Original Research Article

Production and price cycles in beef cattle in Rondônia state, Brazilian Amazon

ABSTRACT

The study evaluates the behavior of production and prices in the beef cattle market in Rondônia, Brazilian Amazon. Covering the period from 1995 to 2020, we used statistical analysis based on the classical multiplicative method of time series. Resultingly, we found that the occurrence of annual seasonality in prices, with a reduction in the first half of the year and an increase in the second half of the year, corresponding to the bovine and off-season harvests, respectively. It was possible to observe the existence of three complete livestock cycles, with an average duration of five years. Trend, seasonality, and cycles of livestock in Rondônia, over the last 25 years, expose a series of relevant information for decision-making by agents in the livestock production chain, in addition to contributing to the understanding of the dynamics of this important agricultural market for Rondônia and Brazilian economy.

Keywords: Livestock market; price analysis; livestock cycle; price seasonality.

1. INTRODUCTION

Brazilian beef cattle is an economic segment of agribusiness of great importance to the national Gross Domestic Product (GDP). In 2020, the GDP of the beef cattle agribusiness, including all businesses and movements in the chain, was R$ 747.05 billion[1]. Beef production has a set of interactive agents, such as input suppliers, the slaughter and processing industries, wholesale and retail distributors, the foreign market, and the final consumers of the domestic market, making this production chain one of the most representative of the national economy. It is the second most-consumed source of animal protein in Brazil, surpassed only by chicken meat, and the fourth in the world, after fish, pork, and chicken [1,2]. It is a product of great importance to the consumer, as its weight in the cost of food is greatly influenced by price variations in the production chain.

Over the last few decades, beef cattle have been showing significant growth in their production systems in all states of Brazil [3]. However, in the states of the Amazon region, in the last 25 years, there was the highest growth rate of the bovine herd, with an express value of 4.20% per year [4]. The other regions of Brazil, Midwest, Northeast, and Southeast, presented rates of 1.30%, 1.13%, and 0.11% per year, respectively. The South region showed a decrease of 0.05% per year. This shows the productive potential of the states of the Amazon region for cattle raising.

One of the states in the Amazon region that has featured prominently in cattle raising is Rondônia state, which has beef cattle production as one of its main economic activities and beef as its main export product. Due to the expansion of this sector in recent years, Rondônia can supply the domestic and export markets. It currently has a bovine herd of

around 14.36 million heads [4], representing 6.7% of the national total, and ranks seventh in the national ranking of beef producers.

Beef cattle raising in Rondônia state has undergone intense modernization, showing a significant increase in production and productivity, due to the incorporation of technological innovations in production systems and for being considered a frontier of Brazilian agribusiness. These factors are crucial for its agricultural development, attracting investments to the region and contributing to employment and income generation [5]. Because of these changes, beef production increased, increasing the meat supply. Thus, the state of Rondônia occupies fifth place in the national ranking in beef exports and the largest exporter in the states of the Amazon region, in 2020.

Rondônia recently obtained worldwide recognition as a Foot-and-Mouth Disease (FMD) free zone without vaccination, which will contribute to the expansion of its markets [6]. According to the Agrosilvopastoral Health Defense Agency of the State of Rondônia [5], the state exports beef to more than 42 countries. With Egypt, Hong Kong, Chile, and the United Arab Emirates as the main importers, corresponding to more than 75% of all exported beef. In 2020, the exported volume was 171 thousand tons of beef (frozen, fresh or refrigerated) [7], having a significant economic weight, both in the Country's Trade Balance and in the state economy.

Beef production generally involves three production phases: breeding, rearing, and fattening. They can be carried out in isolation, involving two phases or the entire production cycle. Each phase is intended for a final product, such as for the production of the calf, lean cattle, and fat cattle. Taking into account the economic importance of livestock and the stages involved in the production process, it is essential to know the behavior of prices involved in the production chain, as well as the variations that occur during the year. This allows the identification of the different phases of the livestock market cycles.

The formation of prices in the cattle market is influenced by several factors, such as the price of inputs for feeding and supplementing animals, demand and supply conditions, economic factors such as the exchange rate, in addition to the seasonality of production-related to annual climatic variations with periods of greater and lesser rainfall. These factors influence the greater or lesser supply of animals for slaughter, with consequences for the price of fattened cattle.

