one rainy and the other one dry, leading thus to a great seasonal
variation in the product’s offer and, consequently, in its price (graph 2). This price dynamics requires attention from this market’s agents in relation to the futures prices and their relationship with the spot prices so that they can predict the business’ profitability. Graph 2: Climate Normals of Two Brazilian Cities from the Center-South Region (1961-1990).

The determination of the pattern of seasonal variation in live cattle futures prices is important for the analysis of the behavior of this commodity’s prices throughout the year, as well as of its relationship with the prices adopted by the live cattle spot market.

Francisco et al (1995) believe that the seasonal variations represent the study of the flotations of periods of time that are equal or inferior to one year, which occur in a time series. This tool can thus help, with the prediction of the price, the chain’s agents to plan the production, the commercialization and the hedge operations.

This article aims to determine the pattern of deseasonalized variation in the live cattle futures prices negotiated in the Brazilian Mercantile and Futures Exchange (BM&FBOVESPA) in comparison to the spot market prices, in two different commercialization places: São Paulo and Goiânia.

2. Methodology

The futures prices were collected at the BM&FBOVESPA database, taking into consideration the adjustment prices of the day previous to the closest contract expiration date, month to month. The spot prices of São Paulo’s spot market refer to the CEPEA database (Center of Advanced Studies in Applied Economics – ESALQ, USP). The prices of Goiânia’s spot market, on the other hand, were obtained on the website of a Consulting Business. The daily data were converted into monthly averages, and for the determination of the pattern of deseasonalized variation we used the method of the Centralized Mobile Geometric Average, according to Hoffmann (2002).

The analysis based on Centralized Mobile Averages of a given period consists of the mitigation of the variations of the series through a process of successive averages. “The greater the number of terms used for the mobile average, the more mitigated the resultant series will be” (MELO ESPARANCINE AND SILVA 2008).

To Spiegel (1993, p.428): “mobile averages have the property of tending to reduce the total of the variation that presents itself in a collection of data”.

Hoffmann (2002) describes that the Centralized Mobile Geometric Average of a given period is calculated through the following equation:
$$G_t = \sqrt[12]{P_{t-6}^{0.5} \cdot P_{t-5} \cdots P_t \cdots P_{t+5} \cdot P_{t+6}^{0.5}}$$

where:

$G_t$ = mobile geometric average in the month $t$;

$P_t$ = price in the month $t$;

$t$ = month of the centralized average.

From this average, the calculations of the Seasonal Index and the Deseasonalized Index were made. The Deseasonalized Index could be calculated through the division of the values of the series of futures prices ($P_t$) by their respective mobile geometric averages ($G_t$), multiplied by 100.

$$I_t = \frac{P_t}{G_t} \cdot 100$$

From then on, the Seasonal Index is obtained for each month, dividing the values of the geometric averages of the Deseasonalized Indexes ($100D_j^*$) by the geometric average of the 12 values of $D_j^*$, given by:

$$D_j^* = \left(\prod_{i=2}^{10} D_i1\right)^{\frac{1}{n}}$$

where:

$j$ = month of the centralized average;

$n$ = number of months of the calculated year.

3. **Results and Discussion**

The analysis of the data reveals that live cattle futures prices oscillate alternating years of slight price drops and stagnations and years of a more intense rise in prices in a period of three to four years (graph 3). We can also observe that the futures price curve frequently oscillates upward and downward in relation to the curve of the Centralized Mobile Geometric Average, indicating periods with a greater offer
expectation, when prices are lower than the average, and periods with a smallest offer expectation, when prices are higher than the average. **Graph 3 – Centralized Mobile Geometric Average of Live Cattle Futures Prices from June 2002 to July 2012.**

The Deseasonalized Index (graph 4) demonstrates a pattern of annual deseasonalized variation in live cattle futures prices in which the first months of the year present the lowest prices, while the highest prices occur by the end of the year.

There are years with greater or smaller amplitudes of variation in the Deseasonalized Index, depending on conditions of offer and demand of the product throughout the year. However, the index has always shown variations between the close values of 92.63 and 114.4. **Graph 4 - Deseasonalized Index of Live Cattle Futures Prices from June 2002 to July 2012.**

The Seasonal Indexes of the futures market and of the two spot markets reflect the period comprised by the last five years, allowing an analysis of the behavior of these prices throughout the year (table 1).

