Abnormal returns in the Brazilian live cattle market
Retornos anormais no mercado de boi gordo brasileiro

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GT01. Mercados agrícolas e comércio exterior

Abstract

We investigated the impact of public *Agromensal* report information on daily live cattle futures prices for the Brazilian market from 2017 to 2022. The Efficiency Market Hypothesis (EMH) theory emphasizes that if an *Event* contains relevant information, market participants will react to the new information causing abnormal volatility. Under this theory, futures prices represent the conditional expectation of spot prices at contract maturity. Using Cumulative Abnormal Returns (CAR), we search for the Agromensal report impact on daily live cattle future returns when the Agromensal reports are published. We group the months and check the Z statistic on the CARs. Our results show significance in some clusters. Some portion of the report's information can affect the returns. However, our work has some limitations, so a deeper investigation of the results is needed. Even so, we believe that we believe that unexpected information released by the reports contributes to market participants, buyers, and sellers improving their strategies.
Key words: Live cattle, cumulative abnormal returns, event study

Resumo
Esse trabalho investiga o impacto das informações públicas do relatório Agromensal sobre os preços futuros diários de boi gordo para o mercado brasileiro de 2017 a 2022. A teoria do Mercado de Eficiência (EMH) enfatiza que, se um Evento contiver informações relevantes, os participantes do mercado reagirão às novas informações causando volatilidade anormal. Segundo essa teoria, os preços futuros representam a expectativa condicional dos preços à vista no vencimento do contrato. Portanto, calculou-se Retornos Anormais Cumulativos (CAR), nos retornos futuros diários do boi grodo ao redor da publicação dos relatórios Agromensal. Os meses foram agrupados de modo a aumentar o número de observações e, consequenteme o poder do teste estatitisco Z. Os resultados mostram significância em alguns clusters. Infere-se que alguma parte das informações do relatório pode afetar os retornos. No entanto, este trabalho apresenta algumas limitações, faz-se necessária uma investigação mais aprofundada dos resultados. Ainda assim, a literatura indica que as informações inesperadas divulgadas pelos relatórios contribuem para que participantes do mercado, compradores e vendedores, aprimorem suas estratégias,
Palavras-chave*: Boi gordo, retornos anormais acumulados, estudo de eventos.*

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1. Introduction

Agribusiness plays an essential role in the Brazilian economy. About 25% of the Brazilian GDP was in 2022 (Cepea, 2022). A successful sector of Brazilian agribusiness is livestock, which between 2020 and 2021 contributed 8.4% to 10% of the national GDP (ABIEC, 2022). Also, Brazil is an important player occupying relevant positions in the beef sector, being the largest holder and exporter, the second-largest producer behind the United States, and the third-largest beef consumer globally, China and the United States (FAO, 2022).

Live cattle is a product with low differentiation and, produced on a large scale, categorized as a commodity. Producers are price takers determined by the supply and demand law (LOIOLA *et al*..., 2019). Moreover, another characteristic of commodities markets is that decisions can be based on future expectations. It is frequently used to protect assets from market uncertainties and price volatilities (COLLING; IRWIN, 1990).

Since 1970, a part of the literature has investigated how public information, as governmental reports, contributes to the formation of expectations and how they are transmitted to commodities prices (FAMA, 1969; MILONAS, 1987; SCHROEDER, BLAIR, AND MINTERT, 1990; SUMNER AND MUELLER, 1989; COLLING & IRWIN, 1990). However, the private sector began providing this information with the increase in market participants and the financialization of commodities markets (ALTURKI AND KUROV, 2021). Hence, the literature started to evaluate the value of public information and the contribution to the market and society of those reports (SILVEIRA *et al*...., 2017; ALTURKI AND KUROV, 2021; HUANG *et al*...., 2021).

This study examines the response of Brazilians' lives cattle futures prices, representing market expectations, to public information in livestock the *AgroMensal*[4]. Even with the advancement of technology and easier access to information, there is still a gap in the Brazilian literature on how reports impact commodities prices. We applied The Event Study to search for cumulative abnormal returns around the release of the *AgroMensal* report (event window) on the days between 2017 to 2022. Plenty of literature searches for the importance of public information in commodities markets using the USDA reports and international commodity's future prices (LEHECKA, 2014; ISENGILDINA-MASSA *et al*...., 2016; ALTURKI AND KUROV, 2021, HUANG *et al*...., 2021). Although the USA is a crucial player in commodities markets, Brazil is also a significant player. Being responsible for 10% of the world's food supply and, by 2050, will produce 40% of the world's food demand (FAO, 2022).

Even if the statistics show the significance of Brazil in the world commodities markets, the influence of information reports on Brazilian live cattle markets has not been studied. We believe that unexpected information released by the reports contributes to market participants improving their strategies. In conclusion, motivated by the increases in food prices, climate change, and the necessity of food security strategies, the impact of public information is a significant source for policymakers to improve the functioning and stability of spot and futures markets and more efficient allocation of economics.

2. Background

According to the Brazilian Association of Meat Exporting Industries (2021), the Brazilian live cattle herd corresponds to 187.55 million heads, which places Brazil as the world's largest holder of live cattle (ABIEC, 2021). High domestic consumption of meat retains

[4] A public report released by the Centro de Estudos e Avançados em Economia Aplicada

around 76% of the total produced by the country (ABIEC, 2021). Even with this high percentage of internal consumption, Brazil remains the largest beef exporter in the world, which contributes positively to Brazilian's balance of payments. In 2021, meat exports moved about 9.20 billion, almost a billion more than the previous year (IPEA, 2022).

