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Do the Political News impact Financial Markets? Evidences from Brazil

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

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Porto Alegre
December 2016

"Science is the great antidote to the poison of enthusiasm and superstition.."

— ADAM SMITH

ACKNOWLEDGMENTS

To my family, Mariana and the community of Stack Overflow

ABSTRACT

This study investigate if political news in Brazil impact Financial Markets. We used web scraping to look for news on the internet and measured their impact on Bovespa Index through the event study methodology. To estimate the normal returns we used a GARCH model. The only news that impacted the market was the opening of the impeachment process against the ex-president Ms. Rousseff, but our model captured a significantly number of news related to the uncertainty about China, besides that wasn't considered a Political News but a Economical News.

Keywords: Event study. political events. financial markets. efficient markets.

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LIST OF ABBREVIATIONS AND ACRONYMS

IR   Ibovespa Returns

Selic   Selic Over

Ibovespa Bovespa Index

CONTENTS

1 INTRODUCTION

The recent political events in Brazil has been grabbing the media's attention. It is normal to find these vehicles associating the political events with financial markets oscillation. Nevertheless, this common sense approach to market prices runs into efficient market hypothesis as posed by Fama (1970).

Actually, the impact of political events on financial markets is a widespread issue. Smales (2015) measured the role of political uncertainty on implied volatility with macroeconomics variables in the regression model and Australian Financial Market data. Jovanovic & Zimmermann (2008) tested whether U.S. Federal Reserve (FED) reacts to market's uncertainty. They concluded that FED decreases the interest rates in periods of abnormal volatility in the stock market and raise them in the opposite case, notwithstanding with inflation rates. In South Africa's Financial Markets, Naraidoo & Raputsoane (2015) found interest rates are guided by inflation uncertainty. PERLIN et al. (2014 founded an interesting result where the search frequency of finance-related words can impact financial variables such as volatility, returns and trade volume.

In this paper, we analyzed whether fixed income and the stock market are impacted by political news. To do so we used a web scraping technique to look on the internet for political news. After that we applied a GARCH model to estimate the normal returns, with that information we used the event study methodology to measure the impact of political news on the Stock Market.

This paper is organized as follows. Chapter 2 is a quick introduction to Brazilian Political Institutions and to the Financial System, which has some singularities compared to countries like United States, France and England. The Chapter 3 is a literature review. The Chapter 4 has the Empirical Strategy, the sections are: Web Scraping, Data, Methods. Section 5 has the Results and Discussion. Chapter 6 has Concluding Remarks and Chapter 7 is the Appendix which contains all the Python and R code used in this study and the news scraped

2 BRAZILIAN POLITICAL INSTITUTIONS AND FINANCIAL SYSTEM

Brazil is a federative republic with a presidential system, where the legislative, executive and judiciary branches of government are independents from each other. The president is elected for a four-year administration and can be reelected for only one subsequent term (Brazil, 2016) . The president chooses his ministers and the president of Central Bank of Brazil. The last one needs to be approved by the senate and he can be fired at any moment, in other words, the Central Bank is not independent.

The Table 2.1 shows the composition of the Brazilian Financial System.

Table 2.1: Brazilian Financial System

Regulating entities	Supervision Entities	Operators				
National Monetary Council (CMN)	Central Bank of Brazil (BCB)	Financial institutions taking demand deposits	Other financial institutions Foreign exchange banks	Other financial intermediaries and entities administering financial assets of third parties		
	Securities and Exchange Commission (CVM)	Commodities and futures exchanges	Stock exchanges			
National Council for Private Insurance (CNSP)	Private Insurance Superintendence (SUSEP)	Reinsurance Companies	Insurance companies	Capitalization companies	Entities operating private open pension funds	
National Council for Complementary Pension (CNPC)	National Complementary Pension Superintendency (PREVIC)	Entities operating private closed pension funds				

Source: Central Bank of Brazil

Financial system is built upon Law 4595/1964 1950, which establishes National Monetary Council (CMN) as the major normative institution of Brazilian Financial System. The institution is composed by the Minister of Finance, Minister of Planning and President of Central Bank of Brazil. The objectives of CMN are defining monetary and exchange rate policies and establishing rules for the financial system.

The Central Bank of Brazil, according to the Constitution 2016, has the monopoly of notes issuance, is the government's banker and also the banker's bank, along with this, the Central Bank is the supervisor of the financial system, the executor of monetary and exchange rate policies.

In June, 1999, Brazil adopted the inflation targeting regime, where the CMN defines the inflation target and the Central Bank pursues this target using monetary policy, although there is a tolerance level for that target. Actually, Monetary Policy Committee (Copom) is Central Bank decision making body on monetary policy responsible for setting the target of short-term interest rate (Selic). There is Copom's meetings each forty-five days and an official note is released informing the directions of the Selic rate target.

In fact, Brazil has only one stock exchange, the BM&FBovespa, which is a company that manages the organized securities, commodities and derivatives markets. According to the BM&FBovespa 2016 "The Bovespa Index (Ibovespa) is compiled as a weighted average of a theoretical portfolio of stocks pursuant to criteria set forth in this methodology". Only shares and units listed on BM&FBovespa that are within the inclusion criteria can compose the index.

The Clearing House for the Custody and Financial Settlement of Securities (CETIP) is a "depositary" of mainly private fixed income, state and city public securities and some securities representing National Treasury debts" (Central Bank of Brazil, 2016a).

3 POLITICAL UNCERTAINTY AND FINANCIAL MARKETS INFORMATIONAL EFFICIENCY

Fama (1970) defined market efficiency in terms of information organized three information subsets to efficient markets: the weak form, where the information set includes only the history of prices; the semi-strong form, where the information set is the publicly available information; and the strong form, where the information set includes all the information, including the private information. In the strong form the existence of abnormal returns is not possible, because the information is repassed so rapidly to the prices that makes impossible to achieve gains.

There is massive literature of empirical analysis of efficient markets hypothesis (EMH). This paper focused to review the literature about these markets on emerging countries. Kamal (2014) studied the Egyptian Exchange (EGX) before and after the $25nth$ January Revolution when the stock market was closed and, for both cases, rejected the weak-form efficiency hypothesis.

Dong, Bowers, & Latham (2013) studied the relationship of the markets around the world and if they are efficient. The authors realized that, to the market be at least efficient, it can't exist any global or regional leader on the market, but they founded evidences of this existence, these conclusion violates the EMH.

