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**SOME EVIDENCE ON POLITICAL INFORMATION AND EXCHANGE COUPON IN
BRAZIL**

Porto Alegre

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Work presented in partial fulfilment of the requirements for the degree of Bachelor in Economics

Advisor: Prof. Dr. Nelson Seixas dos Santos

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ABSTRACT

We investigate whether political news affect the exchange coupon in Brazil, on a period ranging from November 24, 2016, until April 16, 2019. Our sample of news was collected via web scrapping, which we applied on a Brazilian news portal. We used two measures for the exchange coupon, and we utilized a GARCH model to estimate conditional volatility, which we filtered with both parametric and non-parametric approach. The results from the parametric analysis indicate that the exchange coupon was affected by the corruption scandal of President Temer (May 2017), the announcement of Jair Bolsonaro as candidate for the republic's presidency (July, 2018), the first round of the presidential elections (October, 2018), and the announcement of a new Pension Reform (January, 2019). The results from the non-parametric analysis indicate that, besides the events above, the exchange coupon was also affected by news related to the Labour Reform (March 2017) and the impeachment requests of President Temer following the corruption scandal (August and October 2017).

JEL classification: C58, G14.

Keywords: Political information. News. Financial markets. Efficient markets.

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

API   Application Programming Interface

AR   Autoregressive

ARCH   Autoregressive Conditional Heteroscedasticity

BCB   Central Bank of Brazil

BM&F   Commodities and Futures Exchange

BRL   Brazilian Real

CAPM   Capital Asset Pricing Model

CDI   Inter-Bank Deposits Rate

CETIP   Central of Custody and Financial Settlement of Private Securities

CMN   National Monetary Council

CoPoM Monetary Policy Committee

CSD   Conditional Standard Deviation

CVM   Commission of Transferable Securities

DEM   Democrats

DI1   DI1 Exchange Coupon

EMH   Efficient Market Hypothesis

GARCH General Autoregressive Conditional Heteroscedasticity

IPI   Tax on Industrialized Products

OAB   Brazilian Bar Association

OC1   OC1 Exchange Coupon

PR   Party of the Republic

PSDB   Party of Social Democracy

PSL   Liberal Social Party

PSOL   Socialism and Liberty Party

PT	Worker's Party
PTAX	PTAX800
Selic	Special Settlement and Custody System Rate
SFN	Brazilian Financial System
SGS	Time Series Management System
TN	National Treasury
USD	United States Dollar
VAR	Vector Autoregression

CONTENTS

1 INTRODUCTION

It is very common for the media around the world to announce the idea that a given political event has made an impact on the financial markets. In fact, newspapers constantly refer to political news as the cause of fluctuations in prices of financial assets. That explanation is inconsistent with the classical semi-strong market efficiency hypothesis as posed by Fama (1970) although, which states prices reflect all available public information.

The evidence on asset prices being affected by news about the macroeconomy (see, McQueen and Roley (1993), Caporale, Spagnolo and Spagnolo (2015)) complicates the issue further. Still, in general, the semi-strong form market efficiency tests for political information in Brazil have shown supporting evidence for the hypothesis in the case of stock market returns and interest rates (Marques and Santos (2016)).

Indeed, the studies mentioned above test for efficiency on a national investor level, since they took for granted investor's return would be measured in domestic currency terms. However, foreign investors are responsible for 22.61% of the volume daily traded in the Brazilian stock market in 2019 as it can be seen in B3 Participation of Investors Report.

The problem we address here is whether political information affects the exchange coupon, which is the difference between the interest rate and exchange rate variation in a country and measures the return for dollars invested locally. Therefore, the contribution made here is not only to investigate market efficiency in Brazil from an international, broader and more solid perspective but also establish a replicable methodology applicable to other countries' data.

We follow Marques and Santos (2016) methodology, that is: we apply web-scraping to search for news; we find the ones related to national political events by searching the headlines for keywords; we filter the exchange coupon for abnormal volatility, and finally we cross the data to determine whether abnormal volatility was related to political events. To find the periods with abnormal volatility for the exchange coupon, we apply Bollerslev (1986) GARCH as a filter, in which we search for abnormal values of the conditional standard deviation series with both a parametric and non-parametric analysis.

It is worth noticing there are two measures of exchange coupon in Brazil. The first measure is the difference between the average rate of one-day inter-bank deposits (DI) and the exchange rate variation (as measured by PTAX800), while the other is the

excess return of referential rate of the Special Settlement and Custody System (Selic) over exchange rate variation (PTAX800).

The paper is organized as follows: chapter 2 describes the Brazilian institutional environment; chapter 3 reviews the literature on news and market efficiency; Chapter 4 describes the model of market efficiency tested in this paper; Chapter 5 describes the data used and the methods applied; Chapter 6 shows the results; and finally Chapter 7 shows the conclusions.

2 THE INSTITUTIONAL ENVIRONMENT

Brazil's legal basis is defined in the 1988 Constitution (Brasil (1988)). Brazil is a representative federative republic, where the government's power is divided into three branches, the Executive, Legislative and Judiciary, which are independent of each other. The republic's president, chief of the Executive, is elected via universal direct secret compulsory vote by the citizens for a four-year term and can be reelected only once. The senators and deputies, who make up the Legislative, are also elected this way and have terms of eight and four years respectively. The constituents of the Judiciary, on the other hand, are almost all selected by pubic tender, as the ministers from the Supreme Court and Superior Justice Tribunal are indicated by the republic's president.

The Brazilian Financial System (SFN) as it is today was instituted in Law 4.595, from December 1964 (Brasil (1964)). The National Monetary Council (CMN) was established as the major normative institution of the Financial System, while the Central Bank of Brazil (BCB) was established as the major executive institution. CMN is composed by the Minister of Economy and the Central Bank's President, and defines the guidelines for the budget, fiscal, monetary, credit and exchange policies, while also establishing the rules for the Financial System.

The policies which guidelines are defined by the Monetary Council are executed by the Central Bank, whose goal is to enforce the norms defined by the first. The Central Bank has the monopoly of currency issue and executes the monetary and exchange policies with the buying and selling of public debt securities, which are issued by the National Treasury (TN). The Central Bank's president is indicated by the republic's president, who can replace him anytime, therefore the institution is not independent - this issue was recently addressed by President Bolsonaro in a complementary bill project which alters Law 4.595 (Brasil (1964)).

Today's regimes for fiscal, monetary and exchange policies started in 1999, with the establishment of the so-called Economic Tripod, which is a set of three regimes for economic policy: government surplus for the fiscal policy, inflation targeting for the monetary policy and floating exchange rate for the exchange policy. The target for the inflation rate is defined by the Monetary Council, while the Monetary Policy Committee (CoPoM) defines the target for the short term interest rate (Selic) used for the monetary policy. The Central Bank pursues this interest rate.

The transferable securities market (securities, commodities and derivatives ex-

changes) is disciplined and supervised by the Commission of Transferable Securities (CVM), established in Law 6.385, from December 1976 (Brasil (1976)). Brazil has only one stock exchange, B3, which acts in all branches of the transferable securities market. B3 emerged as the fusion, in 2017, between BM&FBOVESPA (itself the fusion of BM&F (Commodities and Futures Exchange) and BOVESPA (São Paulo Securities Exchange)), and CETIP (Central of Custody and Financial Settlement of Private Securities). In Table 2.1 the structure of the National Financial System is represented for better visualization.

Table 2.1: National Financial System

	Currency, Credit, Capital, Currency Exchange		Private Insurance	Closed Pension
Regulating Entities	CMN (National Monetary Council)		CNSP (National Private Insurance Council)	CNPC (National Supplementary Pension Council)
Supervising Entities	BC (Central Bank of Brazil)	CVM (Commission of Transferable Securities)	Susep (Superintendence of Private Insurance)	Previc (National Superintendence of Supplementary Pension)
Operators	Banks and Savings Banks, Credit Co-operatives, Payment Institutions, Consortium Administrators, Brokers and Distributors, other non banking institutions	Stock, Commodities and Futures Exchanges	Insurers and Reinsurers, Open Pension Entities, Capitalization Companies	Closed Entities of Supplementary Pension

The structure described above has a strong impact on the behaviour of the exchange coupon, as the coupon's interest rate component is closely related to the pursuit of an inflation target, and its exchange rate component fluctuates in a floating exchange rate regime.

3 NEWS AND MARKET EFFICIENCY

The Efficient Market Hypothesis (EMH), as posed by Fama (1970), states that security prices "fully reflect" available information, providing "accurate signals for resource allocation". In this model, information is divided into three subsets. For the weak form efficiency, the information set is the historical prices of the security. For the semi-strong form, it is all the publicly available information, and finally, for the strong form, it is all available information, even if held private. There is massive literature on market efficiency, as the hypothesis has enormous implications for trading strategies, as it indicates the impossibility of economic profit with existing information (Kamal (2014)). If weak form market efficiency holds, then chartist or technical analysis is useless, and if the semi-strong form holds, then fundamental analysis, founded on public information, is useless (Oprean (2012)). Our paper focuses on semi-strong form efficiency, as we work with information in the form of publicly available news.

The evidence on the relationship between financial variables and news support that the first responds to the latter. News about the macroeconomy are shown to affect commodity prices in Caporale, Spagnolo and Spagnolo (2015), while McQueen and Roley (1993) displays not only that the stock market responds to this subset of news, but that the response depends on the state of the economy. The use of news for trading strategies is shown to award economic profit in Larsen and Thorsrud (2017). In Moussa, Delhoumi and Ouda (2017) it is shown that information supply has an impact on prices, but the effect is more pronounced on volatility than on returns.

Caporale, Spagnolo and Spagnolo (2015) applies a VAR-GARCH model to analyze the spillovers between mean and variance of both macroeconomic news and commodity returns. The sample of returns is composed of ten commodities and the exchange rate, in a period of over 13 years. The news sample includes the worldwide coverage of four macroeconomic variables: GDP, unemployment, retail sales and durable goods, which are used in the making of two indexes, one for positive and one for negative news. The results show spillovers for all variables but gold and silver. In McQueen and Roley (1993) it is analyzed if stock prices response to news varies over different stages of the business cycle. The sample of equity prices consists in the S&P 500 Index from over 10 years, and the sample of series used to represent the stage of the economy consists of variables related to cash flows and equity discount rates. The results show that the stock market responds positively to good macroeconomic news when the economy is weak, but

negatively when the economy is strong.

Textual data is used to analyze the relationship between news topics and stock returns in Larsen and Thorsrud (2017). The news sample comes from a daily Norwegian newspaper, and the stock prices sample comes from several firms listed in the Oslo Stock Exchange. The results show that news predict daily returns, allowing for investment strategies with economic returns. In Moussa, Delhoumi and Ouda (2017) news headlines are used to measure information supply, while search volume from Google Trends database is used to measure information demand. The sample of stocks is 25 stocks composing the Frech stock market index CAC40 and the index itself, and its time range is seven years. A model is developed to test the relationship between the samples, and the results indicate that information affects asset prices, but while the effect on volatility is considerable, the effect on returns is small.

When testing for political information, the results also support that security prices are responsive. Both Smales (2015) and Marques and Santos (2016) show that political uncertainty is related to market uncertainty, the first for Australia and the latter for Brazil. The Brazilian stock market is also shown to react to tax announcements in Gabriel, Ribeiro and Ribeiro (2013).

Smales (2015) uses electoral polls data to construct two measures of political uncertainty. One represents overall election uncertainty, the other represents uncertainty about reelection, which is considered of importance as economic policies of a reelected president are well known in caparison with the policies of a newly elected president. The financial series are exchange-traded futures and options based on the Australian stock market index S&P/ASX 200. Market volatility is shown to increase with political uncertainty, and decrease with the probability of reelection.

In Marques and Santos (2016) a GARCH model is applied to daily stock returns and short term interest rates in Brazil. The sample for the first is the Bovespa Index, and the sample for the latter is composed by the Selic rate and the DI rate. Samples range from January 2014 to April 2016. The results show that the stock market only responds to political news in the case of elections, as the only period of abnormal volatility related to news happened to occur around the 2014 presidential elections' date. On the other hand, the short term interest rates do not respond to political news.

Gabriel, Ribeiro and Ribeiro (2013) verifies if a government's annunciation of tax cuts affected stock prices of companies from the sector that would be directly affected. The referred tax is the Tax on Industrialized Products (IPI). After filtering for character-

istics that would make the calculations possible, 13 stocks made to the final sample. The results indicate that the stock prices were indeed affected by the tax cut annunciation.

4 THE MODEL

Three market conditions lead the market to efficiency, as posed by Fama (1970), these are: the absence of transaction or information costs and homogeneous expectations. It is worth noticing that these conditions are sufficient but not necessary for market efficiency. Transaction costs do not mean that the transactions do not "fully reflect" available information; if a "sufficient number" of investors have access to information the market may be efficient; and only if there are investors who can consistently make better predictions than the ones implicit in prices market inefficiency will arise (Fama (1970)).

Samuelson (1965) poses returns of prices which fully reflect available information are uncorrelated. Together with the assumption that successive price changes are identically distributed, this leads us to the random walk model (Fama (1970)). The random walk model is a special case of the AR(1) process. Let w_t denote the security price at time t, the process is given by Equation 4.1.

$$w_t = \alpha_0 + \alpha_1 w_{t-1} + \varepsilon \tag{4.1}$$

where

$$\alpha_0 = 0, \quad \alpha_1 = 1$$

The returns from a random walk are white noise. Let r_t denote the security return at time t, white noise is defined in Equations 4.2, 4.3 and 4.4.

$$E(r_t) = 0, \quad \forall t \tag{4.2}$$

$$E(r_t^2) = \sigma^2, \quad \forall t \tag{4.3}$$

$$E(r_t r_{t-j}) = 0 \quad for \quad j \neq 0 \tag{4.4}$$

To find inefficiency, we look for unusual behaviour in the regression residuals. As with the random walk model, the residual at time t (denoted by e_t) is given by Equation 4.5.

$$e_t = r_t - E(r_t)$$

$$e_t = r_t \tag{4.5}$$

To find unusual behaviour in the residuals, we apply a GARCH (Bollerslev (1986)) model to the exchange coupon series, and filter for abnormal values the conditional standard deviation series extracted from the model.

5 METHODS AND DATA

To test the impact of political news on the exchange coupon, we searched for political news, calculated the exchange coupon (both the OC1 and the DI1 measures), tested the coupon for abnormal volatility, and finally, we crossed the periods with abnormal volatility in the exchange coupon with the correspondent political news. The information on political news was gathered with web scrapping technique, applied in the main Brazilian news portal. A filter was applied to the news sample to find the ones related to national political events. We calculated the two different measures of exchange coupon negotiated in Brazil from its components (a shared exchange rate measure and two specific interest rate measures). To find the periods with abnormal volatility, we applied a GARCH model to the exchange coupon, and then filtered its conditional standard deviation for abnormal values, with both a parametric and a non-parametric approach.

5.1 Data

Based on data availability, our news sample begins on November 24, 2016, the first date for which there were political news available on the scrapped website. Our exchange rate and interest rates samples begin one day earlier, to allow for the exchange coupon series to begin with the news sample. All samples end on May 16, 2019.

