LISBON
SCHOOL OF
ECONOMICS &
MANAGEMENT
UNIVERSIDADE DE LISBOA

MASTER

FINANCE

MASTER´S FINAL WORK

DISSERTATION

THE MARKET REACTION ON RETURNS OF THE FISCAL INDICATORS DISCLOSURE IN THE EUROZONE

JOANA PELEIAS DE CARVALHO

OCTOBER - 2019

LISBON
SCHOOL OF
ECONOMICS &
MANAGEMENT
UNIVERSIDADE DE LISBOA

MASTER
FINANCE

MASTER´S FINAL WORK
DISSERTATION

THE MARKET REACTION ON RETURN OF THE FISCAL INDICATORS DISCLOSURE IN THE EUROZONE

JOANA PELEIAS DE CARVALHO

SUPERVISION:
JOAQUIM JOSÉ MIRANDA SARMENTO

OCTOBER - 2019

To my parents

LIST OF ABBREVIATIONS

AR – Abnormal Returns.

EA – European Area.

EDP – Excessive Deficit Procedure.

BCS – Business Cycle Synchronization.

EMU – European Monetary Union.

EU – European Union.

GDP – Gross Domestic Product.

GLS – Generalized Least Squares.

MFW – Master's Final Work.

OECD – Organization for Economic Co-Operation and Development.

OLS – Ordinary Least Squares.

SGS – Stability and Growth Pact.

SWEAP – South West European Periphery.

ABSTRACT AND KEYWORDS

This dissertation provides new insights on stock market index reactions to the fiscal disclosure of public debt and governmental deficit, for every country in the eurozone, using annual panel data for the abnormal returns calculated from index prices from each country stock index over the period 2005-2016. For the research question: "What is the market reaction to the fiscal discloser of deficit in the eurozone?", different models were tested, fixed-effects and random-effects models, GLS regressions, Tobit regressions for the independent variables: GDP variation, debt variation, deficit variation and a dummy variable to control for the financial crisis of 2008, *fincrisi1*. Other econometric tests were used for testing the dependent variable, being the day of the announcement, normality, heteroskedasticity and correlation with the following hypothesis: H_0: The market shows a positive or negative reaction to the fiscal disclosure of public debt and governmental deficit; *H1:*The market has no reaction to the fiscal disclosure of public debt and governmental deficit.

The stock index markets express a reaction to debt and deficit variation, since these variables presents statistical significance. Comprehensibly, the market reacts negatively to an increase in debt and deficit, most notably in the days closer to the event day.

KEYWORDS: Public Debt; Governmental Deficit; Stock Index Markets; Eurozone; Abnormal Returns; Fiscal Disclosure.

RESUMO

Esta dissertação produz uma nova visão sobre as reações dos mercados financeiros à divulgação da divida publica e do défice governamental, para cada país na zona euro, usando dados anuais em painel para calcular os retornos anormais de cada índice de preços de cada país, no período entre 2005 e 2016. A pergunta de investigação é: *"Qual é a reação do mercado à divulgação fiscal do défice na zona euro?"*. Foram testados diferentes modelos, efeitos fixos, efeitos aleatórios, regressões GLS, regressões Tobit, para as variáveis independentes: variação do PIB, variação da divida, variação do défice e uma variável dummy para controlar o efeito da crise de 2008, fincrisis1. Outros testes econométricos foram utilizados para testar a variável dependente, o dia do anúncio: normalidade, hererocedasticidade, e correlação com as seguintes hipóteses, H0: o mercado mostra uma reação positiva ou negativa à divulgação da divida publica e ao défice governamental; H1: o mercado não reage à divulgação fiscal da dívida publica e ao deficit governamental. Os mercados financeiros demonstram uma reação negativa à variação da divida e à variação do défice, uma vez que essas variáveis apresentam alguma significância estatisticamente.

PALAVRAS-CHAVE: Public Debt; Governmental Deficit; Stock Index Markets; Eurozone; Abnormal Returns; Fiscal Disclosure.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

I'd like to start out by thanking my supervisor, Prof. Joaquim José Miranda Sarmento, for the constant availability and dedication into problem solving in the course of this dissertation. A special thanks to my private professors, Prof. Domingos Custódio Cristóvão and Prof. Cândido Jorge Peres Moreira, without their guidance in the beginning of my masters all this work wouldn't be achievable.

Thank you to my friends who always believe in me and understood all the events I missed out because of the effort I put on, not only on this thesis, but throughout my masters, and specially to Filipe for the support and care only he could provide.

Thank you to the colleagues that have crossed paths on this journey, specially to all of my colleagues who didn't believe this would be possible for me to ever achieve.

Last but not least, the utmost gratitude towards my parents for the money afforded for this master and private lessons, for the encouragement to search for more and better and to never give up. A special thank you to my grandparent, Táta who saw me starting but never finishing the most challenging chapter of my life until this moment, who raise me well enough not to give up and would be excessively proud.

1. INTRODUCTION

Over the last years, countries in European periphery have struggled to keep their deficit and public debt in the lowest values possible, or even acceptable, for the European union established norms and its institutions. These norms are established given the fact that the majority of these countries have as their national currency the euro, implemented in 1st January 2002 and now present in nineteen countries. These nineteen countries have distinctive cultures and subsequently different ways of controlling their economy. These differences are more noticeable between European regions, most notably North and South. An example of this are the low interest rates for northern prosperous countries and high interest rates for the southern countries, usually in recession, which is a factor for financial market investors. These are macroeconomic effects that do not help the prospects/projections of southern European markets.

Public debt and governmental deficit became a more important focus after two occurrences: the construction of the European Union (EU) as an organization with its own institutions to supervise the European countries, that were constantly joining EU; and the monetary union, that pressured these countries to have balanced economies and public finances for "a common good" that is the EU being perceived and having a competitive market, as well as being a competitor against other strong economies, as United States and China.

This pressure is applied with diplomatic agreements made between the state members and the EU, namely the "Stability and Growth Pact" (SGP) corrective arm/Excessive deficit procedure *ensured that Member States adopt appropriate policy responses to correct excessive deficit (and/or debts) by implementing the Excessive Deficit procedure (EDP)* (European Commission, 2019), this is only applied when a *Member State that exceed the budgetary deficit* [1](Eurostat, 2019), celling that is obligatory by the EU Stability and Growth Pact legislation, *the procedure entails several steps, potentially culminating in sanctions to encourage a Member State to get its budget deficit under control, a requirement for the smooth functioning of Economic and monetary Union* (Eurostat, 2019). Thus, for every State member or candidate countries there are two most

[1] Budgetary deficit occurs when a government's expenditure is bigger than its revenue (Eurostat, 2019).

notable requests: the public debt must not exceed a 3% deficit of the gross domestic product (GDP); and public debt must not exceed 60% of the GDP.

Another event that made these public debt and deficit such a discussed theme within the European union was the financial crisis of 2008, and the recovery afterwards. The differences between North of Europe and South of Europe became publicly clear, the growth was not the same between the two regions even though the main policies of the European union were the same. The SGP exists since 1997, taking over the Maastricht treaty celebrated in 1992, the 3% maximum deficit and 60% maximum debt of the GDP already existed, but it was only planning the way for the creation of the euro, since these measures can only be applied to countries with the same currency. In this case, the authors Alesina and Tabellini make a good argument about the policy makers within the countries, these individuals can play with the deficit and debt in a way that serves their interests and at margin of the EU, *when a government is likely of losing the office, a large deficit transfer to the next successor. (…) If the current policymakers support the defence of spending and future government has inclinations for social spending, they can increase the deficit, accumulate more debt and thereby, influence its successors to reduce their social expenditure in order to service the debt* (Alesina and Tabellini, 1990).

Financial markets obtained great power in countries' economies with the monetary union. Countries with a fragile economic balance face the increase of the interest rates that have led to extreme measures of austerity subsequently leading to a fiscal crisis (Grauwe, 2013).

The objective of this thesis is to answer the following question: "*What is the market reaction to the fiscal discloser of deficit in the eurozone?".* In other words, analyze the impact on market indexes of public debt and governmental deficit disclosures in countries within the Eurozone, whether there is a connection between these two subjects and if they react favorably or not to debt and deficit rise/fall.

The market reaction is observed through the abnormal returns (AR) calculated from the stock market indexes from each country within the eurozone, for example PSI20 for Portugal and DAX for Germany.

These stock market indexes represent a set of companies that are valued within this index, the index may vary in agreement with the stock from each company and with the

actual trades. However, each index has a way of calculating the weighted-average stock price of all stocks that make up the index. The last price taken is the 'price close', meaning the lasting available price.

Regarding the dividends, the indexes do not pay dividends, nevertheless they are indeed affected by the companies within the index that may contain ex-dividend date, and that may be reflected on the index.

The literature is much interested in understanding the relationship between interest rates and business cycle shocks, failures in the eurozone with the creation of the central banks and the macroeconomic policies, private consumption, inflation, Euribor, and some of them correlate these variables with, for example, government debt and deficit and analyze the impact of them in the market. That being said, there is very little research in understanding the impact of the government deficit and debt disclosures in the markets.

There is interest in predicting the market reaction to the fiscal indicators' disclosure, to understand if the market reacts when the deficit or debt are higher or lower than what it was expected and perceived within the eurozone. If a struggling economy shows a deficit surplus, will the market react positively or negatively to this progression.

It is determined that the stock index markets respond negatively to an increase of debt and deficit disclosure, this is further perceptible 5 days and 10 days after the day of the announcement.