Recently, in Brazil, Gabriel, Ribeiro, & de Sousa Ribeiro (2013) studied the behavior of stock prices of companies that belong to segment of "white line" household appliances, furniture, papers and cellulose during the period of the announcement by Brazilian government of reduction of Industrial Products Tax (IPI) in March of 2012. Using the event study, the results leaded to the conclusion that the market wasn't showed the behavior of EMH, especially the semi-strong form.

Baker, Bloom and Davis (2012) and Baker, Bloom and Davis (2015), realized that, before 2008 crises, the stock market usually moved in response to economic news, however this changed after the subprime crisis, the actions of policy-makers and their statements are impacting directly the stock market. The authors created an index to measure the policy uncertainty where they combine three types of information:

> "(. . .) frequency of newspaper articles that reference economic uncertainty and the role of policy; the number of federal tax code provisions that are set to expire in coming years; the extent of disagreement among economic forecasters about future inflation and future government spending on goods and services" (BAKER; BLOOM; DAVIS, 2012)

At the same time, they created another index to measure the policy uncertainty

searching for news on Google News using keywords as 'uncertain' or 'uncertainty' with 'economic' or 'economy'.

According to Jovanic & Zimmermann (2008), the FED of United States reacts to uncertainty reducing the interest rates when there is high volatility in the stock market and raises in the opposite case, ignoring the inflation control of the last 15 years before the study. Laakkonen (2015) studies the fixed income of United States from investors' viewpoint and how they react to uncertainty. The author uses the volatility of Ten Years US Treasury Note futures and concluded that investors reacts stronger when news are associated with low uncertainty, raising the volatility and the trade volume of those future contracts. The paper uses three types of uncertainties: the macroeconomic, discordance between professional forecasters about the macroeconomic scenario, the financial uncertainty, which is measure through the VIX and the political uncertainty, which is measure by the policy uncertainty index by Baker, Bloom and Davis 2012. The conclusion was that investor react to news significantly stronger when uncertainty is low and they are more sensitive to uncertainty in the financial market.

Smales (2015) analyzed the Australian electoral cycle and the uncertainty from the real economy and financial markets. He found the implied volatility of equity and bond options increases with the election uncertainty, that is, there exists a relationship between financial market uncertainty and political uncertainty.

On the other side, in South Africa, which has a monetary policy institutional framework similar to Brazil's, Naraidoo & Raputsoane (2015) found interest rates are guided by inflation uncertainty, output gap and financial conditions. The author defined financial conditions with the financial condition index, which is made up by the average price of all houses, the real stock prices, the real effective exchange rate, the credit spread, and the future spread.

4 EMPIRICAL STRATEGY

We tested the impact of political news in stock market, private fixed income and public fixed income through Ibovespa Index, DI and Selic Over, respectively. Thew news were collected with web scraping technique, presented at the section 4.1. Once we obtained the data, we applied GARCH only to Ibovespa Returns Series because both of fixed income series had a similar behavior, which is explored at subsection 4.3.2. With the GARCH results, we used Event Study (MACKINLAY, 1997) methodology to measure the impact of political news on the Ibovespa Index and finally analyzing the content of the news obtained and associating them with economic theory

4.1 Web Scraping

> In theory, web scraping is the practice of gathering data through any means other than a program interacting with an API (or, obviously, through a human using a web browser). This is most commonly accomplished by writing an automated program that queries a web server, requests data (usually in the form of the HTML and other files that comprise web pages), and then parses that data to extract needed information. (MITCHELL, 2015, Preface)
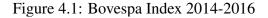
We developed a program in Python to web scrap G1's website, a Brazilian news portal maintained by Rede Globo. Inspired in Baker, Bloom and Davis (2015), we chose three keywords to our program search in G1: *economia*, *política* and *incerteza*. In English these three words mean economics, policy and uncertainty, respectively. The program is available in the Appendix.

All the news which occurred in weekends was pushed forward to Monday, this was used to assure that event study methodology will capture all the political events caught with our web scraper.

4.2 Data

We collect a sample of Bovespa Index, DI and SELIC, because those prices are the most used one to evaluate conditions of capital and private and public bond markets in Brazil, respectively. The first one was collected from the Brazil's Central Bank Time Series Management System (Central Bank of Brazil, 2016c) at 05/11/2016 in the CSV format. The code of Bovespa Index is 7. The series started at 01/02/2014 and ended

at 04/29/2016 and was daily separated. The Figure 4.1 shows the series through the time.item

Figure 4.1: Bovespa Index 2014-2016

A crisis started to surround the Brazilian economy in 2014, which was the year of presidential elections where Ms. Rousseff was reelected to other 4-years mandate. The year of 2015 was marked by the explosion of the crisis, the fall of the Ms. Rousseff's popularity reflected on the popular manifestations demanding the impeachment of her, the failed attempt of government to recover credibility by nominating an orthodox economist to lead the Ministry of Finance and was also marked by the evolution of investigations of corrupt practices with the Brazilian state-controlled oil company, Petrobras. At last, in 2016 the president impeachment happened, where Mr. Temer, a center-right politician and also vice- president, assumed the presidency.

We calculated the returns of Ibovespa in the Equation 4.1

$$IbovespaReturns_t = \ln(\frac{Ibovespa_t}{Ibovespa_{t-1}}) \tag{4.1}$$

We tested the Ibovespa Returns (IR) to observe if the series has unit root and if the series is stationary by using the Augmented Dickey-Fuller (ADF) test (1979) and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test (1992), respectively. Visually, the
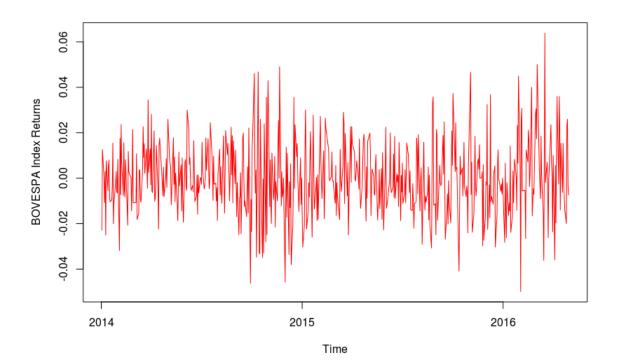
Figure 4.2: Bovespa Index Returns 2014-2016

Figure 4.2 shows a stationarity form, to confirm this hypothesis, the Table 4.1 and Table 4.2 returns the results obtained.