The knowledge of such dynamics on the part of the rancher helps in the planning of the livestock production of animals for slaughter, seeking more favorable moments for commercialization, through the use and management and technologies appropriate to their reality, to intensify production and reduce price seasonality. In this context, this article aimed to characterize the livestock cycle in the state of Rondônia, Brazilian Amazon, through the analysis of trends, seasonality, and cycles in the period from 1995 to 2020.

2. MATERIAL AND METHODS

2.1 Study area and data

The research reference area is Rondônia state, North of Brazil (Figure 1), which has a territorial area of 238,512 km² distributed in eight micro-regions and 52 municipalities with an estimated population of 1.7 million inhabitants [4]. It is an important center for Brazilian livestock production, with the sixth largest herd in Brazil. Also, it contributes economically both nationally and a strong foundation for economic development in the Northern region of the country, with a gross value of livestock production of R$9.9 billion in 2020 [8]. The State

of Rondônia is the 6th largest producer of beef cattle in Brazil and the municipality of Porto Velho is the 4th largest producer in the country. The State of Rondônia participates with 7% of the amount of national beef heads [4].

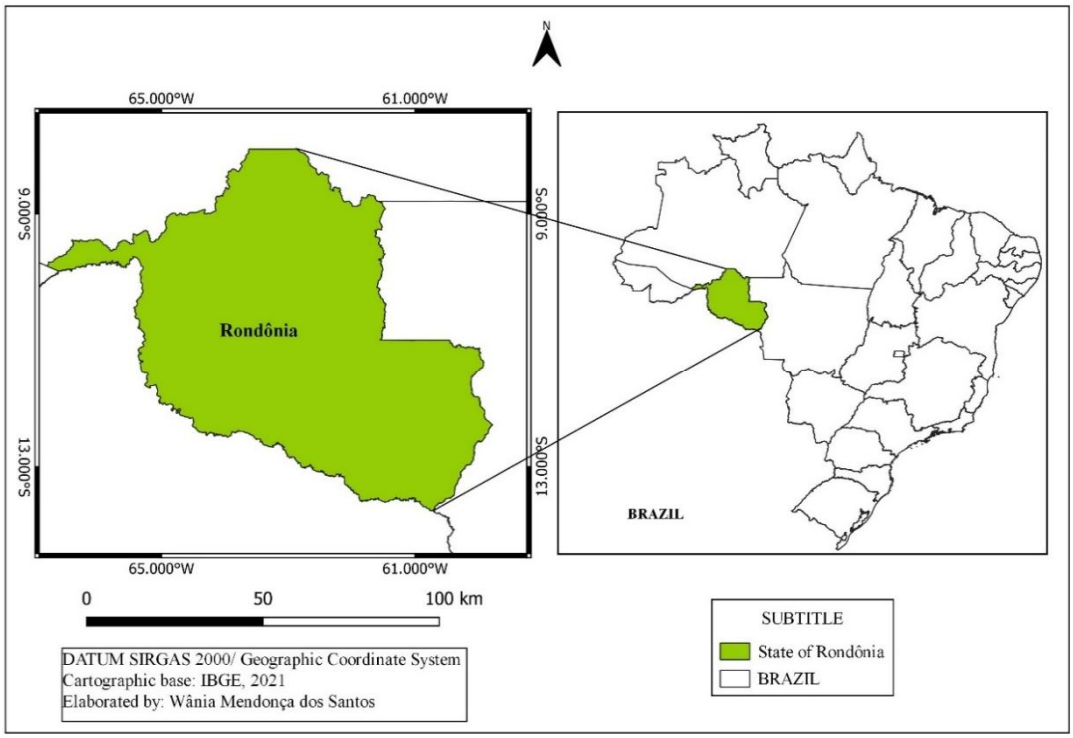

Fig. 1.Location of the state of Rondônia in Brazil.

The bovine herd in the state of Rondônia has 14.8 million heads, with the micro-regions of Porto Velho, Ji-Paraná, Cacoal and Ariquemes being the largest holders of the bovine herd. Livestock in Rondônia is present in all municipalities with a predominance of the extensive breeding system, and the 10 municipalities with the highest number of cattle in the state of Rondônia in 2020 are shown in Table 1.

Table 1.Municipalities in the state of Rondônia with the highest numbers of cattle herds.