5.1.1 Political News

We gathered information on political news by applying web scrapping technique to an online news portal. The scrapping was made in the political section of G1, a Brazilian news portal maintained by Grupo Globo, a conglomerate based in Rio de Janeiro. It provides content from Grupo Globo's television channels, radio stations, newspapers and magazines, besides its content. The scrapping was executed at May 17, 2019, and resulted in a sample of 17.832 news. The dollar market closes at 6 pm, therefore all news after this time were pushed to the subsequent day. News from weekends and holidays were pushed to the closest subsequent business day.

To find political events that could impact the exchange coupon, we follow Baker, Bloom and Davis (2015) as we searched our headlines sample for keywords. The key-

words were: related to market uncertainty, 'incerteza', 'mercado' and 'economia' (uncertainty, market, economy); related to components of the exchange coupon, 'dólar', 'selic' and 'cdi' (dollar, Selic, DI); and related to federal government matters, 'presidente', 'presidência', 'câmara', 'senado', 'tribunal de contas da união', 'tcu', 'superior tribunal federal' and 'stf' (president, presidency, chamber (as in Chamber of Deputies), senate, Federal Accountability Office and its initials, and Supreme Court and its initials). The search resulted in a sample of 2.333 news. The final sample is 13% the size of the unfiltered sample in terms of the number of news, therefore, we excluded 87% of the initial sample as it was composed of political news unrelated to federal political matters.

5.1.2 Exchange Coupon

In order to obtain the series for the exchange coupon (both the OC1 and the DI1 measures), we collected a sample of the dollar exchange rate PTAX 800 (PTAX), that was used for both measures, a sample of the referential rate of the Special Settlement and Custody System (Selic) for the OC1 measure, and a sample of the of the inter-bank deposits rate (DI) for the DI1 measure. All three series were collected from the Central Bank of Brazil Time Series Management System (BACEN-SGS), through its Application Programming Interface (API). The exchange rate is measured in BRL/USD, and the interests rates are measured in % a day.

Our samples range from November 23, 2016, to May 16, 2019. They begin shortly after the end of the impeachment process of President Dilma Rousseff, on August 31, when President Temer (Ms Dilma's Vice President) took office after three months as Interim President. This happened during the largest economic crisis in Brazilian history, with the fourth trimester of 2016 being the last from a series of eleven in which the Gross Domestic Product decreased. The remaining period from our sample saw economic stagnation. Mr Temer's presidency was marked by reforms - like the Labour Reform, which successfully passed, and the Pension Reform, which did not -, and by a corruption scandal involving him and related to Operation Car Wash, a investigation on money laundry involving Brazilian politicians, which was very present in the media since even before his presidency. At October 2018 presidential elections were held, and Mr Bolsonaro was elected. The new president took office with his main focus as a new Pension Reform, which is still awaiting approval by the time this is being written.

Figure 5.1 shows the exchange rate (PTAX) series, Figure 5.2 shows the referential

rate of the Special Settlement and Custody System (Selic) series, and Figure 5.3 shows the inter-bank deposits rate (DI) series. The descriptive statistics for the series are shown in Table 5.1.

Figure 5.1: Dollar Exchange Rate
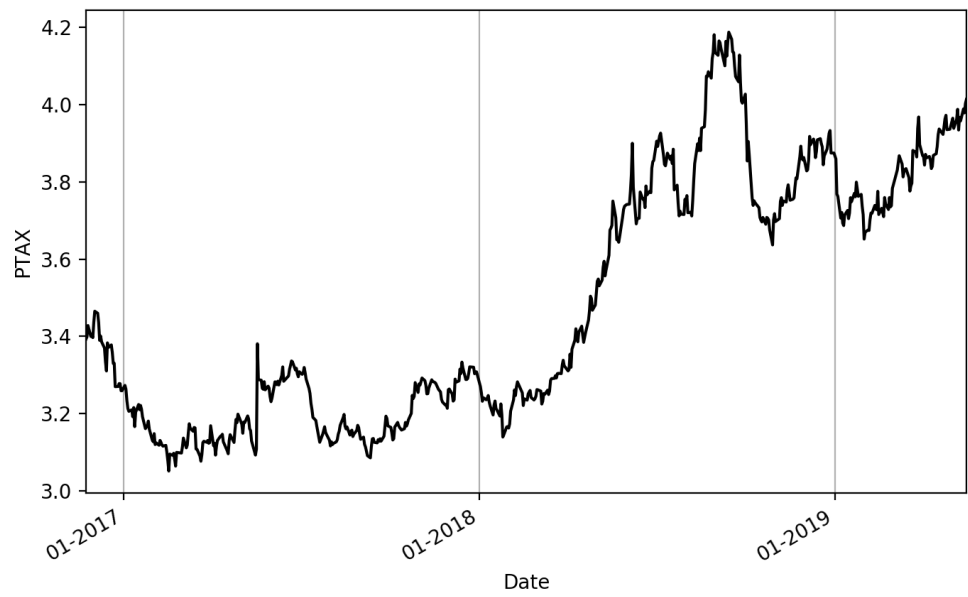
Figure 5.2: Referential Rate of the Special Settlement and Custody System
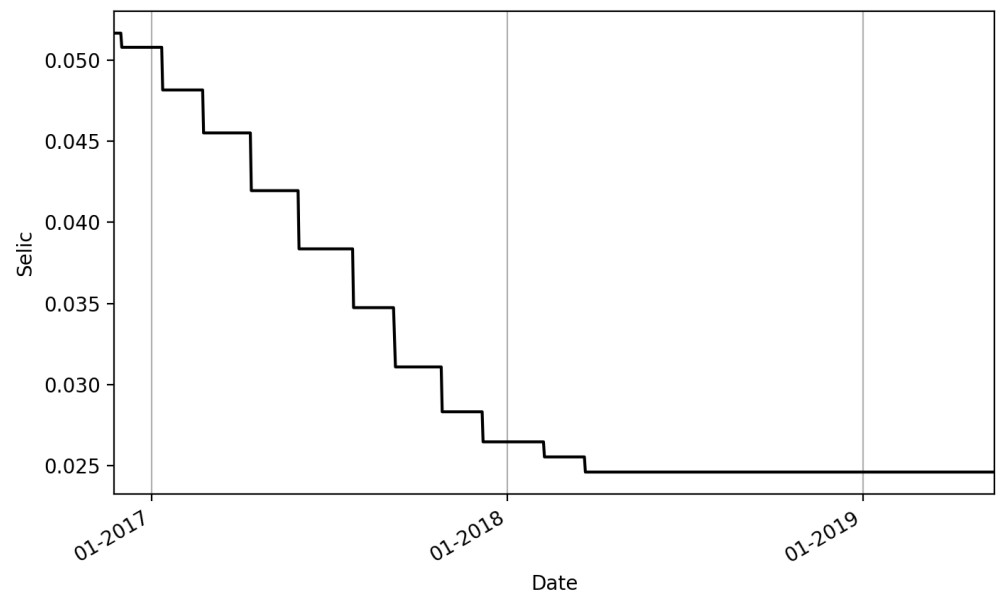
Figure 5.3: Interbank Deposit Rate
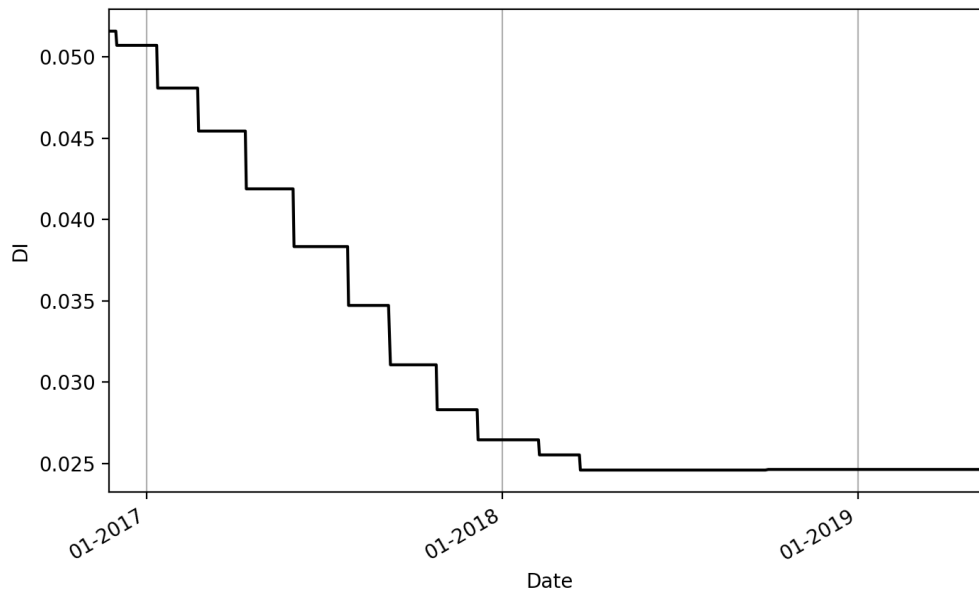
Table 5.1: Descriptive Statistics for PTAX, Selic and DI

Series	Mean	Standard Deviation	Minimum Value	Maximum Value
PTAX	3.481	0.319	3.051	4.188
Selic	0.031	0.009	0.025	0.052
DI	0.031	0.009	0.025	0.052

The exchange coupon is the accrued interest rate over exchange rate variation. We calculated both measures of the exchange coupon via Equation 5.1:

$$ExchangeCoupon_t = \frac{1 + \frac{InterestRate_{t-1}}{100}}{\frac{ExchangeRate_t}{ExchangeRate_{t-1}}} - 1 \qquad (5.1)$$

Figure 5.4 shows the OC1 exchange coupon series, Figure 5.3 shows the DI1 exchange coupon series, and Table 5.2 shows the descriptive statistics for both measures.

Figure 5.4: OC1 Exchange Coupon
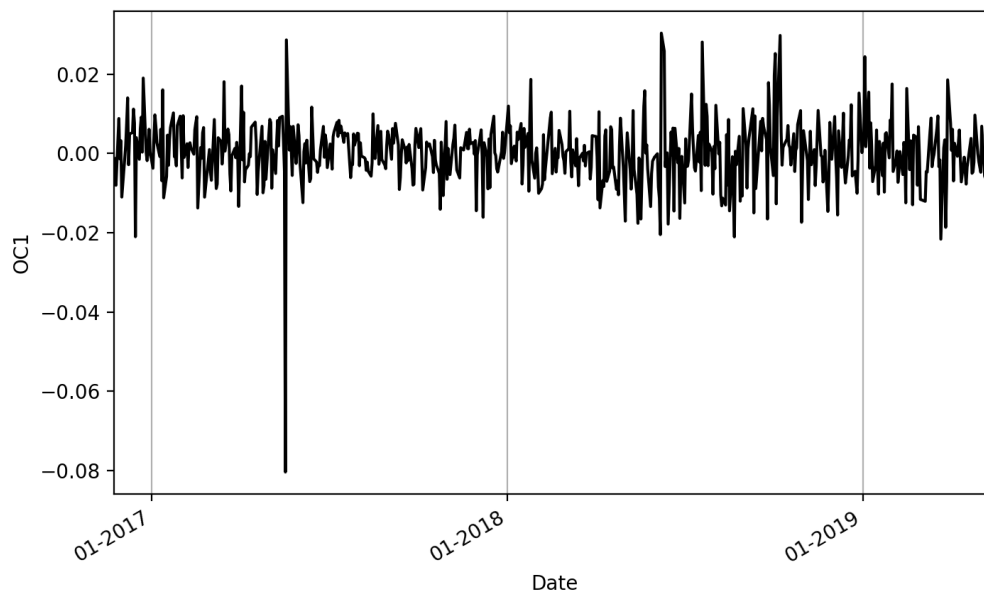
Figure 5.5: DI1 Exchange Coupon
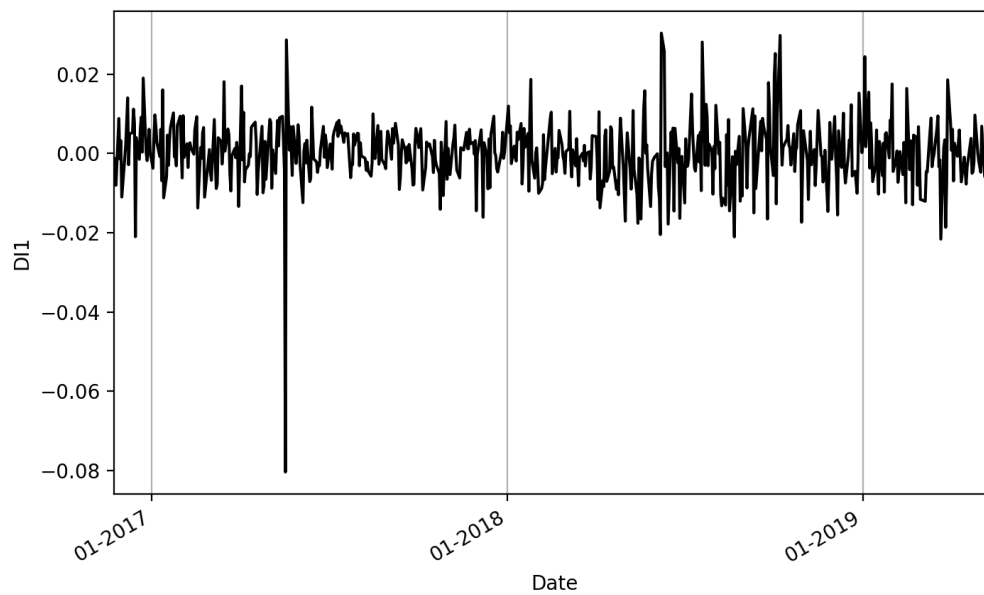
Table 5.2: Descriptive Statistics for OC1 and DI1 Exchange Coupons

Series	Mean	Standard Deviation	Minimum Value	Maximum Value
OC1	0.000	0.008	-0.080	0.030
DI1	0.000	0.008	-0.080	0.030

Visually, both exchange coupon measures show a stationary form, nevertheless, we tested the series against the null hypothesis of presence of a unit root with the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller (1979)), and the null hypothesis of stationarity around a deterministic trend with the Kwiatkowski– Phillips–Schmidt–Shin (KPSS) test (Kwiatkowski et al. (1992)). The results for the ADF test are shown in Table 5.3 and the results for the KPSS test are shown in Table 5.4.

Table 5.3: Augmented Dickey-Fuller Test

Series	Test Statistic	Critical Value at 5% Level
OC1	-2.567e+01	-2.866e+00
DI1	-2.567e+01	-2.866e+00

Table 5.4: Kwiatkowski–Phillips–Schmidt–Shin Test

Series	Test Statistic	Critical Value at 5% Level
OC1	2.167e-01	4.630e-01
DI1	2.165e-01	4.630e-01

The tests result in Tables 5.3 and 5.4 show support for the hypothesis of stationarity of the series that the visual analysis suggested to be true. For both measures of the exchange coupon, the Augmented Dickey-Fuller test rejected the null hypothesis of presence of a unit root and the Kwiatkowski– Phillips–Schmidt–Shin test could not reject the null hypothesis of stationarity around a deterministic trend.

5.2 Methods

5.2.1 Generalized Autoregressive Conditional Heteroskedastic Model

The Generalized Autoregressive Conditional Heteroscedastic (GARCH) model, introduced in Bollerslev (1986), is a generalization of the Autoregressive Conditional Heteroskedastic (ARCH) model introduced in Engle (1982), which models heteroscedasticity. Whilst the most common models for time series assume a constant variance for the process (as ARIMA), the ARCH process assumes an inconstant variance conditional on past variance, together with a constant unconditional variance. The GARCH process assumes inconstant variance conditional on past conditional variance as well as past variance. Both ARCH and GARCH are serial uncorrelated processes with zero mean.