Table 4.1: ADF Critical Values (IR)

	1pct	5pct	10pct	statistic
tau1	-2.5800	-1.9500	-1.6200	-17.0055

Table 4.2: KPSS Critical Values (IR)

test	10pct	5pct	2.5pct	1pct
0.0919	0.3470	0.4630	0.5740	0.7390

The ADF Test rejected the Null Hypothesis of unit root's existence and the KPSS Test accepted the Null Hypothesis of stationarity.

To study the fixed income of private market, we chose the Interbank Deposit, which is calculated by CETIP. We extracted the data from the CETIP webpage (2016a) at 05/11/2016 in the XLS format. The series starts at 01/02/2014 and ends at 04/29/2016. To measure the Interbank Deposit rate (DI), it's necessary to adjust the through the Equation 4.2. The file is only available in Portuguese, daily factor is fator diário in the XLS file.

$$X_t = Fator Diario - 1 \tag{4.2}$$

The Figure 4.3 shows a deterministic trend. The Hypothesis of unit root of ADF Test was accepted and the Null Hypothesis of stationarity of KPSS Test was rejected, implying in non- stationarity. The Table 4.3 and Table 5 returns the results obtained from the tests.

Figure 4.3: DI 2014-2016

Table 4.3: ADF Critical Values (DI)

	1pct	5pct	10pct	statistics
tau3	-3.96	-3.41	-3.12	-1.21
phi2	6.09	4.68	4.03	3.95
phi3	8.27	6.25	5.34	1.24

Table 4.4: KPSS Critical Values (DI)

test	10pct	5pct	2.5pct	1pct
0.3567	0.1190	0.1460	0.1760	0.2160

We solved the unit root problem, as showed at Table 4.5 and Table 4.6, using the daily variation of the DI. The Figure 4 shows the behavior of the data.

Figure 4.4: DI's Daily Variation 2014-2016

Table 4.5: ADF Critical Values (DI's Daily Variation)

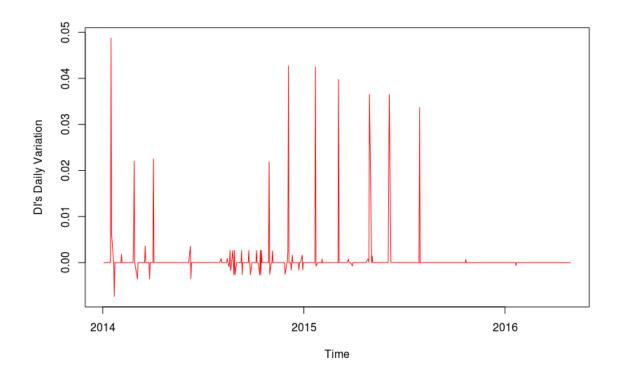|	1pct	5pct	10pct	statistics
tau1	-2.5800	-1.9500	-1.6200	-16.7175

Table 4.6: KPSS Critical Values (DI's Daily Variation)

test	10pct	5pct	2.5pct	1pct
0.3063	0.3470	0.4630	0.5740	0.7390

It's important distinct the Selic Target from the Selic Over, the real interest rate. In this paper the Selic Over is the object of study.

We collected the Selic Over sample from Brazil's Central Bank web-page (2016b) at 06/30/2016 in the xls format. The series started at 01/02/2014 and ended at 04/29/2016 and was daily separated.

As expected, the Figure 4.5 shows that Selic Over is similar with DI, ahead the analysis, this similarity is explored.

The ADF Test accepted the null hypothesis, implying in existence of unit root. The evidence of non-stationarity was found at KPSS Test. The Table 4.7 and Table 4.8 shows the results of both tests.

Figure 4.5: Selic Over 2014-2016

Table 4.7: ADF Critical Values (Selic Over)

	1pct	5pct	10pct	statistic
tau3	-3.9600	-3.4100	-3.1200	-1.1732
phi2	6.0900	4.6800	4.0300	4.0261
phi3	8.2700	6.2500	5.3400	1.1783

Table 4.8: KPSS Critical Values (Selic Over)

test	10pct	5pct	2.5pct	1pct
0.3559	0.1190	0.1460	0.1760	0.2160

Along with the DI, we solved the Selic unit root using the daily variation of the series.

The Figure 4.6 shows the behavior of the data and the Table 4.9 and Table 4.10 shows, respectively, the rejection of unit root existence and non-stationarity

Table 4.9: ADF Critical Values (Selic Over Daily Variation)

	1pct	5pct	10pct	statistic
tau1	-2.5800	-1.9500	-1.6200	-16.9800

The Table 4.11 and Table 4.12 contains the descriptive statistics of the five series.

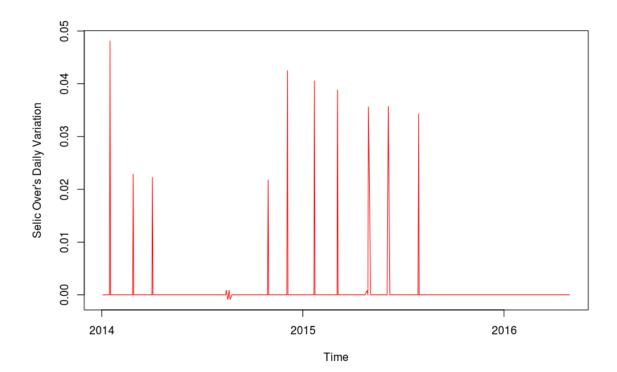Figure 4.6: Selic Over Daily Variation 2014-2016

Table 4.10: Selic Over Daily Variation

test	10pct	5pct	2.5pct	1pct
0.2963	0.3470	0.4630	0.5740	0.7390

Table 4.11: Descriptive Statistics

Statistic	N	Mean	St. Dev.	Min	Max
Ibovespa	584	50,441.36	4,681.578	37,497	61,895
Ibovespa Returns	584	0.000078	0.016094	−0.04988	0.063867
DI	584	0.000462	0.000054	0.00037	0.000525
Selic Over	584	0.000464	0.000053	0.000375	0.000525

Table 4.12: Descriptive Statistics of Selic and DI Daily Variation

Statistic	N	Mean	St. Dev.	Min	Max
DI's Daily Variation	583	0.000610	0.004724	−0.007368	0.048759
Selic Over Daily Variation	583	0.000590	0.004594	−0.000876	0.048094

All the political news in periods of abnormal returns were shown at Table 4.13. 24 news in 12 different days were found. In the section 5 we analyzed each one of these news.