	Municipalities	Thousand heads
1	Porto Velho	1.267.441
2	Nova Mamoré	769.264
3	Jaru	526.279
4	Buritis	520.182
5	Ariquemes	499.067
6	Alta Floresta D'Oeste	460.450
7	São Francisco de Guaporé	453.890
8	Campo Novo de Rondônia	437.296
9	Cacoal	427.096
10	Machadinho D'Oeste	407.629

The herd consists, majority, of zebu animals with a predominance of the Nellore breed. In general, there is specialization of producers regarding the breeding phases (breeding, growing, fattening) in an extensive system, although intensive production has been used by producers as a technology to increase the rate of enjoyment of the property [9]. Cultivated pastures constitute the main source for feeding the herds, which are basically formed by grasses.

The study followed the type of descriptive exploratory research, through time series analysis of average monthly prices, by arroba, received by the fattened cattle producer, in order to identify the trend in the behavior of arroba prices, seasonal variations and the occurrence of cyclical price changes. In Brazil, one arroba is equivalent to 14.688 kilograms [10], rounded up to 15 kg, which refers to the weight of the bovine carcass (bone-in meat, without by-products).

For the consultation and collection of secondary data on bovine herd size and the total number of animals slaughtered under inspection, the database of the Brazilian Institute of Geography and Statistics (Brazilian Institute of Geography and Statistics – IBGE) was used where the data stored in the Statistical Table Database were consulted through IBGE System at Automatic Recovery (SIDRA) [4]. The behavior data of the state beef cattle production were evaluated in the period from 2003 to 2020 for the analysis of the slaughtering evolution and from 1995 to 2020 for the analysis of the herd evolution.

The data used for the analysis of the fattened cattle price behavior were collected from the Technical Assistance and Rural Extension Company of the State of Rondônia [11]. The monthly averages of the nominal prices of the arroba of fattened cattleby ranchers in Rondônia state over a 25-year period, from January 1995 to December 2020, were consulted.

2.1 Analysis models and description of parameters

To compare prices over time, the necessary monetary corrections were made to nominal prices. For price analysis over a long time period, it requires updating the values of each period (nominal prices) by an index (deflator) so that real prices can be compared (in constant values). Thus, the price variable was deflated through the General Price Index-Internal Availability (IGP-DI) based on 100 in December 2020 made available by the Institute of Applied Economic Research [12]. The mathematical formula used for deflation is described below:

$$RP_c = \frac{Bi}{Ip} * NP_c \quad (1)$$

Where *RPc* = Real price of cattle; *Bi* = Base index; *Ip* = Index of each period; *NPc* = Nominal price of cattle.

The statistical analysis of the data was based on the classical multiplicative method of time series, which assumes that a historical price series can be decomposed into four basic components: trend, cycle, seasonality and random variations [13]. Considering the original series of fattened cattle prices, the mathematical model used was:

$$P_t = T_t * C_t * S_t * E_t \quad (2)$$

WhereP_t = the price of the arroba of fattened cattle in month *t*, in R$/arroba; T_t = trend of the time series in period *t*; C_t = cyclical variation of the time series in period *t*; S_t = seasonal variation of the time series in period t; and E_t= random variations.

The trend of real prices was estimated by linear regression, in which the monthly average real price was considered as the dependent variable and the time period in months as the independent variable, according to the following equation.

$$\hat{Y}it = a_0 + a_1 t + a_2 t^2 + a_3 t^3 + e_t \quad (3)$$

WhereYi_t= the estimated value of the fattened cattle price that reflects the trend in month *i*, in year *t*; *t* = trend variable, assuming the following values (T = 0, for 1995, ..., T = 25, for 2020; a_0 = function intercept, represents the average price in the period analyzed; α = function angular coefficients; e_t = term of random error).

The trend model was estimated for beef cattle in Rondônia in order to compare the evolution of fattened cattle prices between 1995 and 2020. The cyclical index was calculated by dividing the centralized moving average for 12 months by the trend value for each month. The seasonal component of the series was analyzed using the centralized moving average method for 12 months and its fluctuations were quantified using the standard deviation and coefficient of variation [6].

The seasonality of a time series is configured by short-term fluctuations, that is, within the same year. To obtain the seasonal indices, the methodology of Mendes and Padilha Júnior[14] was followed, where the General Seasonal Index (GSI) of each month is calculated through the relation of the values of the historical series and the respective moving averages, multiplying the values per 100. Then, the seasonal indexes (SI) were calculated for each month of the year, and for the 12-month average, if the average is not equal to 100, the monthly indexes are corrected, given by (100/ by average index). Finally, the irregularity index (upper and lower) is determined, which is obtained by calculating the standard deviation between each seasonal index and its average.