Let y_t denote a real-valued discrete time process and ψ_t denote the information set at time t, the GARCH process is given by Equation 5.2 and Equation 5.3.

$$y_t | \psi_{t-1} \sim N(0, h_t) \tag{5.2}$$

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i y_{t-i}^2 + \sum_{i=1}^{p} \beta_i h_{t-i} \tag{5.3}$$

where

$$q > 0, \quad p \geq 0$$

$$\alpha_0 > 0, \quad \alpha_i \geq 0, \quad i = 1, ..., q$$

$$\beta_i \geq 0, \quad i = 1, ..., p$$

As we can see above, if $p = 0$ than it becomes an ARCH process. If also $q = 0$ than the process is white noise. We will use h_t, the conditional standard deviation, as an estimate for the exchange coupon's standard deviation at time t.

5.2.2 Estimation

We estimate a GARCH model for both measures of the exchange coupon. After the fitting of the model, the residuals must behave like white noise. First, we inspect this behaviour visually with the residuals graphs, which are shown in Figure 5.6 for the OC1 measure, and in Figure 5.7 for the DI1 measure.

Figure 5.6: Residuals of OC1's GARCH
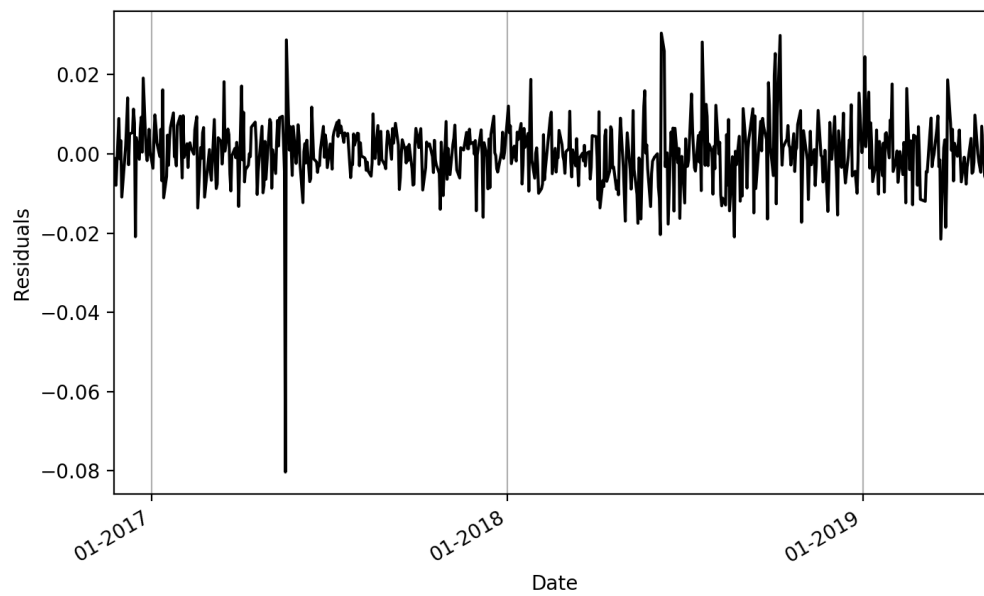
Figure 5.7: Residuals of DI1's GARCH
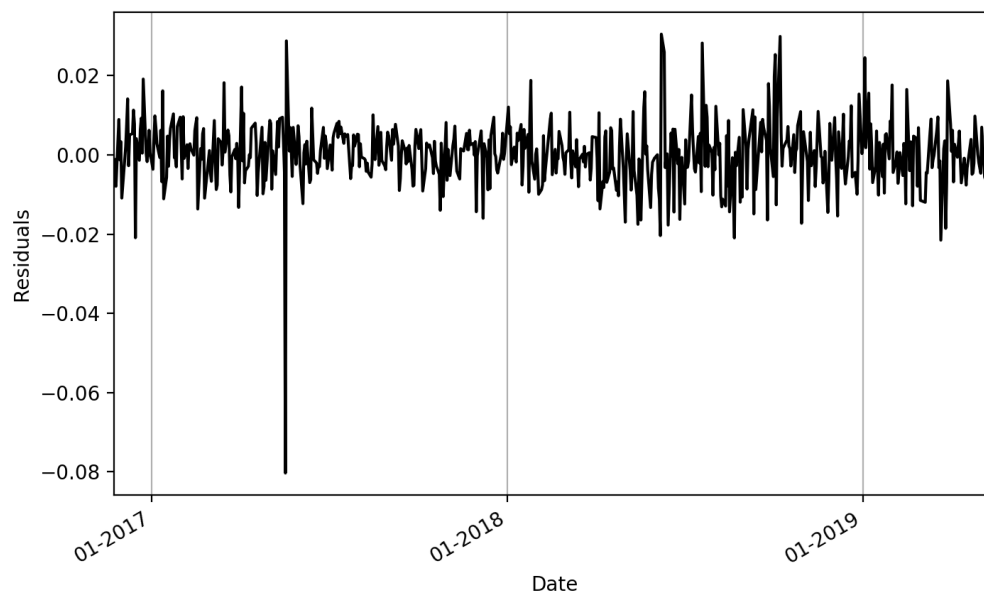
The visual inspection shows white noise behaviour. To certify this behaviour, we test the null hypothesis that the residuals are independently distributed with the Ljung-Box test (Ljung and Box (1978)). The result for the test, for both measures of the exchange coupon, are shown in Table 5.5.

Table 5.5: Ljung-Box Test

Series	P-value
Residuals of OC1's GARCH	8.881e-01
Residuals of DI1's GARCH	8.880e-01

The results shown in Table 5.5 support the hypothesis that the residuals behave like white noise. The Ljung-Box tests cannot reject the null hypothesis that the residuals are independently distributed.

5.2.3 Conditional Standard Deviation

From the GARCH model, we extract the conditional standard deviation (CSD) series, which values we use as an estimate for each period's standard deviation. The CSD series are shown in Figure 5.8 for the OC1 measure, and in Figure 5.9 for the DI1 measure. The descriptive statistics for the series are shown in Table 5.6

Figure 5.8: OC1's Conditional Standard Deviation
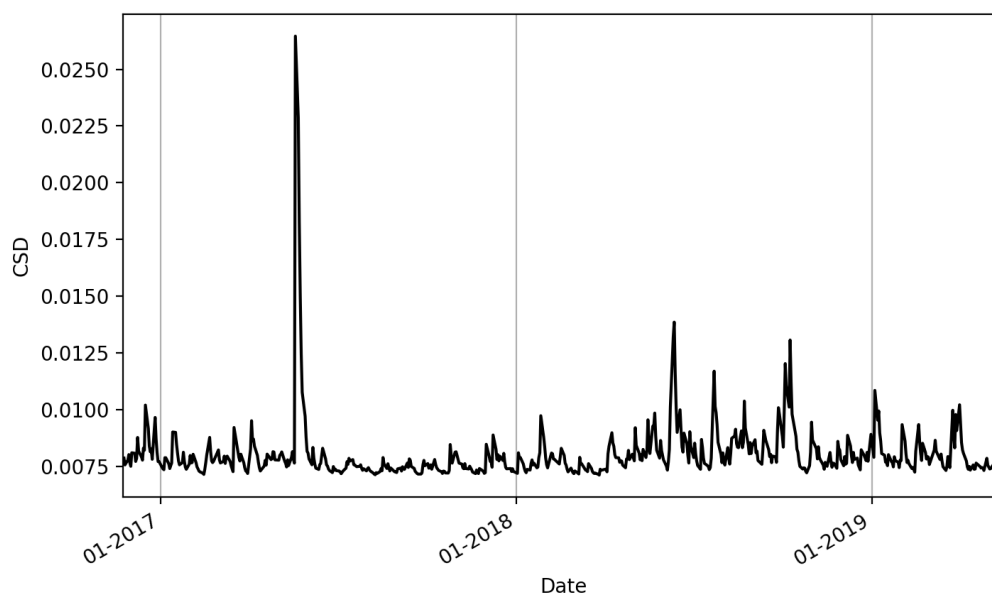
Figure 5.9: DI1's Conditional Standard Deviation
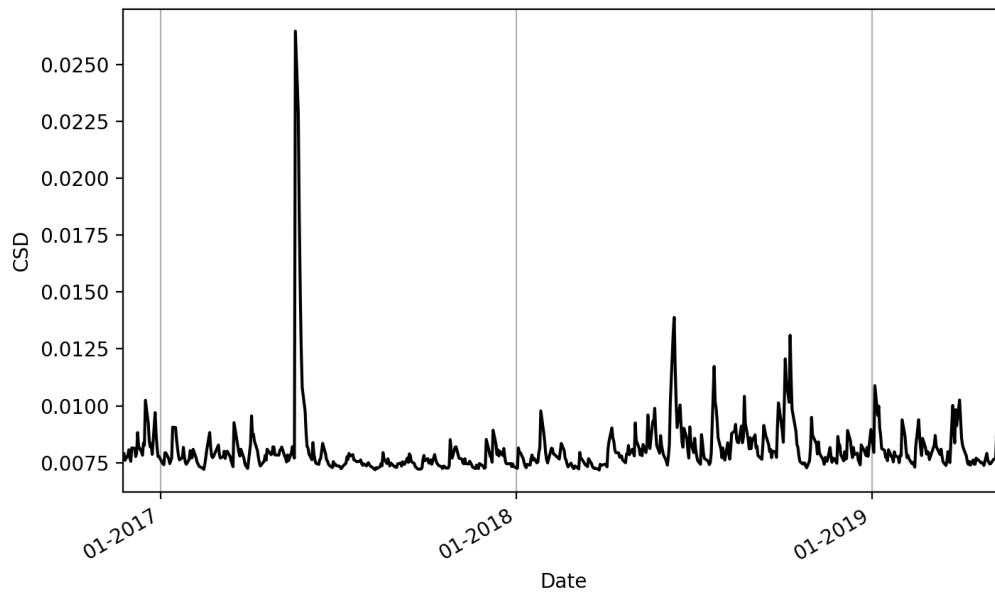
Table 5.6: Descriptive Statistics for OC1 and DI1's CSD

Series	Mean	Standard Deviation	Minimum Value	Maximum Value
OC1's CSD	0.008	0.001	0.007	0.026
DI1's CSD	0.008	0.001	0.007	0.026

We consider abnormal volatility every value outside the 95% confidence interval, and we use both a parametric and a non-parametric analysis to filter for abnormal volatility. In the former, we assume a two-parameter distribution for the population, in the latter we do not make this assumption.

5.2.4 Parametric

In the parametric analysis, we assume a two parameter distribution for the conditional standard deviation series when computing the 95% confidence interval that will be used to filter the series for abnormal volatility. The upper and lower limits are defined in Equations 5.4 and 5.5:

$$\bar{X} = \frac{1}{n} \sum_{i=0}^{n} CSD_t$$

$$\sigma^2 = \frac{1}{n-1} \sum_{i=0}^{n} (CSD_t - \bar{X})^2$$

$$\sigma = \sqrt{\sigma^2}$$

$$UpperLimit_t = \bar{X} + 1.96 * \sigma \tag{5.4}$$

$$LowerLimit_t = \bar{X} - 1.96 * \sigma \tag{5.5}$$

We test the null hypothesis that the conditional standard deviation samples come from a normally distributed population with the Shapiro-Wilk test, which results are shown in Table 5.7.

Table 5.7: Shapiro-Wilk Test

Series	P-value
OC1's CSD	1.497e-39
DI1's CSD	1.405e-39

The test results shown in Table 5.7 reject the null hypothesis that the samples come from a normally distributed population.

The lower and upper limits from the confidence interval are shown in Table 5.8 for both measures of the exchange coupon. Figure 5.10 and Figure 5.11 show the upper and lower limits altogether with the CDS series, for the OC1 and DI1 exchange coupons respectively.

Table 5.8: Limits from Parametric Analysis

Series	Upper Limit	Lower Limit
OC1's CSD	0.011	0.005
DI1's CSD	0.011	0.005

Figure 5.10: Parametric Limits for OC1's CSD

Figure 5.11: Parametric Limits for DI1's CSD

Table 5.9 and Table 5.10 show the details of each day with abnormal volatility, that is, the days in which the conditional standard deviation was outside the limits of the 95% confidence interval, for the OC1 exchange coupon and the DI1 exchange coupon respectively.

Table 5.9: Days with Abnormal Returns for OC1 Exchange Coupon by Parametric Analysis

	Date	Exchange Coupon	CSD	Lower Limit	Upper Limit
1	2017/05/19	0.029	0.026	0.005	0.011
2	2017/05/22	0.001	0.023	0.005	0.011
3	2017/05/23	0.007	0.018	0.005	0.011
4	2017/05/24	0.001	0.015	0.005	0.011
5	2017/05/25	-0.006	0.012	0.005	0.011
6	2017/05/26	0.007	0.011	0.005	0.011
7	2018/06/11	0.026	0.013	0.005	0.011
8	2018/06/12	-0.003	0.014	0.005	0.011
9	2018/06/13	-0.000	0.012	0.005	0.011
10	2018/07/23	-0.003	0.012	0.005	0.011
11	2018/10/04	-0.013	0.012	0.005	0.011
12	2018/10/05	0.009	0.011	0.005	0.011
13	2018/10/09	0.006	0.013	0.005	0.011
14	2018/10/10	-0.003	0.011	0.005	0.011
15	2019/01/04	0.002	0.011	0.005	0.011

Table 5.10: Days with Abnormal Returns for DI1 Exchange Coupon by Parametric Analysis

	Date	Exchange Coupon	CSD	Lower Limit	Upper Limit
1	2017/05/19	0.029	0.026	0.005	0.011
2	2017/05/22	0.001	0.023	0.005	0.011
3	2017/05/23	0.007	0.018	0.005	0.011
4	2017/05/24	0.001	0.015	0.005	0.011
5	2017/05/25	-0.006	0.012	0.005	0.011
6	2017/05/26	0.007	0.011	0.005	0.011
7	2018/06/11	0.026	0.013	0.005	0.011
8	2018/06/12	-0.003	0.014	0.005	0.011
9	2018/06/13	-0.000	0.012	0.005	0.011
10	2018/07/23	-0.003	0.012	0.005	0.011
11	2018/10/04	-0.013	0.012	0.005	0.011
12	2018/10/05	0.009	0.011	0.005	0.011
13	2018/10/09	0.006	0.013	0.005	0.011
14	2018/10/10	-0.003	0.011	0.005	0.011
15	2019/01/04	0.002	0.011	0.005	0.011

As we see in the tables above, the results coincide for both measures. There were 15 days of abnormal volatility.

5.2.5 Non Parametric

While in the parametric analysis we assumed a normal distribution for the population, in the non-parametric analysis we do not make this assumption. We calculated the mean and standard deviation for each day with a 63 days window (22 days before and 22 days after), which corresponds to three months of data. The definition of the 63 days window was made based on the frequency of CoPoM meetings (one for every one and a half month), in which the goal for the Selic is defined, affecting directly both the Selic and the DI. The window is twice the period between meetings, therefore a quarter of the year.