Table 4.13: Political News in Periods of Market Stress

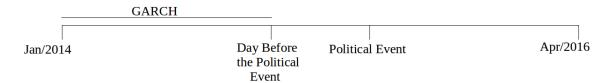| Date	Event Title
2015-08-07	Economia - Banco central da China faz alerta sobre níveis crescentes de dívida
2015-08-24	Economia - 37,3% dos empresários do comércio estão com estoque acima do desejado
2015-08-24	G1 - Dólar dispara e chega a bater R$ 3,58, máxima em mais de 12 anos,- notícias em Mercados
2015-08-24	Economia - Em cenário de incerteza e alta do juro, governo diz que dívida será mais alta
2015-08-24	G1 - Bovespa fecha no menor nível desde 2009 com temores sobre China - notícias em Mercados
2015-08-26	Economia - Consumo de máquinas cai e deve encerrar ano em baixa de até 15%
2015-08-26	Economia - Moody's acredita que gastos do governo continuarão subindo
2015-08-27	G1 - Demanda por crédito tem queda de 9,9% no acumulado do ano - notícias em Seu Dinheiro
2015-10-02	G1 - Dólar fecha em queda e termina semana abaixo de R$ 4,- notícias em Mercados
2015-10-13	G1 - Dólar opera em alta e chega a R$ 3,88, com China e incerteza política - notícias em Mercados
2015-10-13	G1 - Dólar sobe mais de 3% e encosta em R$ 3,90, com preocupações políticas - notícias em Mercados
2015-11-03	Economia - BCE vê sucesso de programa de estímulos antes de possível extensão
2015-11-03	Economia - Atividade industrial atinge o nível mais fraco em 6 anos e meio, diz PMI
2015-11-03	G1 - Real fraco e gasto reduzido ameaçam caixa da Petrobras, diz Moody's - notícias em Negócios
2015-11-03	G1 - Dilma afirma que 'reorganização' da economia não afetará políticas sociais - notícias em Distrito Federal
2015-11-25	Economia - Brasil tem ingresso de US$ 10 bilhões no acumulado de 2015
2015-11-25	G1 - Cenário econômico da região é debatido em seminário gratuito - notícias em Presidente Prudente e Região
2015-11-25	Economia - Dividido, Copom decide manter os juros em 14,25% ao ano
2015-12-03	Economia - BC vai 'monitorar' cenário para definir próximos passos da política de juros
2015-12-03	Jornal Nacional - Mercado reage à decisão de Cunha sobre impeachment
2015-12-03	G1 - Hartung pede para que decisão sobre impeachment seja resolvida logo - notícias em Espírito Santo
2015-12-09	Jornal da Globo - Crise política afeta a economia e também a previsão do PIB do Brasil
2016-01-29	G1 - BC do Japão surpreende mercado ao adotar taxa de juros negativa - notícias em Mercados
2016-03-03	Economia - Queda de 3,8% do PIB confirma 'cenário temeroso', veem economistas

4.3 Methods

4.3.1 Event Study

Once we had all the political news stored and adjusted, became possible to apply the Event Study Methodology

4.3.1.1 Normal Returns with GARCH

After we collected all the news inside the period of the sample, we applied GARCH to Ibovespa's Returns Series from the first day of the series until the day before of the news scraped date. The interval is drawn at Figure 4.7

Figure 4.7: Event Study Timeline

We defined normal returns as the one step ahead prediction of Ibovespa Returns GARCH.

4.3.1.2 Abnormal Returns

We defined abnormal returns as the Equations 4.3 and 4.4. If the observed IR in a day where happened ate least one political event and respect one of the conditions of the equations 4.3 and 4.4, we considered that the political events on this day had caused impact on the Ibovespa Returns.

$$AbnormalReturn > MeanForecast + 2 * \sigma \qquad (4.3)$$

$$AbnormalReturn < MeanForecast - 2 * \sigma \qquad (4.4)$$

Where σ was the standard deviation of the Ibovespa Returns Forecast and $MeanForecast$ was the normal return.

The measure of the impact of political events follows the Equation 4.5

$$AbnormalReturn = ObservedReturn - PredictedReturn \qquad (4.5)$$

4.3.2 The Relation Between DI Index and Selic Over

We found a correlation of 0.99 between Selic Over and DI, so political news doesn't impact the Selic Over and, consequently, doesn't impact DI. To corroborate this argument, the Engle-Granger two-step method (ENGLE; GRANGER, 1987) was applied to test if they are cointegrated.

The residuals series of the linear regressions of DI as dependent variable and Selic Over as explanatory variable doesn't have unit root implying through the Engle-Granger two-step method that the series are cointegrated.The Table 4.14 and Table 4.15 show the results of ADF and KPSS test, respectively.

Table 4.14: ADF Critical Value (Residuals of DI and Selic Linear Regression

	1pct	5pct	10pct	statistic
tau1	-2.5800	-1.9500	-1.6200	-7.2978

Table 4.15: KPSS (Residuals of DI and Selic Linear Regression

test	10pct	5pct	2.5pct	1pct
0.2633	0.3470	0.4630	0.5740	0.7390

5 RESULTS AND DISCUSSION

Our results point to acceptance Fama's semi-strong efficiency market hypothesis. The web scraper program captured 147 dates with political events, then 25.1% of our sample has at least on political event on the sames. The Table 5.1 shows twelve dates with political news and abnormal returns.