The beef market has a cycle of high and low prices on commercialization. The high occurs with the increase in female slaughter, which reduces the supply of calves, increasing the price of live cattle arroba, while the low cycle occurs the opposite (OLIVEIRA SILVA *et al...*, 2017). According to the IBGE (2020), in 2020, cattle supply fell for the first time in three years, reaching 29.7 million heads, resulting in a reduction in the slaughter of females and a rise in meat prices (IBGE, 2021).

Indeed several variables influence price changes in agricultural commodities, seasonality, weather, supplements, exchange rates, and interest rates (CARVALHO AND FELEMA, 2022; CAMMELLI *et al....*, 2021; LOIOLA *et al....*, 201; SHIKIDA *et al....*, 2016; CARVALHO AND SABBAG, 2016). Moreover, as explained above, public information contributes to price expectations. For example, a commodity report contains information about crops, production expectations, prices, and the number of live cattle, pork, and poultry, among other information. When a report is released, the market participants will confirm or not their expectations. If the market is efficient, it is assumed that the public information in these reports or news announcements will quickly be incorporated into market prices (FAMA, 1969; COLLING AND IRWIN, 1990).

However, providing this type of information has a high cost. As it is considered a public good, governments started to be responsible for transmitting it to agents. The principal objective was to prevent traders from exploiting public information to make it profitable (FRENCH; ROLL, 1986). In addition, with the evolution of the electronic sector, computers, trading algorithms, trading strategies, and online trading platforms have become common in commodity futures markets. Thus, this market transitioned from using a telephone in outcry trading into computer system trading. For example, live cattle futures contracts trading in Brazil began in the Brazilian Exchange in 1980. However, only in May 1994 began the contract as a financial settlement. After some adjustments, in 2000, live cattle contracts began to be marketed in the modality we see today (ROCHELLE, 2019). Finally, in 2005, an electronic system was introduced.

Public information has a notary debate in the new context of "big data" since agents are exposed to different types, and price changes can be caused by new market information (ADJEMIAN; IRWIN, 2019; Isengildina-Massa *et al..*., 2020). As public reports are considered a public good, researchers have been occupied with verifying whether governmental reports benefit the market and its participants (ADJEMIAN, SCOTT, 2018; KARALI *et al....*, 2019; ISENGILDINA-MASSA *et al....*;2020; MOON AND TONSOR, 2020). The international literature has confirmed that hypothesis on livestock, oils, and grains markets with public reports (SILVEIRA, MATTOS, 2016; ISENGILDINA-MASSA *et al....*, 2020; ALTURKI *et al....*, 2022).

Over the years, the *Event* methodology has been adopted to verify public information's impact on commodities prices. Some authors have used cumulative abnormal returns, and others have applied the volatility GARCH measures. The seminal paper of Schroeder, Blair, and Mintert (1990) uses the *Event* by applying CAR to verify the impact of USDA inventory reports on future livestock prices in the USA. The results do not show strong evidence of abnormal returns inferring no impact of new information on prices. Irwin, Good, and Gomez (2001) used an *Event* study to determine the value of USDA and WASDE for the soybeans, corn futures, and options in the USA market. The results suggest that the mean difference for corn and soybeans on the report's day was significantly different from the previous day. This leads them to concludes that USDA and WASDE information has significantly impacted corn and soybean markets (IRWIN GOOD; GOMEZ, 2001).

In 2012, the Chicago Board of Trade eliminated morning trading in commodities markets that coincided with the regular publication of USDA commodity reports. Taking advantage of this exogenous *Event*, Adjemian and Scott (2018) demonstrate that the market participants had hours to review the information in the reports and adjust their strategies. Their GARCH estimations results show that agricultural futures markets presented volatility spikes in real-time trading on USDA crop announcements. Adjemian and Irwin (2019) demonstrated that continuous trading of government news (the *Event* USDA reports) coincided with higher daily price volatility ranges in the CBOT corn market. After the changes, traders must digest news under the real-time format elevated trading volatility, as concluded by the GARCH estimation. Similarly, Isengildina-Massa *et al..*. (2020) examined how reports information as production, inventory, and the crop from the USDA can affect the corn, soybeans, and wheat returns. They applied a GARCH model and found that reports information could change commodities production plans, especially corn and soybean, which suffered the most impact.

Specifically, to live cattle markets volatility measures, the international literature on the value of reports is vast (GRUNEWALD *et al...*., 1993; ISENGILDINA *et al...*., 2006; PENDELL *et al...*.,2006, ISENGILDINA-MASSA *et al...*., 2021). In the last years, Karali *et al..*. (2018) investigated the impact of public and private livestock information on hogs and lived cattle returns in USA markets. Their goal was to verify if the public information still impacts these products since the market concentration is on the livestock market. They specified a GARCH system and concluded that livestock reports provide valuable information to market participants beyond private analysts' expectations.

On the contrary, Karali *et al..*. (2019) found contrasting results when verifying the impact of subsamples of reports on live cattle and hog returns in the U.S. markets. They used three report subsamples: *feed inventory*, which represents the number of animal points in time, *placements* which is information on additions to these animal stocks; and *marketings,* which represents the information about reductions in these stocks. The authors applied a market surprise test and concluded that just *marketings* information impacts the live cattle futures prices.

Unfortunately, the national market has not gained the same relevance as the abroad studies. We aim to fill the Brazilian live cattle literature gap. Since this commodity has been part of spot and futures markets, understanding the contribution of the public can contribute to a better allocation of resources and financial strategies for producers, investors, government, and consumers.