We define the limits of the non-parametric analysis in Equations 5.6 and 5.7.

$$\bar{X}_t = \frac{1}{63} \sum_{i=t-22}^{t+22} CSD_t$$

$$\sigma_t^2 = \frac{1}{62} \sum_{i=t-22}^{t+22} (CSD_t - \bar{X}_t)^2$$

$$\sigma_t = \sqrt{\sigma^2 t}$$

$$Upper Limit_t = \bar{X}_t + 1.96 * \sigma_t \qquad (5.6)$$

$$Upper Limit_t = \bar{X}_t - 1.96 * \sigma_t \qquad (5.7)$$

The lower and upper limits are shown in Table 5.11 for both measures of the exchange coupon. Figure 5.12 and Figure 5.13 show the upper and lower limits altogether with the CDS series, for the OC1 and DI1 exchange coupons respectively.

Table 5.11: Limits from Non Parametric Analysis

Series	Mean of Upper Limits	Mean of Lower Limits
OC1's CSD	0.010	0.006
DI1's CSD	0.010	0.006

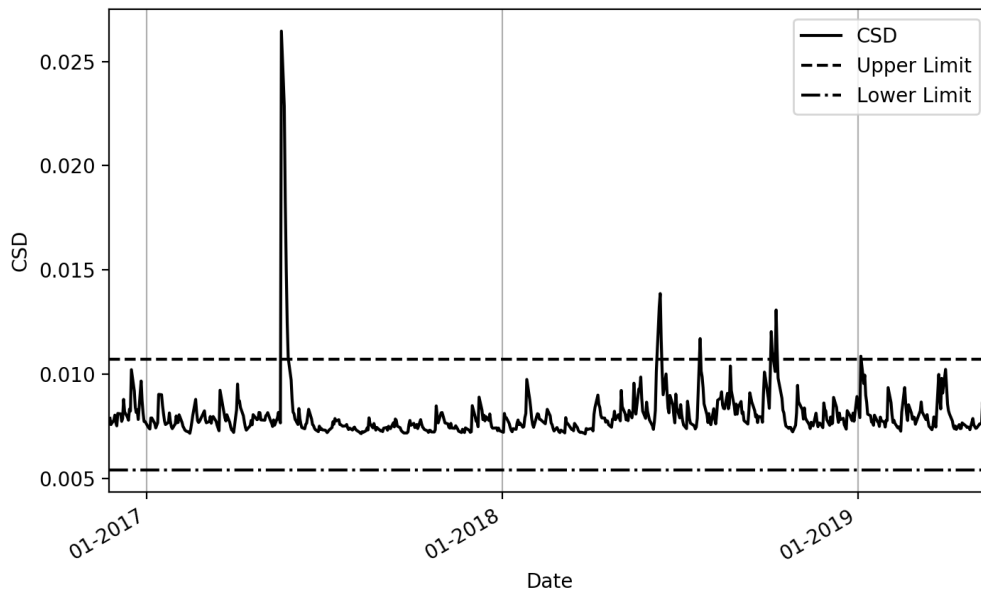Figure 5.12: Non Parametric Limits for OC1's CSD

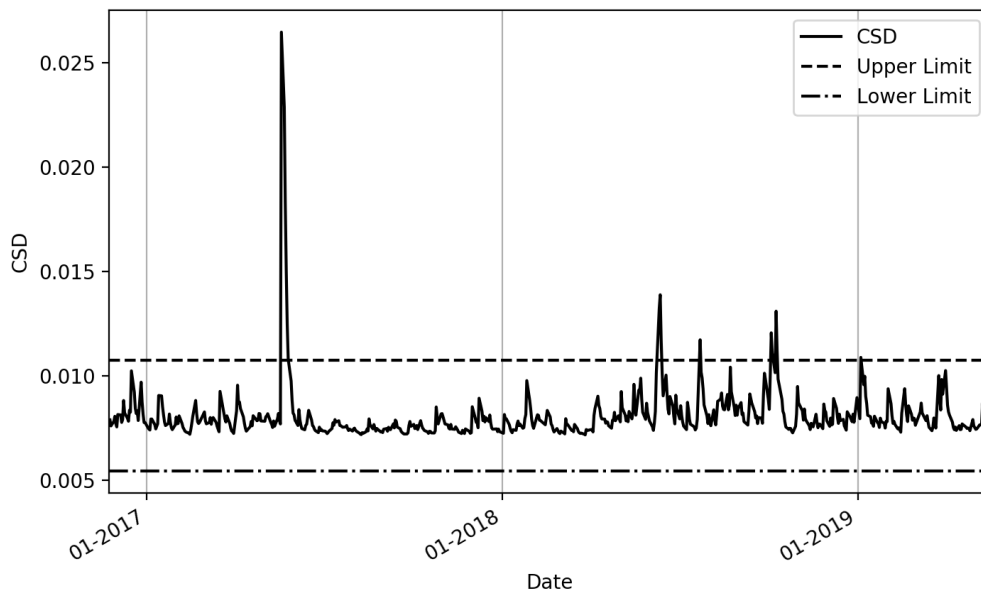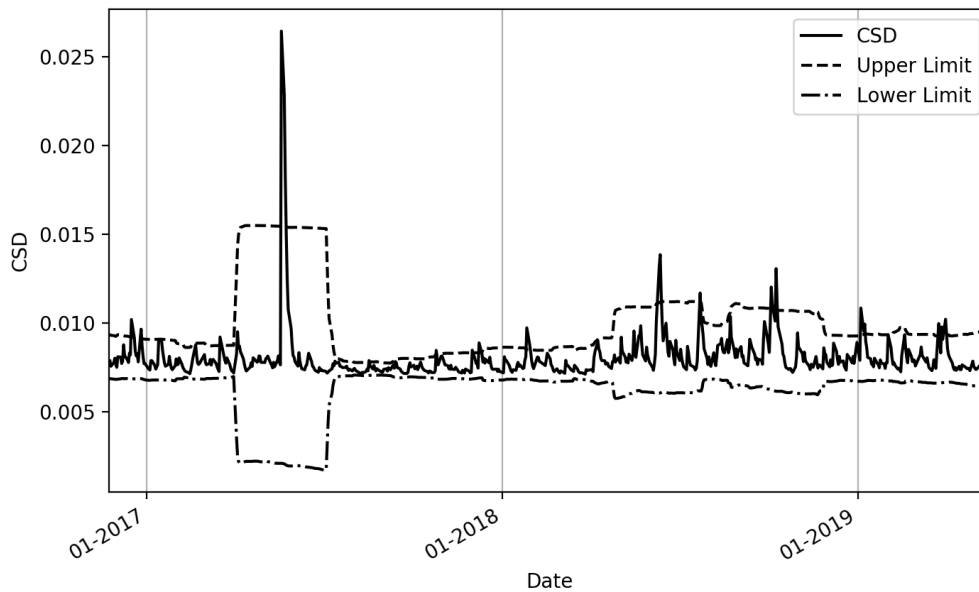Figure 5.13: Non Parametric Limits for DI1's CSD
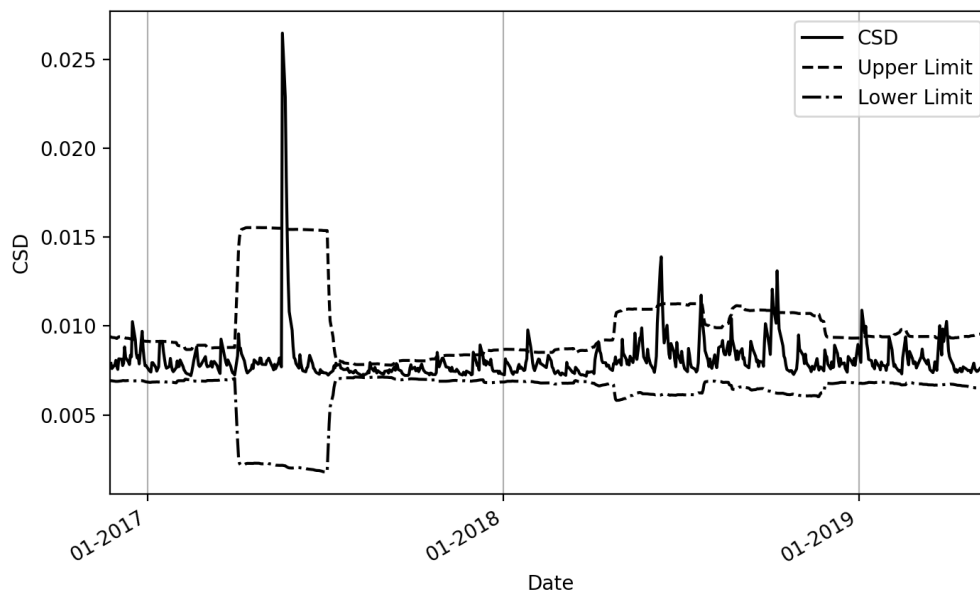
Table 5.12 and Table 5.13 show the details of each day with abnormal volatility, that is, the days in which the conditional standard deviation was outside the limits of the 95% confidence interval, for the OC1 exchange coupon and the DI1 exchange coupon respectively.

Table 5.12: Days with Abnormal Returns for OC1 Exchange Coupon by Non Parametric Analysis

	Date	Exchange Coupon	CSD	Lower Limit	Upper Limit
1	2016/12/16	0.004	0.010	0.007	0.009
2	2016/12/26	0.000	0.010	0.007	0.009
3	2017/03/17	0.001	0.009	0.007	0.009
4	2017/05/19	0.029	0.026	0.002	0.015
5	2017/05/22	0.001	0.023	0.002	0.015
6	2017/05/23	0.007	0.018	0.002	0.015
7	2017/08/17	0.002	0.008	0.007	0.008
8	2017/10/25	0.003	0.008	0.007	0.008
9	2017/12/01	-0.000	0.008	0.007	0.008
10	2017/12/08	0.003	0.009	0.007	0.008
11	2018/01/26	-0.002	0.010	0.007	0.009
12	2018/01/29	-0.006	0.009	0.007	0.009
13	2018/06/11	0.026	0.013	0.006	0.011
14	2018/06/12	-0.003	0.014	0.006	0.011
15	2018/06/13	-0.000	0.012	0.006	0.011
16	2018/07/23	-0.003	0.012	0.006	0.011
17	2018/10/04	-0.013	0.012	0.006	0.011
18	2018/10/05	0.009	0.011	0.006	0.011
19	2018/10/09	0.006	0.013	0.006	0.011
20	2018/10/10	-0.003	0.011	0.006	0.011
21	2019/01/04	0.002	0.011	0.007	0.009
22	2019/01/07	0.015	0.010	0.007	0.009
23	2019/01/08	-0.004	0.010	0.007	0.009
24	2019/03/25	0.001	0.010	0.007	0.009
25	2019/03/28	-0.007	0.010	0.007	0.009
26	2019/04/01	0.008	0.010	0.007	0.009
27	2019/04/02	0.001	0.009	0.007	0.009

Table 5.13: Days with Abnormal Returns for DI1 Exchange Coupon by Non Parametric Analysis

	Date	Exchange Coupon	CSD	Lower Limit	Upper Limit
1	2016/12/16	0.004	0.010	0.007	0.009
2	2016/12/26	0.000	0.010	0.007	0.009
3	2017/03/17	0.001	0.009	0.007	0.009
4	2017/05/19	0.029	0.026	0.002	0.015
5	2017/05/22	0.001	0.023	0.002	0.015
6	2017/05/23	0.007	0.018	0.002	0.015
7	2017/08/17	0.002	0.008	0.007	0.008
8	2017/10/25	0.003	0.009	0.007	0.008
9	2017/12/01	-0.000	0.009	0.007	0.008
10	2017/12/08	0.003	0.009	0.007	0.008
11	2018/01/26	-0.002	0.010	0.007	0.009
12	2018/01/29	-0.006	0.009	0.007	0.009
13	2018/06/11	0.026	0.013	0.006	0.011
14	2018/06/12	-0.003	0.014	0.006	0.011
15	2018/06/13	-0.000	0.012	0.006	0.011
16	2018/07/23	-0.003	0.012	0.006	0.011
17	2018/10/04	-0.013	0.012	0.006	0.011
18	2018/10/05	0.009	0.011	0.006	0.011
19	2018/10/09	0.006	0.013	0.006	0.011
20	2018/10/10	-0.003	0.011	0.006	0.011
21	2019/01/04	0.002	0.011	0.007	0.009
22	2019/01/07	0.015	0.010	0.007	0.009
23	2019/01/08	-0.004	0.010	0.007	0.009
24	2019/03/25	0.001	0.010	0.007	0.009
25	2019/03/28	-0.007	0.010	0.007	0.009
26	2019/04/01	0.008	0.010	0.007	0.009
27	2019/04/02	0.001	0.009	0.007	0.009

As we see in the tables above, the results, just as in the parametric analysis, coincide for both measures. There were 27 days of abnormal volatility

6 RESULTS AND DISCUSSION

After having filtered the exchange coupon for abnormal volatility, and the news for national political events, we match the two samples to find what political events happened to occur in the days of abnormal volatility. With this information, we can analyze the impact of political news in the exchange coupon. The results coincide for the OC1 and DI1 measures, therefore we will show the results without specifying a specific measure..

6.1 Parametric

The news for each day of abnormal volatility, for both the OC1 and DI1 measures, are shown in Table 6.1. After the table, we briefly describe the political events which brought abnormal volatility to the exchange coupon.