Table 5.1: Days with News and Abnormal Returns

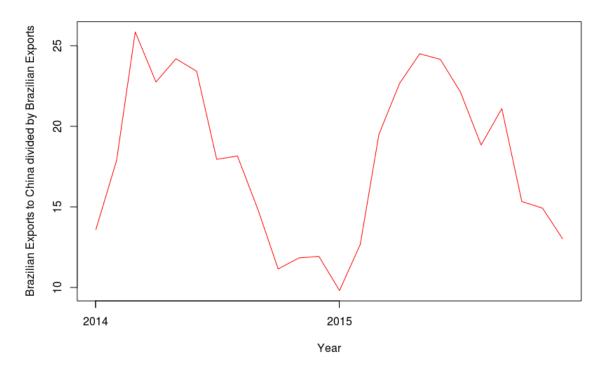|	Normal Returns (IR)	Observed Return (IR)	Abnormal Return (IR)	Event Date
1	0.00031	-0.02909	-0.02940	$2015-08-07$
2	0.00006	-0.03072	-0.03078	$2015-08-24$
3	0.00002	0.03299	0.03297	$2015-08-26$
4	0.00014	0.03578	0.03564	$2015-08-27$
5	0.00012	0.03726	0.03714	$2015-10-02$
6	0.00028	-0.04087	-0.04116	$2015-10-13$
7	0.00012	0.04654	0.04642	$2015-11-03$
8	0.00025	-0.02981	-0.03005	$2015-11-25$
9	0.00009	0.03240	0.03231	$2015-12-03$
10	0.00009	0.03678	0.03668	$2015-12-09$
11	-0.00016	0.04492	0.04509	$2016-01-29$
12	0.00007	0.04996	0.04990	$2016-03-03$

Almost all of the news caught by our model are related with China's crisis, only news about the impeachment process impacted Ibovespa Returns. The uncertainty about China cause stress to Brazilian financial markets because, as shown at Figures 5.1 and 5.2, China is one of the biggest commercial partners of Brazil, a crisis in this country could impact the Brazilian's Net Exports.

The market reacted positively to the impeachment process, one day after the lower house speaker authorized the opening of the impeachment process against the ex-president Ms. Rousseff, the Abnormal Return in Ibovespa Returns was 0.04509. This conclusions is aligned with Baker, Bloom and Davis (2015). The actions of policy-makers took and their statements are impacting directly on the stock market.

Different from United States, where the Federal Reserve reacts to abnormal volatility on the stock market reducing the interest rates and ignoring the inflation (JOVANOVIC; ZIMMERMANN, 2008), in Brazil inflation targeting system focus only on inflation rate and, therefore, doesn't allow to react to financial market events.
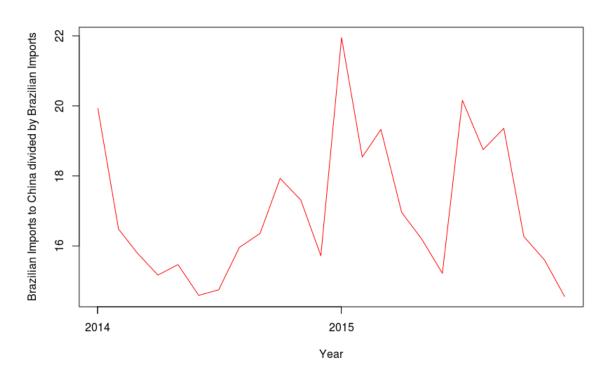
The government uses short-term federal bond markets to aim Selic target as a result of inflation targeting monetary policy adopted. Consequently, the possibility of reacting

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Figure 5.1: Brazilian Exports to China divided by Brazilian Exports

Source : Ministry of Industry, Foreign Trade and Services (2016)

Figure 5.2: Brazilian Imports to China divided by Brazilian Imports

Source : Ministry of Industry, Foreign Trade and Services (2016)

to political events should not be observed.

Since as we had already noticed Selic wasn't managed taking into account political events, it is expected the non-existence of abnormal volatility in Selic Over. The DI series had the same results of the Selic Over, that is also expected because they cointegrate. Political events also cannot impact on this series for the same reasons that they cannot on the Selic Over series.

The results returned periods which only can be associated with the uncertainty about China and the impeachment process, bringing conclusions that only an event with this proportion can cause abnormal stress on the market. Events like politicians being arrested, corruptions scandals and things like that, although it might seem important, don't actually impact on the returns. Therefore, our results point to the acceptance of the semi-strong efficient market hypothesis

6 CONCLUDING REMARKS

This paper has the objective of associate the political events to the financial market through the Ibovespa Returns, the DI rate and the Selic Over Rate. The method used Web Scraping to collect political news inside G1's website. Garch was applied to predict the normal returns of Ibovespa Returns. After this, we used the event study methodology to measure the impact of political news in the Stock Market.

Our approach concluded that only one political news impacted Brazilian Financial Market, the opening of the impeachment process. Other news collected by our web scraper were about the China's economic uncertainty and unrelated with political events. The Selic Over and DI were not impacted by political events, that could be explained with the caution of the Central Bank of Brazil in preserving the control of inflation

Anyway, to be more confident about the result we presented we intend to improve our web scraper program, increase the period of analysis and make a deeper study of the news founded,