3. The Efficiency Market Hypothesis (EMH)

The guiding theory Efficiency Market Hypothesis (EMH) emphasizes that if an *Event* (in this case, the release of a commodity report) contains relevant information, market participants will react to the new information causing a larger than normal volatility (FAMA, 1970). In addition, given the marketplace's rationality, an event's effects will be reflected immediately in the commodity price (MACKINLAY, 1997).

In the seminal paper of Fama's (1969) hypothesis, the information will be quickly incorporated into market prices if a market is efficient. In their study, the author made the reasoning in the stock markets by testing the weak, semi-strong, and strong forms of information. The weak information is considered, by the author, as the historical asset prices. The semi-strong form is when the information is publicly available, as in the live cattle reports. The strong form is when the information is held by monopoly markets (FAMA, 1969).

As commodities derivates markets are also integrated into the financial sector, studies in this mark*et al*..so use the EMH theoretical to guide the results (MATTOS AND SIQUEIRA, 2015; SIQUEIRA *et al*...., 2017; KARALI *et al*....,2019; ISENGILDINA-MASSA *et al*....,2021). In Brazil, academics have been occupied with finding the weak form of information. Moraes *et al*... (2009) use the live cattle futures prices to verify an existence efficiency in that market. The results show that future markets are unbiased predictors of spot prices. On the other hand, Rodrigues *et al*... (2015) found that some agricultural commodities, including live cattle, are inefficient in the weak information form. Our work takes a step forward and seeks aims to identify the semi-strong form of efficiency through reports.

3.1 Expected Return or "Fair Game" Models in commodities context

The theory adapted to commodities markets indicates that commodities futures prices are conditional information expectations at time *t.* Prices at contract maturity, crops and livestock reports, and private information can be considered conditional information. Fama's (1969) model named Fair Game can be written as Equation (1):

$$E\left(\tilde{p}_{j,t+1}\middle|\Phi_t\right) = 1 + E\left(\tilde{r}_{j,t+1}\middle|\Phi_t\right) p_{j,t} \quad (1)$$

where E is the expected value; $p_{j,t}$ is the price of commodity *j* at time *t*; $p_{j,t+1}$ is the commodity *j* price at $t + 1$; $r_{j,t+1}$ are the commodities prices return in one period $[(p_{j,t+1} - p_{j,t}) \,/\, p_{j,t}]$; Φ_t is a general symbol for whatever set of information at *t* time; and the tildes indicate that $\tilde{p}_{j,t+1}$ and $\tilde{r}_{j,t+1}$ are random variables at *t+1*.

Equation (1) indicates that expected prices are equal to a commodity return between one period plus the value of the commodity in time *t,* and that sum depends on current information. Assume that Φ_t is the new information in the Brazilian live cattle content in some reports, also, suppose there are a sufficiently large number of market players. In that case, the information can modify the market's perception, which should cause more variability in future prices as market participants adjust their expectations. (FAMA, 1969; GARCIA *et al*..., 1997).

Fama (1969) defined a *Fair Game* as the difference between the observed price and the expected value of the price projected at *t* based on information Φ_t are equal to zero. Let z_j be sequential of *"Fair Game"* concerning the information Φ_t, or equivalently a, Equation (2):

$$z_{j,t+1} = r_{j,t+1} - E\left(\tilde{r}_{j,t+1}\middle|\Phi_t\right)$$
$$E\left(\tilde{z}_{j,t+1}\middle|\Phi_t\right) = 0 \quad (2)$$

equation (2) indicates that when a market is efficient, the information in time *t* is fully incorporated into prices.

Moreover, the parameter Φ_t is also a random variable that can assume any value for different *j* commodities. For example, the live cattle report can impact the live cattle futures prices and other commodities such as corn, but the results would be different magnitudes. Then, the expected return or fair game to any sequential valor is expressed as Equation (3):

$$V_{t+1} = \sum_{j=1}^{n} \alpha_j(\Phi_t)\left[r_{j,t+1} - E\tilde{r}_{j,t+1}\middle|\Phi_t\right] \quad (3)$$

$$E(\tilde{V}_{t+1}|\Phi_t) = \sum_{j=1}^{n} \alpha_j(\Phi_t)E(\tilde{z}_{j,t+1}|\Phi_t) = 0$$

When V_{t+1} represents any sequential valor for fair game and $E(\tilde{V}_{t+1}|\Phi_t)$ represents its expectation based on information, $\alpha_j(\Phi_t)$ it is the amount of information available at the time *t*, $r_{j,t+1} - E\tilde{r}_{j,t+1}$ represents the return and the expected return between one period, and $E(\tilde{z}_{j,t+1}|\Phi_t)$ represents the fair game to commodities returns.

Indeed, the *fair game* proposed by Fama (1969) has three sufficient conditions: (i) there are no transactions costs in trading commodities, (ii) all available information is costlessly available to all market participants, and (iii) all agree on the implications of current information for the current price and distributions of future prices of each commodity. However, these conditions are sufficient for market efficiency but not necessary. The market may be efficient if "sufficient numbers" of investors can access available information (FAMA, 1960; FAMA; FRENCH, 1987).

4. Methodology

4.1Data

The data consists of Brazilian live cattle futures daily prices from the Brazilian Stock Exchange B3. Specifically, they are daily closing quotes for BGI rolled-over nearby contracts between January 2017 and May 2022. The time interval corresponds, on average, to the live cattle complete cycle. We construct a rolled-over nearby future replacing the nearby contract price at the end of the month with the second nearby contract price. Then the delivery period when abnormal price observations may occur is avoided (DORFMAN; KARALI, 2015).