Table 6.1: Political News Related to both OC1 and DI1, for Parametric Analysis

	Ab. Vol.	News Time	Headline
1	2017/05/19	05/18 19:00	Manifestações em diferentes cidades brasi[...]
2	2017/05/19	05/18 19:29	Após denúncias, PTB na Câmara e PR reiter[...]
3	2017/05/19	05/19 15:12	Delator diz que ouviu de Temer que presid[...]
4	2017/05/19	05/19 14:28	Dono da JBS diz que deu R$ 30 milhões pa[...]
5	2017/05/19	05/19 15:11	JBS admite que comprou dólar nos últimos [...]
6	2017/05/19	05/19 15:45	Gravação de Joesley com Temer é legal, di[...]
7	2017/05/22	05/19 19:14	CVM investiga JBS por uso de informação p[...]
8	2017/05/22	05/20 14:52	Temer diz que segue na Presidência e pede[...]
9	2017/05/22	05/21 00:23	OAB decide apresentar à Câmara pedido de [...]
10	2017/05/22	05/22 16:20	Câmara acumula 14 pedidos de impeachment [...]
11	2017/05/23	05/22 18:28	Câmara deve discutir e votar reforma da P[...]
12	2017/05/24	05/23 20:33	Câmara aprova MP que libera saque das con[...]
13	2017/05/24	05/24 00:02	Presidente de comissão na Câmara adia aná[...]
14	2017/05/24	05/24 00:02	Presidente de comissão na Câmara adia aná[...]
15	2017/05/24	05/24 14:02	Presidência da República faz alerta a sit[...]
			Continued on next page

Table 6.1 – continued from previous page

	Ab. Vol.	News Time	Headline
16	2017/05/24	05/24 14:38	Câmara decide manter salário de R$ 33,7 [...]
17	2017/05/24	05/24 16:04	Sessão da Câmara tem gritaria e troca de [...]
18	2017/05/24	05/24 17:12	Deputados governistas e de oposição entra[...]
19	2017/05/25	05/24 19:46	Sem oposição em plenário, Câmara aprova M[...]
20	2017/05/25	05/25 00:16	Câmara aprova texto-base de MP que prevê [...]
21	2017/05/25	05/24 20:07	Câmara aprova MP que aumenta carência par[...]
22	2017/05/25	05/25 13:22	Presidente da Câmara prorroga CPI da Funa[...]
23	2017/05/25	05/25 13:22	Presidente da Câmara prorroga CPI da Funa[...]
24	2017/05/25	05/25 15:06	OAB entrega à Câmara pedido de impeachmen[...]
25	2017/05/26	05/26 16:11	Presidente do BNDES, Maria Silvia Bastos [...]
26	2018/06/11	06/10 11:13	Empresas buscam proteção após alta do dól[...]
27	2018/06/11	06/11 13:46	Presidente eleito do Paraguai, Benítez vi[...]
28	2018/06/11	06/11 17:38	Deputado preso volta a trabalhar na Câmar[...]
29	2018/06/12	06/12 14:16	Ministério da Fazenda diz que greve dos c[...]
30	2018/06/12	06/12 14:35	Presidente da Petrobras se encontra com c[...]
31	2018/06/12	06/12 17:28	Em audiência na Câmara, representantes do[...]
32	2018/06/13	06/13 07:00	Laurita Vaz deve assumir processos da Cal[...]
33	2018/06/13	06/13 11:12	Ampliação dos saques do PIS-Pasep vai inj[...]
34	2018/06/13	06/13 17:54	Senado retira de texto da Câmara obrigaçã[...]
35	2018/06/13	06/13 17:37	Judiciário precisa assumir papel na 'agen[...]
36	2018/06/13	06/13 16:53	Câmara aprova MP que criou Ministério da [...]
37	2018/07/23	07/21 11:06	PMN rejeita Valéria Monteiro para disputa[...]
38	2018/07/23	07/20 20:57	PSTU oficializa Vera Lúcia para disputa d[...]
39	2018/07/23	07/23 05:00	Temer viaja para o México nesta segunda-f[...]
40	2018/07/23	07/22 12:47	PSL oficializa candidatura de Jair Bolson[...]
41	2018/07/23	07/22 09:39	Servidores têm bancada mais forte da Câma[...]
42	2018/07/23	07/21 16:37	PSOL confirma Guilherme Boulos para dispu[...]
43	2018/07/23	07/23 08:37	Só em 2020 economia anulará perdas da rec[...]
44	2018/07/23	07/23 13:59	Com Cármen Lúcia no Planalto, Dias Toffol[...]
45	2018/07/23	07/23 13:01	Alckmin trabalha para acalmar aliados em [...]
			Continued on next page

Table 6.1 – continued from previous page

	Ab. Vol.	News Time	Headline
46	2018/10/04	10/03 18:55	Pesquisa Ibope para presidente: Bolsonaro[...]
47	2018/10/04	10/04 05:00	Pesquisa Ibope de 3 de outubro para presi[...]
48	2018/10/04	10/04 06:00	Pesquisa Ibope de 3 de outubro para presi[...]
49	2018/10/04	10/03 22:14	Candidato à Presidência, João Goulart Fil[...]
50	2018/10/04	10/04 14:27	Pesquisas Ibope nos estados: veja evoluçã[...]
51	2018/10/05	10/04 18:42	Pesquisa Datafolha em Pernambuco: Paulo C[...]
52	2018/10/05	10/04 19:54	Pesquisa Datafolha para presidente: Bolso[...]
53	2018/10/05	10/04 18:59	Sem votar projetos há mais de um mês, Câm[...]
54	2018/10/05	10/05 09:23	Candidatos a presidente usam anúncios no [...]
55	2018/10/05	10/05 05:00	Pesquisa Datafolha de 4 de outubro para p[...]
56	2018/10/05	10/05 05:00	Pesquisa Datafolha de 4 de outubro para p[...]
57	2018/10/05	10/05 02:16	Saiba o que disseram os candidatos à Pres[...]
58	2018/10/05	10/05 16:55	Veja as propostas das equipes dos preside[...]
59	2018/10/05	10/05 15:57	Justiça manda soltar diretor-presidente d[...]
60	2018/10/09	10/09 05:00	Número cai, mas quase metade da Câmara se[...]
61	2018/10/09	10/08 19:43	Levy Fidelix, presidente do partido do vi[...]
62	2018/10/09	10/08 19:43	Levy Fidelix, presidente do partido do vi[...]
63	2018/10/09	10/09 11:12	Novo declara que não apoiará nenhum candi[...]
64	2018/10/09	10/09 16:17	CNJ afasta presidente do TRE-MS suspeita [...]
65	2018/10/10	10/09 19:05	De 513 deputados eleitos na Câmara, só 27[...]
66	2018/10/10	10/09 22:39	Três deputados reeleitos vão para o oitav[...]
67	2018/10/10	10/10 16:25	Bolsonaro dá sinais contraditórios na eco[...]
68	2018/10/10	10/10 16:25	Bolsonaro dá sinais contraditórios na eco[...]
69	2019/01/04	01/03 21:10	PT e PSOL denunciam invasão de gabinetes [...]
70	2019/01/04	01/04 12:30	Bolsonaro sinaliza reforma da Previdência[...]
			End of table

At May 2017, the corruption scandal of President Michel Temer broke out. The scandal begun with the disclosure by the Supreme Court of a recording of a conversation between Mr Temer and the businessman Joesley Batista - owner of JBS, which was, and still is by the time this is written, the largest meat processing company in the world -, who delivered the recording to the authorities as part of a plea bargain. The date when the

recording was revealed was commonly dubbed as 'Joesley Day', as it was a day of high volatility for both stock and dollar markets. In fact, the conditional standard deviation for both exchange coupons was of 0.026 (for scale, the maximum and minimum values of the 95% confidence interval were of 0.011 and 0.005 respectively).

At July 2018, both Jair Bolsonaro, from Liberal Social Party (PSL), and Guilherme Boulos, from Socialism and Liberty Party (PSOL), were confirmed as candidates for the presidential elections that would be held in October. A vote intent survey released less than a week before the elections' first-round showed a result of, in the case of a second-round between Jair Bolsonaro (PSL) and Fernando Haddad (Worker's Party (PT)), 43% of votes for the first and 42% for the latter, therefore a technical draw. Both the announcement of Mr. Bolsonaro as candidate and the elections' first round affected the coupon. At January 2019, Bolsonaro indicated he would try to pass a new Pension Reform rather than working on the approval of the one from the previous president, Mr Temer.

6.1.1 Results of the Parametric Analysis

In the parametric analysis, we considered that mainly matters related to changes in the presidency affected the exchange coupons, followed by matters about the Pension Reform. Both the arise of the possibility of an impeachment of President Temer caused by a corruption scandal, and the presidential elections with two opposing leading candidates brought abnormal volatility. The announcement of a new Pension Reform also had this effect. These periods are shown in Table 6.2.

Table 6.2: Periods of Abnormal Volatility Related to Political News, by Parametric Analysis

Date	News Topic
May, 2017	President Temer's corruption scandal
July, 2018	Announcement of Mr Bolsonaro's candidacy
October, 2018	First round of Presidential Elections
January, 2019	Announcement of new Pension Reform

6.2 Non Parametric

The news for each day of abnormal volatility for both the OC1 and DI1 measures are shown in Table **??**. After the table, we will briefly describe the political events which brought abnormal volatility to the exchange coupon.

Table 6.3: Political News Related to both OC1 and DI1, for
Non Parametric Analysis

	Ab. Vol.	News Time	Headline
1	2016/12/16	12/15 18:27	CCJ define relator de consulta sobre reel[...]
2	2016/12/16	12/15 18:27	CCJ define relator de consulta sobre reel[...]
3	2016/12/16	12/15 19:55	PSDB prorroga mandato de Aécio como presi[...]
4	2016/12/16	12/16 13:35	Câmara envia a Fux recurso contra decisão[...]
5	2016/12/16	12/16 17:32	Janot reitera ao STF pedido para afastar [...]
6	2016/12/26	12/23 19:39	Presidente do STJ nega liberdade a ex-ass[...]
7	2016/12/26	12/24 13:52	Deputado do PDT lança pré-candidatura à p[...]
8	2016/12/26	12/24 13:52	Deputado do PDT lança pré-candidatura à p[...]
9	2017/03/17	03/16 20:29	Maia diz que reforma trabalhista será vot[...]
10	2017/03/17	03/17 03:00	Empreiteiras encolheram e perderam protag[...]
11	2017/03/17	03/17 12:39	Presidente do STF diz que 'já passou da h[...]
12	2017/03/17	03/16 21:23	Presidente do Senado dominicano nega vínc[...]
13	2017/05/19	05/18 19:00	Manifestações em diferentes cidades brasi[...]
14	2017/05/19	05/18 19:29	Após denúncias, PTB na Câmara e PR reiter[...]
15	2017/05/19	05/19 15:12	Delator diz que ouviu de Temer que presid[...]
16	2017/05/19	05/19 14:28	Dono da JBS diz que deu R$ 30 milhões pa[...]
17	2017/05/19	05/19 15:11	JBS admite que comprou dólar nos últimos [...]
18	2017/05/19	05/19 15:45	Gravação de Joesley com Temer é legal, di[...]
19	2017/05/22	05/19 19:14	CVM investiga JBS por uso de informação p[...]
20	2017/05/22	05/20 14:52	Temer diz que segue na Presidência e pede[...]
21	2017/05/22	05/21 00:23	OAB decide apresentar à Câmara pedido de [...]
22	2017/05/22	05/22 16:20	Câmara acumula 14 pedidos de impeachment [...]
23	2017/05/23	05/22 18:28	Câmara deve discutir e votar reforma da P[...]
			Continued on next page

Table 6.3 – continued from previous page

	Ab. Vol.	News Time	Headline
24	2017/08/17	08/16 22:03	Câmara inicia discussão, mas adia votação[...]
25	2017/08/17	08/16 22:48	Aldo Rebelo pediu afastamento do partido,[...]
26	2017/08/17	08/16 20:44	Câmara discute PEC que cria fundo eleitor[...]
27	2017/08/17	08/16 19:40	Câmara aprova tornar crime hediondo posse[...]
28	2017/08/17	08/17 10:35	OAB aciona Supremo para que presidente da[...]
29	2017/08/17	08/17 10:35	OAB aciona Supremo para que presidente da[...]
30	2017/10/25	10/24 18:44	Presidente do Conselho de Ŏ0c9tica arqu[...]
31	2017/10/25	10/25 09:21	Câmara inicia sessão para votar denúncia [...]
32	2017/10/25	10/24 20:55	Para Maia, Câmara precisa encerrar nesta [...]
33	2017/10/25	10/25 05:01	Saiba como será a votação na Câmara da de[...]
34	2017/10/25	10/25 14:36	G1 checa pronunciamentos da sessão da Câm[...]
35	2017/10/25	10/25 10:11	Veja frases da votação da segunda denúnci[...]
36	2017/10/25	10/25 11:53	Câmara vota segunda denúncia contra Temer[...]
37	2017/10/25	10/25 14:33	Maia encerra sessão, e Câmara terá que re[...]
38	2017/10/25	10/25 17:04	Após 8 horas, Câmara atinge quórum e inic[...]
39	2017/12/01	12/01 09:17	Presidente do PR usou apartamento funcion[...]
40	2017/12/01	12/01 09:17	Presidente do PR usou apartamento funcion[...]
41	2017/12/08	12/07 20:01	João Batista Brito Pereira é eleito novo [...]
42	2017/12/08	12/07 19:55	Sérgio Moro manda desbloquear dinheiro da[...]
43	2018/01/26	01/26 11:50	Contrariando tendência histórica, corrupç[...]
44	2018/01/29	01/26 19:26	Vice-presidente do TSE libera outdoors de[...]
45	2018/01/29	01/29 16:00	Comissão ligada à Presidência da Repúblic[...]
46	2018/01/29	01/29 16:00	Comissão ligada à Presidência da Repúblic[...]
47	2018/06/11	06/10 11:13	Empresas buscam proteção após alta do dól[...]
48	2018/06/11	06/11 13:46	Presidente eleito do Paraguai, Benítez vi[...]
49	2018/06/11	06/11 17:38	Deputado preso volta a trabalhar na Câmar[...]
50	2018/06/12	06/12 14:16	Ministério da Fazenda diz que greve dos c[...]
51	2018/06/12	06/12 14:35	Presidente da Petrobras se encontra com c[...]
52	2018/06/12	06/12 17:28	Em audiência na Câmara, representantes do[...]
53	2018/06/13	06/13 07:00	Laurita Vaz deve assumir processos da Cal[...]

Continued on next page

Table 6.3 – continued from previous page

	Ab. Vol.	News Time	Headline
54	2018/06/13	06/13 11:12	Ampliação dos saques do PIS-Pasep vai inj[...]
55	2018/06/13	06/13 17:54	Senado retira de texto da Câmara obrigaçã[...]
56	2018/06/13	06/13 17:37	Judiciário precisa assumir papel na 'agen[...]
57	2018/06/13	06/13 16:53	Câmara aprova MP que criou Ministério da [...]
58	2018/07/23	07/21 11:06	PMN rejeita Valéria Monteiro para disputa[...]
59	2018/07/23	07/20 20:57	PSTU oficializa Vera Lúcia para disputa d[...]
60	2018/07/23	07/23 05:00	Temer viaja para o México nesta segunda-f[...]
61	2018/07/23	07/22 12:47	PSL oficializa candidatura de Jair Bolson[...]
62	2018/07/23	07/22 09:39	Servidores têm bancada mais forte da Câma[...]
63	2018/07/23	07/21 16:37	PSOL confirma Guilherme Boulos para dispu[...]
64	2018/07/23	07/23 08:37	Só em 2020 economia anulará perdas da rec[...]
65	2018/07/23	07/23 13:59	Com Cármen Lúcia no Planalto, Dias Toffol[...]
66	2018/07/23	07/23 13:01	Alckmin trabalha para acalmar aliados em [...]
67	2018/10/04	10/03 18:55	Pesquisa Ibope para presidente: Bolsonaro[...]
68	2018/10/04	10/04 05:00	Pesquisa Ibope de 3 de outubro para presi[...]
69	2018/10/04	10/04 06:00	Pesquisa Ibope de 3 de outubro para presi[...]
70	2018/10/04	10/03 22:14	Candidato à Presidência, João Goulart Fil[...]
71	2018/10/04	10/04 14:27	Pesquisas Ibope nos estados: veja evoluçã[...]
72	2018/10/05	10/04 18:42	Pesquisa Datafolha em Pernambuco: Paulo C[...]
73	2018/10/05	10/04 19:54	Pesquisa Datafolha para presidente: Bolso[...]
74	2018/10/05	10/04 18:59	Sem votar projetos há mais de um mês, Câm[...]
75	2018/10/05	10/05 09:23	Candidatos a presidente usam anúncios no [...]
76	2018/10/05	10/05 05:00	Pesquisa Datafolha de 4 de outubro para p[...]
77	2018/10/05	10/05 05:00	Pesquisa Datafolha de 4 de outubro para p[...]
78	2018/10/05	10/05 02:16	Saiba o que disseram os candidatos à Pres[...]
79	2018/10/05	10/05 16:55	Veja as propostas das equipes dos preside[...]
80	2018/10/05	10/05 15:57	Justiça manda soltar diretor-presidente d[...]
81	2018/10/09	10/09 05:00	Número cai, mas quase metade da Câmara se[...]
82	2018/10/09	10/08 19:43	Levy Fidelix, presidente do partido do vi[...]
83	2018/10/09	10/08 19:43	Levy Fidelix, presidente do partido do vi[...]
			Continued on next page