7 APPENDIX

7.1 R-Code

```r
# Author: Thales Batiston Marques
# Data: 02/11/2016
# Version: 1.0.0
# Descritpion: Measuring the impact of political events

setwd("~/Dropbox/Google_Drive/Trabalho")


# Packages

        library(urca)                    # ADF package

        library(fGarch)                  # Garch package

        library(quantmod)                #P Daily Variation
          ↪ package

        library(stargazer)               # Latex Package

    library(xtable)        # Latex Package

# Variables

        t                                        <-
          ↪          data.frame()    # period of analysis
        ibov_ret                         <-
          ↪ data.frame()    # ibovespa returns - 2014 to
          ↪ 2016 - Source: Centra Bank of Brazil
        selic                            <-
          ↪ data.frame()    # selic over - 2014 to 2016 -
```

```r
                   ↪   Source: Centra Bank of Brazil
di                                                  <-
    ↪          data.frame()    # di - 2014 to 2016 -
    ↪ Source: Cetip
var_selic                                    <-
    ↪ data.frame()    # selic's daily variation
var_di                                       <-
    ↪ data.frame()    # di's daily variation
news                                         <-
    ↪ data.frame()    # days with political news
adf_ret                                      <-
    ↪ attr(1, "dim")  # adf test for ibovespa
    ↪ returns
kpss_ret                                     <-
    ↪ attr(1, "dim")  # kpss test for ibovespa
    ↪ returns
adf_di                                       <-
    ↪ attr(1, "dim")  # adf test for DI
kpss_di                                      <-
    ↪ attr(1, "dim")  # kpss test for DI
adf_var_di                                   <-
    ↪ attr(1, "dim")  # adf test for DI's daily
    ↪ variation
kpss_var_di                                  <-
    ↪ attr(1, "dim")  # kpss test for DI's daily
    ↪ variation
adf_var_selic                      <-       attr(1, "
    ↪ dim")  # adf test for selic's daily variation
kpss_var_selic                     <-       attr(1, "
    ↪ dim")  # kpss test for selic's daily
    ↪ variation
lm_di_selic                        <-       attr(1, "
    ↪ dim")  # linear regression of DI in selic
```

```
lm_di_selic_res                    <-        attr(1, "
  ↪ dim")  # residuals of lm_di_selic
adf_lm_di_selic_res                <-        attr(1, "
  ↪ dim")  # adf test of lm_di_selic
kpss_lm_di_selic_res    <-        attr(1, "dim")  #
  ↪ kpss test of lm_di_selic
t_news                             <-        c()
  ↪        # variable saving the number of the day
  ↪ where political event happened
garch_ibov                         <-        c()
  ↪        # garch of ibovespa returns where the
  ↪ range is the first day of the sample until
  ↪ one day before of each political event
forecast_garch                     <-        data.frame
  ↪ ()     # matrix with the forecast of ibovespa
  ↪ returns,
# the standard deviation of the forecast, the upper
  ↪  and lower limit of mean +- 2*standar
  ↪ deviation, and the impact of political events
event_study                        <- data.
  ↪ frame() # same as the forecast_garch, but
  ↪ only with dates with abnormal returns
contador                           <-        1
  ↪        # counter used in loops
descriptive_statistics  <- data.frame() # data
  ↪ frame with ibovespa, ibovespa returns, di and
  ↪  selic
descriptive_statistics_var    <- data.frame() #
  ↪ data frame with var_di and var_selic


# Input



t <- read.csv("Datas.csv", header = TRUE)
```

```r
    t <- as.Date(t$Data, format = "%d/%m/%Y")


selic <- read.csv("Selic.csv", header = TRUE)
        selic <- data.frame(t, selic)
                names(selic) <- c("Time", "Selic
                    ↪ Rate")



di <- read.csv("DI.csv", header = TRUE)
        di <- data.frame(t, di)
                names(di) <- c("Time", "DI")


ibov <- read.csv("IBOVESPA.csv", header = TRUE)
        ibov <- data.frame(t, ibov)
                names(ibov) <- c("Time", "Ibovespa"
                    ↪ )


ibov_ret <- read.csv("Retorno.csv", header = TRUE)
        ibov_ret <- data.frame(t, ibov_ret)
                            names(ibov_ret) <-
                                ↪ c("Time","
                                ↪ Ibovespa
                                ↪ Returns")


var_di <- na.omit(Delt(di[,2], x2 = NULL, type = c(
    ↪ "arithmetic")))
        var_di <- data.frame(t[2:length(t)], var_di
            ↪ )



var_selic <-na.omit(Delt(selic[,2], x2 = NULL, type
    ↪ = c("arithmetic")))
        var_selic <- data.frame(t[2:length(t)], var
            ↪ _selic)
```

```r
news <- read.csv("noticias.csv", header = TRUE)
news <- as.Date(news$News.Date)


descriptive_statistics <- data.frame(ibov[,2], ibov_
  ↪ ret[,2], di[,2], selic[,2])
names(descriptive_statistics) <- c("Ibovespa",
  ↪ "Ibovespa_Returns", "DI", "Selic_Over")


descriptive_statistics_var <- data.frame(var_di[,2],
  ↪ var_selic[,2])
names(descriptive_statistics_var) <- c("DI's_Daily_
  ↪ Variation", "Selic_Over_Daily_Variation")



forecast_garch<- data.frame(NA,NA,NA,NA,NA,NA)
names(forecast_garch) <- c("normal_return",
  ↪ "upper_limit","lower_limit","ibov_ret
  ↪ _political","abnormal_return","Event_
  ↪ Date")


event_study <- data.frame(NA,NA,NA,NA)
names(event_study) <- c("Normal_Returns_(IR
  ↪ )","Observed_Return_(IR)","Abnormal_
  ↪ Return_(IR)","Event_Date")




# Processing



# Unity Root Tests
```

```
adf_ret <- ur.df(ibov_ret[,2],type = "none"
    ↪ , selectlags = c("AIC")) # ibovespa
    ↪ reuturns adf test

kpss_ret <- ur.kpss(ibov_ret[,2],type = c("
    ↪ mu"), lags = c("long"), use.lag =
    ↪ NULL) # ibovespa returns kpss test




adf_di <- ur.df(di[,2], type = "trend",
    ↪ selectlags = c("AIC")) # di's adf
    ↪ test

kpss_di <- ur.kpss(di[,2],type = c("tau"),
    ↪ lags = c("long"), use.lag = NULL) #
    ↪ di's kpss test




adf_var_di <- ur.df(var_di[,2], type = "
    ↪ none", selectlags = c("AIC")) # var_
    ↪ di adf test

kpss_var_di <- ur.kpss(var_di[,2],type = c(
    ↪ "mu"),lags = c("long"), use.lag =
    ↪ NULL) # var_di kpss test




adf_selic <- ur.df(selic[,2], type = "trend
    ↪ ", selectlags = c("AIC")) # selic's
    ↪ adf test
```

```r
kpss_selic <- ur.kpss(selic[,2], type = c("
  tau"), lags = c("long"), use.lag =
  NULL) # selic's kpss test


adf_var_selic <- ur.df(var_selic[,2], type
  = "none", selectlags = c("AIC")) #
  var_di adf test

kpss_var_selic <- ur.kpss(var_selic[,2],
  type = c("mu"), lags = c("long"), use.
  lag = NULL) # var_di kpss test


# Unity Root Test Tables

        kpss_ret_table <- c(kpss_
          ret@teststat, kpss_ret@cval)
              names(kpss_ret_table) <- c(
                "test","10pct","5pct"
                ,"2.5pct","1pct")
        kpss_di_table <- c(kpss_di@teststat
          , kpss_di@cval)
              names(kpss_di_table) <- c("
                test","10pct","5pct",
                "2.5pct","1pct")
        kpss_var_di_table <- c(kpss_var_
          di@teststat, kpss_var_di@cval)
              names(kpss_var_di_table) <-
                 c("test","10pct","5
                pct","2.5pct","1pct")
        kpss_selic_table <- c(kpss_
          selic@teststat, kpss_
```

```
                                   ↪ selic@cval)
                          names(kpss_selic_table) <-