In the section *1 - Introduction* a summary of the thesis is presented, what is focus of the study, the research question and the subject is presented in a more abstract way. In section 2 – *Literature Review* a review of the related research is presented. In section 3 – *Methodology and data* – data used is presented as well as the models applied. In Section 4 – *Analysis of Results* the results of the most models and data used in the section 3 are stated. Section 5 – *Conclusion*, *contributions, limitations and future investigation,* the main conclusions are expressed, as well as the contribution of this thesis, the limitation suffered, and suggestions for future investigation.

2. LITERATURE REVIEW

From 1970 to 2008, Checherita and Rother studied the relation between government debt-to-GDP ratio and per-capita GDP growth rate, in 12-euro area countries, analysing the non-linear relationship between debt and growth. There is a comparison made between peacetime and wartime debts. The authors refer Reinhart and Rogoff that stated that in peace time, the debt build-ups could be more problematic for future growth since they can be persistent for a longer timespan compared to war time debt. In a way, debt build ups can be important from an economic point of view. Between 2007-2010 the deficit ratio increased 0.7% of GDP in 2007, to 6.0% of GDP in 2010 (Checherita-Westphal & Rother, 2010). Public debt is also found to have a *non-linear impact on economic growth rate, private savings, as well as (…) public investment and total factor productivity* (Checherita-Westphal & Rother, 2010). When estimated individually, public debt can affect economic growth rate through numerous channels simultaneously.

Alesina and Tabellini (1990) provided another perspective on government debt, stating that this can become a political instrument for the policymaker to influence future choices, and also that budget deficits and debt accumulation can have different purposes: provide means of reallocating income over time and through generations. When a government is likely of losing the office, a large deficit transfer to the next successor is likely, specifically if they have different preferences in regard to the allocation of spending. Thus, if the current policymakers support the defence of spending and future government has inclinations for social spending, they can increase the deficit, accumulate more debt and thereby, influence its successors to reduce their social expenditure in order to service the debt.

The authors follow a model with a constant population of individuals in the same time horizon that represent voters, workers and consumers, having obvious differences in tastes, especially in goods delivered by the state. Then, two political parties are chosen by the policymaker and each party maximizes the utility function of the consumers. The paper indicates the variance in debt policies can be explained by the differences in political institutions, this varies between countries, especially the change in governments and how difficult it can be to manage public debt with constant switch of political parties. Briefly, published papers show that fiscal deficits are a result of political conflicts.

Sgherri and Zoli explore the critical impact of the financial crisis in the euro area economy and what markets perceived of this event as discrimination between some government issuers, since sovereign risk premium were spreading even with a low risk of default. These government issuers required total higher risk premiums. With the euro as a unique currency, the *sovereign risk premium differentials have raised doubts about the ability of the financial markets provide discipline across the euro area* (Sgherri & Zoli, 2009). The paper analyses a change throughout time in euro area of sovereign bond markets and the modifications in the investors' appetite, through a theoretical model. It also studies the changes on bond spreads of the euro area since it has the advantage of controlling other factors, and also influence the spreads outside the monetary union, in the behaviour of sovereign's spreads. The paper concludes that the financial markets responded to the decline in fiscal position by the requirement of higher sovereign default risk premiums in most countries. In a country specific development, there is increasing predictable debt levels and at the same time, a rising concern about the solvency of national banking systems. The eurozone is now more concerned and disciplined with national fiscal and financial market policies, than before the crisis. The authors recommend various aspects to prevent future financial crisis, for example some structural reforms to enhance growth and possible revenue predictions, declaring that this measure can predict and prevent for the future but doesn't support the tomorrow's *vicious domestic debt dynamics* (Sgherri & Zoli, 2009).

Coccia analyses public debts and government deficits in European countries, stating that public debt is a critical problem for countries with a fragile economy, since it can cause instability and sovereign debt crisis; also, high public debt-to-GDP ratio is considered an issue for policymakers since it has a negative effect in the capital markets and reduces investments, employment and economic growth in the long run.

Coccia formulates two research questions: (1) *How is the evolution of public debt across European countries, before and after the introduction of the euro currency?* (2) *Have countries within European Monetary Union (EMU) an evolution of the public debt similar or different to other countries?* (Coccia, 2018).

The authors answer to the first question states that general government gross debt as a percentage of GDP has increased from 2001 to 2014 for countries inside the EMU

compared to the countries outside the EMU. Referring to the differences in the evolution of the public debt, Coccia affirms that within EMU, an austere deterioration of general government deficit as a percentage of GDP was experienced, with an arithmetic mean of -3.83 in 2003/04, in comparison to countries outside EMU with an average value of -1.32, in the same period.

Coccia also concludes that countries within EMU have higher levels of current taxes on income, wealth as a percentage of GDP, and taxes on production and imports as a percentage of GDP than countries outside the EMU, relating this to the guidelines of Maastricht Treaty, The Stability and Growth Pact, etc. Coccia makes a future scenario that may negatively affect the public debt, employment and economic growth, being the *current problematic evolution of economic and demographic factors* (Coccia, 2018).

Grauwe and Ji (2013) observe that in 2007 the governments saw their debt levels rise intensely, with the authors analysing US, UK and the Eurozone. They observed that, since 2007, the increase in the debt to GDP ratios was faster in the US and UK than in the Eurozone. As the authors state, the eurozone was the one that ultimately experienced a severe sovereign debt crisis and not the US or the UK.

In this paper Grauwe and Ji tried to better explain fragility theory of the Eurozone: an empirical test theory made by Grauwe in 2011, that was better tested in this paper. This fragility that Grauwe refers to is related to government bond markets in a monetary union and the vulnerability to self- fulfilling liquidity crisis, comparing to a self-governing country. The self-governing country can issue money and give a guarantee to the bondholder that the cash will be available at maturity, unlike a monetary union member, that cannot provide any guarantee because its more susceptible to the negative market sentiment that can create a liquidity crisis. The authors confirm this hypothesis, having found evidence that there's a big part of the flow of the spread from the peripheral eurozone countries.

The authors also discovered evidence that debt to GDP ratio is important to investors, and that the high ratios of debt in the eurozone and the increase of the spreads, are progressively more important. It is also stated that the austerity implemented in countries that were affected by a liquidity-crisis, may force them into a recession. Therefore, there is a reduction of effectiveness in this policy of austerity.

Lukmanova and Tondl (2016) investigate the effect of business cycle synchronization (BCS) within the European monetary union, confirming that it had been varying considerably. The BCS was high when there was economic stability between 2002 and 2003 and even higher in the economic crisis in 2008; questioning if the BCS in the eurozone can function optimally.

International debt finance deficit, which is worse for the position of the international investment, accumulation of debt in the European area (EA) increases the interest level and can result in a debt crisis followed by a fall in an economic activity. The paper analyses the effect of macroeconomic imbalances inside the EA members, and the increasing imbalances in other members. The model centres on the effects on BCS arising from particularities: (1) competitiveness and current account imbalances; (2) imbalances on fiscal deficits and public and private debt; (3) imbalances in wages development; (4) decoupling.

The authors formed various hypothesis to test the effects of the particularities from the score board indicators, that are summarized in the 4 particularities cited above.

To conclude, the authors determine that the current account balance between the EA create a decoupling effect on BCS that has grown after the crisis. The study also affirms that the fiscal policies in public debt among EA members don't contest BCS, since they are divergent and it's difficult to implement an appropriate fiscal policy to all members, it wouldn't be suitable. Thus, the authors affirm that the BCS would reduce unemployment and inflation which are important for differences in government deficits; the differences in public debt through the EA after the crisis didn't weaken BCS, since there was a difference in debt prior to the crisis and an unequal output growth, and after the crisis the growth frequency was reduced in all countries. The authors also conclude different relations: (1) there was accumulation of debt in countries of the periphery that produced unequal growth rates during the prosperous times, by consequence the private debt level led to a deeper recession in countries that already had high private debt; (2) there is a negative relation between private debt accumulation and BCS over different times of the Business Cycle (BC); (3) endogeneity was found between BCS and differences in private debt levels, since there is a negative effect of private debt differences for BCS. The estimations made by the authors also found that members from

the EA with divergent wage developments lead to decoupling of BC proper to demand effects.

Aizenman, Hutchison and Jinjarak (2013) developed a pricing model of sovereign risk for a large number of countries, within and outside Europe, before and after the financial crisis of 2008, based on the fiscal space and other economic fundamentals such as: (1) foreign interest rate, (2) external debt, (3) trade openness, (4) nominal depreciation, (5) inflation, (6) GDP/Capita and (7) economic growth; with the purpose of explaining the CDS (Credit Default Swaps) spreads and determine if the market pricing of risk is comparable or not with the affected European countries and other countries outside Europe and determine if there are systematically large prediction errors for the CDS spreads during the financial crisis of 2008 and in 2010 when the sovereign debt crisis in Europe appeared.

By matching the SWEAP (South West European Periphery) with 5 middle income countries outside Europe that were similar in terms of fiscal space (debt/tax) during the crisis, the authors concluded that SWEAP default risk is priced much higher than the matched countries in 2010, since the authors in order to validate that fiscal space (being an important determinant of market-based sovereign risk) found prediction errors in pricing SWEAP risk, since in 2008 it was surprisingly high. Also, other OECD countries tended to have very high prediction errors, meaning high CDS spreads when compared with the model predictions.