3. RESULTS AND DISCUSSION

Production behavior

In the period from 1995 to 2020, the cattle herd in Brazil presented a growth rate of 1.34% per year, and the North, Center-West, Northeast, Southeast, and South regions had rates of 4.20%; 1.30%; 1.13%; 0.11% and -0.05% per year, respectively. The production of the North and Center-West regions had continuous growth from 1996 to 2004, influenced, in large part, by economic stabilization promoted by the Real Plan [15], by the development of new technologies by universities and research centers, by the implementation of agricultural defense agencies that contributed to sanitary improvements in meat production for the domestic and foreign market, increasing exports of Brazilian meat.

Regarding the percentage share of Brazilian regions in the cattle national herd, in 1995, the positions were as follows: Midwest, 34.15%; Southeast, 23.05%; South, 16.52%; Northeast, 14.37; and North, 11.90%. In 2020, the North region moved to the second position: Center-West, 34.58%; North, 24.03%; Southeast, 17.16%; Northeast, 13.11%; and South, 11.82% [4]. The percentage changes in the North region were quite expressive in relation to the others.

According to Arima and Uhl [16] the price of land for pasture formation in the North region, between 1970 and 2000, was about five to ten times lower than in the states of Southeastern Brazil. Shifting livestock from the South and Southeast regions to the North of the country (Brazilian Amazon), and therefore, there were investments in the livestock activity and in the implementation of meatpacking plants in the region, increasing the production of animals for slaughter. Considering that in the 1960s, the concentration of meatpacking plants was in São Paulo state, which was a strong driver of beef prices. Currently, there is a different scenario, where several Brazilian states have relevant participation in slaughtering.

The state of Rondônia presents itself as a strong producer and slaughterer of cattle. The number of cattle in the state of Rondônia presented an increased in the bovine herd of 5.36%per year, going from 3.9 million cattle, in 1995, to 14.8 million, in 2020.Possibly, the use of technologies to increase productivity has contributed to this scenario. According to the last 2017 IBGE Agricultural Census, the state of Rondônia has about 5.9 million hectares of planted pastures, giving an animal stocking rate of 2.35 cab./ha/year [4]. Furthermore, the growth of cattle ranching in Rondônia was driven by tax incentives that made it possible to expand the herd extensively, boosting growth and modernization in the North region of Brazil, especially from the beginning of this century [4].

Until mid-2000, the growth of the number of cattle in all micro-regions was not very expressive, being characterized as an extensive cattle raising with low technology and productivity. Since then, there has been a change in the production model due to environmental issues, with the intensification of control and inspection actions by the Brazilian Environment Institute-IBAMA [17], and expressive herd growth.

Table 2 shows the growth of the bovine herd in the eight geographic micro-regions of Rondônia, between the years 1995 to 2020. The micro-region of Ji-Paraná, until 2015, held the largest amount of the bovine herd, representing 21.5% of the total herd in the state of Rondônia, in that year. The Porto Velho micro-region, which in 1995 represented 4.0% of the total, passed to 24.1% in 2020, presenting the highest geometric growth rate of the micro-regions belonging to the state of Rondônia, in the period 1995-2020.Herd growth in the micro-region of Porto Velho is due to the increase in the pasture area (km^2), and in 10 years, it has doubled its area (km^2), going from 6.879 km^2 in 2004 to 12.443 km^2 in 2014, showing an average annual growth rate of 36.9%. Ariquemes, Cacoal, Guajará-Mirim and Ji-Paraná micro-regions exhibited rates of 14.7%, 7.2%, 6.7% and 2.1%, respectively [18].

Table 2.Cattle herd growth in Rondônia micro-regions (1995-2020).

	1995	2000	2005	2010	2015	2020	
Micro-regions (RO)	**Thousand heads**	**Thousand heads**	**Thousand heads**	**Thousand heads**	**Thousand heads**	**Thousand heads**	**(%)***
Porto Velho	156	426	1.651	2.168	2.706	3.570	13.93
Guajará-Mirim	101	97	520	691	807	852	9.31
Ariquemes	400	649	1.553	1.680	1.804	2.118	7.19
Ji-Paraná	1.025	1.631	278	2.698	2.875	2.898	4.42
Alvorada D'Oeste	182	369	858	816	912	975	7.23
Cacoal	728	1.290	2.107	2.032	2.264	2.309	4.93
Vilhena	680	602	1.046	935	1.103	1.187	2.35

