The effect of Behavioural Factors on the Government bond yield spread in the European Union.

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Abstract

The recent European sovereign debt crisis puts pressure on the conventional models which explain the government yield spread using 3 components; international risk factors, liquidity risk factors and country risk factors. Only limited research is done on the effect of behavioural factors. The main objective of this paper is to determine the effects of behavioural factors on the level of the 10 year government bond yield spread within two groups of Eurozone countries, GIIPS and SEZ, versus Germany. The empirical results show that the behavioural effects, which are indicators of the investors and consumers sentiment, have a significant effect on both the short run and long run. I also found that the effects of the behavioural variables are significantly larger in the GIIPS countries compared to the SEZ countries in all the models. This implicates that a change in the investor sentiment leads to a much stronger yield movement in the GIIPS countries.

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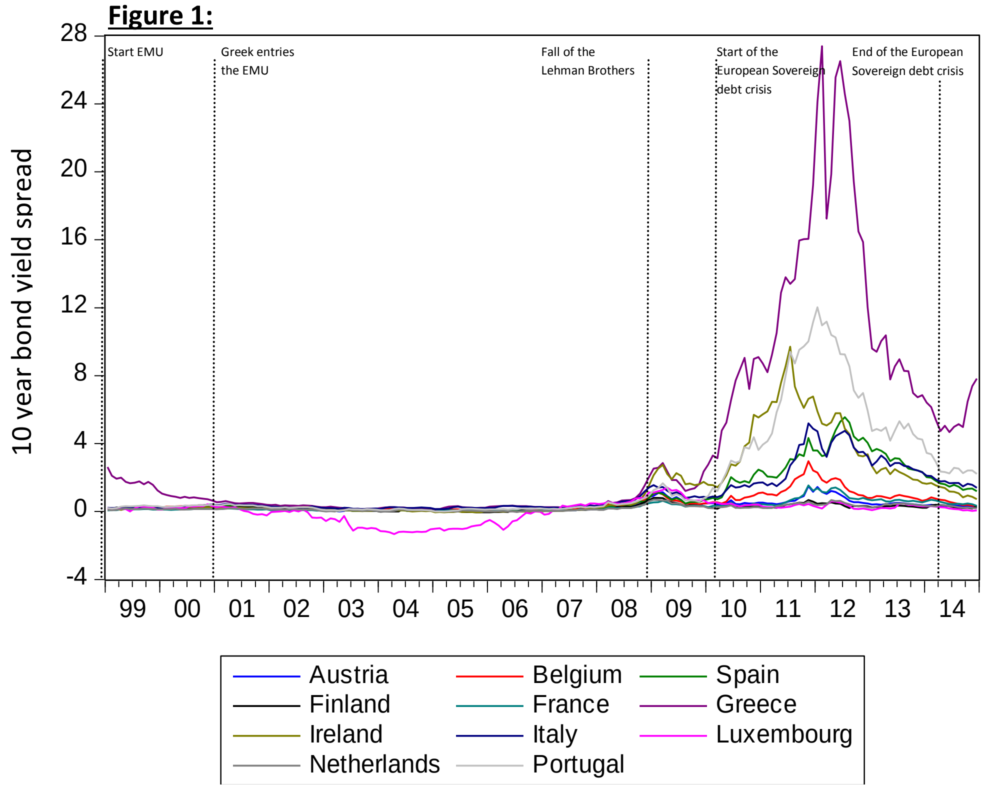
1 Introduction

The assessment of the government bond yield spread in the European Monetary Union (EMU) is nowadays a widely discussed topic in the scientific literature. Since the recent European sovereign debt crisis started in 2008 this subject has even drawn more attention. During this crisis the sovereign bond spread of almost all countries increased relatively to the benchmark country Germany. This is especially true for the countries Greece, Ireland, Italy, Portugal and Spain (GIIPS). Their sovereign bond yield increased even more drastically with yield differentials of 50 basis points up to almost 300 basis points. This high yield spread could be interpreted as the loss of market confidence in certain countries. This has led to the need of a financial support package for 4 of the 5 GIIPS countries to save them from going bankrupted.[1][2][3][4] Figure 1 provides a graphical representation of the European bond yields over time.

Figure 1:



Note: This figure represents the evolution of the European ten year Government bond yield spread. The data is monthly and in percentage points from quarter 1 1999 till quarter 4 2014. The data is extracted from the Eurostat database.