Table 6.3 – continued from previous page

	Ab. Vol.	News Time	Headline
84	2018/10/09	10/09 11:12	Novo declara que não apoiará nenhum candi[...]
85	2018/10/09	10/09 16:17	CNJ afasta presidente do TRE-MS suspeita [...]
86	2018/10/10	10/09 19:05	De 513 deputados eleitos na Câmara, só 27[...]
87	2018/10/10	10/09 22:39	Três deputados reeleitos vão para o oitav[...]
88	2018/10/10	10/10 16:25	Bolsonaro dá sinais contraditórios na eco[...]
89	2018/10/10	10/10 16:25	Bolsonaro dá sinais contraditórios na eco[...]
90	2019/01/04	01/03 21:10	PT e PSOL denunciam invasão de gabinetes [...]
91	2019/01/04	01/04 12:30	Bolsonaro sinaliza reforma da Previdência[...]
92	2019/01/07	01/04 18:18	Câmara pode gastar mais de R$ 1,8 milhão[...]
93	2019/01/07	01/05 18:36	Reajuste do STF aumentou gasto da Câmara [...]
94	2019/01/07	01/06 21:45	Bolsonaro dá posse nesta segunda a presid[...]
95	2019/01/07	01/07 08:52	Empresas querem medidas para destravar ec[...]
96	2019/01/07	01/07 11:21	Presidentes de BNDES, BB e Caixa tomam po[...]
97	2019/01/07	01/07 15:31	Antes de dar posse a presidentes de banco[...]
98	2019/01/07	01/07 13:18	Presidente do Ibama se demite após minist[...]
99	2019/01/07	01/07 11:26	Guedes diz que mercado de crédito sofreu [...]
100	2019/01/07	01/07 16:15	Partidos de centro e de esquerda articula[...]
101	2019/01/07	01/07 16:10	Bolsonaro vai a Davos participar do Fórum[...]
102	2019/01/08	01/07 18:05	'Não vai ter financiamento de pontes que [...]
103	2019/01/08	01/07 19:04	PSDB declara apoio à reeleição de Maia co[...]
104	2019/01/08	01/07 19:04	PSDB declara apoio à reeleição de Maia co[...]
105	2019/01/08	01/08 13:06	Filho de Mourão assume assessoria especia[...]
106	2019/01/08	01/07 18:51	Novo presidente da Caixa diz que juros do[...]
107	2019/01/08	01/07 18:51	Novo presidente da Caixa diz que juros do[...]
108	2019/01/08	01/08 11:34	PR e Podemos anunciam apoio à reeleição d[...]
109	2019/01/08	01/08 11:34	PR e Podemos anunciam apoio à reeleição d[...]
110	2019/01/08	01/08 15:15	Toffoli analisa nesta semana se votos da [...]
111	2019/03/25	03/23 08:46	No terceiro dia no Chile, Bolsonaro tem r[...]
112	2019/03/25	03/24 12:08	De volta do Chile, Bolsonaro recebe líder[...]
113	2019/03/25	03/23 09:40	Maia diz que Bolsonaro deve liderar refor[...]

Table 6.3 – continued from previous page

	Ab. Vol.	News Time	Headline
114	2019/03/25	03/24 18:43	Presidente que não entende que Ž018o Co[...]
115	2019/03/25	03/25 08:14	Apesar do tom de Bolsonaro, Câmara deve m[...]
116	2019/03/28	03/28 08:35	Maia e Bolsonaro prolongam troca de farpa[...]
117	2019/03/28	03/27 20:31	Câmara aprova texto que altera regras par[...]
118	2019/03/28	03/28 12:03	Presidente do PSL diz que o partido fecho[...]
119	2019/03/28	03/28 17:00	Delegado Marcelo Freitas é escolhido rela[...]
120	2019/03/28	03/28 14:52	Câmara aprova projeto que exige notificaç[...]
121	2019/03/28	03/28 13:13	Presidente afastado da Vale diz que nunca[...]
122	2019/03/28	03/28 17:10	Presidente da Embratur pede demissão, diz[...]
123	2019/04/01	03/30 13:19	Presidente Bolsonaro embarca para Israel,[...]
124	2019/04/01	03/29 21:08	Rodrigo Maia anula convocação de Sérgio M[...]
125	2019/04/01	03/31 15:53	A incerteza do voto, link: https://g1.glo[...]
126	2019/04/01	04/01 17:36	'Decisão do presidente. Foi divulgado pel[...]
127	2019/04/02	04/02 09:06	Porta-voz da Presidência diz que vídeo so[...]
128	2019/04/02	04/02 08:40	Bolsonaro minimiza crítica palestina, Mer[...]
			End of table

At March 2017, the Chamber of Deputies' president, Mr Maia, announced the voting of the Labour Reform. At April, the corruption scandal of President Temer broke out, as mentioned in the previous section. Abnormal volatility returned at August when the Brazilian Bar Association (OAB) triggered the Supreme Court to make the Chamber of Representatives' President analyze the impeachment requests he had received (there were 25 at the time). The impeachment matter correlated with abnormal volatility for the last time at October, when the Chamber of Representatives voted for the corruption denunciation against President Temer not to be sent to the Supreme Court, where it would be judged.

At July 2018, both Jair Bolsonaro, from Liberal Social Party (PSL), and Guilherme Boulos, from Socialism and Liberty Party (PSOL), were confirmed as candidates for the presidential elections that would occur in October. As in the parametric analysis, the days surrounding the first round of the presidential elections (held at October 8) were of abnormal volatility. The fourth day of 2019 was the first day of Bolsonaro's presidency to show abnormal volatility - at the time, Bolsonaro indicated he would try to pass a new

Pension Reform rather than working on the approval of the reform from the previous president, Mr Temer.

6.2.1 Results of the Non-Parametric Analysis

The results from the non-parametric analysis add to the results of the parametric analysis, as they show that not only matters related to changes in the republic's presidency and the Pension Reform affected the exchange coupon, but matters related to the Labour Reform also did. The announcement of the voting of the Labour Reform affected in March 2017. Even in the matters related to the republic's presidency, more political events affected the exchange coupon: the possibility of impeachment of President Temer impacted the exchange coupon not only on May 2017 (as in the parametric analysis) but in August and October as well. The 2018 presidential elections affected the exchange coupon just like in the parametric analysis, with the announcement of Jair Bolsonaro as a candidate (July 2018) and the first round of the elections (October 2018). As in the parametric analysism the announcement of a new Pension Reform in January 2019 also affected the exchange coupon. These periods are shown in Table 6.4.

Table 6.4: Periods of Abnormal Volatility related to Political News, by Non Parametric Analysis

Date	News Topic
March, 2017	Voting of the Labour Reform
May, 2017	President Temer's corruption scandal
August, 2017	OAB's triggering of the Supreme Court
October, 2017	Rejection of the denunciation against President Temer
July, 2018	Announcement of Mr Bolsonaro's candidacy
October, 2018	First Round of Presidential elections
January, 2019	Announcement of a new Pension Reform

7 CONCLUSION

To test the market for semi-strong form efficiency, we analyzed the impact of political news on the exchange coupon. We cross-referenced the days with abnormal returns for the exchange coupon with the days with political news. Ir order to achieve that, we filtered the news collected via web scrapping for national political events and applied a GARCH filter in the exchange coupon to find abnormal returns. We performed both a parametric and non-parametric analysis.

Both the parametric and non-parametric analysis show support to the semi-strong form efficient market hypothesis. From 2333 political news, only a small fraction affected the exchange coupon - 70 for the parametric analysis (3.0% of the total), and 128 news for the non-parametric analysis (5.5%). Nevertheless, if compared to other types of news that could impact the exchange coupon - such as macroeconomic and international - political news had considerable impact. For the parametric analysis, political news were accountable for 11 out of 15 days of abnormal volatility (73%), and in the non-parametric analysis, they were accountable for 12 out of 25 days (48%).

The analysis indicates that the exchange coupon was affected by political news about changes in the republic's presidency and the Pension Reform. Changes in the presidency mean both the 2018 elections, with its first round and the announcement of later-to-become president Jair Bolsonaro as a candidate, and the corruption scandal with President Temer at May 2017, which was followed by various impeachment requests. The Pension Reform had its effect with the announcement by President Bolsonaro of a new one, rather than working for the approval of the Reform proposed by Mr Temer.

While the parametric analysis indicates that the relationship between political news and the exchange coupon is limited to the one mentioned above, the non-parametric analysis indicates that this relationship goes further, as political news of less (but in no way small) significance also affected the exchange coupon. In the case of the corruption scandal with President Temer, abnormal volatility was brought also by the triggering of the Supreme Court, by the Brazilian Bar Association (OAB), to make the Chamber of Representatives' President analyze the impeachment requests he had received (August 2017), and by the voting by the Chamber of Deputies for the corruption denunciation not to be sent to the Supreme Court (October 2017). In the non-parametric analysis, not only the Pension Reform affected the exchange coupon but also the Labour Reform, when the Chamber of Deputies' president announced its voting in March 2017.

These results follow Smales (2015) and Marques and Santos (2016), as they both show that political uncertainty, as with who will win the elections, causes market uncertainty. Nevertheless, while our analysis shows that fixed income returns for foreign investors were affected by political events, Marques and Santos (2016) shows returns of fixed income for the local investor were not. This contrast in results indicates a considerable difference in fixed income market dynamics for the two groups of investors.

As an extension to the current research, the analysis could be made on an more extensive period and news sample (this could be achieved with the scrapping of more websites), on the return for the foreign investor of other securities from the Brazilian market, and with more types of news (not only political).

48

8 APPENDIX - CODES

8.1 Main

```
"""
NOME: Some Evidence on Political Information and Exchange
    ↪ Coupon in Brazil − main
AUTHOR: Bernardo Paulsen
DATE: 2019/07/09
VERSION: 2.0.0
LINK: https://github.com/profnssorg/information−asset−
    ↪ returns

DESCRIPTION: Outputs all graphs and tables from the paper

"""

# IMPORT PACKAGES ########


# IMPORT MODULES ########


from modules.bacen import ∗  # module for importing data
    ↪ from BACEN SGS
from modules.calculations import ∗  # module for
    ↪ calculations with time series
from modules.graph import ∗  # muodule for output of graphs
from modules.table import ∗  # module for output of tables
from modules.news import ∗  # module for dealing with news

# IMPORT DATA ########
```

```
# IMPORT TIME SERIES
BASE = ImportBacen.create(names=['Ptax', 'Selic', 'Di'],
                          numbers=[1, 11, 12],
                          initial_date='23/11/2016',
                          final_date='16/05/2019')


# PRECESS DATA ########


# APPENDS EXCHANGE COUPONS TO DATAFRAME
Calculations.exchange_coupon(BASE,
    'Ptax',
    ['Selic', 'Di'],
    ['Oc1', 'Di1'])


# APPENDS GARCH'S CSD AND RESIDUALS OF EXCHANGE COUPONS TO
   ↪ DATAFRAME
Calculations.garch(BASE, ['Oc1', 'Di1'])


# APPENDS LIMITS FROM BOTH PARAMETRIC AND NON PARAMETRIC
   ↪ ANALYSIS TO DATAFRAME
Calculations.limits(BASE, [5, 7])


# CREATES LIST WITH RELEVANT NEWS
noticias_relevantes = News.transform(
    News.separate_news(
        News.join(
            News.correct(
                News.days_of_year(),
                BASE.Ptax),
            News.nextday(
                News.arrange(
                    News.news('noticias.json')),
```

```
                    News.list_days(
                        News.correct(
                            News.days_of_year(),
                            BASE.Ptax)))),
        ['incerteza',
         'mercado',
         'economia',
         'd\\u00f3lar',
         'selic',
         'cdi',
         'c\\u00e2mara',
         'senado'
         'stf'
         'superior_tribunal_federal'
         'tcu',
         'tribunal_de_contas_da_uni\\u00e3o',
         'presidente',
         'presid\\u00eancia']))

# OUTPUT DATA ########

# GRAPHS ####

Graph.multiple((

    # GRAPH FOR PTAX
    ([BASE.Ptax], # Series
    [], # Series labels
    'PTAX', # Y axis' name
    'Dollar_Exchange_Rate', # Title
    'ptax'), # Graph label

    # GRAPH FOR SELIC
    ([BASE.Selic], # Series
```

```
    [], # Series labels
    'Selic', # Y axis' name
    'Referential␣Rate␣of␣the␣Special␣Settlement␣and␣Custody
      ↪ ␣System', # Title
    'selic'), # Graph label


# GRAPH FOR DI
([BASE.Di], # Series
    [], # Series labels
    'DI', # Y axis' name
    'Interbank␣Deposit␣Rate', # Title
    'di'), # Graph label


# GRAPH FOR OC1
([BASE.Oc1], # Series
    [], # Series labels
    'OC1', # Y axis' name
    'OC1␣Exchange␣Coupon', # Title
    'oc'), # Graph label


# GRAPH FOR DI1
([BASE.Di1], # Series
    [], # Series labels
    'DI1', # Y axis' name
    'DI1␣Exchange␣Coupon', # Title
    'di1'), # Graph label


# GRAPH FOR OC1 RESIDUALS
([BASE.Oc1Res], # Series
    [], # Series labels
    'Residuals', # Y axis' name
    'Residuals␣of␣OC1\'s␣GARCH', # Title
    'ocres'), # Graph label
```

```
# GRAPH FOR DI1 RESIDUALS
([BASE.Di1Res], # Series
[], # Series labels
'Residuals', # Y axis' name
'Residuals_of_DI1\'s_GARCH', # Title
'dires'), # Graph label


# GRAPH FOR OC1 CSD
([BASE.Oc1Csd], # Series
[], # Series labels
'CSD', # Y axis' name
'OC1\'s_Conditional_Standard_Deviation', # Title
'occsd'), # Graph label


# GRAPH FOR DI1 CSD
([BASE.Di1Csd], # Series
[], # Series labels
'CSD', # Y axis' name
'DI1\'s_Conditional_Standard_Deviation', # Title
'dicsd'), # Graph label


# GRAPH FOR OC1 PARAMETRIC LIMITS
([BASE.Oc1Csd, BASE.Oc1CsdParUp, BASE.Oc1CsdParLo], #
    ↪ Series
['CSD', 'Upper_Limit', 'Lower_Limit'], # Series labels
'CSD', # Y axis' name
'Parametric_Limits_for_OC1\'s_CSD', # Title
'oclimpar'), # Graph label


# GRAPH FOR DI1 PARAMETRIC LIMITS
([BASE.Di1Csd, BASE.Di1CsdParUp, BASE.Di1CsdParLo], #
    ↪ Series
['CSD', 'Upper_Limit', 'Lower_Limit'], # Series labels
'CSD', # Y axis' name
```

```
        'Parametric Limits for DI1\'s CSD',  # Title
        'dilimpar'),  # Graph label


        # GRAPH FOR OC1 NON PARAMETRIC LIMITS
        ([BASE.Oc1Csd, BASE.Oc1CsdNonUp, BASE.Oc1CsdNonLo],
        ['CSD', 'Upper Limit', 'Lower Limit'],  # Series labels
        'CSD',  # Y axis' name
        'Non Parametric Limits for OC1\'s CSD',  # Title
        'oclimnon'),  # Graph label


        # GRAPH FOR DI1 NON PARAMETRIC LIMITS
        ([BASE.Di1Csd, BASE.Di1CsdNonUp, BASE.Di1CsdNonLo],
        ['CSD', 'Upper Limit', 'Lower Limit'],  # Series labels
        'CSD',  # Y axis' name
        'Non Parametric Limits for DI1\'s CSD',  # Title
        'dilimnon'),  # Graph label
))


# TABLES ####


# DESCRIPTIVE STATISTICS FOR PTAX, SELIC AND DI
Table.des('PTAX, Selic and DI',
        'desptaxselicdi',
        [BASE.Ptax, BASE.Selic, BASE.Di],
        ['PTAX', 'Selic', 'DI'])


# DESCRIPTIVE STATISTICS FOR OC1 AND DI1
Table.des('OC1 and DI1 Exchange Coupons',
        'desocdi',
        [BASE.Oc1, BASE.Di1],
        ['OC1', 'DI1'])


# DESCRIPTIVE STATISTICS FOR OC1 AND DI1 CSD
Table.des('OC1 and DI1\'s CSD',
```

```
    'descsd',
    [BASE.Oc1Csd, BASE.Di1Csd],
    ['OC1\'s_CSD', 'DI1\'s_CSD'])


# ADF TEST FOR OC1 AND DI1
Table.adf('ocdiadf',
    [BASE.Oc1, BASE.Di1],
    ['OC1', 'DI1'])


# KPSS TEST FOR OC1 AND DI1
Table.kpss('ocdikpss',
    [BASE.Oc1, BASE.Di1],
    ['OC1', 'DI1'])


# LJUNG-BOX TEST FOR BOTH CSD RESIDUALS
Table.ljung('reswhite',
    [BASE.Oc1Res, BASE.Di1Res],
    ['Residuals_of_OC1\'s_GARCH', 'Residuals_of_DI1\'s_
        ↪ GARCH'])


# SHAPIRO WILK TEST FOR BOTH CSD
Table.shapiro('csdshapiro',
    [BASE.Oc1Csd, BASE.Di1Csd],
    ['OC1\'s_CSD', 'DI1\'s_CSD'])


# PARAMETRIC LIMITS FOR OC1 AND DI1
Table.limits('limpar',
    [BASE.Oc1CsdParUp, BASE.Di1CsdParUp],
    [BASE.Oc1CsdParLo, BASE.Di1CsdParLo],
    ['OC1\'s_CSD', 'DI1\'s_CSD'],
    par=True)


# NON PARAMETRIC LIMITS FOR OC1 AND DI1
Table.limits('limnon',
```

```
    [BASE.Oc1CsdNonUp,  BASE.Di1CsdNonUp],
    [BASE.Oc1CsdNonLo,  BASE.Di1CsdNonLo],
    ['OC1\'s_CSD',  'DI1\'s_CSD'],
    par=False)


# DAYS OF ABNORMAL VOLATILITY FOR OC1 BY PARAMETRIC
    ↪ ANALYSIS
oc_par = Table.outside('ocparout',
    BASE,
    'Oc1',
    'Oc1Csd',
    ['Oc1CsdParUp', 'Oc1CsdParLo'],
    di=False,
    non=False)


# DAYS OF ABNORMAL VOLATILITY FOR DI1 BY PARAMETRIC
    ↪ ANALYSIS
di_par = Table.outside('diparout',
    BASE,
    'Di1',
    'Di1Csd',
    ['Di1CsdParUp', 'Di1CsdParLo'],
    di=True,
    non=False)


# DAYS OF ABNORMAL VOLATILITY FOR OC1 BY NON PARAMETRIC
    ↪ ANALYSIS
oc_non = Table.outside('ocnonout',
    BASE,
    'Oc1',
    'Oc1Csd',
    ['Oc1CsdNonUp', 'Oc1CsdNonLo'],
    di=False,
    non=True)
```