Colorado do Oeste	655	600	830	820	927	895	1.31
Total	3.928	5.664	11.349	11.842	13.398	14.804	-

* **Geometric Growth Rate (% p.a.), referring to the period from 1995 to 2020.**

With the creation of the Agrosilvopastoril Health Defense Agency of the State of Rondônia (IDARON) in 1999, there was a significant improvement in animal health policy, in accordance with the guidelines of the World Organization for Animal Health (OIE), which aims to eradicate and prevent FMD and control and eradication of Brucellosis and Animal Tuberculosis. In 2003, Rondônia was recognized as an FMD-free area with vaccination [6]. During this period, there was an expansion of the agro-industrial base of slaughterhouses in the North region, thus increasing the supply and slaughtering capacity of inspected cattle.

According to IBGE data [4], in 2006 and 2007 it was the period with the highest participation of bovine matrices for slaughter, corresponding to 43% of the total herd. As a result, the total volume of animals offered increases, causing a drop in arroba prices and a reduction in the calves' production with a consequent reduction in heifers to replace cull cows and a lower future supply of fattened cattle, with a consequent increase in prices in following periods due to reduced calf supply. In 2020, the number of cattle officially slaughtered in Rondônia was 2.2 million heads, a quantity 20.8 times greater than in 1997, corresponding to 7.29% of the total number of cattle slaughtered in Brazil.

In periods of high prices, cattle raisers increase their demand for replacement animals to produce fattened cattle to supplymeatpacking industry. The intensity in the bovine matrices slaughter rate and their retention varies according to the values of the livestock market. In this way, the use of production technologies to increase production efficiency in the brooding phase allows to reduce the length of the production cycle, where the heifers,when they reach maturity, have their first calf and their product reaches the slaughter age earlier, being a strategy linked to the balance of supply and demand for beef, as well as the price of the arroba of fattened cattle.

Other factors directly influence the demand and supply of animals for slaughter, such as input prices, arroba price, the value of replacement animals, consumer purchasing power, seasonality of forage production, and availability of bovinematrices for slaughter. Because of this, there are fluctuations in the price of the calf and variation in the price of fattened cattle and a rise in the price for animal replacement.

Price behavior

Figure 2 shows the variations in the real price of fattened cattle in the state of Rondônia from 1995 to 2020. During this period, it was possible to identify, through graphic analysis, three complete livestock cycles, which are represented by vertical lines, with distinct duration, amplitude and symmetry. The higher vertical lines separate the livestock price cycles. The lower vertical lines separate the low and high phases within each livestock cycle. The livestock cycle starts with the lowest price of a period of decreasing prices, followed by rising prices and subsequent decline to a lower value, thus starting the next cycle [19].