The paper written by Fernández-Villaverde, Garicano and Santos argues that *euro facilitated large flows of capital and a financial bubble in peripherical countries, economic reforms were abandoned, institutions deteriorated, the response to the credit bubble was delayed, and the growth prospects of these countries declined* (Fernandez-Villaverde, Garicano, & Santos, 2013). The authors focus on five specific countries: Spain, Portugal, Greece, Ireland and Germany, and analyse how the dynamics functioned in these distinctive countries, by dynamics meaning: abandonment of economic reforms and debt extension from excessive borrowing.

The authors, make an observation regarding the economic reform: with the arrival of the euro it was expected when national governments needed monetary autonomy and had limited fiscal autonomy, they would suffer pressure to adopt structural reforms that they

had already refused to adopt, but in its place countries in the periphery of Europe had their interest rates dropped and the same for the exchange rate risk.

3. METHODOLOGY AND DATA

In order to assess the impact in the market of fiscal indicators such as public debt and deficit, the stock index from each country within the eurozone was used. The stock prices of each index were analyzed, between 2005 to 2016, fifteen days ahead and fifteen days prior to the announcement day of the fiscal indicator by each government, taking into account the weekend days and holidays where the market is closed.

Abnormal returns (AR) were calculated for each stock index in the time period for each country. The AR are correlated with the returns that exceed the normal returns or the expected returns, in this case the level of immersion the index of each country in systematic risk. Thus, positive market reaction should give a positive AR result, meaning that the investors value the new information and increases future perspectives. Therefore, the rate of return is adjusted by subtracting the expected return from the actual, to thus obtain the AR the calculation was:

$$R_1=\left((t_1/t_2)-1\right)*100$$

Where,

R_1 daily rate of return of stock market[2] on the day after the announcement day;

t_1 is the last price of the stock market on the day after the announcement day;

t_2 is the last price of the stock market on the announcement day.

Thus, our daily AR series includes 31 observations since it goes from time period of t-15 to t+15, for each country, a total of 6,671 observations for the calculated abnormal returns.

The generation of the AR_k is for 10 days, 5 days, and 1 day prior to the event, and 1 day, 5 days and 10 days after the event. Subscript *k* is used to classify these events at -1, -5, -10, and 1, 5, 10 respectively.

[2] Prices from each stock market: Austria – ATX; Belgium – BEL 20; Cyprus – CYSMAIN; Estonia – OMXBBGI; Finland – OMXH25; France – CAC 40; Germany – DAX; Greece – ASE; Ireland – ISEQ; Italy – FTSE MIB; Latvia – OMXRGI; Lithuania – OMXVGI; Luxembourg – LUXXX; Malta – MSE; Netherlands – AEX; Portugal - PSI20; Slovakia – SAX; Slovenia – SBITOP; Spain – IBEX.

By analyzing the abnormal returns proximate to the event day, the uncertainty concerning the real date of the event is somewhat controlled. In this sample, the analysis considers the announcement day as when the public debt and governmental deficit is disclosed in the month of April, however the announcement day is the day considered as the dependent variable more studied during this work since the announcement was before the closing time of the stock exchange. Also, the effect may spread over the days that surround the event day and the examination of abnormal returns allows the researcher to apprehend the cumulative effect of an event, this may happen due to the accessibility of information over the period, and the interpretation of the event's impact in a future perspective.

The main hypothesis was established in order to give some answers to the tests and to the research question:

H_0 = The market shows a positive or negative reaction to the fiscal disclosure of public debt and governmental deficit.

H_1 = The market has no reaction to the fiscal disclosure of public debt and governmental deficit.

To test the dependent variable as well as the residuals and their normality, one used a fixed effects model regression, Kernel density and Shapiro-Wilk test.

The dependent variable is the r0, the day of the announcement, and following the fixed effects model it specifies:

$$(1)\ \boldsymbol{y_{it}} = \beta_1 \boldsymbol{X_{1,it}} + \cdots + \beta_k \boldsymbol{X_{k,it}} + \alpha_i + \boldsymbol{u_{it}}$$

y_{it} – is the dependent variable, the day of the announcement, observed for a country *i* at time *t;*

$X_{1,it}$ – is the time invariant 1 × k, with k being the number of independent variables, regressor vector. The independent variables are six: debt, the variation of the debt, the variation of GDP, the variation of deficit, the deficit variation if negative and deficit surplus, a dummy variable: *fincrisis1, fincrisis2 and fincrisis3.*

β – is the k × 1 matrix of the parameters;

α_i – is the time-invariant that is unobservable individual effect, country for example.

u_{it} – is the error term.

The GDP is an important variable since public debt and deficit data come as a percentage of the gross domestic product, this is easily explained since the GDP is a monetary measure of production of all gross values added, including institutions absorbed in production and services, as well as taxes (OECD, 2002); for example governmental deficit as a percentage of the GDP is described if a country needs to incur in more debt or can it pay to his creditors with the services and goods produced. GDP has a variable is tested with the calculated variation, having the GDP data between 2005 and 2016 for each country. The variable used for this is the GDP_var.

Governmental deficit is defined by the Organization for Economic Co-operation and Development (OECD) as a balance of income and expenditure of the government, this including the capital income and capital expenditures, *net lending means the government has a surplus, and is providing financial recourses to other sectors, while net borrowing mean the government has a deficit, and requires financial resources from other sectors* (OECD, 2002), in a very simple way is the difference between income and expenses given a period of time, for which there are two possible outcomes: surplus or a deficit, surplus when we have a positive balance between income and expenditures, and deficit when the opposite happens.

The variation of the variable deficit is calculated the same way as the GDP and debt, having two other indicators which are the deficit variation: negative and surplus. The deficit variation negative is given the values of 0 or 1, when the variable deficit_var is positive deficit variation negative takes the value of 0, and 1 otherwise. Deficit surplus takes the value of 0 or 1, when the variable deficit is positive the value is 0, otherwise is 1.

Public debt is the opposite of the governmental debt, it is not the difference between income and expenditures but all the external obligations that the government has as well as public sector agencies (OECD, 2002), OECD defines government debt in a more specific way: *it's a key indicator for the sustainability of government finance Debt is calculates as the sum of the: currency and deposits, debt securities, loans, insurance, pensions and standardized grantee schemes, and other accounts payable. Changes in government debt over time primarily reflect the impact of pact government deficits.*

Public debt is tested with the variation of the variable *debt*, similar to GDP_var and deficit_var.

Ultimately, as the dependent variable (AR) captures the market reaction, the 2008 financial crisis effects are controlled with a dummy variable, *fincrisis*, for the financial crisis of 2008, taking the value of 0 before 2007 and 1 after this date. This first financial crisis variable is intentional to capture if there are any effects of the financial crisis perceived before 2008. *fincrisis2* is an alternative dummy variable for the 2008 financial crisis, taking the value of 0 before 2008 and 1 after this date. This dummy variable is intended to capture whether the effect of the 2008 financial crisis affected the stock market values in that year, or just later on. *fincrisis3* is another alternative dummy variable for the 2008 financial crisis, taking the value of 0 before 2009, and 1 after this date. The results of using the three variables are similar, the financial crisis is also expected to have some impact in the results, increasing the market reaction (due to the collapse of the stock markets).

The Kernel Density is a non-parametric test, used to estimate the probability density function of a variable. It's beneficial to make a comparison between different groups and to compare a *benchmark density such as the normal* (Cameron & Trivedi, 2005). It's non-parametric test because it does not assume several underlying distributions for the variable, so figure 2 shows the kernel density distribution for the dependent variable.

Shapiro-Wilk test can tell if a random sample derives from a normal distribution, the test provides the W value, as its presented in table 1, when this value represents a small number, it indicates that the sample it's not normally distributed. This test has only two possible outputs, the sample is normal distributed, or it is not normal distributed.

Table 7 presents the descriptive statistics. For the residuals, observable in figure 3, the normal probability is approximately linear, thus the error terms are normally distributed. Figure 1 shows that all dependent variables show proximity to a normal distribution.

For the independent variables several tests were performed, multicollinearity, heteroskedastic, B-Pagan, Wald test, Ramsey test, specification link test and fixed effects and robust GLS regressions.

The Multicollinearity test was performed to see the correlation present between all independent variables, knowing that if there is multicollinearity between the variables the model can be linearly predicted. The test shows multicollinearity between the variables.

Heteroskedasticity assumes that the modeling error are uniform and uncorrelated, to test for heteroskedasticity it was used the Shapiro-Wilk test, in table 2 its observable normality and it is confirmed no heteroscedasticity.

Breusch-Pagan was tested for heteroskedasticity, similar to the previous test. The null hypothesis of the test is that the residuals are homoskedastic, the Breusch-Pagan test suggest the possibility of heteroskedasticity in the model, contradicting the previous test, as it is observable in table 2.

However, a way to correct this is to use *heteroskedasticity-robust Standard Errors* regression, goes against heteroscedasticity, *heteroskedastic-consistent estimate of the asymptotic variance matrix of the OLS estimator, and it leads to standard errors that are called heteroskedasticity-robust standard errors, or even more simply robust standard errors* (Cameron & Trivedi, 2005).

To test the independent variables the Wald test was used, to better understand if the model is robust with these variables, in a way to discover if the variables are explanatory and the model is significant, the Wald test gives us the F value and the probability of F. The F value is a ratio of the sum of mean squares of the regression divided by the sum of mean square errors, its value varies from zero to a subjectively big number. The value of the probability of F value or Prob(F) is the probability of the null hypothesis being true for the whole model, in this specific test for the Prob(F) is 0.000 meaning all coefficients of the independent variables are zero. Moreover, the Wald test says, “some parameter equals some value”, this way all our variables equal 0, as it’s presented in table 3, meaning the null hypothesis is rejected.