A large number of studies attempted to identify the factors that affect the government bond yield spread before and after the crisis. The paper by Codogno et al. (2003) is one of the early papers which tries to identify these factors. The fundamental variables pointed out by this paper are since then thoroughly used by other researchers. This has led to an overall consensus that there are three categories of underlying variables that can be identified as the main determinants of the spread in the government bond yield spreads: international risk factors, country specific factors and liquidity

[1] http://ec.europa.eu/economy_finance/assistance_eu_ms/ireland/index_en.htm
[2] http://ec.europa.eu/economy_finance/assistance_eu_ms/portugal/index_en.htm
[3] http://ec.europa.eu/economy_finance/assistance_eu_ms/greek_loan_facility/index_en.htm
[4] http://ec.europa.eu/economy_finance/assistance_eu_ms/spain/index_en.htm

factors. The interest in this subject increased after the large yield spread during the crisis. Many scholars try to explain this large increase, for instance Schuknecht et al. (2011) and Bernoth et al. (2012). These papers find that during the crisis the spread can still partly be explained by using the fundamental variables. However, the markets started to discriminate between countries. Moreover, the markets are penalizing countries with loose fiscal policy and fiscal imbalances more severely. The elasticities of the different indebtness variables, such as deficit and total debt, are three to seven times as high during the crisis, especially when combined with a high risk aversion. The majority of the papers, including the ones above, conclude that the increase in the spread can mainly be ascribed to the increased global risk aversion. For example, Arghyrou and Kontonikas (2012) and Heinz and Sun (2014). This rise in risk aversion has not only increased the spread but also magnifies the effect of the fundamenal variables, according to Barrios et al. (2009). The majority of the research on this topic focuses on the effects of the fundamentals, but there is a rising numbers of papers which try to find other explanatory variables. The paper by Martelli and Aristei (2014) uses behavioural factors to explain the yield spreads. They add behavioural variables to their model to visualise the effect of consumer and investor sentiments. This paper concludes that, on top of the fundamentals, the behavioural variables still have significant explanatory power on the sovereign bond yield spread.

As showed in previous literature, it is clear that the countries in the Eurozone share many common risk characteristics and are exposed to similar systematic risk such as the global risk aversion. From table 3, we can see that the first principle component explains 63,3% of the overall variability in the government bond yield spread for 11 European countries from 1999 to 2014 Meanwhile, the first principle component explains 96,5% of the variability from 1999 to 2008, but only 60,73% from 2008 to 2014, which implies that there appears to be a discrepancy in the Eurozone during the debt crisis.. For example, during the crisis the bilateral correlations between Portugal and the SEZ countries become negative in 4 of the 6 cases. In contrary, the correlations between Portugal and the other GIIPS countries are at least 0,72. During the crisis similar results apply to the other GIIPS countries.

In this paper, I analyse the determinants of government bond yield spreads documented in the literature and explore to what extend these variables affect the government bond yield spreads in the GIIPS and SEZ countries. The models consist of fundamental and behavioural variables, but the focus lies on the effect of the behavioural variables. The goal of this paper is to explore whether or not the behavioural factors have different implications for the two groups by answering the following two research questions:

(I) How do the behavioural factors affect the spreads in Eurozone countries?

(II) Is there a difference in how the behavioural factors affect the GIIPS and the SEZ countries?

To answer this question the following hypothesis is formulated:

H0: The effects of the behavioural factors on the government bond yield spreads of the GIIPS and SEZ countries are equal.

HA: The behavioural factors have a larger effect on the government bond yield spread in the GIIPS countries.

To test the hypothesis, both the short run and long run models are conducted for the SEZ countries and the GIIPS countries. As a result, it is possible to compare the outcomes between the two groups. After controlling for the fundamental determinates such as country specific factors and liquidity factors, in both of the long run models the behavioural variables are highly significant and have the same signs. I find that the government bond yield spreads for GIIPS countries increase by 0,05% to 1% when the investors sentiment decrease by 1% depending on the sentiment variables. The magnitudes of the coefficients of the behavioural factors in the GIIPS countries are two to ten times as high as the coefficients in the SEZ countries. The Z-test on the equality of coefficients between the two models is highly rejected, which supports these previously mentioned results. In the short run models the behavioural variables are still of influence, but for the SEZ countries the international risk factor is the key variable, while the liquidity has the most influence on the spread of the GIIPS countries.

This paper has the following structure: Section 2 gives a brief overview of the available literature on the subject. Section 3 presents the outline of the used methodology as well as the description of the data utilized in this paper. Section 4 shows the results and discussion part which consists of a *time series analysis* and a *cross-section analysis*. This paper ends with Section 5, which holds the conclusion of the results and an answer to the research question.

2 Literature Review

The literature review gives a brief assessment of the literature regarding the government bond yields over time and per topic. The assessment of the government bond yield spread in Europe is nowadays a widely discussed topic in the scientific literature, especially since the European sovereign debt crisis in 2008. However, before this crisis, little was written on this subject. Before the establishment of the EMU, the number of literature on this topic is even scarcer. Favero et al. (1997) is one of the first papers who attempted to identify the determinants of the interest differentials in European. Their conclusion is that there are three key components which are responsible for the yield differentials: the expectations of exchange rate, the market's view on the default risk and the individual countries different taxation treatment on the 10-year yields. They also find that there is a large common trend in the spreads of Spain and Italy. This trend could be driven by global risk factors or country specific factors and shocks.