**Table 1 - Seasonal Indexes of Live Cattle Spot and Futures Prices from June 2008 to July 2013.**

We can infer that the greatest Seasonal Indexes of price have occurred in November; the smallest indexes, in turn, have occurred in March, May and June, for the Goiânia (spot), futures and São Paulo (spot) markets, respectively. The amplitude of the Seasonal Index, corresponding to the difference between the greatest and the smallest indexes, has indicated a variation of 4.5% for the spot prices of Goiânia, 3.15% for the spot prices of São Paulo and 7.57% for the futures prices. **Graph 5 – Seasonal Indexes of Live Cattle Spot and Futures Prices from June 2008 to July 2013.**

The graph above reveals that the dynamics of variation in the live cattle futures prices presents two well-defined periods, a period with a largest offer (index below 100), relative to the first semester, and a period with a smallest offer (index above 100), relative to the second semester. On the other hand, Goiânia has differed a little from this dynamic, for there is an increase in prices only from August on.

We can perceive that the period with the largest offer and the period with the smallest offer maintain a relationship with the pattern of climatic variation, since live cattle prices increase with the arrival of the dry season, which lasts up to October or November, when the prices begin to drop due to the increase in the offer of confined live cattle.

A similar pattern was demonstrated by Sá and Silva Júnior (2007) for the actual prices of live cattle in the state of Goiás: **Graph 6 – Deseasonalized Variation in the Price Of Live Cattle in Goiás From 1979 to 1984.**
In spite of the referential of actual prices in Sá and Silva Júnior’s research (2007), that study presents a pattern of deseasonalized variation that is very similar to the one here observed in relation to the conformation of the graph and to periods of raises and drops of the prices’ average. On the other hand, we have graphically noticed that the amplitude of the Seasonal Index found by the authors was greater than the one observed in the last five years, what is justified by the fact that that was the period of greater inflationary variation.

4. Conclusion

The analysis of the data shows that the prices of the futures and spot markets of live cattle present a similar pattern of deseasonalized variation, especially amongst the series of futures and spot prices in São Paulo. The series of Goiânia, however, showed a greater amplitude of the index, corresponding to the difference between the greatest and the smallest indexes, and also presented greater volatility of prices.

We have verified that over the last decade, the history of the behavior of the futures prices has revealed years with a first semester of greater offer and a second semester of smallest offer. The price average of May was the lowest, while the price average of November was the highest. This dynamics is related to the precipitation distribution on the most important regions of production.

The pattern of deseasonalized variation identified in this article helps us to understand the seasonality of the production over the year and the behavior of the price averages in the last few years. Other studies to deal with the same subject, not only in relation to the commodity in question, are necessary for the identification of changes in the pattern of variation and foreseeability of the prices, which can influence the planning of the production and commercialization of live cattle.
Tables and Figures

Table 1 - Seasonal Indexes of Live Cattle Spot and Futures Prices from June 2008 to July 2013.

<table>
<thead>
<tr>
<th></th>
<th>Futures Market (BM&amp;F)</th>
<th>Spot Market (São Paulo)</th>
<th>Spot Market (Goiânia)</th>
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<tbody>
<tr>
<td>January</td>
<td>98.95</td>
<td>100.09</td>
<td>100.32</td>
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<td>February</td>
<td>98.93</td>
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<td>99.74</td>
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<td>March</td>
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<td>April</td>
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<td>May</td>
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<tr>
<td>July</td>
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<td>December</td>
<td>99.76</td>
<td>99.99</td>
<td>100.71</td>
</tr>
</tbody>
</table>

Source: resource data.

Graph 1: World Leaders in Beef Exportation.

Source: USDA (2012).
Graph 2: Climate Normals of Two Brazilian Cities from the Center-South Region (1961-1990).

Graph 3 – Centralized Mobile Geometric Average of Live Cattle Futures Prices from June 2002 to July 2012.
Graph 4 - Deseasonalized Index of Live Cattle Futures Prices from June 2002 to July 2012.

Graph 5 – Seasonal Indexes of Live Cattle Spot and Futures Prices from June 2008 to July 2013.
Graph 6 – Deseasonalized Variation in the Price Of Live Cattle in Goiás From 1979 to 1984.

References


Morettin P.A; Toloi, C. M. C. 2004. Análise de Séries Temporais. Editora Blucher; São Paulo, SP.