Ramsey test allows for testing if non-linear patterns of fitted valued may explain the dependent variable, thus the objective of the Ramsey test is: if the independent variables have any power to explain the dependent variable, the model can be misspecified meaning the data may be estimated by a polynomial or another non-linear function. The null hypothesis is only rejected when the F-test is zero. In this test, the null hypothesis of the research question is rejected.

The linktest was tested to observe the relation between the independent variable and the dependent variable. The linktest is a test of specification for the dependent variable, we may interpret this test as: if the independent variables are stated imperfectly. Linktest is observed by *hatsq,* a variable given by STATA, the value of the test must be significant, bigger than 0.05. In this case our variable is well stated.

Concluded the tests, linear models were applied: fixed effects model and random-effects GLS regressions, as well as the regression with Driscoll-Kraay standard errors.

The fixed effects regression is an estimation method that allows one to control for time-invariant unobserved individual features that can be correlated with the known independent variables, *for unobserved individual heterogeneity that may be correlated with regressors. Such unobserved heterogeneity leads to omitted variables bias that could in principle be corrected by instrumental variables* (Cameron & Trivedi, 2005).

For this fixed effect regression model, the dependent variable is maintained: r0, the day of the announcement and the dependent variables are the GDP variation, debt variation, deficit variation and the dummy variable fincrisis1. The formula is the same as (1) with the differences in variables being:

y_{it} – is the dependent variable, the day of the announcement, observed for a country *i* at time *t;*

$X_{1,it}$– is the time invariant 1 × k, being k the number of independent variables, regressor vector. The independent variables are four: the variation of the debt, the variation of GDP, the variation of deficit, *fincrisis1.*

β – is the k × 1matrix of the parameters;

α_i – is the time-invariant that is unobservable individual effect, country for example.

u_{it} – is the error term.

In this first regression only fixed effects are controlled, with 209 observation. The t-values tests the hypothesis that every coefficient is different from 0. To be able to reject this, the t-values has to be higher than 1.96 for a 95% confidence interval, in this case it's conceivable to affirm the variable has effect on the dependent variable. The greater the t-value, greater the significance of the variance.

The two-tail p-values test the hypothesis that every coefficient is unlike from 0, to be able to reject this the p-value must be lower than 0.05 for a 95% confidence interval, in this case the variable has significant influence on the dependent variable. The only variable that shows significance is the GDP variation.

The Random effects model follows the following equation:

$$(2)\ \boldsymbol{Y_{it}} = \beta \boldsymbol{X_{it}} + \alpha + \boldsymbol{u_{it}} + \boldsymbol{\varepsilon_{it}}$$

The random effects model is, unlike the fixed effects model, the variation across entities. And its presumed to be random and uncorrelated with the predictor or the independent variables. This equation varies from the fixes effects since it has the uit is the random effects and the εit is the individual-specific random effect. Thus, if Y_{it} be the dependent variable r0, and i = country at the t = year.

α – is the unidentified intercept for each individual effect;

u_{it} – is the r0, specific random effect, measuring the difference between the average of the stock market index per country with stock market index per year;

ε_{it} – is the individual-specific random effect, this case the derivation of the stock market index per country from the average for the stock index per year.

For these random effects one added “robust” to control for heteroskedasticity, and the other regression ensured the reference for the group variables “i. country” and “i. year”, this way this variables are listed, so it’s more perceptible to observe which one has more significance through countries and years.

The Driscoll-Kraay regression is performed for pooled OLS estimators. The Driscoll-Kraay regression assumes the error structure to be heteroskedastic, autocorrelated and with a possibility of correlation between sections; the standard errors are robust. In this regression the estimators are adjusted to use unbalanced and balanced panel datasets, correspondingly.

The dependent variable is maintained: r0; the other variables are the same used in the linear model: the day of the announcement and the dependents variables are the GDP variation, debt variation, deficit variation and the dummy variable fincrisis1.

Considering the linear regression model,

(3) $y_i = \mathbf{X'_{it}}\,\theta + \boldsymbol{\varepsilon_{it}}$

- y_i – represents the dependent variable;
- $\mathbf{X'_{it}}$ – represents the vector of the independent variables, with the first element being 1;
- θ – represents another vector, but for the unknown coefficients
- I and t – represent cross section units and time, country and year, respectively.

Knowing that the model is under normal distribution, a Tobit regression can be applied, *truncation and censoring arise most often in econometrics in the linear regression model with normally distributed error* (Cameron & Trivedi, 2005), meaning the dependent variables can be censored in some way: with left-truncation or right-truncation.

The data cannot be observable in two ways: by truncation or censoring. By truncating data, some of the observation on the dependent variable and the regressors are lost; for censored data, the information about the dependent variable is lost, but not the data on the regressors, thus way *truncation entails greater information loss than does censoring* (Cameron & Trivedi, 2005). The left-censored at zero can have the dependent variable equal to zero, or bigger than zero, this suppresses the dependence on the independent variables giving a linear mean. Since the dependent variable is the abnormal returns on the day of the announcement, and a stock price can never be negative, thus the data is left censored.

The Tobit regression is as follows (Cameron & Trivedi, 2005):

(4) $y* = \boldsymbol{x'}\beta + \varepsilon$, [3]

where the error term,

(5) $\varepsilon \sim N[0, \sigma^2]$

[3] $\boldsymbol{x'}\beta$ – represents a matrix for a linear regression the regressor, similar to regression (4).

For the tobit regression the dependent variable is the announcement day and the independent variables are the GDP variation, public debt, governmental deficit, and the dummy variable fincrisis1, as used in the previous regressions

4. ANALYSIS OF RESULTS

This is the final section of the main text. The maximum length is 10 per cent of the textual part, i.e. 3.5 pages.

Regarding the research question: *What is the market reaction to the fiscal discloser of deficit in the eurozone?",* with the following hypothesis:

H_0 = The market shows a positive or negative reaction to the fiscal disclosure of public debt and governmental deficit.

H_1 = The market has no reaction to the fiscal disclosure of public debt and governmental deficit.

In figure 1, the results for the dependent variables (AR) are presented for the r0, the day of the announcement, rr5 that represents 5 days after the day of the announcement, and rr10 that is 10 days after the day of the announcement.

The principal dependent variable is the r0, even though all variables show normal distribution the r0 is the day of the announcement which makes more sense to be the principal dependent variable, to see what the effect on the day of this disclosure is.

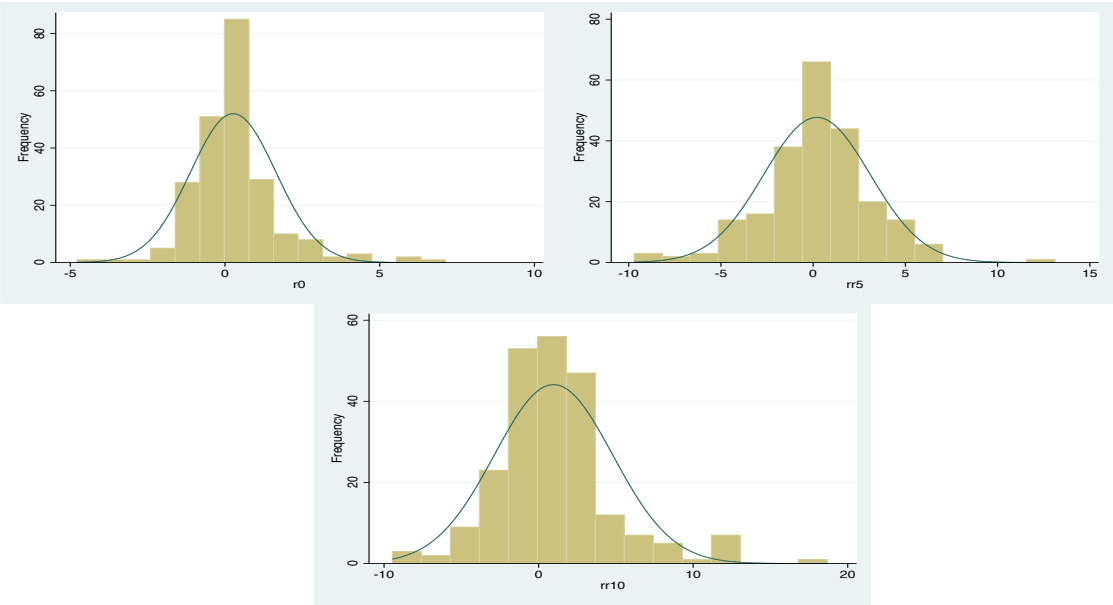

Figure 1 – Histogram: dependent variables

Note: in these histograms the dependent variables tested are r0, rr5 and rr10, the day of the announcement, 5 days after the announcement day, and 10 days after the announcement day. There's significance concentration around 0.

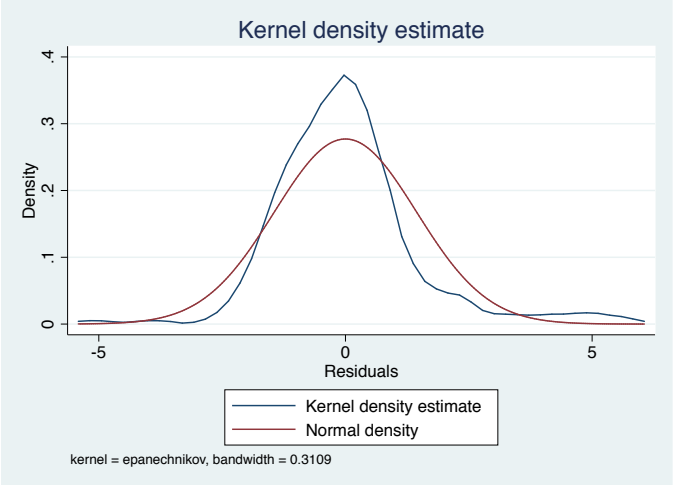

Figure 2 – Kernel Density Estimate

Note: shows the normality under the kernel density estimate for the dependent variable r0. Shows a close normal distribution of a kernel density estimate, comparison is not meaningful.