Agromensal is a mensal report by Centro de Estudos Avançados em Economia Aplicada (Cepea). Since 2018, its announcements have become standardized. Most cases, the publication occurs around the first week of the month. The *Agromensal* contains information about live cattle and calves as prices in different places in Brazil, exports, and relations in spot and future prices. In our sample, we analyzed 43 reports between 2017 and 2022.

4.2 The market's Abnormal Returns on live cattle

Over the years, the researchers have applied the Event Study using cumulative abnormal returns (CAR) or the GARCH model to verify the effect of announcements on commodity futures prices. As the social benefits are not directly observable, one way to answer these questions is to examine the behavior of future prices given a change in the information in the reports (HUANG *et al...*, 2021). Our question is to verify the effect of *Agromensal* on live cattle future prices by applying the Event Study using the CAR specification.

The goal is to compare returns over the estimation window (the period before the release of *Agromensal*) with returns over the event window (the day of *Agromensal* release) (MOGHADAM; SCHMIDT; GRIER, 2013). If the returns on the announcement day differ from the average days when there was no announcement, the reports could affect prices (MACKINLAY, 1997). As described above, futures prices represent the conditional expectation of spot prices at contract maturity under the market efficiency hypothesis. Suppose a spike in future returns is seen when the *Agromensal* is published. The market participants might have understood the information and adjusted their orders, which could explain the variability (SIQUEIRA *et al.*..., 2017; KARALI *et al.*..., 2019; ISENGILDINA-MASSA *et al.*..., 2021).

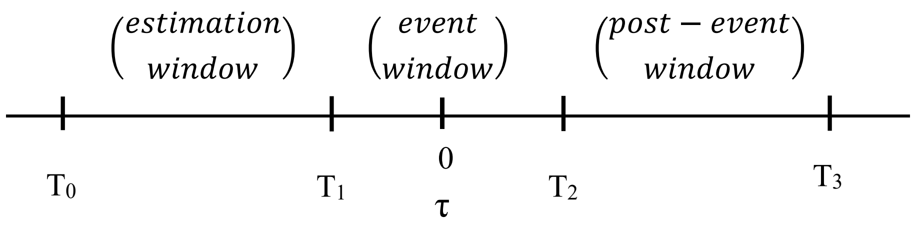
To search for abnormal returns, first, we calculated the commodity return, as in Equation (4):

$$RBGI_t = ln\left(\frac{pBGI_t}{pBGI_{t-1}}\right) * 100 \quad (4)$$

where $pBGI_t$ is the market closing price on date *t*; $pBGI_{t-1}$ s is the market closing price on the previous date *t-1,* and *ln* is the natural logarithm function. The $RBGI_t$ return series gives the daily price change at close from date $t\text{-}1$ to t, reflecting market reactions to livestock new information between the end of the trading sessions for two consecutive days (ISENGILDINA-MASSA *et al.*..,2021).

However, choosing an Event window is fundamental to avoiding some problems, such as anticipation, information leakage, and the complete absorption of information (BELTRATTI AND PALADINO, 2013; ASPRIS *et al.*..., 2017; BOHMANN AND PATEL, 2020). If information is leaked, the event window may not capture the real impact of the report. In addition, some commodities might be incorporated more quickly information than others (CHRISTIANSEN; RANALDO, 2007, KARALI, 2012; ISENGILDINA-MASSA *et al.*..., 2021). Then the response could not be instantaneous to the report's release but around minutes, hours, or even days. Hence, following the literature (MATTOS; SIQUEIRA, 2015; SIQUEIRA *et al.*..., 2017; KARALI *et al.*...,2019; MASSA *et al.*...,2021), we use the following estimation and event window:

Figure 1: The Event 1



Where τ=0 represents the release of *Agromensal,* $\tau = T_1 + 1$ until $\tau = T_2$ is the event window*,* $\tau = T_0 + 1$ until $\tau = T_1$ is the estimation window, and $\tau = T_2 + 1$ until $\tau = T_3$ is the pos-event window.

After establishing the estimation and the *Event* window, following the literature (MACKINLAY, 1997; MOGHADAM; SCHMIDT; GRIER,2013) the next step is calculating the abnormal returns. The estimation of abnormal returns is defined as the difference between the actual ex-post return of the live cattle returns minus the expected return, defined as in the following Equation (5):

$$AR_t = R_t - E(R_t) \quad (5)$$

where AR_t is the abnormal return of live cattle at time *t*, R_t is the realized log return of live cattle on period t and $E(R_t)$ is the market expected return. There are some choices for modeling the normal return $E(R_t)$. The two more commons are the constant mean return and market models. In the first case, it assumes that the mean return of the live cattle is constant through time. On the second, it assumes a stable linear relation between the market return and the live cattle return (MACKINLAY, 1997). We chose to use the second model as the following Equation (6):

$$R_t = \alpha + \beta RM_t + \varepsilon_t \qquad (6)$$

Where RM_t is the market proxy or portfolio that, in our study, corresponds to the Araçatuba[5] live cattle prices. According to (CORRADO, 2010), the constant model may give a naive result, and a more sophisticated procedure uses the market model.
The abnormal return observations must be aggregated to conduct some inferences for the Event of interest, the publication of *Agromensal*. A cumulative abnormal return must accommodate a multiple-period event window (MACKINLAY, 1997, CORRADO, 2010). Define $CAR_i(\tau_1, \tau_2)$ as the sample cumulative abnormal return (CAR) from τ_1 to τ_2 where $T_1 \leq \tau_1 \leq \tau_2 \leq T_2$.The CAR from τ_1 to τ_2 is the sum of the included abnormal returns. As presented in Equation (7):