After the establishment of the European Monetary Union (EMU) in 1999, new possibilities for researchers were available regarding the European government bond yield explanation. Before the EMU, a significant component of the government bond yield differentials was due to the Exchange rate risk. However, with the establishment of the EMU, the different currencies disappeared for the Euro and, therefore, eliminate the exchange rate risk component.

The paper by Codogno et al. (2003) is one of the early papers on explaining the government bond yield spreads in the EMU. They conclude that the spreads in the bonds come from the movement of the international risk factor. They also show that there is a small role for liquidity factors, which could explain the different effect of the international risk factor on the European countries. The final result is that the country specific risk to default is relatively small but important factor in explaining the yield differentials. This variable shows the perspective from the market about the vulnerability of a particular country on their fiscal policies.

The fundamental variables pointed out by Codogno et al. (2003) are thoroughly used by other researchers. This has led to an overall consensus that there are three categories of factors that are the main determinants of the spread in the Government bond yield: (A) international risk factors, (B) country specific factors and (C) liquidity factors. However, there is not a shared conclusion on the effects of the different determinants on the government bond yield spread.

The international risk factor (A) is the most important determinant in explaining the government bond yield spread (Barbosa and Costa, 2010). This variable often takes the form as the difference between the risk-free US government bond and Moody's AAA US corporate bonds. An increase in this value shows an increase of the risk aversion and is correlated positively with the European sovereign bond yield spread (see Barrios et al., 2009; Manganelli & Wolswijk, 2009 and de Sanctis, 2012). However, several other papers use the VIX variable as the global risk aversion. The VIX index captures market expectations with respect to near-term volatility and is globally known as one of the key measurements of investors' sentiment (CBOE). This measurement has been used in papers, such as Arghyrou & Kontonikas (2012) and Longstaff et al. (2011).

The country specific risk (B) is sometimes mentioned as the credit risk of a country. This variable is, together with the international risk component, an important determinant of government bond yield spreads. The main variables in this category are the total debt divided by GDP fiscal deficit and the debt payments divided by current revenue (debt service)[5]. A paper Hilscher & Nosbusch (2010) finds that above fundamentals also have explanatory in developing countries even when controlling for international risk factors and credit ratings. They also find that the volatility of terms of trade contributes significantly to the model. However, the impact of the fundamentals on the sovereign bond spread has changed over time. During the crisis the impact of the country specific risk components are amplified by the international risk factors. In other words, during time of high market stress and therefore higher risk aversion, investors punish detoriations in the fiscal performance more severe (Haugh et al., 2009 and Barrios et al., 2009).

The liquidity risk factor also plays a nontrivial part in explaining the sovereign bond yield spreads (Sgherri & Zoli, 2009, Favero et al., 2010 and Monfort & Renne, 2014). The roll of the liquidity risk is especially visible during time of high market stress and in countries with a low credit quality such as the GIIPs countries in Europe, according to Beber et al. (2009).

Where the previous described papers mainly focus on the long run relationship, this paper constructs spread in both the long run and short run, for example, Poghosyan (2014) and Csonto & Ivaschenko (2013). However, the former mainly focuses on the country specific factors and tries to find out how they differ in the short and long run, and the latter concludes that in the long run both country-specific variables as international factors are important, but that in the short run the international factor is a better estimator. In addition, they do not analyse the effect of behavioural factors.

This paper introduces another innovative feature by dividing the Eurozone into two groups of countries (GIIPS and SEZ countries). This is contrary to the traditional literature which mainly focuses on the Eurozone as a whole. The majority of these papers, which follow the same approach by dividing the sample, look at the contagion effect of the global financial crisis and the Eurozone debt crisis (see among others, Antonakakis & Vergos, 2013, Claeys & Vasicek, 2012 and Metiu, 2012). The overall conclusion of these papers is that there is a significant contagion effect in the Eurozone, especially since the start of the global crisis. A recent paper by Costantini et al. (2014) finds that the expected government debt to GDP and liquidity risk are the main long run drivers in the sovereign bond yield spread. However this result strongly changes when the sample is divided in members of a Optimal Currency Area and countries who fail to this test. The long run drivers of government yield spread almost dissappear in the OCA countries while it still has a large effect for the countries which fails the OCA test. My paper shows a new finding that the behaviours factors affect the GIIPS and SEZ countries differently before and during the crisis.

As pointed out at the beginning of this literature review, most of the literature focuses on the fundamentals as the explanatory variables in government bond yield spread analysis. However, more and more researched doubt if the extreme movements of the government bond yield spread in the recent years can be explained by using fundamentals only.

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[5] See among others, Chinn and Frankel (2005), Bernoth et al. (2006), Bernoth et al. (2012).

The effect of behavioural factors have been recently documented in the sovereign bond litarature. In the stock market research the use of market sentiment variables is used quite often to explain the level of stocks and corparate bond spreads, see for example, Brown, (2004) Baker and Wurgler, (2007), Tetlock, (2007) and Nayak, (2010).