Figure 2 shows the normal distribution of the principal dependent variable, r0 under the kernel density estimate. In figure 3 it's possible to observe the residuals normality of the dependent variable, that show a close normality for the error terms. The normal probability of the residuals is approximately linear; hence the error terms are normally distributed.

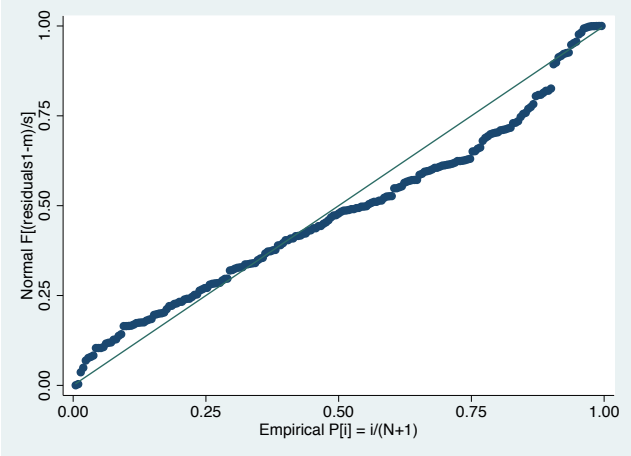

Figure 3 - Residuals for r0

The same tests that were performed for r0, were also performed for the other dependent variables to see if any effects would be of notice.

The first conclusion that can be taken is that the dependent variable is normal distributed, as well as the other possible dependent variables, rr0 and rr10, as is observed in Figure 1.

For the independent variables which are: GDP, governmental deficit and public debt, and the dummy variable *fincrisis1.* The variables of control are the GDP and the dummy variables for the financial crisis.

Following the tests for the independent variables several tests were implemented to observe if heteroskedasticity was present in the independent variables and if they presented normality. In figure 4 the test shows normality for the independent variables with the Prob>z being lower than 0.05, but the variables might be heteroskedastic. Breusch-Pagan test confirms the Shapiro-Wilk test, there is heteroskedasticity present in the variables.

The heteroskedasticity was corrected, using the random model in the regressions, with the *robust* command in STATA, with *heteroskedasticity-robust Standard Errors* regression, goes against heteroscedasticity.

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
r0	**227**	**0.88485**	**19.187**	**6.841**	**0.00000**

.

Table 1 - Shapiro- Wilk test

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of r0

         chi2(1)      =    11.02
         Prob > chi2  =   0.0009
```

Table 2 - Breusch-Pagan Test

```
( 1)  gdp_var = 0
( 2)  debt2_var = 0
( 3)  deficit_var = 0
( 4)  fincrisis1 = 0
( 5)  fincrisis2 = 0
( 6)  fincrisis3 = 0

      F(  6,   202) =    7.28
           Prob > F =    0.0000
```

Table 3 - Wald Test

In figure 6 the Wald-Test is presented and its possible to conclude that the model is robust, and the variables are explanatory. The value of the probability of F value or Prob(F) is the probability of the null hypothesis being true for the whole model, all variables are equal to zero, meaning that it's possible to reject the null hypothesis of the research question and conclude that the market has no reaction to the fiscal disclosure of the public debt and governmental deficit.

The tests were concluded for the independent variables, so the models applied given the results are fixed-effects model and random-effects GLS regressions, as well as the regression with Driscoll-Kraay standard errors and tobit regressions.

For r0 we can observe in Table 4 the GDP variation shows significance; in Table 5 *fincrisis1* has significance, thus the control variables have significance. In Table 6 none of the variables show significance. Thus, we may reject the null hypothesis and conclude that on the day of the announcement the markets do not react to the fiscal indicators disclosure.

```
Fixed-effects (within) regression               Number of obs     =       209
Group variable: country                         Number of groups  =        19

R-sq:                                           Obs per group:
     within  = 0.0416                                         min =        11
     between = 0.0001                                         avg =      11.0
     overall = 0.0355                                         max =        11

                                                F(4,186)          =      2.02
corr(u_i, Xb)  = -0.0611                        Prob > F          =    0.0934