56

```
# DAYS OF ABNORMAL VOLATILITY FOR DI1 BY NON PARAMETRIC
    ↪ ANALYSIS
di_non = Table.outside('dinonout',
    BASE,
    'Di1',
    'Di1Csd',
    ['Di1CsdNonUp', 'Di1CsdNonLo'],
    di=True,
    non=True)


# NEWS COMMON TO OC1 AND DI1 BY PARAMETRIC ANALYSIS
par = Table.noticia_para_cada_dia('par',
    oc_par, noticias_relevantes,
    'Political_News_Related_to_both_OC1_and_DI1,_for_
        ↪ Parametric_Analysis')


# NEWS COMMON TO OC1 AND DI1 BY NON PARAMETRIC ANALYSIS
non = Table.noticia_para_cada_dia('non',
    oc_non, noticias_relevantes,
    'Political_News_Related_to_both_OC1_and_DI1,_for_Non_
        ↪ Parametric_Analysis')
```

8.2 Modules

8.2.1 Scrapping Spider

```
"""

Nome: Spider G1
Objetivo: Coletar informaeoes −titulo, texto e data − para
    ↪ cada uma
das noticias sonbre politica presentes no site do G1
```

```
Autor: Bernardo Paulsen
Data: 31/03/2019
Versao: 1.0.0
Detalhes versao: Tudo certo


O q vai fazer
    Entrada: "https://g1.globo.com/politica/"
    Saida: arquivo de texto com informacoes (titulo, data e
        ↪   link)
    sobre todas as noticias publicadas no site de entrada.
    Processamento: classe .Spyder vai buscar pelas
        ↪   informacoes
Planejamento de codigo:
    Procurar, no site, os links para ir para as paginas das
        ↪   noiticas
    publicadas, e tambem para ir ate a proxima pagina de
        ↪   noticias.
    Nas paginas das noticias, coletar titulo, data e link.
        ↪ Na
    proxima pagina de noticias, repetir o processo. Parar
        ↪ quando
    houver mais uma proxima pagina.


"""


import scrapy

n = 1

class news3(scrapy.Spider):
    name = 'g1'
    start_urls = ['https://g1.globo.com/politica/']
```

```python
def parse(self, response):
    global n
    # follow links to news pages
    for page in response.xpath('//div/div[2]/div/div/a/
        ↪ @href').getall():
        yield response.follow(page, self.parse_noticia)


    # follow pagination links
    n += 1
    if n <= 2000:
        next_page = ("https://g1.globo.com/politica/
            ↪ index/feed/pagina-%d.ghtml" % (n))
        yield response.follow(next_page, self.parse)


def parse_noticia(self, response):
    yield {
        'data': response.xpath('//time/text()')[0].get
            ↪ (),
        'titulo': response.xpath('//h1/text()')[2].get
            ↪ (),
        'link': response.url,
        }
```

8.2.2 Manipulation of News Data

```python
'''
NOME: Some Evidence on Political Information and Exchange
    ↪ Coupon in Brazil -
        News Module
AUTHOR: Bernardo Paulsen
DATE: 2019/06/24
```

```python
VERSION: 2.0.0
LINK: https://github.com/profnssorg/information-asset-
    ↪ returns

DESCRIPTION: Class for processing the news data

'''

# IMPORT PACKAGES ########


import pandas as pd


# CLASS DEFINITION ########


class News():

    def __init__(self):

        self.init = 'OK'

    # fazer lista com noticias do arquivo json
    def news(arq):
        arquivo = open(arq)
        lista = []
        i = 0
        for linha in arquivo.readlines():
            lista.append(linha[1:-3])
        lis = lista[1:-1]
        return (lis[::-1])
        arquivo.close()
```

```python
# arrumar lista das noticias, deixando bonitinho
def arrange(notic):
    lista = []
    for noticia in notic:
        lista.append('data: {}; hora: {}; titulo: {}; 
            ↪ link: {}'.format(noticia[10:20],
            noticia[21:26],
            noticia[noticia.find('titulo') + 10:noticia
                ↪ .find('link') - 4],
            noticia[noticia.find('link') + 8:]))
    return (lista)


# Criar lista com datas do ano
def days_of_year():
    ser = pd.DataFrame(index=pd.date_range('2016-09-26'
        ↪ , periods=964))
    return (ser)


#
#
# faz lista de todas as datas do ano, usado para
    ↪ colocar noticia no dia seguinte
def list_days(poxa):
    datas = []
    for coisa in poxa:
        data = str('{}/{}/{}'.format(coisa[8:10], coisa
            ↪ [5:7], coisa[:4]))
        if data not in datas:
            datas.append(data)
    return (datas)


#
#
#
```

```python
#
# lista de noticias com dia para o qual a noticia vale
def nextday(noticis, datas):
    completa = list()
    for noticia in noticis:
        data_noticia = noticia[6:16]
        hora_noticia = noticia[24:26]
        minuto_noticia = noticia[27:29]
        titulo_noticia = noticia[noticia.find('titulo')
            + 8:noticia.find('link') - 2]
        link_noticia = noticia[noticia.find('link') +
            6:]
        ja_achou = False
        for i in range(len(datas) - 1):
            data = datas[i]
            if ja_achou == False:
                if str(data_noticia) == str(data):
                    o = i
                    if int(hora_noticia) >= 18:
                        o += 1
                    completa.append('data: {}; hora: 
                        {}; minuto: {}; dia: {}; 
                        titulo: {}; link: {}'.format(
                        data_noticia,
                        hora_noticia,
                        minuto_noticia,
                        datas[o],
                        titulo_noticia,
                        link_noticia))
                    ja_achou = True
    return (completa)

#
#
```

```python
# Retorna lista com dia do ano e dia de cupom cambial
    ↪ correspondente
def correct(datas, serie):
    e = []
    for i in range(len(datas)):
        t = True
        n = i
        o = 0
        while t == True:
            if (datas.index[n] in serie.index) == True:
                e.append('{} ——— {}'.format(datas.index
                    ↪ [i], datas.index[n]))
                t = False
            else:
                n += 1
                if n > (len(datas) − 1):
                    t = False
    return (e)


# pega as noticias e coloca antes delas a data de cupom
    ↪ com a qual ela    relacionada
def join(eita, noti):
    opa = []
    for noticia in noti:
        ja = False
        data = noticia[45:55]
        for dia in eita:
            if ja == False:
                date = '{}/{}/{}'.format(dia[8:10], dia
                    ↪ [5:7], dia[:4])
                cup = '{}/{}/{}'.format(dia[32:34], dia
                    ↪ [29:31], dia[24:28])
                if data == date:
                    ja = True
```

```python
                        opa.append('cupom: {} // {}'.format
                        ↪ (cup, noticia))
        return (opa)


# separa as noticias que interessam
def separate_news(arq, palavras):
    lista = []
    for linha in arq:
        achou = False
        for palavra in palavras:
            if achou == False:
                if (palavra.lower() in linha.lower()[:
                    ↪ linha.find('link')]) == True:
                    lista.append(linha)
                    achou == True
    return (lista)


# transforma o formato do texto para o normal
def transform(lista):
    final = []
    asci = ['$', ';', '%', '\\u00f4', '\\u00f5', '\\
        ↪ u00e1', '\\u00e0',
    '\\u00e3', '\\u00e2', '\\u00e9', '\\u00ea','\\u00ed
        ↪ ', '\\u00f3',
    '\\u00fa', '\\u00e7']
    utf = ['\\$', ',', ' por cento', ' ', ' ', ' ',
        ↪ ' ', ' ', ' ', ' ',
    ' ', ' ', ' ', ' ', ' ']
    for noticia in lista:
        a = noticia
        ja = False
        for i in range(len(asci)):
            if ja == False:
                a = noticia.replace(asci[i], utf[i])
```

```
                    ja = True
            else :
                a = a.replace(asci[i], utf[i])
        final.append(a)
    return (final)
```

8.2.3 Importing of Time Series from BACEN-SGS

```
'''

NOME: Some Evidence on Political Information and Exchange
    ↪ Coupon in Brazil −
        BACEN SGS API Module
AUTHOR: Bernardo Paulsen
DATE: 2019/06/24
VERSION: 2.0.0
LINK: https://github.com/profnssorg/information−asset−
    ↪ returns

DESCRIPTION: Class for the import of data from BACEN SGS
    ↪ API

'''


# IMPORT PACKAGES ########


import pandas as pd


# DEFINING CLASS ########
```

```python
class ImportBacen():

    ''' CLASS WITH METHODS TO IMPORT DATA FROM BACEN SGS
        ↪ API '''

    def __init__(self):

        self.init = 'OK'

    def create(names=list(),  # names to be assign to
        ↪ series
        numbers=list(),  # series' numbers on SGS
        initial_date=str(),  # initial date
        final_date=str()):  # final date

        ''' CREATES DATAFRAME WITH BACEN–SGS SERIES '''

        for i in range(len(names)):

            name = str(names[i])

            url = 'http://api.bcb.gov.br/dados'
            url += '/serie/bcdata.sgs.{}'.format(numbers[i
                ↪ ])
            url += '/dados?formato=csv&'
            url += '&dataInicial={}&dataFinal={}'.format(
                ↪ initial_date,
                final_date)
            df = pd.read_csv(url,
                sep=';', index_col=0, parse_dates=[0],
                infer_datetime_format=True, decimal=',')

            if not i:
                DF = pd.DataFrame({name: df.valor},
```

```python
                         index=df.index)
            else:
                DF[name] = df.valor


        return (DF)



    def append(self,            # DataFrame to append Series
        names=list(),           # names to be assign to Series
        numbers=list(),         # series' numbers on SGS
        initial_date=str(),     # initial date
        final_date=str()):      # final date


        ''' APPENDS BACEN–SGS SERIES TO DATAFRAME '''


        for i in range(len(names)):


            name = str(names[i])


            url = 'http://api.bcb.gov.br/dados'
            url += '/serie/bcdata.sgs.{}'.format(numbers[i
              ↪ ])
            url += '/dados?formato=csv&'
            url += '&dataInicial={}&dataFinal={}'.format(
              ↪ initial_date,
                final_date)


            df = pd.read_csv(url, sep=';', index_col=0,
              ↪ parse_dates=[0],
                infer_datetime_format=True, decimal=',')
            self[name] = df.valor
```