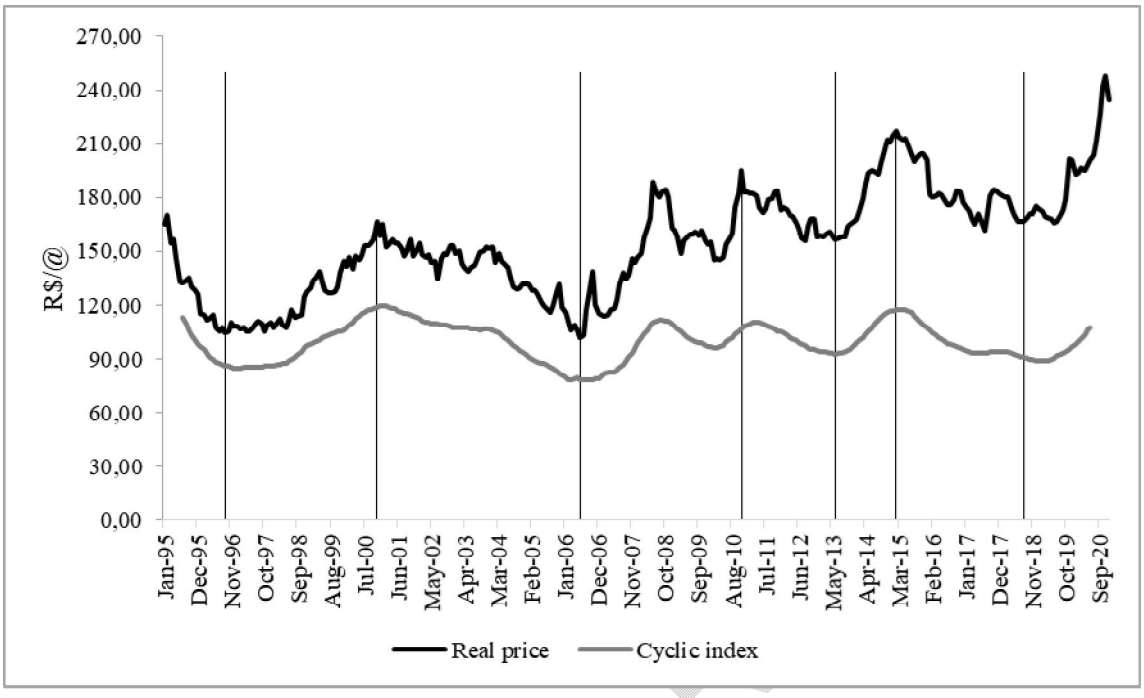

Fig. 2.Behavior of cycles of price of fattened cattle in Rondônia (1995-2020).

The first cycle of this historical series lasted approximately 10 years, from September 1996 to June 2006. The end of the previous cycle and the beginning of this one was motivated by the increase in bovine matrices slaughter and the restriction in exports to some markets important due to the records of FMD outbreaks in Mato Grosso do Sul state, affecting the other beef exporting states. This cycle showed an increase in prices in the first four years, which is considered the high phase of the cycle that reached a peak of R$167.00/arroba. The next phase was the write-off, which reached the minimum value of R$101.55/arroba.

The second cycle lasted seven years, corresponding to the period between June 2006 and June 2013. This cycle presented two peaks of maximum price. The first occurred in June 2008 with a value of R$188.64/arroba followed by a drop with successive fluctuations until mid-2010. This period was marked by the global financial crisis of 2008, the subprime crisis in the North American real estate market, affecting the external demand for beef, thus generating a production surplus in the Brazilian domestic market. As a result, the arroba's price paid to the rancher reduced, forcing sending more matrices cattle for slaughter, further reinforcing the drop in prices. The second price peak was in November 2010, with a value of R$195.44/arroba, having this as the turning point between the high and low phase of the cycle, thus starting the descending phase.

The price of fattened cattle, like the other categories, is influenced both by the economic situation in the country and by the international economy. When the economy is heated, there are greater investments in the agro-industrial sector, an increase in the population's income with a consequent increase in demand, the opening of new markets for livestock, generating an increase in the price of fattened cattle. However, in stagnation times, economic recession, or even unusual events, livestock prices are negatively affected by the retraction in consumption due to the credit scarcity in the external and internal market.

The third cycle had the shortest duration of the analyzed historical series, approximately five years (Jun/2013 to Aug/2018). The high phase was 1.7 years and the low of 3.6 years, ranging from a minimum of R$156.47/arroba and a maximum of R$217.11/arroba. An event that took place in Brazil in March 2017, known worldwide as the "Weak Meat" operation, was caused by fraud in the issuance of health certificates for meat with adulterated composition and expired validity, damaged the domestic and foreign beef market. As a result, slaughtering was suspended because of embargoes on Brazilian meat, due to the distrust of international importers about the quality of Brazilian meat. As a result, there was oversupply at home, leading to a drop in prices, causing the market to “lock-up”.

A new cycle started in August 2018 and is underway. Currently, it is in a high phase, driven by the increase in exports to China and the exchange devaluation against the dollar, which placed Brazilian beef at a more competitive level in the international market. The additional demand from China for Brazilian meat was mainly due to a sanitary nature, with the country facing the outbreak of the swine fever disease that affected swine herds in the country.

The average duration of the livestock cycle in Rondônia state, in the analyzed period, was approximately seven years. The average length of the livestock cycle in Brazil is to seven years. The lowest prices were observed in 1996, 1997, and 2006, which marked the lowest points of the livestock cycle in the analyzed period. As of 2006, there is a trend towards higher real prices and a reduction in the duration of cycles compared to previous decades, similar to what was found by Santos et al. [6] for the livestock cycle in the Brazilian Amazon.

Price variation is influenced by the supply of cattle for slaughter. The supply of males is balanced over the years with low amplitude, while the supply of bovine matrices is a factor that has a substantial effect on the low and high price phases throughout the livestock cycle. In other words, the bovine matrices is a determinant variable in the behavior of the livestock cycle and can be used for the production of calves, future fattened cattle, or for slaughter, becoming raw material (meat) for the meat industry.