One of the first papers which introduces behavioural factors in the European bonds litarature, is the case study by Spyrou, (2011). This paper tries to explain the sovereign bond yield spread of Greece during the crisis period. He concludes that the local and international investor sentiment are an important and significant determinants of the Greece sovereign bond spread, especially during the Greece crisis. Giordano et al. (2012) and Giordano et al (2013) also take the sentiment into account. They conclude that prior to the European sovereign debt crisis, investors largely ignores the quality of the fundamental variables. After this date, the investors have a 'wake-up call' and start to discriminate countries based on their fundamentals. This has led to an overpricing and a sharp increase in countries with a low quality of fundamentals such as Greece and Portugal. This result shows the importance of the investors sentiment, since a positive (negative) market sentiment can signifcantly improve (detoriate) the sovereign bond yield spread of a country. These results are supported by the case study of Fernades et al (2014) whichs finds that investors not only base their decision on fundamentals but also on the currente sentiment. Therefore, the sentiment has a negative impact on expected spreads. The paper by Martelli & Aristei (2014) is one of the latest paper which uses behavioural factors to explain the government bond yield spread. Martelli and Aristei (2014) find that the traditional model does not analyse the spreads in a most optimal way, especially not during increased market stress. They add several behavioural which captures the consumer and market sentiment and conclude that these variables have strongly significant explanatory power on explaining government bond yield spread within the Eurozone.

This paper introduces some new features in the literature regarding the government bond yield spread. First, I add behavioural factors instead of only fundamentals. There are a limited number of studies on the government bond yield spread which include non-fundamental variables. Secondly, the goal of this research is to explore whether or not behavioural factors have different effects for the GIIPS and SEZ countries. The breakdown of the Eurozone into two groups is a rather new method because almost all literature regarding the subject uses a dataset which consists of all the Eurozone countries. However, as the cross reference part shows, there is a dichotomy in the Euro-area. This paper is one of the first to explore this dichotomy in the Eurozone over time in depth and compare if the fundamentals variables and the behavioural factors respond differently in the two groups. Furthermore the results of the two groups are compared in both the long and short term.

3 Methodology and Data

This section describes the methodology and data used in this paper. Section 3.1 focuses on the methodology used for analyzing the government bond yield spreads. Section 3.2 explains the used data.

3.1 Methodology

In this paper I estimate two separate models with monthly data on the government bond yield spreads in the European Monetary Union. The government bond yield spread is defined as the difference between the yields on 10-year government bonds of a certain country and the German counterpart, which is known as the benchmark:

$$Spread_{i,t} = Sp_{it} = Yield_{i,t} - Yield_{Ger,t} \quad (1)$$

where t stands for time in months and goes from 1, 2, 3,..., T and i stands for a specific country which goes from 1, 2, 3,..., 6.

The independent variables in this paper can be divided into country specific variables and common variables. The country specific variables are similarly constructed as equation (1), which implies that it is the difference between the country specific variables and the benchmark country Germany.

$$Variable = X_{it} = \text{Country specific variable}_{i\,t} - \text{Country specific variable}_{Ger,t} \quad (2)$$

This paper constructs the long run relationship between 1999 and 2014. Multiple papers such as Barrios et al. (2009) conduct the long run relationship to describe the effects of the different variables on the yield spreads. The long run model takes the following form when only fundamentals are used:

$$Sp_{i,t} = \alpha + Z_{it}\beta_i' + F_t V_i' + \varepsilon_{it} \quad (3)$$

where t = time = 1,2,3,....,T, α is the average intercept term, β_i is the vector of coefficient terms and Z_{it} is a vector of explanatory variables. Z_{it} consists of the country specific explanatory variables such as liquidity risk variables and country specific risk variables (fiscal variables and general fundamentals). V_i' is the vector of coefficients of the common explanatory variables with F_t as the vector of the two common factor terms: VIX and Euribor.

The model presented above is the basic model and only consists of an average intercept, country specific effects and common factors. This model is extended with sentiment indicators (both common and country specific). Furthermore, a country specific intercept a_i is included. The country specific intercept corrects for the unobserved heterogeneity between the countries. This intercept is correlated with the independent variables and is asssumed to be constant over time. A model with a country specific intercept is called a fixed effect estimator. To test whether this fixed effect model rejected, the Hausman test (Hausman, 1978) and the Likelihood ratio are presented in section 4.2.1.

The complete country specific long run model for the SEZ countries (i) and GIIPS countries (j) is presented by the following two equations:

$$Sp_{it} = a_i + Z_{it}\beta_i' + F_tV_i' + M_{it}\chi_i' + S_t\gamma_i' + \varepsilon_{it} \tag{4}$$

$$Sp_{jt} = a_j + Z_{jt}\beta_j' + F_tV_{ij}' + M_{jt}\chi_j' + S_t\gamma_j' + \varepsilon_{jt} \tag{5}$$

where a_i is the country specific intercept, β' is the vector of the country specific coefficient terms and Z_{it} is the vector of six country specific explanatory variables[6]. $V'$is the vector of coefficients of the common factors while Z_t^i is the vector of the two common factor terms. χ' is the vector of the country specific market sentiment coefficients terms and M_{it} is the vector of the three country specific market sentiment variables[7]. $\gamma_i'$is the vector of coefficients of the two common market sentiment factors while S_t is the vector which represent the two common market sentiments factors IFO and Michigan.