------------------------------------------------------------------------------
          r0 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    gdp_var |   -4.59325   2.087914    -2.20   0.029    -8.712286   -.4742138
  debt2_var |  -.0260907   .0193151    -1.35   0.178    -.0641954    .012014
deficit_var |  -.0434237   .0325707    -1.33   0.184    -.1076792    .0208319
 fincrisis1 |   .0673708   .3586325     0.19   0.851    -.6401395    .7748811
      _cons |   .4395191   .3690317     1.19   0.235    -.2885067    1.167545
-------------+----------------------------------------------------------------
    sigma_u |  .39213663
    sigma_e |  1.4225739
        rho |   .0706186   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Table 4 – Fixed effects GLS regression for r0

```
Random-effects GLS regression                   Number of obs     =       209
Group variable: country                         Number of groups  =        19

R-sq:                                           Obs per group:
     within  = 0.2304                                         min =        11
     between = 1.0000                                         avg =      11.0
     overall = 0.2832                                         max =        11

                                                Wald chi2(13)     =         .
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =         .

                              (Std. Err. adjusted for 19 clusters in country)
------------------------------------------------------------------------------
             |               Robust
          r0 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     gdp_var |  -7.530833   2.848498    -2.64   0.008    -13.11379   -1.947878
   debt2_var |  -.0246551   .0242046    -1.02   0.308    -.0720952    .0227851
 deficit_var |  -.0049403   .0244542    -0.20   0.840    -.0528696     .042989
  fincrisis1 |    -.47527   .2499435    -1.90   0.057    -.9651502    .0146103
             |
     country |
     Belgium |  -.2727282   .0131738   -20.70   0.000    -.2985484    -.246908
      Cyprus |  -.7160028   .0529091   -13.53   0.000    -.8197027    -.612303
     Estonia |  -.2340958   .0858722    -2.73   0.006    -.4024022   -.0657895
     Finland |  -.3621333   .0149564   -24.21   0.000    -.3914473   -.3328193
      France |  -.9648388   .0293862   -32.83   0.000    -1.022435   -.9072429
     Germany |   .0613507   .0272194     2.25   0.024     .0080016    .1146998
      Greece |   .2230775   .1198235     1.86   0.063    -.0117723    .4579272
     Ireland |  -.4540407   .1046872    -4.34   0.000    -.6592238   -.2488576
       Italy |  -.7195874   .0466854   -15.41   0.000    -.8110891   -.6280858
      Latvia |   .5217166   .1174856     4.44   0.000      .291449    .7519842
   Lithuania |  -.2424718   .0974149    -2.49   0.013    -.4334014   -.0515422
  Luxembourg |  -.0706112   .0646633    -1.09   0.275     -.197349    .0561267
      Malta  |  -.2835626   .0817484    -3.47   0.001    -.4437866   -.1233387
 Netherlands |   -.496732   .0263174   -18.87   0.000    -.5483132   -.4451509
    Portugal |  -.9275896   .0923627   -10.04   0.000    -1.108617    -.746562
    Slovakia |   -.106263   .1162014    -0.91   0.360    -.3340136    .1214877
    Slovenia |  -.0527763   .0803056    -0.66   0.511    -.2101724    .1046197
       Spain |  -.9600947   .0694375   -13.83   0.000     -1.09619   -.8239998
             |
        year |
        2007 |   .7794666   .4688612     1.66   0.096    -.1394844    1.698418
        2008 |   2.092423   .6193796     3.38   0.001     .8784615    3.306385
        2009 |   .1211128   .2480431     0.49   0.625    -.3650428    .6072683
        2010 |  -.3288882   .4189539    -0.79   0.432    -1.150023    .4922463
        2011 |   .2901053   .4549953     0.64   0.524     -.601669     1.18188
        2012 |   .4981132   .4776679     1.04   0.297    -.4380987    1.434325
        2013 |  -.2067609   .3106498    -0.67   0.506    -.8156233    .4021016
        2014 |   .0918856   .2971404     0.31   0.757    -.4904989    .6742701
        2015 |   .5461396   .4023528     1.36   0.175    -.2424574    1.334737
        2016 |          0  (omitted)
             |
       _cons |   .9975214   .2330435     4.28   0.000     .5407645    1.454278
-------------+----------------------------------------------------------------
     sigma_u |          0
     sigma_e |  1.3068125
         rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Table 5 – Random effects GLS robust regression for r0

Regression with Driscoll-Kraay standard errors — Number of obs = 209
Method: **Fixed-effects regression** — Number of groups = 19
Group variable (i): **country** — F(4, 18) = 7.55
maximum lag: **2** — Prob > F = 0.0009
— within R-squared = 0.0416

r0	Drisc/Kraay Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_var	-4.59325	2.324243	-1.98	0.064	-9.476303	.2898035
debt2_var	-.0260907	.0160391	-1.63	0.121	-.0597876	.0076061
deficit_var	-.0434237	.0454916	-0.95	0.352	-.138998	.0521506
fincrisis1	.0673708	.2145565	0.31	0.757	-.3833956	.5181372
_cons	.4395191	.1588975	2.77	0.013	.1056878	.7733504

Table 6 - Driscoll-Kraay with fixed effects for r0

For the relevant variables, deficit and debt, spots of significance start to appear 5 and 10 days after the announcement.

For debt variation, in Table 10, a random effects GLS regression for 5 days after the announcement day, shows that debt have some significance, however this represents a negative impact in the market. Table 15 and 21, random effects GLS regression and a tobit regression respectively, also show debt variation has significance after 10 days of the announcement day, nevertheless is also a negative impact in the stock market indexes. All tests have left-censored observations, meaning the dependent variable data was lost, only the data from the regressors was analyzed.

For the deficit variation Table 11, 12 and 13 show deficit variation as a variable with statistical significance 5 days after the day of the announcement, first for a random effects GLS robust regression, and then for Driscoll-Kraay with fixed effects and without fixed effects. The deficit variation shows a negative impact in the stock market index 5 days after the announcement. However, for 10 days after, for the fixed effects GLS regression and random effects GLS regression the impact of deficit is also negative, as observable in Tale 14 and 16.

We can conclude that on the day of the announcement, 5 days after and 10 days after, the markets display a response to the GDP variation, deficit and debt disclosure, even though these two variables represent some statistical significance, this is a negative impact that is represented in the markets, since all the coefficients observed are negative.

Thus, the null hypothesis is accepted, and the alternative rejected: The market shows a negative reaction to the fiscal disclosure of public debt and governmental deficit.

5. CONCLUSION, CONTRIBUTIONS, LIMITATIONS AND FUTURE INVESTIGATION

This thesis focuses on the market reaction to the fiscal disclosure of public debt and governmental deficit. The market may react by an increase or a reduction on the market value of each company that is within each stock index for every eurozone country. To measure this reaction, the abnormal returns (AR) were used. The fiscal disclosure day is used as the reference for the AR and is measured for 10 and 5 days after the announcement day and for that very same day. All of these values are independent, since they are calculated over different periods of time.

The research question to be answered is: "*What is the market reaction to the fiscal disclosure of deficit in the eurozone?".*

The models used to predict this behavior analyzed through the abnormal returns of the stock prices indexes were the fixed effects model, random-effects model, and GLS regression model, as well as the Driscoll-Kraay regression and Tobit regression.

From the results obtained, one can observe that the stock index markets react to the GDP variation and dummy variable *fincrisis1*, used to try and control sudden changes in the markets (mainly financial crisis of 2008). The stock index markets are also shown to react to the debt and deficit variation, since these variables presents statistical significance. Understandably, the market reacts negatively to an increase in debt and deficit, most notably in the days closer to the event day (disclosure of debt and deficit values).

Some limitations to the models developed are clearly identifiable such as the use of data for countries within the eurozone and for timespan between 2005 and 2016, which could be expanded in order to obtain a more robust analysis. The indicators prescribed previously were seen as the most relevant for the proposed study, but are not at all mandatory or exclusive, more detailed information regarding the financial markets as well as the countries themselves could benefit the outputs of the models used. Finally, the fiscal disclosure dates of governmental deficit and public debt are not the same for each country, in terms of data collection.

To better understand how the markets, react to the fiscal disclosure, more studies are needed that cover this relationship between the markets and disclosure of the financial indicators, and perhaps more countries and longer timespans, yielding more observations,

could help to better analyze such behavior. Also useful for future research would be the comparison between countries.

The indicators used are an interesting subject to approach the problem, but maybe add more that would be equivalent for example unemployment rate, nature of government, political system, and a better way to analyze and calculate the market as a whole.