$$CAR_{lc,i}(\tau_1, \tau_2) = \sum_{t=\tau_1}^{\tau_2} AR_{lc,i,t} \qquad (7)$$

where, $CAR_{lc,i}$represents the cumulative abnormal returns over the event window $[\tau_1; \tau_2]$ for a report and $AR_{lc,i,t}$ is the mean abnormal return for live cattle for a report *i* on period t. We follow the literature (MOGHADAM *et al.*...,2013; MOON *et al.*..., KOČENDA; MORAVCOVÁ, 2018; 2020) and estimate the statistical parametric test, Z[6] as represents Equation (10):

$$\begin{cases} H_0: CAR_{alc}(\tau_1, \tau_2) \geq 0 \\ H_1: CAR_{alc}(\tau_1, \tau_2) < 0 \end{cases} \qquad (8)$$

the null hypothesis supposes that the live cattle reports have no impact on live cattle's future returns, and the cumulative abnormal returns will be nonnegative. In contrast, under the alternative hypothesis, a significant impact on the cumulative abnormal returns will be negative.

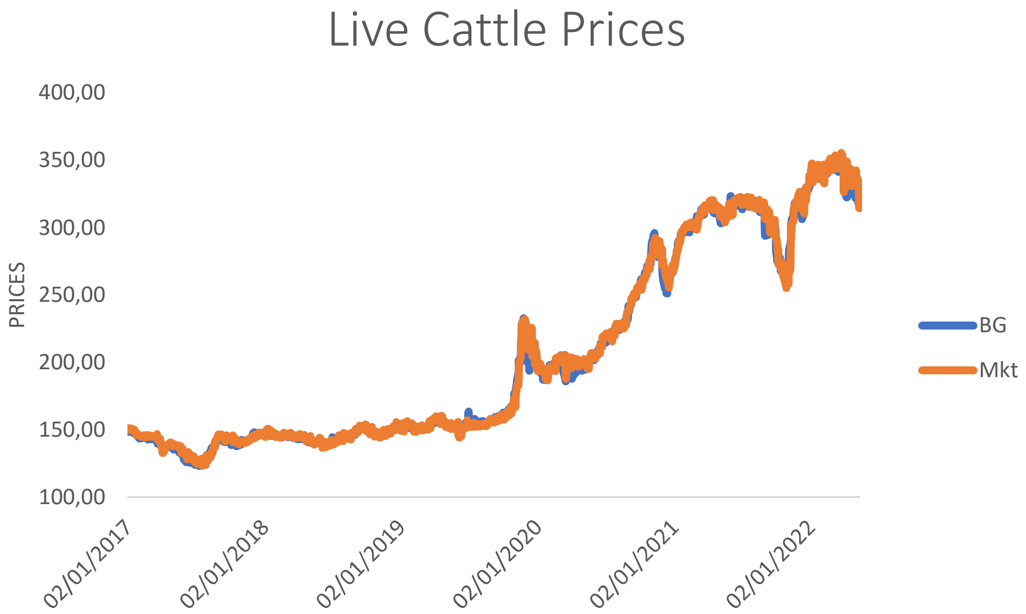
5. Results

Our results investigate whether the moment of disclosure of *Agromensal* is the determining information for changes in the return of future prices of live cattle. On the hypothesis of unexpected information by the market, they present an abnormal return on the days of the announcement and around it when compared to days that do not present announcements (MACKINLAY, 1997). Then, we analyze price graphs, price returns graphs, and tables in search of answers to our questions.

Graph 1 shows the future prices of live cattle traded on the B3 stock exchange and the prices referring to the market, using the Araçatuba price as a proxy. We can see that the values are close between these two prices. In addition, it is noted that prices were almost constant until the end of 2019. From this year onwards, it is possible to observe oscillations for both increases and reductions. We believe these oscillations are due to the coronavirus pandemic, announced worldwide at the end of 2019. Since then, economic instability has largely reflected prices,

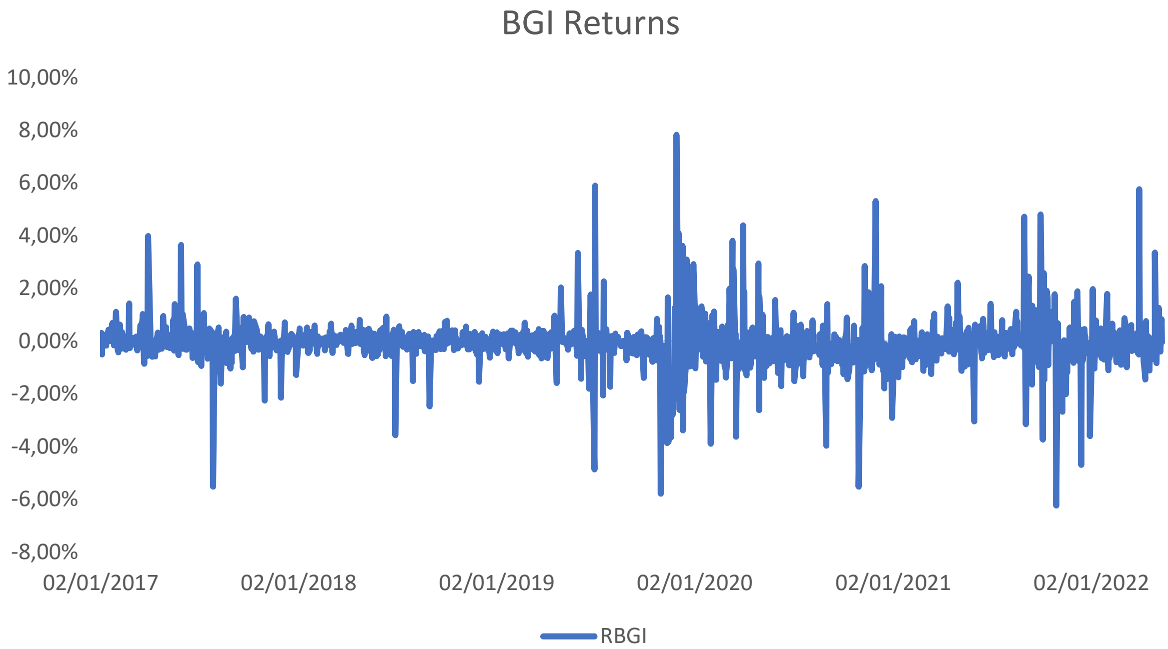
[5] Araçatuba is a city in the state of São Paulo influences the prices of cattle
[6] $Z = \frac{CAR_{alc}(\tau_1,\tau_2)}{var(CAR_{alc}(\tau_1,\tau_2))^{\frac{1}{2}}} \sim N(0,1)$