                             ↪ c("test","10pct","5
                             ↪ pct","2.5pct","1pct")
                   kpss_var_selic_table <- c(kpss_var_
                      ↪ selic@teststat,kpss_var_
                      ↪ selic@cval)
                          names(kpss_var_selic_table)
                             ↪ <- c("test","10pct",
                             ↪ "5pct","2.5pct","1pct
                             ↪ ")
                   kpss_lm_di_selic_res_table <- c(
                      ↪ kpss_lm_di_selic_res@teststat
                      ↪ ,kpss_var_selic@cval)
                          names(kpss_lm_di_selic_res_
                             ↪ table) <- c("test","
                             ↪ 10pct","5pct","2.5pct
                             ↪ ","1pct")


   # Engel Granger Cointegration Test


        lm_di_selic <- lm(di[,2]~selic[,2])


        lm_di_selic_res <- resid(lm_di_selic)


        adf_lm_di_selic_res <- ur.df(lm_di_selic_
           ↪ res, type = "none", selectlags = c("
           ↪ AIC")) # residuals adf test


        kpss_lm_di_selic_res <- ur.kpss(lm_di_selic
           ↪ _res,type = c("mu"),lags = c("long"),
           ↪ use.lag = NULL) # residuals kpss
           ↪ test
```

```r
# Correlation between DI and Selic

            cor_di_selic <- cor(di[,2],selic
                ↪ [,2])


# Matching the days of political events with the
    ↪ variable t

        for(i in 1:length(t)){
                for(j in 1:length(news)){
                        if(t[i] == news[j]){
                                print(i)
                                t_news[contador] <-
                                    ↪ i
                                contador <-
                                    ↪ contador+1
                        }
                }
        }

contador <- 1

# measuring the abnormal returns in periods of
    ↪ abnormal volatility

for(i in 1:length(t_news)){
    garch_ibov <- garchFit(formula = ~garch(1, 1),
        ↪ data= ibov_ret$'Ibovespa Returns'[1:t_
        ↪ news[i]-1], init.rec = c("mci"))
    predict_garch <- predict(garch_ibov)
    forecast_garch[contador,1] <- predict_garch$
        ↪ meanForecast[1]
```

```r
        forecast_garch[contador,2] <- (predict_garch$
          ↪ meanForecast[1] + (2*predict_garch$
          ↪ meanError[1]))
        forecast_garch[contador,3] <- (predict_
          ↪ garch$meanForecast[1] - (2*predict_
          ↪ garch$meanError[1]))
        forecast_garch[contador,4] <- ibov_ret[t_
          ↪ news[i],2]
      if(forecast_garch[contador,4]>forecast_garch[
        ↪ contador,2] | forecast_garch[contador,4]<
        ↪ forecast_garch[contador,3] ){
        forecast_garch[contador,5] <- forecast_
          ↪ garch[contador,4] - forecast_garch[
          ↪ contador,1]
        forecast_garch[contador,6] <- t_news[i]
      }
    contador <- contador + 1
}

contador <- 1



for(i in 1:length(forecast_garch[,6])){
      if(is.na(forecast_garch[i,6])){
      }
      else{
      event_study[contador,1] <- forecast_garch[i
        ↪ ,1]
      event_study[contador,2] <- forecast_garch[i
        ↪ ,4]
      event_study[contador,3] <- forecast_garch[i
        ↪ ,5]
```

```
            event_study[contador,4] <- forecast_garch[i
              ↪ ,6]
            contador                 <- contador + 1
            }
        }


# Output

        # Graphs

            # Series graphs

                par(mfrow=c(1,1))


                plot(t, ibov_ret[,2], type = "l",
                  ↪ col = "red", xlab = "Time",
                  ↪ ylab = "BOVESPA_Index_Returns
                  ↪ ")

                plot(t, ibov[,2], type = "l", col =
                  ↪  "red", xlab = "Time", ylab =
                  ↪  "BOVESPA_Index")
                      abline(lm(ibov[,2]~t), col
                        ↪ = "blue")

                plot(t, di[,2], type = "l", col = "
                  ↪ red", xlab = "Time", ylab = "
                  ↪ DI")
                      abline(lm(di[,2]~t), col =
                        ↪ "blue")
```

```r
plot(t[2:584], var_di[,2], type = "
  ↪ l", col = "red", xlab = "Time
  ↪ ", ylab = "DI's Daily
  ↪ Variation")

plot(t, selic[,2], type = "l", col
  ↪ = "red", xlab= "Time", ylab=
  ↪ "Selic Over")

plot(t[2:584], var_selic[,2], type
  ↪ = "l", col = "red", xlab = "
  ↪ Time", ylab = "Selic Over's
  ↪ Daily Variation")


# Latex

    # descriptive statistics

        stargazer(descriptive_statistics,
          ↪ type = "latex", digits = 6 ,
          ↪ title = "Descriptive
          ↪ Statistics")
        stargazer(descriptive_statistics_
          ↪ var, type = "latex", digits =
          ↪  6, title = "Descriptive
          ↪ Statistics of Selic and DI
          ↪ Daily Variation")

    # adf's table

        stargazer(adf_ret@cval, type = "
          ↪ latex", digits = 4, title = "
          ↪ ADF Critical Values (IR)")
```

```
stargazer(adf_ret@teststat, type =
    ↪ "latex", digits = 4, title =
    ↪ "ADF␣Test−Statistic␣(IR)")


stargazer(adf_di@cval, type = "
    ↪ latex", digits = 4, title = "
    ↪ ADF␣Critical␣Values␣(DI)")
stargazer(adf_di@teststat, type = "
    ↪ latex", digits = 4, title = "
    ↪ ADF␣Test−Statistic␣(DI)")


stargazer(adf_var_di@cval, type = "
    ↪ latex", digits = 4, title = "
    ↪ ADF␣Critical␣Values␣(DI's␣
    ↪ Daily␣Variation)")
stargazer(adf_var_di@teststat, type
    ↪ = "latex", digits = 4, title
    ↪ = "ADF␣Test−Statistic␣(DI's␣
    ↪ Daily␣Variation)")


stargazer(adf_selic@cval, type = "
    ↪ latex", digits = 4, title = "
    ↪ ADF␣Critical␣Values␣(Selic␣
    ↪ Over)")
stargazer(adf_selic@teststat, type
    ↪ = "latex", digits = 4, title
    ↪ = "ADF␣Test−Statistic␣(Selic␣
    ↪ Over)")


stargazer(adf_var_selic@cval, type
    ↪ = "latex", digits = 4, title
    ↪ = "ADF␣Critical␣Values␣(Selic
    ↪ ␣Over␣Daily␣Variation)")
```

```
stargazer ( adf_var_selic @ teststat ,
    ↪ type = "latex" , digits = 4 ,
    ↪ title = "ADF_Test−Statistic_(
    ↪ Selic_Over_Daily_Variation ) " )


stargazer ( adf_lm_di_selic_res @ cval ,
    ↪ type = "latex" , digits = 4 ,
    ↪ title = "ADF_Critical_Value_(
    ↪ Residuals_of_DI_and_Selic_
    ↪ Linear_Regression" )
stargazer ( adf_lm_di_selic_
    ↪ res @ teststat , type = "latex" ,
    ↪ digits = 4 , title = "ADF_
    ↪ Critical_Value_( Residuals_of_
    ↪ DI_and_Selic_Linear_
    ↪ Regression" )


# kpss' tables

stargazer ( kpss_ret_table , type = "
    ↪ latex" , digits = 4 , title = "
    ↪ KPSS_(IR) " )
stargazer ( kpss_di_table , type = "
    ↪ latex" , digits = 4 , title = "
    ↪ KPSS_(DI) " )
stargazer ( kpss_var_di_table , type =
    ↪ "latex" , digits = 4 , title =
    ↪ "KPSS_(DI's_Daily_Variation"
    ↪ )
stargazer ( kpss_selic_table , type =
    ↪ "latex" , digits = 4 , title =
    ↪ "KPSS_( Selic_Over ) " )
```

```
stargazer(kpss_var_selic_table,
    ↪ type = "latex", digits = 4,
    ↪ title = "KPSS (Selic Over
    ↪ Daily Variation)")
stargazer(kpss_lm_di_selic_res_table, type
    ↪ = "latex", digits = 4, title = "KPSS
    ↪ (Residuals of DI and Selic Linear
    ↪ Regression")


# Events

    stargazer(event_study, type = "
        ↪ latex", digits = 5, title = "
        ↪ Days with News and Abnormal
        ↪ Returns", summary = FALSE)


#Unity Root


    summary(adf_ret)

    summary(kpss_ret)




    summary(adf_di)

    summary(kpss_di)




    summary(adf_var_di)

    summary(kpss_var_di)
```