REFERENCES

Aizenman, J., Hutchison, M., & Jinjarak, Y. (2013). What is the risk of European sovereign debt defaults? Fiscal space, CDS spreads and market pricing of risk. *Journal of International Money and Finance*, pp. 35-59.

Alesina, A., & Tabellini, G. (1990). A positive theory of fiscal deficits and government debt in a democracy. *Review of Economic Studies 57, no. 3*, 403-414.

Blinder, A., & Solow, R. (1972). Does Fiscal Policy Matter? Princeton University.

Cameron, Colin A., & Trivedi, Pravin A. (2005). Microeconometrics – Methods and Applications. Cambridge University Press, New York.

Cameron, Colin A., & Trivedi, Pravin A. (2009). Microeconometrics Using Stata. College Station, Texas.

Checherita-Westphal, C., & Rother, P. (2010). *The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area.* Frankfurt, Germany: European Central Bank.

Coccia, M. (2018). National debts and government deficits within European monetary union: statistical evidence of economic issues. *CNR - National research council of Italy*.

European Commission (2019), *Stability and Growth Pact – The corrective arm / Excessive deficit Procedure,* views October 5, 2019,

<https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/stability-and-growth-pact/corrective-arm-excessive-deficit-procedure_pt>.

Eurostat (2019), Eurostat: statistic explained, *Glossary: Excessive deficit procedure (EDP),* views October 5, 2019,

<*https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Excessive_deficit_procedure_(EDP)*>.

Fernández-Villaverde, J., Garicano, L., & Santos, T. (2013). Political credit cycles: the case of the eurozone. *Journal of Economic Perspectives*, pp. 145-166.

Gavazzi, F., & Spaventa, L. (28 de December de 2010). Why the current account may matter in a monetary union? *Lessons from the financial crisis in the Euro area*.

Grauwe, P. (2013). Design failures in the Eurozone: Can they be fixed? *LSD Europe in 'Question' Discussion Paper Series, nº 57*, 1-30.

Grauwe, P., & Ji, Y. (2013). Self-fulfilling crises in the Eurozone: an empirical test. *Journal of International Money and Finance*, pp. 15-36.

Lukmanova, E., & Tondl, G. (2016). Macroeconomic imbalances and business cycle synchronization. Why common economic governance is imperative for the eurozone? *Vienna University of Economics and Business*.

OCDE 2002, *Glossary of Statistical Terms*, views September 14, 2019, <https://stats.oecd.org/glossary/detail.asp?ID=1163>.

Sgherri, S., & Zoli, E. (2009). Euro area sovereign risk during the crises. *International Monetary Fund*.

Variable	Obs	Mean	Std. Dev.	Min	Max
country	228	10	5.489277	1	19
year	228	2010.5	3.459648	2005	2016
gdp_var	209	.0357634	.0646353	-.23016	.3439625
gdp	228	510526.5	761406.3	5142.1	3159750
debt2_var	209	2.519139	6.773628	-27.3	25.90001
debt2	228	66.26754	37.78957	3.7	178.9
deficit_va~e	228	.3815789	.4868429	0	1
deficit_var	209	.0650718	3.194523	-18.3	19.3
deficit_su~s	228	.8070175	.3955077	0	1
deficit2	228	-3.12193	4.023439	-32.1	5.1
code	228	228.3158	164.7893	30	421
index	228	10	5.489277	1	19
date	0				
yearannoun~t	228	2011.5	3.459648	2006	2017
ISIN	228	10	5.489277	1	19
debt	228	522.6243	779.8803	5.38614	3277.34
deficit	228	43.03862	6.011881	26.926	58.8092
t_15	218	4172.534	5930.589	43.704	40882
t_14	227	4193.601	5860.058	43.42	40697
t_13	227	4196.65	5855.874	43.42	40277
t_12	227	4181.715	5814.664	43.848	39290
t_11	227	4189.507	5828.763	44.323	39916
t_10	227	4196.177	5817.02	44.326	39868
t_9	227	4204.474	5854.849	43.982	40480
t_8	227	4206.502	5851.034	44.573	40519
t_7	227	4201.603	5840.095	44.196	40719
t_6	227	4214.087	5859.64	44.335	41547
t_5	227	4220.633	5876.727	44.3	41816
t_4	227	4218.798	5865.51	44.839	41343
t_3	226	4240.028	5877.966	45.676	41337
t_2	226	4236.663	5884.329	45.948	41201
t_1	227	4219.449	5896.568	46.365	41766
t0	227	4220.363	5877.549	45.884	41771
t1	227	4237.34	5929.455	46.299	41990
t2	227	4251.129	5951.957	46.081	42398
t3	228	4229.129	5939.201	46.455	42412
t4	228	4237.295	5961.548	46.594	42463
t5	228	4239.763	5966.512	46.426	42463
t6	227	4259.625	5991.919	46.386	42463
t7	228	4259.607	5990.042	47.008	42892
t8	228	4259.047	5983.256	47.663	42805
t9	228	4268.673	5989.026	47.663	42756
t10	227	4282.157	6000.77	47.663	43016
t11	227	4281.839	6011.128	47.509	43440
t12	227	4279.957	6002.826	46.675	43476
t13	227	4280.599	6004.633	46.632	43286
t14	228	4262.617	5998.597	47.028	42974
t15	228	4272.048	6026.49	47.04	43549
r_14	218	-.0000847	1.154324	-5.554986	3.666529
r_13	227	.0588863	1.268759	-4.222952	8.007768
r_12	227	-.1933691	1.267679	-5.105261	3.003736
r_11	227	.1707941	1.346942	-5.997752	5.130325
r_10	227	.1031072	1.344385	-4.899361	5.099175
r_9	227	.0587768	1.344024	-10.31814	2.782319
r_8	227	.1329584	1.554189	-11.32175	7.614157
r_7	227	.0477017	.9853615	-3.48425	2.976587
r_6	227	.2575623	1.272494	-3.004429	7.519212
r_5	227	.0841207	1.065985	-6.077204	3.350051
r_4	227	.0965903	1.197103	-5.534963	4.763586
r_3	226	.0968035	1.152109	-5.959109	7.902141
r_2	226	-.1141299	1.133978	-4.924181	4.569383
r_1	226	-.0102949	1.677388	-6.571621	12.61476
r0	227	.2661283	1.3837	-4.782641	7.12899
r1	227	.1999716	1.14351	-4.178616	4.185149
r2	227	.7809928	2.803021	-7.674384	13.43094
r3	226	.5853872	2.981597	-7.117522	13.02841
r4	226	.4275248	3.235898	-8.722533	14.29689
r5	227	.4347636	3.690044	-14.38568	15.2572
r6	226	.6764356	3.973892	-16.33839	16.25633
r7	227	1.082528	4.298124	-11.1046	20.51624
r8	227	1.404844	4.880802	-10.76682	29.57811
r9	227	1.624399	5.026114	-12.22644	31.91862
r10	226	1.85955	5.978158	-15.61023	40.91305
r11	226	1.885295	6.223798	-19.67236	42.34639
r12	226	1.917561	6.591822	-22.41814	42.74027
r13	226	2.174213	7.627048	-24.22226	49.99867
r14	227	1.876315	7.527392	-23.68947	52.90041
r15	227	1.968121	7.788639	-25.2	54.71286
rr_10	227	.9096577	3.857806	-17.48344	18.32459
rr_5	227	.3228179	2.513254	-7.839736	14.83538
rr_1	227	.2661283	1.3837	-4.782641	7.12899
rr1	227	.1999716	1.14351	-4.178616	4.185149
rr5	227	.2062412	2.886356	-9.705939	13.10959
rr10	226	.9640063	3.834012	-9.458041	18.68374
fincrisis1	228	.8333333	.373498	0	1
fincrisis2	228	.75	.4339654	0	1
fincrisis3	228	.6666667	.4724417	0	1

Table 7 - Summary Descriptive Statistics

Regression with Driscoll-Kraay standard errors — Number of obs = 209
Method: **Pooled OLS** — Number of groups = 19
Group variable (i): **country** — F(4, 18) = 3.70
maximum lag: **2** — Prob > F = 0.0228
R-squared = 0.0356
Root MSE = 1.4119

r0	Drisc/Kraay Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_var	-4.150885	2.311558	-1.80	0.089	-9.007289	.7055188
debt2_var	-.026081	.0179868	-1.45	0.164	-.0638699	.011708
deficit_var	-.0417637	.0427049	-0.98	0.341	-.1314834	.047956
fincrisis1	.0961706	.1880235	0.51	0.615	-.2988522	.4911934
_cons	.3973844	.1622336	2.45	0.025	.0565444	.7382245

Table 8- Driscoll-Kray for r0

Fixed-effects (within) regression — Number of obs = 209
Group variable: **country** — Number of groups = 19

R-sq: — Obs per group:
within = 0.0416 — min = 11
between = 0.0001 — avg = 11.0
overall = 0.0355 — max = 11

F(4,186) = 2.02
corr(u_i, Xb) = -0.0611 — Prob > F = 0.0934

r0	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_var	-4.59325	2.087914	-2.20	0.029	-8.712286	-.4742138
debt2_var	-.0260907	.0193151	-1.35	0.178	-.0641954	.012014
deficit_var	-.0434237	.0325707	-1.33	0.184	-.1076792	.0208319
fincrisis1	.0673708	.3586325	0.19	0.851	-.6401395	.7748811
_cons	.4395191	.3690317	1.19	0.235	-.2885067	1.167545
sigma_u	.39213663					
sigma_e	1.4225739					
rho	.0706186	(fraction of variance due to u_i)				

Table 9 - Fixed Effects GLS regression for rr5

Random-effects GLS regression — Number of obs = 209
Group variable: country — Number of groups = 19

R-sq: — Obs per group:
within = 0.3139 — min = 11
between = 1.0000 — avg = 11.0
overall = 0.3599 — max = 11

Wald chi2(13) = .
corr(u_i, X) = 0 (assumed) — Prob > chi2 = .

(Std. Err. adjusted for 19 clusters in country)

rr5	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
gdp_var	-11.75036	5.511399	-2.13	0.033	-22.5525	-.9482141
debt2_var	-.1489113	.081997	-1.82	0.069	-.3096225	.0117999
deficit_var	.0159472	.0814991	0.20	0.845	-.143788	.1756824
fincrisis1	-1.137844	.5428837	-2.10	0.036	-2.201877	-.073812
country						
Belgium	-.1449047	.0331126	-4.38	0.000	-.2098042	-.0800052
Cyprus	-1.080801	.178467	-6.06	0.000	-1.43059	-.7310126
Estonia	-.1838409	.1564487	-1.18	0.240	-.4904748	.122793
Finland	-.3484491	.0710214	-4.91	0.000	-.4876484	-.2092497
France	-.3067684	.1029824	-2.98	0.003	-.5086102	-.1049267
Germany	-.810456	.1065259	-7.61	0.000	-1.019243	-.6016691
Greece	-1.923703	.3472269	-5.54	0.000	-2.604255	-1.243151
Ireland	1.089474	.3114102	3.50	0.000	.479121	1.699826
Italy	.9960206	.103408	9.63	0.000	.7933446	1.198697
Latvia	-.2905552	.263242	-1.10	0.270	-.8065	.2253895
Lithuania	-.5268031	.2068001	-2.55	0.011	-.9321238	-.1214824
Luxembourg	-.1896649	.1233422	-1.54	0.124	-.4314112	.0520814
Malta	-.5329245	.1985248	-2.68	0.007	-.922026	-.143823
Netherlands	.3277813	.055706	5.88	0.000	.2185995	.4369631
Portugal	-.1304228	.3109824	-0.42	0.675	-.7399372	.4790915
Slovakia	-1.023065	.2313129	-4.42	0.000	-1.47643	-.5696998
Slovenia	.6666706	.2822488	2.36	0.018	.1134732	1.219868
Spain	.9861391	.2902878	3.40	0.001	.4171856	1.555093
year						
2007	2.575189	1.109864	2.32	0.020	.3998967	4.750482
2008	3.271435	.8827012	3.71	0.000	1.541372	5.001497
2009	.4532474	1.027021	0.44	0.659	-1.559676	2.466171
2010	.2294738	.5916173	0.39	0.698	-.9300748	1.389022
2011	-1.086898	.6763923	-1.61	0.108	-2.412603	.2388066
2012	-1.241244	.5649274	-2.20	0.028	-2.348481	-.1340068
2013	-.741887	.7875635	-0.94	0.346	-2.285483	.8017091
2014	-1.628703	.666948	-2.44	0.015	-2.935897	-.3215086
2015	-.7042327	.4297151	-1.64	0.101	-1.546459	.1379935