including commodities. In addition, at the beginning of 2022, we noticed an abnormal fall in the price series, probably conditioned by the war in Russia and Ukraine



Graph 2 shows the returns of BGI futures traded on B3. There are some problems in the study of the events. An example is the calendar effect, which consists of a natural market abnormality close to the contract's maturity. Around maturity, the returns show high variability related to the end of the period (SAMUELSON, 1965; MILONAS, 1991; KARALI, 2012; QADAN *et al.*...,2021). This can result in a comparability problem. As greater variability in returns is expected close to maturity, the report's impact can be merged with another variability. Samuelson (1965), who first analyzed the maturity effect, states that future price changes exhibit increasing variability as contract maturity nears. This occurs because, as maturity nears, the futures price is forced to react to any new information since, upon maturity, it must exactly equal the cash price (MILONAS, 1991).

In the literature on Events Study for commodities prices, some authors have related the presence of the time maturity effect (ANDERSON, 1985; FAMA AND FRENCH, 1988; IRWIN *et al.*.., 1996; ADJEMIAN, 2012; DORFMAN AND KARALI, 2015; YING *et al.*..., 2019; MCKENZIE AND KE, 2021; PHAN *et al.*..., 2022). However, some spikes are seen on other dates. To solve this problem, we follow Dorfman and Karali (2015) and construct a rolled-over nearby future, replacing the nearby contract price at the end of the month with the second nearby contract price as explained in the methodology.



Even so, some peaks are still seen, mainly at the end of the month. We understand that this instability is also originating from the issues mentioned above. Pandemics and Russia and Ukraine war brought volatility in the financial market not only for nearby but also reached the next nearby maturity. This is because the Pandemics are still impacting the economy, and the world economy has not yet recovered from the entire crisis. Even with a more controlled sanitary situation, its effects are durable. As for the war, this is still happening, which brings a sense of insecurity and uncertainty. Mainly to the entire agricultural chain that is dependent on fertilizers imported from Russia.

Table 1: *Agromensal* announcement days between 2017 and 2018

Relatório *Agromensal*	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**
Dezembro		06/12/2021	04/12/2020	05/12/2019	07/12/2018	
Novembro		05/11/2021	05/11/2020	06/11/2019	08/11/2018	
Outubro		06/10/2021	06/10/2020	04/10/2019		
Setembro		03/09/2021	08/09/2020	05/09/2019		
Agosto		04/08/2021	05/08/2020	07/08/2019		25/08/2017
Julho		06/07/2021	06/07/2020	05/07/2019		24/07/2017
Junho		07/06/2021	04/06/2020	05/06/2019		02/06/2017
Maio	05/05/2022	05/05/2021	06/05/2020	08/05/2019		
Abril	06/04/2022	06/04/2021	08/04/2020	05/04/2019		
Março	07/03/2022	09/03/2021	06/03/2020			
Fevereiro	03/02/2022					15/02/2017
Janeiro	05/01/2022					23/01/2017

Source: Results of Research

The Agromensal reports began to have a publication pattern in 2019. Before that year, as seen in Table 1, publications did not occur every month, and the days also varied. In 2018, for example, only two Agromensals were released yearly; in 2017, there were 5. Since 2019, the report has been published in the first weeks of every month, except for January and February, which are now included in 2022. Only two dates occurred in the second week, but at the beginning of it, they were 09/03 and 05/08.

Our CAR results are presented below in Table 2.

Table 2: Cumulative Abnormal Returns 2022-2017

Window				
		Abnormal Returns 2022		
	January - March	May - April		
AR(%)	-0,89%	0,38%		
CAR (-1,1)	0,018***	0,001		
		Abnormal Returns 2021		
		March - May	June - August	September - December
AR(%)		0,17%	-0,04%	-2,16%
CAR (-1,1)		-0,005	0,002*	-0,075***
		Abnormal Returns 2020		
		March -May	June- August	September- December
AR(%)		0,05%	-0,40%	-0,63%
CAR (-1,1)		-0,008	-0,010***	-0,035***
		Abnormal Returns 2019		
		March -May	June- August	September- December
AR(%)		-0,24%	-0,14%	-0,42%
CAR (-1,1)		-0,002	-0,004***	-0,03
		Abnormal Returns 2018		
				November-December
AR(%)				-0,45%
CAR (-1,1)				0,001
		Abnormal Returns 2017		
	January - February		June- August	
AR(%)	0,14		0,09%	
CAR (-1,1)	0,005***		0,000	

Source: Results of Research.

We investigated the impacts of 14 *Agromensal* reports between 2017 and 2022. Although we had reports for analysis almost every month, we built a cluster for months. This is because the market model used to verify abnormal returns is calculated through a regression whose estimator is MQO. If we did it every month, we would not get reliable information about the power of the z test since, considering the commercial calendar, we would have less than 30 observations each month.