The variation in the amount of beef produced from the slaughter of bovine matrices is important driver for the evolution of the price of fattened cattle in the domestic market. In other words, the increase in the slaughter of matrices forces the price of fattened cattledownwards, with a negative correlation between the two variables (slaughter of matrices and price of fattened cattle). This influences the smaller number of animals for replacement and finishing, beingnoticed after two or three years with the increase in prices. Given the increase in prices, cattle raisers tend to retain matrices for the production of calves with a long-term supply of fattened cattle, thus restarting a new livestock cycle [20].

Figure 3 shows the evolution of the price of the arroba of fattened cattle and the slaughter rate of bovine matrices in Rondônia state from 2003 to 2020.

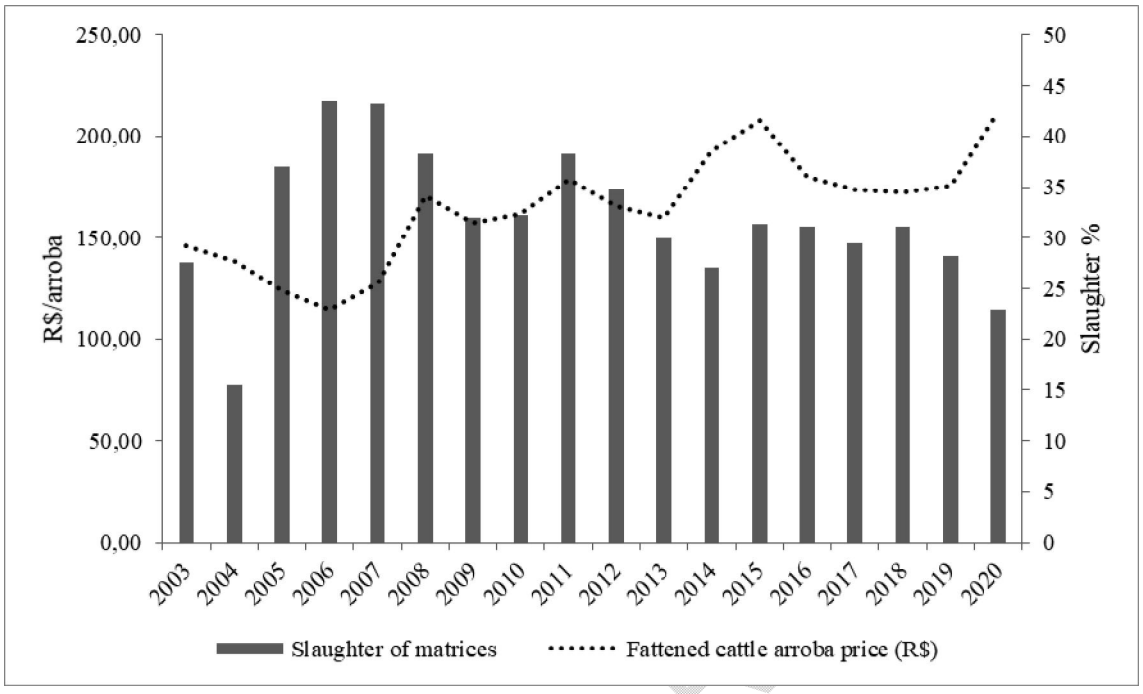

Fig. 3.Evolution of the price of the arroba of fattened cattleand the slaughter rate of bovine matrices to the total slaughter in Rondônia (2003-2020).

Price Seasonality

Table 3 summarizes the behavior of seasonal variations in the real price fattened cattle in Rondônia. The seasonal analysis showed that the real price of fattened cattle presents seasonal indices (SI) below 100, between February and August, with increases above 100, from September to January. Thus, it can be inferred that the first period corresponds to the harvest when prices are lower, and the second period refers to the off-season when prices are higher.

Table 3. Descriptive statistics of seasonal indices of the price of fattened cattle in Rondônia state (1995-2020).