2016	0	(omitted)				
_cons	2.149752	.523573	4.11	0.000	1.123568	3.175936
sigma_u	0					
sigma_e	2.5580178					
rho	0	(fraction of variance due to u_i)				

Table 10 – Random Effects GLS regression for rr5

Random-effects GLS regression — Number of obs = 209
Group variable: **country** — Number of groups = 19

R-sq:
within = **0.0862**
between = **0.0636**
overall = **0.0845**

Obs per group:
min = 11
avg = 11.0
max = 11

Wald chi2(**4**) = 18.28
corr(u_i, X) = **0** (assumed) — Prob > chi2 = 0.0011

(Std. Err. adjusted for **19** clusters in country)

rr5	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
gdp_var	-4.050487	2.955993	-1.37	0.171	-9.844126	1.743153
debt2_var	-.1348819	.086097	-1.57	0.117	-.3036289	.0338651
deficit_var	-.1401686	.0556005	-2.52	0.012	-.2491436	-.0311936
fincrisis1	-.7574807	.4372902	-1.73	0.083	-1.614554	.0995924
_cons	1.425478	.4108103	3.47	0.001	.6203046	2.230651
sigma_u	0					
sigma_e	2.8790564					
rho	0	(fraction of variance due to u_i)				

Table 11– Random Effects GLS robust regression for rr5

Regression with Driscoll-Kraay standard errors — Number of obs = 209
Method: **Fixed-effects regression** — Number of groups = 19
Group variable (i): **country** — F(4, 18) = 22.41
maximum lag: **2** — Prob > F = 0.0000
within R-squared = 0.0867

rr5	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_var	-3.186069	2.829361	-1.13	0.275	-9.130336	2.758198
debt2_var	-.1363728	.0397947	-3.43	0.003	-.2199784	-.0527672
deficit_var	-.1346906	.0540951	-2.49	0.023	-.2483401	-.0210411
fincrisis1	-.6918022	.8004806	-0.86	0.399	-2.37355	.9899451
_cons	1.338255	.2735736	4.89	0.000	.7634983	1.913012

Table 12 – Driscoll-Kraay Fixed Effects regression for rr5

Regression with Driscoll-Kraay standard errors — Number of obs = 209
Method: **Pooled OLS** — Number of groups = 19
Group variable (i): **country** — F(4, 18) = 54.51
maximum lag: **2** — Prob > F = 0.0000
R-squared = 0.0845
Root MSE = 2.8494

rr5	Drisc/Kraay Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_var	-4.050487	1.639632	-2.47	0.024	-7.495226	-.6057471
debt2_var	-.1348819	.0344786	-3.91	0.001	-.2073187	-.0624451
deficit_var	-.1401686	.0615395	-2.28	0.035	-.2694584	-.0108789
fincrisis1	-.7574807	.6454753	-1.17	0.256	-2.113574	.5986127
_cons	1.425478	.128385	11.10	0.000	1.155751	1.695205

Table 13 – Driscoll-Kraay regression for rr5

Fixed-effects (within) regression — Number of obs = 209
Group variable: **country** — Number of groups = 19

R-sq: — Obs per group:
within = 0.0675 — min = 11
between = 0.0285 — avg = 11.0
overall = 0.0529 — max = 11

F(4,186) = 3.36
corr(u_i, Xb) = -0.0939 — Prob > F = 0.0110

rr10	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_var	-5.759129	5.659102	-1.02	0.310	-16.92341	5.405149
debt2_var	-.153547	.0523517	-2.93	0.004	-.2568264	-.0502675
deficit_var	-.2143289	.0882801	-2.43	0.016	-.3884879	-.0401699
fincrisis1	-.697823	.9720413	-0.72	0.474	-2.615466	1.21982
_cons	2.327406	1.000227	2.33	0.021	.3541573	4.300654
sigma_u	1.1897696					
sigma_e	3.8557591					
rho	.08693738	(fraction of variance due to u_i)				

F test that all u_i=0: F(18, 186) = 0.98 — Prob > F = 0.4873

Table 14- Fixed Effects GLS regression for rr10

Random-effects GLS regression — Number of obs = 209
Group variable: **country** — Number of groups = 19

R-sq: — Obs per group:
within = **0.4304** — min = 11
between = **1.0000** — avg = 11.0
overall = **0.4743** — max = 11

Wald chi2(13) = .
corr(u_i, X) = **0** (assumed) — Prob > chi2 = .

(Std. Err. adjusted for **19** clusters in country)

rr10	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
gdp_var	-13.52526	4.266132	-3.17	0.002	-21.88672	-5.163791
debt2_var	-.1387302	.0808034	-1.72	0.086	-.2971021	.0196416
deficit_var	.0187395	.0869563	0.22	0.829	-.1516918	.1891707
fincrisis1	-1.111362	.6666019	-1.67	0.095	-2.417878	.195154
country						
Belgium	-1.345169	.0265811	-50.61	0.000	-1.397267	-1.293071
Cyprus	-.3076775	.1836693	-1.68	0.094	-.6676626	.0523076
Estonia	-1.039658	.1294433	-8.03	0.000	-1.293362	-.7859538
Finland	-.7863756	.0942958	-8.34	0.000	-.971192	-.6015592
France	-.7304154	.1179409	-6.19	0.000	-.9615753	-.4992554
Germany	-1.122906	.1158794	-9.69	0.000	-1.350026	-.8957865
Greece	.2096479	.3598842	0.58	0.560	-.4957121	.9150079
Ireland	1.106881	.2905431	3.81	0.000	.5374273	1.676335
Italy	1.357608	.1100072	12.34	0.000	1.141997	1.573218
Latvia	-.7124657	.2079355	-3.43	0.001	-1.120012	-.3049196
Lithuania	-1.613168	.1601376	-10.07	0.000	-1.927032	-1.299304
Luxembourg	-1.324816	.0974702	-13.59	0.000	-1.515854	-1.133778
Malta	-2.18078	.2297281	-9.49	0.000	-2.631039	-1.730521
Netherlands	-1.143747	.0425394	-26.89	0.000	-1.227123	-1.060372
Portugal	.2558254	.3133524	0.82	0.414	-.3583341	.8699849
Slovakia	-2.828678	.1775065	-15.94	0.000	-3.176584	-2.480771
Slovenia	-1.852099	.2858929	-6.48	0.000	-2.412438	-1.291759
Spain	-.3155723	.3347261	-0.94	0.346	-.9716235	.3404788
year						
2007	1.486659	1.151405	1.29	0.197	-.7700541	3.743372
2008	6.795535	1.517856	4.48	0.000	3.820592	9.770478
2009	.3105899	1.169497	0.27	0.791	-1.981582	2.602762
2010	-1.804964	.7282269	-2.48	0.013	-3.232263	-.3776655
2011	-2.317284	1.07836	-2.15	0.032	-4.430831	-.2037376
2012	.1118879	.6270268	0.18	0.858	-1.117062	1.340838
2013	-2.017987	.8435816	-2.39	0.017	-3.671376	-.3645971
2014	-1.334186	.7568332	-1.76	0.078	-2.817552	.1491796
2015	-.5380897	.8073175	-0.67	0.505	-2.120403	1.044224
2016	0	(omitted)				
_cons	3.622181	.5548227	6.53	0.000	2.534749	4.709614
sigma_u	0					
sigma_e	3.0891359					
rho	0	(fraction of variance due to u_i)				

Table 15 – Random Effects GLS regression for rr10

Random-effects GLS regression — Number of obs = 209
Group variable: **country** — Number of groups = 19

R-sq: — Obs per group:
within = **0.0621** — min = 11
between = **0.0160** — avg = 11.0
overall = **0.0579** — max = 11

Wald chi2(**4**) = **48.26**
corr(u_i, X) = **0** (assumed) — Prob > chi2 = **0.0000**

(Std. Err. adjusted for **19** clusters in country)

rr10	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
gdp_var	-9.932975	3.51854	-2.82	0.005	-16.82919	-3.036763
debt2_var	-.1419517	.0868037	-1.64	0.102	-.3120839	.0281804
deficit_var	-.1867183	.0744998	-2.51	0.012	-.3327353	-.0407013
fincrisis1	-.9881023	.570593	-1.73	0.083	-2.106444	.1302394
_cons	2.70956	.5003291	5.42	0.000	1.728933	3.690187
sigma_u	0					
sigma_e	3.8557591					
rho	0	(fraction of variance due to u_i)				

Table 16 - Random Effects GLS robust regression for rr10

Regression with Driscoll-Kraay standard errors — Number of obs = 209
Method: **Fixed-effects regression** — Number of groups = 19
Group variable (i): **country** — F(4, 18) = 4.95
maximum lag: **2** — Prob > F = 0.0072
within R-squared = 0.0675

rr10	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_var	-5.759129	4.385992	-1.31	0.206	-14.97376	3.455499
debt2_var	-.153547	.0487927	-3.15	0.006	-.2560565	-.0510374
deficit_var	-.2143289	.1452818	-1.48	0.157	-.5195546	.0908968
fincrisis1	-.697823	.9654493	-0.72	0.479	-2.726157	1.330511
_cons	2.327406	.3225675	7.22	0.000	1.649717	3.005095

Table 17- Driscoll-Kraay Fixed Effects regression for rr10

Regression with Driscoll-Kraay standard errors — Number of obs = 209
Method: **Pooled OLS** — Number of groups = 19
Group variable (i): **country** — F(4, 18) = 31.71
maximum lag: **2** — Prob > F = 0.0000
R-squared = 0.0579
Root MSE = 3.8519

rr10	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_var	-9.932975	2.967685	-3.35	0.004	-16.16785	-3.6981
debt2_var	-.1419517	.0294086	-4.83	0.000	-.2037368	-.0801666
deficit_var	-.1867183	.1465961	-1.27	0.219	-.4947053	.1212687
fincrisis1	-.9881023	.8567267	-1.15	0.264	-2.788018	.8118137
_cons	2.70956	.1901008	14.25	0.000	2.310173	3.108947

Table 18 - Driscoll-Kraay regression for rr10

Tobit regression — Number of obs = 209; F(4, 205) = 1.35; Prob > F = 0.2532; Log pseudolikelihood = -287.7759; Pseudo R2 = 0.0178

r0	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_var	-6.947604	3.674154	-1.89	0.060	-14.19158	.2963709
debt2_var	-.0363472	.0280389	-1.30	0.196	-.0916289	.0189345
deficit_var	-.0236797	.0398921	-0.59	0.553	-.1023312	.0549717
fincrisis1	.2157352	.3335132	0.65	0.518	-.4418207	.873291
_cons	.2110576	.3697176	0.57	0.569	-.5178789	.9399941
/sigma	1.568914	.1681056			1.237476	1.900351

88 left-censored observations at r0 <= 0
121 uncensored observations
0 right-censored observations

Table 19 - Tobit regression for r0

Tobit regression — Number of obs = 209; F(4, 205) = 4.66; Prob > F = 0.0013; Log pseudolikelihood = -349.1203; Pseudo R2 = 0.0219

rr5	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_var	-7.524316	4.068349	-1.85	0.066	-15.54549	.4968541
debt2_var	-.1229548	.0442463	-2.78	0.006	-.210191	-.0357185
deficit_var	-.2096171	.078015	-2.69	0.008	-.3634317	-.0558025
fincrisis1	-.9277685	.4018146	-2.31	0.022	-1.719987	-.1355495
_cons	1.709359	.3932503	4.35	0.000	.934025	2.484692
/sigma	2.651744	.3176857			2.025394	3.278094

89 left-censored observations at rr5 <= 0
120 uncensored observations
0 right-censored observations

Table 20 - Tobit regression for rr5

Tobit regression — Number of obs = 209; F(4, 205) = 3.26; Prob > F = 0.0127; Log pseudolikelihood = -422.23697; Pseudo R2 = 0.0120

rr10	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_var	-11.46232	5.538122	-2.07	0.040	-22.3813	-.5433423
debt2_var	-.1423277	.0695148	-2.05	0.042	-.2793833	-.0052721
deficit_var	-.2543269	.1358781	-1.87	0.063	-.5222247	.0135709
fincrisis1	-1.436031	.6385147	-2.25	0.026	-2.694929	-.1771332
_cons	2.721172	.6355213	4.28	0.000	1.468176	3.974168
/sigma	4.280934	.4401995			3.413035	5.148833

83 left-censored observations at rr10 <= 0
126 uncensored observations
0 right-censored observations

Table 21 - Tobit regression for rr10