To explore the effects of the fundamental and behavioural variables in the short run, an autoregressive model in first differences is conducted. Two lags of the dependent variable are added. These lags are included to correct for serial correlation in the model. In this model I add the first lag of the inflation variable. To take the high fluctuation of the sovereign spreads into account, I add three different time dummies: The first time dummy takes the start of the financial crisis with the fall of the Lehman Brothers in August 2008 until the approximate start of the Greek debt crisis in December 2010 into account. The second time dummy is between January 2010 and December 2012 and takes the Sovereign debt crisis in the Eurozone into account. During this time, the spread within the Eurozone was historical high and multiple countries needed financial aid from the European Central Bank and International Monetary Fund. The last dummy is between January 2013 and December 2014. During this time period the SEZ countries went back to their long time equilibrium and most of the GIIPS countries almost recovered from the crisis (with the exception of Greece).

The two models take the following form:

$$\Delta Sp_{it} = a + \theta_i \Delta Sp_{it-k} + \Delta Z_{it-h}\beta_i' + \Delta F_tV_i' + \Delta M_{it}\chi_i' + \Delta S_t\gamma_i' + dummy_{it} + \varepsilon_{it} \tag{6}$$

$$\Delta Sp_{jt} = a + \theta_i \Delta Sp_{ij-k} + \Delta Z_{jt-h}\beta_i' + \Delta F_tV_j' + \Delta M_{jt}\chi_j' + \Delta S_t\gamma_j' + dummy_{jt} + \varepsilon_{it} \tag{7}$$

Where k is 1 or 2 and h is 0 or 1. The main difference between this model and the long run model, besides the first differences, is that this is a pooled mean model. The first differences correct for the country specific factors within a country. Therefore, conducting a fixed panel model is unnecessary, since the difference between the coefficients will be minimal.

3.2 Data

The dataset in this paper consists of two groups i.e. GIIPS and the SEZ countries. The dataset starts from January 1999, the establishment of the EMU, till December 2014 with the exception of Greece. This data starts in January 2001, when they entered the EMU.

[6] Gov debt, Deficit, GDP growth, Inflation, Current account, and DebtEu17

[7] ESI, OECD Business and OECD Consumer

Other Euro-countries are excluded from the dataset for several reasons. Germany is not in the dataset since it is used as the Benchmark country in this paper. The usage of Germany as a benchmark country is in line with the majority of papers written about the European government bond yield spread, for example Codogno et al. (2003) and Schuknecht et al. (2011). The other Euro countries (Slovenia, Cyprus Malta, Slovakia, Estonia, Latvia, Lithuania) (European Commission)[8] are excluded from the sample due to their later entrance of the EMU and therefore the lack of data. The dataset consists of monthly data from 1 January 1999 till 31 December 2014. However, due to a lack of data in the begin and end period, the adjusted sample period is from March 2000 till February 2014, which includes 168 periods. Most of the fundamental data is only quarterly available. To convert this to monthly data, the quarterly data is held constant for a three month period in advance. Data published in December is held constantly in January and February. The assumption is that the investors only know the state of a country in December and therefore will also hold their thoughts about the state of a country constant till the next publication.

The variables used are similar to the determinants used in the paper by Martelli & Aristei (2014) and are summarized into four main groups: The international risk factor, country specific risk factors, liquidity risk factors and sentiment variables. The variables can be country specific or are common which means that they are equal for all countries.

In this paper the CBOE Volatility Index (VIX) is used as a proxy to measure the international risk. The VIX index measures the market expectation based on the S&P 500 stock index option prices and is one of the leading measurements of investor sentiment and market volatility. An increase of the VIX index implies that there is more volatility in the options market in the United States. More volatility indicates a greater risk aversion in the United States. Since the United States has a large global influence, this leads to a higher risk aversion globally (CBOE)[9]

The country specific factors are in line with previous papers and are linked to the countries risk to default. To measure the country specific risk, investors look for instance at the fiscal performance of country, which can be measured by the following variables: government debt as a percentage of the total GDP , countries deficit/surplus as a percentage of the country's GDP and the country's GDP growth. All three variables are extracted from the statistical office of the European Union (Eurostat[10]) and are published quarterly. Especially the first two determinants are often used in the government bond literature[11]. Not only the fiscal performance is important in assessing the government bond yield spread, but also the general state of a country. To capture this general state this paper uses the current account deficit/surplus (Eurostat) and the year to year inflation is used. During the crisis the current account reflected the great imbalances between countries in the Eurozone. The SEZ countries have large current account surpluses, where the GIIPS countries face high current account deficits (Deutsche Bank Research, 2009). These high current account deficits can make it harder to finance the countries debt and may have negative impact on the government budget. This can both have effect on the sovereign yield. (Barrios et al., 2009). The inflation rate in this paper is based on the *Harmonised indices of consumer prices* (HICP) with 2005 as base year.