8.2.4 Useful Calculations on Time Series

```python
"""
NOME: Some Evidence on Political Information and Exchange
↪ Coupon in Brazil −
     Calculations Module
AUTHOR: Bernardo Paulsen
DATE: 2019/07/09
VERSION: 2.0.0
LINK: https://github.com/profnssorg/information−asset−
↪ returns

DESCRIPTION: Class for the output of graphs' image and
↪ latex text

"""



######## IMPORT PACKAGES ########



from arch import arch_model
import numpy as np
from scipy import stats



######## CLASS DEFINITION ########


class Calculations():

    def __init__(self):

        self.init = 'OK'
```

```python
def exchange_coupon(self, # DataFrame containing the
    ↪ Series for the exchange coupon
                    dol=str(), # column number of
                        ↪ exchange rate Series
                    rs=list(),
                    # columns numbers for interest
                        ↪ rates Series (min 1 number,
                        ↪ if > 1 then more than one
                        ↪ measure of exchange coupon is
                        ↪ generated)
                    names=list()): # names for
                        ↪ exchange coupons

    '''APPENDS EXCHANGE COUPON TO DATAFRAME'''

    for i in range(len(rs)):
        self[names[i]] = ( (1 + self[rs[i]].shift(1) /
            ↪ 100) / (self[dol] / self[dol].shift(1)) -
            ↪ 1)


def garch(self, # DataFrame containing the Series
        cols=list()): # columns numbers of Series

    '''APPENDS GARCH'S CSD AND RESIDUALS TO DATAFRAME
        ↪ '''

    for i in range(len(cols)):
        fitted_model = arch_model(self[cols[i]][1:]).
            ↪ fit()
        self['{}Csd'.format(cols[i])] = fitted_model.
            ↪ conditional_volatility
        self['{}Res'.format(cols[i])] = fitted_model.
            ↪ resid
```

```python
def limits(self,   # DataFrame containing the Series
           cols=list()):   # columns numbers of Series

    '''APPENDS PARAMETRIC AND NON PARAMETRIC LIMITS TO
     ↪ DATAFRAME'''

    def create(par = True,
        up=True):

        '''RETURNS ARRAY OF PARAMETRIC LIMIT (UPPER OR
         ↪ LOWER)'''

        if par:
            mean = series.mean()
            std = series.std()
        if not par:
            mean = series.rolling(window=63,
                ↪ min_periods=0, center=True).mean()
            std = series.rolling(window=63, min_periods
                ↪ =0, center=True).std()

        if up:
            value = mean + stats.norm.ppf(q=0.975) * (
                ↪ std)
        if not up:
            value = mean − stats.norm.ppf(q=0.975) * (
                ↪ std)

        return (value)

    for e in range(len(cols)):
        name = self.columns[cols[e]]
        series = self[name]
```

```
                    # PARAMETRIC
                    # ——––UPPER
                    self['{}ParUp'.format(name)] = create(par =
                      ↪ True, up=True)
                    # ——––LOWER
                    self['{}ParLo'.format(name)] = create(par =
                      ↪ True, up=False)
                    # NON PARAMETRIC
                    # ——––UPPER
                    self['{}NonUp'.format(name)] = create(par =
                      ↪ False, up=True)
                    # ——––LOWER
                    self['{}NonLo'.format(name)] = create(par =
                      ↪ False, up=False)
```

8.2.5 Output of Graphs

```
"""
NOME: Some Evidence on Political  Information and Exchange
  ↪ Coupon in Brazil  –
      Graph Module
AUTHOR: Bernardo Paulsen
DATE: 2019/06/24
VERSION: 2.0.0
LINK: https://github.com/profnssorg/information-asset-
  ↪ returns


DESCRIPTION: Class for the output of graphs' image and
  ↪ latex text

"""
```

```python
# IMPORTING PACKAGES ########


from matplotlib import pyplot as plt # graphs
from matplotlib import dates as mdates # dates on graphs


# DEFINING CLASS ########


class Graph():

    ''' CLASS FOR THE OUTPUT OF GRAPHS '''

    def __init__(self):

        self.init = 'OK'

    def series(series=list(), # list with Series to be
       ↪ plotted
       legends=list(), # legends for Series. if empty,
          ↪ legends are not included
       y_axis=str(), # name of y axis
       title=str(), # title of graphic in LaTeX
       label=str()): # label to use in LaTeX

        lines = ['solid', 'dashed', 'dashdot', 'dotted']

        for i in range(len(series)):
            ax = series[i].plot(figsize=(8, 5), color='
               ↪ black', linestyle=lines[i])
        if len(legends) > 0:
            ax.legend(legends)
```

```python
        ax.grid(axis='x')
        ax.xaxis.set_major_locator(mdates.YearLocator())
        ax.xaxis.set_major_formatter(mdates.DateFormatter('
          ↪ %m-%Y'))
        plt.gcf().autofmt_xdate()
        plt.xlabel('Date')
        plt.ylabel(y_axis)
        plt.savefig('latex/graphs/{}'.format(label), dpi
          ↪ =200)
        plt.show()


        a = open('latex/graphstext/{}.txt'.format(label), '
          ↪ w')
        a.write('''\\begin{{figure}}[H]
\\caption{{{0}}}
\\label{{fig:{1}}}
\\centering
\\includegraphics[width=\\textwidth]{{graphs/{1}.png}}
\\end{{figure}}'''.format(title, label))
        a.close()


    def multiple(tup=tuple()):

        '''FOR VARIOUS GRAPHS '''

        for i in range(len(tup)):
            Graph.series(tup[i][0],
                tup[i][1],
                tup[i][2],
                tup[i][3],
                tup[i][4], )
```

8.2.6 Output of Tables

```
'''

NOME: Some Evidence on Political Information and Exchange
    ↪ Coupon in Brazil −
        Tables Module
AUTHOR: Bernardo Paulsen
DATE: 2019/06/24
VERSION: 2.0.0
LINK: https://github.com/profnssorg/information−asset−
    ↪ returns


DESCRIPTION: Class for the output of latex tables

'''



# IMPORT PACKAGES ########



import pandas as pd
from scipy import stats
import statsmodels.tsa.stattools as stat # adf, kpss,
    ↪ shapito white
import statsmodels.stats.diagnostic as dig #ljung box



# CLASS DEFINITION ########



class Table():

    def __init__(self):
```

```python
        self.init = 'OK'


    def des(title=str(),  # series names for input in table
        → 's title
        label=str(),
        series=list(),
        names=list()):


        '''TABLE WITH DESCRIPTIVE STATISTICS'''


        b = open('latex/tables/{}.txt'.format(label), 'w')
        a = '''\\begin{{table}}[H]
\\caption{{Descriptive Statistics for {}}}
\\label{{tab:{}}}
\\centering
\\begin{{tabular}}{{ | c | c | c | c | c | }}
\\hline
Series & Mean & Standard Deviation & Minimum Value &
    → Maximum Value \\\\
\\hline \\hline'''.format(title, label)
        for i in range(len(series)):
            var = series[i]
            a += '\n{0}_&_{1:.3f}_&_{2:.3f}_&_{3:.3f}_&_
                → {4:.3f}_\\\\'.format(names[i],
                var.mean(),
                var.std(),
                var.min(),
                var.max())
            a += '\n\\hline'
        a += '''\n\\end{tabular}
\\end{table}'''
        b.write(a)
        b.close()
```

```python
def adf(label=str(),
        series=list(),
        names=list()):

    '''TABLE FOR AUGMENTED DICKEY-FULLER TEST'''

    b = open('latex/tables/{}.txt'.format(label), 'w')
    a = '''\\begin{{table}}[H]
\\caption{{Augmented Dickey-Fuller Test}}
\\label{{tab:{}}}
\\centering
\\begin{{tabular}}{{ | c | c | c | }}
\\hline
Series & Test Statistic & Critical Value at 5\% Level \\\\
\\hline \\hline '''.format(label)
    for i in range(len(series)):
        adf = stat.adfuller(series[i][1:])
        a += '\n{0} & {1:.3e} & {2:.3e} \\\\'.format(
            names[i],
            adf[0],
            adf[4]['5%'])
        a += '\n\\hline'
    a += '''\n\\end{tabular}
\\end{table}'''
    b.write(a)
    b.close()


def kpss(label=str(),
         variables=list(),
         names=list()):

    '''TABLE FOR KWIATKOWSKI-PHILLIPS-SCHMIDT-SHIN TEST
        '''
```

```python
        b = open('latex/tables/{}.txt'.format(label), 'w')
        a = '''\\begin{{table}}[H]
\\caption{{ K w i a t k o w s k i PhillipsSchmidtShin    Test}}
\\label{{tab:{}}}
\\centering
\\begin{{tabular}}{{ | c | c | c | }}
\\hline
Series & Test Statistic & Critical Value at 5\\% Level \\\\
\\hline \\hline '''.format(label)
        for i in range(len(variables)):
            kpss = stat.kpss(variables[i][1:])
            a += '\n{0} & {1:.3e} & {2:.3e} \\\\'.format(
                → names[i],
                  kpss[0],
                  kpss[3]['5%'])
            a += '\n\\hline'
        a += '''\n\\end{tabular}
\\end{table}'''
        b.write(a)
        b.close()


    def ljung(label=str(),
        variables=list(),
        names=list()):

        '''TABLE FOR LJUNG–BOX TEST'''

        b = open('latex/tables/{}.txt'.format(label), 'w')
        a = '''\\begin{{table}}[H]
\\caption{{Ljung−Box Test}}
\\label{{tab:{}}}
\\centering
\\begin{{tabular}}{{ | c | c | }}
```

```python
\\ hline
Series & P-value \\\\
\\ hline \\ hline '''.format(label)
        for i in range(len(variables)):
            var = variables[i][1:]
            a += '\n{0}_&_{1:.3e}_\\\\'.format(names[i],
                dig.acorr_ljungbox(var)[1][39])
            a += '\n\\hline'
        a += '''\n\\end{tabular}
\\end{table}'''
        b.write(a)
        b.close()


    def shapiro(label=str(),
        variables=list(),
        names=list()):


        '''TABLE FOR SHAPIRO-WILK TEST'''


        b = open('latex/tables/{}.txt'.format(label), 'w')
        a = '''\\begin{{table}}[H]
\\caption{{Shapiro-Wilk Test}}
\\label{{tab:{}}}
\\centering
\\begin{{tabular}}{{ | c | c | }}
\\hline
Series & P-value \\\\
\\hline \\hline '''.format(label)
        for i in range(len(variables)):
            var = variables[i][1:]
            a += '\n{0}_&_{1:.3e}_\\\\'.format(names[i],
                stats.shapiro(var)[1])
            a += '\n\\hline'
        a += '''\n\\end{tabular}
```

```
\\end{table}'''
        b.write(a)
        b.close()


    def limits(label=str(),
        upper_limits=list(),
        lower_limits=list(),
        names=list(),
        par=True):

        '''TABLE WITH LIMITS'''

        if par == True:
            title = 'Parametric'
            up = 'Upper Limit'
            lo = 'Lower Limit'
        else:
            title = 'Non Parametric'
            up = 'Mean of Upper Limits'
            lo = 'Mean of Lower Limits'

        b = open('latex/tables/{}.txt'.format(label), 'w')
        a = '''\\begin{{table}}[H]
\\caption{{Limits from {} Analysis}}
\\label{{tab:{}}}
\\centering
\\begin{{tabular}}{{ | c | c | c | c | c | }}
\\hline
Series & {} & {} \\\\
\\hline \\hline '''.format(title, label, up, lo)
        for i in range(len(upper_limits)):
            upper = upper_limits[i]
            lower = lower_limits[i]
```

```python
        a += '\n{0}_&_{1:.3f}_&_{2:.3f}_\\\\'.format(
            ↪ names[i],
            upper.mean(),
            lower.mean())
        a += '\n\\hline'
    a += '''\n\\end{tabular}
\\end{table}'''
        b.write(a)
        b.close()


    def outside(label=str(),
        df=pd.DataFrame(),
        ec=str(),
        csd=str(),
        limits=list(),
        di=False,
        non=False):


        '''TABLE WITH DAYS WITH ABNORMAL VOLATILITY'''


        exc_cou = df[ec]
        con_std = df[csd]
        upp_lim = df[limits[0]]
        low_lim = df[limits[1]]


        dias = []
        if di == False:
            cupom = 'OC1'
        else:
            cupom = 'DI1'


        if non == False:
            anal = 'Parametric'
        else:
```

```python
        anal = 'Non_Parametric'


        b = open('latex/tables/{}.txt'.format(label), 'w')
        a = '''\\begin{{table}}[H]
\\caption{{Days with Abnormal Returns for {} Exchange
    ↪ Coupon by {} Analysis}}
\\label{{tab:{}}}
\\centering
\\begin{{tabular}}{{| c | c | c | c | c | c |}}
\\hline
& Date & Exchange Coupon & CSD & Lower Limit & Upper Limit
    ↪ \\\\
\\hline \\hline '''.format(cupom, anal, label)
        n = 0
        for i in range(len(con_std.index)):
            if con_std[i] > upp_lim[i] or con_std[i] <
                ↪ low_lim[i]:
                poxa = con_std.index[i]
                date = '{}/{}/{}'.format(str(poxa)[:4], str
                    ↪ (poxa)[5:7], str(poxa)[8:10])
                n += 1
                dias.append(upp_lim.index[i])
                a += '\n{0}_&_{1}_&_{2:.3f}_&_{3:.3f}_&_
                    ↪ {4:.3f}_&_{5:.3f}\\\\'.format(n,
                      date,
                      exc_cou[i],
                      con_std[i],
                      low_lim[i],
                      upp_lim[i])
                a += '\n\\hline'
        a += '''\n\\end{tabular}
\\end{table}'''
        b.write(a)
        b.close()
```

```python
        return (dias)


    def noticia_para_cada_dia(refName, dias, noticias,
        ↪ titulo):


        ''' TABLE WITH NEWS IN EACH DAY OF ABNORMAL
            ↪ VOLATILITY '''


        diass = list()
        for poxa in dias:
            diass.append('{}/{}/{}'.format(str(poxa)[8:10],
                ↪ str(poxa)[5:7], str(poxa)[:4]))


        lista = list()


        b = open('latex/tables/{}.txt'.format(refName), 'w'
            ↪ )
        a = '''\\begin{{longtable}}{{ | c | c | c | c | }}
\\caption{{{}}}
\\label{{tab:{}}}
\\hline \\multicolumn{{1}}{{|c|}}{{\\textbf{{}}}} & \\
    ↪ multicolumn{{1}}{{c|}}{{\\textbf{{Ab. Vol.}}}} & \\
    ↪ multicolumn{{1}}{{c|}}{{\\textbf{{News Time}}}} & \\
    ↪ multicolumn{{1}}{{c|}}{{\\textbf{{Headline}}}} \\\\
    ↪ \\hline \\hline
\\endfirsthead
\\multicolumn{{4}}{{c}}%
{{{{\\bfseries \\tablename\\ \\thetable{{}} —— continued
    ↪ from previous page}}}} \\\\
\\hline \\multicolumn{{1}}{{|c|}}{{\\textbf{{}}}} & \\
    ↪ multicolumn{{1}}{{c|}}{{\\textbf{{Ab. Vol.}}}} & \\
    ↪ multicolumn{{1}}{{c|}}{{\\textbf{{News Time}}}} & \\
    ↪ multicolumn{{1}}{{c|}}{{\\textbf{{Headline}}}} \\\\
    ↪ \\hline \\hline
```

```python
\\ endhead
\\ hline \\ hline \\ multicolumn {{4}}{{| r |}}{{{{ Continued on
    ↪    next page }}}} \\\\ \\ hline
\\ endfoot
\\ hline \\ hline \\ multicolumn {{4}}{{| r |}}{{ End of table }}
    ↪    \\\\ \\ hline
\\ endlastfoot '''. format ( titulo , refName )
        n = 0
        for dia in diass :
            for noticia in noticias :
                if ( dia in noticia [7:17]) :
                    data_cupom = '{}/{}/{}'. format ( noticia
                        ↪ [13:17] ,
                        noticia [10:12] ,
                        noticia [7:9])
                    data_hora_noticia = '{}/{}_{}:{}'.
                        ↪ format ( noticia [30:32] ,
                        noticia [27:29] ,
                        noticia [45:47] ,
                        noticia [57:59])
                    n += 1
                    a += '\n{}_&_{}_&_{}_&_{}[...]_\\\\'.
                        ↪ format (n ,
                        data_cupom ,
                        data_hora_noticia ,
                        noticia [ noticia . find ('titulo') + 8:
                            ↪ noticia . find ('titulo') + 49])
                    a += '\n\\ hline '
                    lista . append ( noticia )
        a += '''\n\\ end{longtable}'''
        b. write (a)
        b. close ()
        return ( lista )
```

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