First we decided to divide into groups of three months. However, some groups would not have reported. We kept three months from June to August in the middle of the year. At the end of the year, we kept four months when we did not have reports, we kept two 2. For the beginning of 2017 and 2022, as we have a report we constructed a cluster of three months to

2017 and a cluster of three months in 2022. In sum, it was not possible to maintain the same standard every year since the reports were not released every month.

Our results do not indicate a pattern over months. At the beginning of the year, some reports (2017 and 2022) may have impacted prices as we see abnormal returns at the 1% significance level. We also note that the months between June and August showed some significance in all years of analysis except 2017. We can also say that some of the information may have been negative in these months, causing the returns to present a negative sign. The grouping report for the end of the years 2020 and 2021 showed a statistical significance of 1%, stating that the information may have generated abnormal returns on prices.

Although we perceive some significance, we must be careful when suggesting they come from the reports since we work under limitations. First, as we built groupings, we could not isolate other information from other reports or events of those months. Second, traditionally commodities show supply and demand seasonality. However, with its growth in the financial market, other seasonalities began to be seen, such as calendar effects (Thaler, 1987; Milonas, 1991; Karali, 2012; Qadan et al.,2019; Qadan et al., 2021). In this vein, we can have an effect of January in our first cluster. Its because when approaching the new year, some financial assets may show abnormal returns due to investors' expectations for that year, in addition to reporting and dividend disclosures on other financial assets that may compete with commodities or even balance investors' portfolios.

6. Conclusion

Our question was to verify the Agromensal report's impact on live cattle future prices. We are aware that our methods have limitations. Although, we believe that unexpected information released by the reports contributes to market participants improving their strategies. The derivative market is an environment where both parties (buyers and sellers) negotiate, which might provide additional protection for weaker parts. Moreover, with the evolution of this market, technological development, and financialization of commodities markets, new participants began to act in this market, including individuals and financial institutions. On the one hand, the new participants brought more liquidity to the market.

Knowing the movements and expectations of the Brazilian live cattle market can help participants make better decisions. Therefore, public information can contribute to a better allocation of resources and financial strategies for both parties (buyers and sellers), which justifies our study. For future works, we recommend the use of different estimation windows, GARCH family methods, and the use of intraday data. The most parsimonious results are likely to be obtained from intraday data.

References

ABIEC. *Beef Report 2019 – ABIEC*. Disponible em:<http://abiec.com.br/publicacoes/beef-report-2019/>. Access on 13 July 2022

ABRAFRIGO. *No Title*. Disponible in: <https://www.abrafrigo.com.br/index.php/estatisticas/>. Access on 13 July 2022

Anderson, R. W., & Danthine, J. P. (1983). Hedger diversity in futures markets. *The Economic Journal*, *93*(370), 370-389. DOI: https://doi.org/10.2307/2232798

Blank, S. C., Carter, C. A., & Schmiesing, B. H. (1991). *Futures and options markets:trading in commodities and financials* (Vol. 1). Prentice Hall.

Carter, C. A. (1999). Commodity futures markets: a survey. *Australian Journal of Agricultural and Resource Economics*, *43*(2), 209-247. DOI: https://doi.org/10.1111/1467-8489.00077

da Fonseca Boechat, A. M. (2013). Análise do comportamento dos preços do boi gordo e do boi magro entre 2000 e 2012. *Revista de Economia e Agronegócio*, *11*(3).

da Silva, V. A., de Mattos, L. B., & Coelho, A. B. (2014). Análise da Influência do Mercado Financeiro sobre o Mercado Futuro Agropecuário no Brasil. *Revista de Economia*, *40*(2). DOI: http://dx.doi.org/10.5380/re.v40i2.33983

da Silveira Bueno, R. D. L. (2002). Conceitos de" hedge" em mercados futuros. *Revista de Administração*, *37*(4), 83-90.

de Fátima Monteiro, W., Rodrigues, M. A., Alves, A. F., & Parré, J. L. (2013). A não efetividade do hedge para o boi gordo. *Revista de Economia*, *39*(1), 149-166. DOI: http://dx.doi.org/10.5380/re.v39i1.29108

de Lima Silva, T., & de Faria, A. F. G. (2016). Estatística como ferramenta para mitigar o risco de preço sobre o hedge de boi gordo. *Revista iPecege*, *2*(1), 40-56. DOI: https://doi.org/10.22167/r.ipecege.2016.1.40

de Oliveira Neto, O. J., Figueiredo, R. S., & Machado, W. B. (2021). Gestão do risco de preços do boi gordo Paraguaio no mercado futuro do boi gordo Brasileiro. *Brazilian Journal of Business*, *3*(1), 553-578. DOI: https://doi.org/10.34140/bjbv3n1-034

de Oliveira Silva, R., Barioni, L. G., Hall, J. J., Moretti, A. C., Veloso, R. F., Alexander, P., ... & Moran, D. (2017). Sustainable intensification of Brazilian livestock production through optimized pasture restoration. *Agricultural systems*, *153*, 201-211. DOI: https://doi.org/10.1016/j.agsy.2017.02.001

do Brasil, F., & Brasília, D. F. (2016). Ministério da agricultura, pecuária e abastecimento. *Secretaria de Defesa Agropecuária. Disponível em: Acesso em*, *5*(10), 2016.

Fernandes, P. (2015). Projeto Integração Lavoura-Pecuária-Floresta na Região Norte do Brasil pela Embrapa (2007-2012). *Embrapa Amazônia Oriental-Documentos (INFOTECA-E)*. 27

Ferreira, M. D. P., & Vieira Filho, J. E. R. (2019). *Inserįão no mercado internacional e a produįão de carnes no Brasil* (No. 2479). Texto para Discussão.