[8] http://ec.europa.eu/economy_finance/economic_governance/timeline/index_en.htm
[9] http://www.cboe.com/micro/vix/vixintro.aspx
[10] http://ec.europa.eu/eurostat
[11] For example in Bernoth et al. (2012), Baldacci & Kumar, (2010) and Gibson et al. (2015).

The third group of variables are the liquidity risk variables, heavily discussed in combination with the risk to default factors in for example in Codogno et al. (2003) and Haugh et al. (2009). This paper uses two different liquidity risk variable. The first variable Eurodebt17 is the country specific liquidity variable which is defined as the total outstanding debt divided by the total outstanding debt of the EU17[12]. This variable implies that when the total outstanding debt of a country is relatively high compared to the EU17, the sovereign bonds market is more liquid and therefore it is easier and safer for investors to buy and sell the bonds. This country specific data is extracted from Eurostat. The second variable is the 3-month Eurobor. *"Euribor® is the rate at which Euro interbank term deposits are offered by one prime bank to another prime bank within the EMU zone*" (European Money Market Institute). This variable does not report unique country levels, but is equal for all countries and is a variable that is often used to measure the liquidity in the whole euro area (Alexopoulou et al., 2009).

The last group of variables are the sentiment variables which consist of 3 country specific variables and two common factors. *''Market sentiment indicators is used by investors to see how the people in a country think about the market conditions ''* (Investopedia).

The first country specific market sentiment variable is *the Economic Sentiment Indicator (ESI).* This indicator consists of 5 different confidence indicators[13], each with their individual weight. The ESI tries to capture the general mood in the European Union and its member states.[14] The second and third country specific market sentiment variables are the OECD Business indicator and OECD Confidence indicator. These variables are published monthly by the Organisation for Economic Co-Operation and Development (OECD). The consumer confidence index is conducted from households all over the world and tells something about the consumers' plans for future expenses and their expectations of the development in their economic situations[15] (OECD). The business confidence index is based on a business review about future production, sales and stocks as well as their opinion about their change of position in the following weeks (OECD) [16].

The Common factors consist of the following two indicators: *the German IFO Business Climate Index* and *the University of Michigan Consumer Sentiment Index. The IFO Business Climate index* is an early indicator for the current economic developments in Germany. It is published monthly by the Center for Economic Studies in München and is one of the most significant market sentiment indicators in Europe (The CESifo Group)[17]. The final common factor market sentiment indicator is the *University of Michigan Consumer Sentiment Index*. The Michigan index is one of the oldest sentiment indices and is conducted by the University of Michigan. The data is gathered by interviewing US citizens about their expectations about the Economy. It is useful for investors since the outcome shows whether or not consumers are willing to purchase (University of Michigan). Table 1A, Table 1B and Table 1C present an overview of all the variables, shows how the variables are presented in the model and from which database they are obtained.

[12] Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, The Netherlands, Portugal, Slovakia, Slovenia, Spain (Latvia and Lithuania are excluded due to their late entry in the Eurozone and therefore the lack of data. (https://www.ecb.europa.eu/euro/intro/html/map.en.html)

[13] Industrial confidence indicator, Services confidence indicator, Consumer confidence indicator, Construction confidence indicator Retail trade confidence indicator

[14] http://ec.europa.eu/eurostat/en/web/products-datasets/-/TEIBS010

[15] https://data.oecd.org/leadind/consumer-confidence-index-cci.htm#indicator-chart

[16] https://data.oecd.org/leadind/business-confidence-index-bci.htm#indicator-chart

[17] https://www.cesifo-group.de/ifoHome/facts/Survey-Results/Business-Climate.html

4 Empirical results and Discussion

In this section, I discuss the results of the principal component analysis and the results of the two fixed effect models with behavioural factors.

4.1 Time series analysis

4.1.1: Correlation Matrix

Before presenting the principal component analysis and the results of the two panel data, I explain the reason to split the dataset of the Eurozone countries into two groups. This dichotomy is not common in previous literature and needs some clarification. I follow (Longstaff, Pan, Pedersen, & Singleton, 2011) to find commonality in the sovereign government yield by making a correlation matrix and conducting a principal component analysis.