Months	Seasonal indexes			Standard deviation	CV (%)
	Inferior limit	Average	Upper limit		
January	97.74	100.70	103.67	2.96	2.94
February	96.31	99.48	102.66	3.18	3.19
March	95.49	98.96	102.43	3.47	3.51
April	96.20	99.23	102.25	3.03	3.05
May	95.61	98.45	101.29	2.84	2.88
June	94.42	98.31	102.21	3.90	3.96
July	93.78	97.70	101.62	3.92	4.01
August	95.70	98.81	101.92	3.11	3.14
September	96.74	100.52	104.30	3.78	3.76

October	97.27	102.30	107.33	5.03	4.91
November	100.18	103.84	107.50	3.66	3.52
December	99.02	101.69	104.37	2.68	2.63

It is observed that in periods when there is a lower supply of cattle for slaughter (off-season), this results in an upward price phase. Arroba of fattened cattlearroba paid better in September, October, November, and December. While in the descending phase of prices (harvest), the lowest prices were observed in March, May, June, and July. The peak of below average prices occurred in July (93.78%) and that of high prices in November (107.50%), and the amplitude of price changes throughout the year was 13.72%. The coefficients of variation of the average monthly prices of the arroba of fattened cattle show greater price variability in the second half of the year, with a maximum variation of 4.91%, in October, and a minimum of 2.63%, in December.

The period of the fattened cattle harvest occurs during the rainy season when there is greater production of forage and better quality, providing the animals with available food and nutrients necessary for the greater weight gain of cattle finished on pasture. During this period, there is a greater supply of fattened cattle on the market. The off-season for cattle, that is, when there is less supply of animals ready for slaughter, is due to the lower production of pastures and the reduction in their nutritional value, which directly impacts negatively on the performance and yield of the animals. As a result, beef cattle producers do not sell their animals, resulting in a lower supply of animals with a consequent increase in seasonal price indices.

According to the analysis of seasonal indices, the months in which ranchers have the greatest opportunities to sell fattened cattle the arroba of the at a high price are June, July, September, October and November, whose UL values differ from the historical mean values. On the other hand, the lowest risks of selling fattened cattle at prices far below the historical average are those whose IL values are closer to the historical average of prices. Thus, for the meatpacking industry, the context is opposite to that of the rancher, that is, when the UL is closer to the SI, the lesser are the chances of the meatpacking industry to acquire the arroba of the fattened cattle at very high prices, thus unfavorable to the producer. In July, price quotations are 3.92 percentage points below the historical average, and in November this difference is 3.66 percentage points above the average. However, this does not mean that in the following year these variations will be repeated in the same months.

The variation in prices throughout the year can be considered a reflection of the type of production system adopted for beef cattle. In the state of Rondônia, the predominant breeding system is extensive, in which the animals feed exclusively on pasture. This generates oscillations in the price paid per arroba of the fattened cattle throughout the year, as there is great dependence on soil and climate factors. Considering that edaphoclimatic factors have a great impact on forage production throughout the seasons, although each region has a greater or lesser intensity of these factors [21].

For beef cattle ranching agents, this analysis is important to guide the most favorable moment for the negotiation of fattened cattle. For the producer, in particular, it guides the decision making of the best period to keep or make the animals available for slaughter, taking into account the months that present greater or lesser risks. The behavior of price seasonality throughout the year is mostly a reflection of the type of system adopted in livestock farming. Dueto the fact that Rondônia has a predominantly extensive livestock

production system [22], which depends on weather conditions, fattened cattle prices in the first semester are lower than those practiced in the second semester.

4. CONCLUSION

The analyzes showed that fattened cattle prices showed an upward trend in the period from January 1995 to December 2020. There was an annual seasonality in prices, with a reduction in prices in the first half of the year and an increase in the second half of the year, corresponding to the crop and off-season of the livestock market, respectively. There was a long-term cyclical period in the quotations, with an average of seven years, and a reduction in the livestock cycle to approximately five years.

The growth of the bovine herd in Rondônia was more evident in the micro-regions of Porto Velho and Ariquemes. Porto Velho presented a geometric growth rate of 13.93%, Guajará-Mirim with 9.31%, Alvorada D'Oeste with 7.23% and Ariquemes with 7.19%.

The results found in the research related to the components of trend, seasonality and cycles of livestock in Rondônia, expose a series of information capable of guiding decisions of agents of the livestock production chain, in addition to contributing to the understanding of the dynamics of this important agricultural market for the economy of Brazil state of Rondônia.

In order to reduce the seasonality of prices, it is recommended the productive intensification of beef cattle in the state of Rondônia. Therefore, it is essential that public policies are aimed at contributing to technological investments for beef cattle, in addition to supporting qualified technical assistance to promote and accelerate the process of transition from extensive production systems to intensive systems.

Based on the current research, it is suggested for future work the analysis of the zootechnical conditions, as well as the production technologies used in beef cattle in the state of Rondônia that influence the reduction of the duration of the livestock cycle.

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