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```
                    summary(adf_selic)

                    summary(kpss_selic)


                    summary(adf_var_selic)

                    summary(kpss_var_selic)
```

7.2 Web Scraping Code

7.2.1 Function

```
# Author: Thales Batiston Marques
# Data: 02/11/2016
# Version: 1.0.0
# Description: G1's Web Scraper



import re
from bs4 import BeautifulSoup
from urllib.request import urlopen



def scrap_g1(bsObj):
```

```python
with open('redirecionadores_duplicados.txt','w') as
    redirecionadores_duplicados_txt:
        for link in bsObj.findAll('a', href = re.
            compile('^(//g1.globo.com/busca/)')):
                print(link['href'], file =
                    redirecionadores_duplicados_
                    txt)


with open('redirecionadores_duplicados.txt','r') as
    redirecionadores_duplicados_txt:
        links = redirecionadores_duplicados_txt.
            read().splitlines() # list with all
            link redirections
        links = sorted(set(links)) # Removing
            duplicated link redirectors
        with open('redirecionadores.txt','a') as
            links_busca: # creates a file without
            duplicated itens
                for link in links: # input links on
                    txt file
                        print(link, file = links_
                            busca)


with open('materias.txt','a') as materias:
        for link in links:
                html_redirecionador = urlopen("http
                    :"+link)
                bsObj_redirecionador =
                    BeautifulSoup(html_
                    redirecionador) # Beautiful
                    Soup of redirector
```

```
                    buscador_link_materia = bsObj_
                        ↪ redirecionador.find('meta',
                        ↪ attrs={'http-equiv': 'refresh
                        ↪ '}) # Search for the news url
                        ↪  in the redirector
                    link_final = buscador_link_materia[
                        ↪ 'content'].partition('=')[2].
                        ↪ replace("'","") # cleaning
                        ↪ the url
                    print(link_final, file = materias)
                        ↪ # input link in a text file
```

7.2.2 Code

```python
# Author: Thales Batiston Marques
# Data: 02/11/2016
# Version: 1.0.0
# Descritpion: Scraping Gl

from bs4 import BeautifulSoup
import requests
import re
from itertools import count
from urllib.request import urlopen
import scrap_g1




# Variables

contador        =        1        # counter identifying which
    ↪  page is being scraped
```

```python
page_count       =        0        # variable responsible for
  ↪ defining which page will be scraped
url                      =        ""        # news url
html             =        ""        # open the url
bsObj            =        ""        # beautifulsoup object


# Input


contador = 1

url = "http://g1.globo.com/busca/?q=incerteza+pol%C3%ADtica
  ↪ +economia&cat=a&ss=4da73052cb8296b5&st=G1&species=not
  ↪ %C3%ADcias&page={}"
page_count = count(1)


html = requests.get(url.format(next(page_count))).content


bsObj = BeautifulSoup(html)


# Processing


print("————————————————————————Scraping_page_%d
  ↪ ————————————————————————" %contador)
scrap_g1.scrap_g1(bsObj) # call the g1's web scraping
  ↪ module




while True:
```

```python
    html = requests.get(url.format(next(page_count)),
        allow_redirects=False) # open the page
    if html.status_code == 301:
        break # if the page is redirected, break the
            function
    bsObj = BeautifulSoup(html.content) #beautifulsoup of
        the page
    contador+=1
    print("——————————————————————Scraping_page_%d
        ——————————————————————" %contador)
    scrap_g1.scrap_g1(bsObj)


with open('materias_data.txt','w') as materias_data:
        with open('materias.txt','r') as materias:
                for materia in materias:
                        url             = urlopen(materia)
                        bsObj   = BeautifulSoup(url)
                        date    = bsObj.find('abbr', {'
                            class': 'published'}).text.
                            rstrip().lstrip()
                        print(date, file = materias_data)
                        print("imprimindo_data")

with open('materias_titulo.txt','w') as materias_titulo:
        with open('materias.txt','r') as materias:
                for materia in materias:
                        url             = urlopen(materia)
                        bsObj   = BeautifulSoup(url)
                        title   = bsObj.title.text
                        print(title, file = materias_titulo
                            )
                        print(title)
```

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