In the appendix, Table 2 presents the correlation matrices between the 10 year government bond yields spread within in the Eurozone. The correlation matrix in Table 2A, which captures the whole time period, presents the first piece of evidence that within the Eurozone, government bond yield are not all moving in the same way or with the same magnitude since the average correlation is only 0,447. One of the most striking results is the negative correlation between Greece and Austria, Belgium, Finland, France, Germany, the Netherlands and Luxembourg while it has a positive correlation with the other GIIPS countries. However, the SEZ countries have a very high correlation with an average bilateral correlation of 0,9582, a minimum of 0,885 and an maximum of 0,9988 correlation between Finland and the Netherlands. This result shows a great commonality within in the SEZ countries on their Government bond spread. The correlation between the five GIIPS countries is somewhat smaller, but this correlation, with an average of 0,667, is still significantly larger than the correlation between the SEZ countries and the GIIPS countries (0.0687)

The division of the sample period, before 2008 and after 2008, shows interesting patterns. As can be seen in Table 2B, the correlation before the crisis is much higher than in the full sample. Even the correlation between Greece and the SEZ countries is above 80% instead of a negative correlation which was presented in the previous table. This result is not very surprising, Figure 1 shows the evolution of the government bond yield. In this figure it is clearly visible that till the start of the crisis in 2008 the yields of the different countries within the Eurozone are closely together and are quite stable. Table 2C present the correlation matrix after the start of the crisis in 2008. This table shows somewhat the same results as Table 2A. The bilateral correlation between the SEZ countries is again very high with an average correlation off 0,946 with each other and 0,947 between the SEZ countries and Germany. This indicates that the SEZ countries are still moving in the same way as Germany and do not show strange outliers during the crisis. The correlation of the whole panel is still only 0,501 while the GIIPS countries have an average bilateral correlation of 0,734. However, the correlation of the GIIPS countries with Germany shows that the GIIPS countries move very different during the crisis than the SEZ countries. The SEZ countries have a correlation of 0,947 with Germany where the GIIPS countries only have an average correlation of 0,031 with Germany. Greece and Portugal even have a negative correlation with Germany.

4.1.2: Principal Component Analysis

The tables above prove that there are different levels of commonality within the sovereign bonds. The size of this common factor can be found by estimating a principal component analysis. Longstaff et al, (2011) find that the sovereign credit risk in different countries is highly correlated, much higher than for example the equity index return in the same countries. The underlying source of this correlations is the dependency of the bond yield spread on a common set of international risk factors, risk premiums and liquidity factors. Similar results are found by Borgy et al.(2011). There principal component analysis reveals that over 80% of the spread can be explained by a common factor, namely the time-varying global risk aversion. This section conducts the principal component of the government bond yield values of and the changes in the government bond yield of the 9 European Union countries.

The PCA results in Table 3 show that the first PC explains 64 percent of the variation in sovereign government bonds yield spreads during the entire sample period. In addition, the first three PCs explain almost 85 percent of the variation over the whole sample period.

Figure 2A plots the weighting factors for the first PCA and we see a roughly uniform weighting factor except Greece. The second PCA, represented in Figure 2B, put some substantial positive weights to the GIIPS countries and negative weights to the other countries. So here we see a clear distinction between the GIIPS countries that faces serious difficulties during the sovereign debt crisis and the other SEZ countries. The third PC graphically represented in Figure 2C is heavily positive weighted towards Greece, which has experienced significant recent political turmoil and economic turmoil. On the other hand, the graph is negatively weighted towards Spain and Italy, which both gone through some strong improvements of their government bond yield spread.

From the correlation matrix and the Principal component analysis, it can be concluded that the differences in the Eurozone and the way the countries move is prominent. Therefore, the cross-section part present two different models for both the SEZ countries and the GIIPS countries.

4.1.3 Unit root test

This section presents the findings of the Unit root test. This test is conducted on the different variables used in both models. The Unit root test is used to check in which order the series are integrated. None of the series should exceed the order of 1 integration because this will lead to an inconsistent outcome. Integrated of order 0 implies that the series is stationary, which means that the variance and autocovariance are independent over time and are finite (Verbeek, A Guido to Modern Econometrics, 2012). When a series become stationary after conducting the first differences the series is integrated of order 1. Series integrated of order 1 are usually referred as a random walk.

This paper uses three different tests to check for a unit root. The lag length selection of the three tests is based on the Akaike information criteria (Akaike, 1973). The AIC is a criterion for selecting the right model since different lags can lead to different outcomes.

For the common factors, I use the Augmented Dickey Fuller test (ADF-test) based on the Dickey-Fuller statistic (Dickey & Fuller, 1979): The augmented Dickey-Fuller test suitable for complicated and large set of time series model and takes the following form:

$$\Delta Y_t = a_0 + \theta Y_{t-1} + a_1 \Delta Y_{t-1} + a_2 \Delta Y_{t-2} + \cdots + a_p \Delta Y_{t-p} + a_t \quad (8)$$

The null hypothesis of this test is $H_o: \theta = 0$ versus the alternative hypothesis $H_a: \theta < 0$. While the Augmented Dickey-Fuller works well for the common factors, it does not have significant explanation power on country specific variables since it looks at the whole sample at not at the independent countries. As a result, it rejects the null hypothesis when it is false to often which leads to the conclusion of too much unit roots in the model. Therefore, I use two other models to test for unit roots on the country specific variables. The first model which is better for testing on the unit root in panel data for country specific variables, is the Levin-Lin-Chu test (Levin, Lin, & Chu, 2002).[18] The null hypothesis of this test is: $H_o =$ each time series contains a unit root with the alternative hypothesis $H_a =$ each time series is stationary.