Gaio, L. E., & Capitani, D. H. D. (2019). O desempenho do hedge para contratos futuros de boi gordo: uma análise a partir das principais praças produtoras brasileiras. *Organizações Rurais & Agroindustriais*, *21*(1-3), 65-78.

Garcia, P., & Leuthold, R. M. (2004). A selected review of agricultural commodity futures and options markets. *European review of agricultural economics*, *31*(3), 235-272. DOI: https://doi.org/10.1093/erae/31.3.235

Hull, J., Treepongkaruna, S., Colwell, D., Heaney, R., & Pitt, D. (2013). *Fundamentals of futures and options markets*. Pearson Higher Education AU.

Isengildina-Massa, O., Cao, X., Karali, B., Irwin, S. H., Adjemian, M., & Johansson, R. C. (2021). When does USDA information have the most impact on crop and livestock markets?. *Journal of Commodity Markets*, *22*, 100137. Doi: https://doi.org/10.1016/j.jcomm.2020.100137

Isengildina-Massa, O., Irwin, S. H., Good, D. L., & Gomez, J. K. (2008). The impact of situation and outlook information in corn and soybean futures markets: Evidence from WASDE reports. *Journal of Agricultural and Applied Economics*, *40*(1), 89-103. DOI: https://doi.org/10.1017/S1074070800027991

Isleimeyyeh, M., Amar, A. B., & Goutte, S. (2021). Commodity markets dynamics: What do crosscommodities over different nearest-to-maturities tell us?.

Jacobs, B. I., & Levy, K. N. (1988). Calendar anomalies: Abnormal returns at calendar turning points. *Financial Analysts Journal*, *44*(6), 28-39. DOI: https://doi.org/10.2469/faj.v44.n6.28

Jebabli, I., & Roubaud, D. (2018). Time-varying efficiency in food and energy markets: Evidence and implications. *Economic Modelling*, *70*, 97-114. Karafiath, I. (1988). Using dummy variables in the event methodology. *Financial Review*, *23*(3), 351-357. DOI: https://doi.org/10.1016/j.econmod.2017.10.013

Karali, B. (2012). Do USDA announcements affect comovements across commodity futures returns?. *Journal of Agricultural and Resource Economics*, 37(1), 77-97. Disponible in: <https://www.jstor.org/stable/23243050> Access on 13 July 2022

Karali, B., Isengildina-Massa, O., Irwin, S. H., Adjemian, M. K., & Johansson, R. (2019). Are USDA reports still news to changing crop markets?. *Food Policy*, *84*, 66-76. DOI: https://doi.org/10.1016/j.foodpol.2019.02.005

Kassouf, A. L., & Hoffmann, R. (2019). Previsão de preços do boi gordo no estado de São Paulo. *Revista de Economia e Sociologia Rural*, *26*(2), 181-194.

Kolari, J. W., Pape, B., & Pynnonen, S. (2018). Event study testing with cross-sectional correlation due to partially overlapping event windows. *Mays Business School Research Paper*, (3167271). DOI: http://dx.doi.org/10.2139/ssrn.3167271

Kyle, A. S. (2019). Market structure, information, futures markets, and price formation. In *International Agricultural Trade* (pp. 45-64). CRC Press.

Lehecka, G. V., Wang, X., & Garcia, P. (2014). Gone in ten minutes: Intraday evidence of announcement effects in the electronic corn futures market. *Applied Economic Perspectives and Policy*, *36*(3), 504-526. DOI: https://doi.org/10.1093/aepp/ppu010

Li, W., Zhu, Q., Wen, F., & Nor, N. M. (2022). The evolution of day-of-the-week and the implications in crude oil market. *Energy Economics*, *106*, 105817. DOI: https://doi.org/10.1016/j.eneco.2022.105817

Liu, M., Choo, W. C., & Lee, C. C. (2020). The response of the stock market to the announcement of global pandemic. *Emerging Markets Finance and Trade*, *56*(15), 3562- 3577. DOI: https://doi.org/10.1080/1540496X.2020.1850441

McKenzie, A. M., & Holt, M. T. (2002). Market efficiency in agricultural futures markets. *Applied economics*, *34*(12), 1519-1532. DOI: https://doi.org/10.1080/00036840110102761

Santos, G. J., Marion, J. C., & Segatti, S. (2009). Administração de custos na agropecuária (4.ed.). São Paulo: Atlas

Shikida, C., Paiva, G. L., & Junior, A. F. A. (2016). Análise de quebras estruturais na série do preço do boi gordo no Estado de São Paulo. *Economia Aplicada*, *20*(2), 265. DOI: http://dx.doi.org/10.11606/1413-8050/ea137759

Silveira, R. L. F. D., & Ferreira Filho, J. B. D. S. (2003). Análise das operações de cross hedge do bezerro e do hedge do boi gordo no mercado futuro da BM&F. *Revista de Economia e Sociologia Rural*, *41*, 881-899. DOI: https://doi.org/10.1590/S0103-20032003000400008

Silveira, R. L. F. D., Maciel, L., & Ballini, R. (2014). Derivativos sobre commodities influenciam a volatilidade dos preços à vista? Uma análise nos mercados de boi gordo e café arábica no Brasil. *Revista de Economia e Sociologia Rural*, *52*, 417-436. DOI: https://doi.org/10.1590/S0103-20032014000300001

Working, H. (1953). Futures trading and hedging. *The American Economic Review*, *43*(3)