The second test I conduct on the individual series is the Breitung test**.** (Breitung, 2005)**.** The Breitung test is somewhat similar to the Levin-Lin-Chu test. It has the same hypothesis namely: $H_o: p_i = 1$ for all I hence each time series contains a unit root. The alternative hypothesis is $H_o: p_i \neq 1$ for all i.

Table 4 reports the results of the unit root test on both the levels and first differences. At first, it is important to note that none of the variables exceeds the order 1 integration. Second, Table 4A represents the outcome of the Breitung and Levin-Lin-Chu unit root test concerning the country specific variables. The variables Spread, Government Debt, Current account, Debt EU17 and ESI are all integrated of order 1 but that on a 5% level GDP growth and Inflation are stationary in levels (except inflation in the GIIPS dataset). Third, on a 10% significance level the OECD market sentiment variables are also integrated of order 0. The ADF test on Common factors, Table 4B shows that only the Euribor is integrated of order 1. The other common factors (Vix, IFO and Michigan) are all three integrated of order 0 for both the GIIPS as SEZ countries dataset. To conclude, the ADF-test does now reveal results that will cause a problem regarding the consistency of the models since none of the variables exceeds the order 1 integration.

4.1.4: Cointegration test

The final step before it is possible to conduct a long run relationship with I(1) variables, is to conduct the Engle-Granger residual approach (Granger & Engle, 1987). The idea of this approach is that after the long run models are established, you test whether or not the residuals have a unit root. When a unit root is present, the H0 of cointegration must be rejected and the long run relationship is not efficient. Table 5 shows the outcome of the cointegration test. As can be seen, none of the variables exceed the I(0) which implies that the errors are cointegrated and it is possible to conduct a long run relationship of the government bond yield spread.

4.2 Cross section analysis

This part discusses the results of the fixed effect panel data model of the explanation of the government bond yield spreads using fundamentals and market sentiment indicators.

4.2.1 Fixed Effects versus Random Effects

The first section of the cross section analysis starts with the estimation of the Hausman test and the likelihood ratio test. The Hausman test, first introduced by Hausman (1978), is a statistical hypothesis

[18] http://homepage.univie.ac.at/robert.kunst/pan2011_pres_nell.pdf

test which checks the consistency of an estimator. This test can be used to make a decision about which model is the most consisted, random effects model or fixed effects model (Greene, 2012) This test has the following form:

$$Hm = (b_{FE} - \hat{\beta}_{RE})' (V_{FE} - V_{RE})^{-1} (b_{FE} - \hat{\beta}_{RE}) \quad (9)$$

The Hausman test uses a Chi-squared distribution and has the following Null hypothesis: HO = The random effects model is preferred over the fixed effects model. However, if rejected the fixed effects model is preferred over the random effects model.

The Likelikhood ratio test also uses a Chi-squared distribution and has the same hypothesis as the Hausman test and takes the following form:

$$X^2 = -2logLik(H_0) + 2logLik(H_{A)} \quad (10)$$

Table 6 presents the results of both the Hausman tests and the Likelihood ratio test. From this table, it can be concluded that the fixed effect models are highly recommended above the random effects models since the null hypothesis is rejected for all the models in both hypothesis tests.

4.2.1 Fixed panel analysis

This next section of the cross section analysis starts with the results of the two different panel data model of government bond yield spread. The results of the SEZ country are presented in the appendix in Table 7A and for the GIIPS countries in Table 7B. As mentioned before, eight long run models on both the SEZ countries as well as the GIIPS countries are conducted to test whether behavioural factors act differently in the GIIPS countries compared to the SEZ countries. All but the Base and Euribor model consists of the VIX variable as the international risk factor and a behavioural factor. The first two models Base and Euribor are the models without behavioural factors and only include country specific risk factors and liquidity risk factors. It is interesting to notice that while that government debt is significantly negative and small in the SEZ countries model , it is significantly positive and have a relatively high effect in the GIIPS countries. This result is in line with previous papers. Furthermore, GDP growth is not significant in both models while current account is only significant for the SEZ countries. However, in contrary to most of the literature, the liquidity variable DebtEU17 seems to have the greatest explaining power in the first two models for both groups. Finally the last result I want to discuss is the Euribor variable. This common factor of liquidity risk is positive for the SEZ countries but negative for the GIIPS countries. The reason for this could be that the SEZ countries benefit more from an increased Eurobond market liquidity than the GIIPS countries due to the flight to liquidity effect ((Beber et al., 2009).

The third model is the VIX model. In this model I add the individual behavioural factors to find their individual effects on the two groups. The VIX contributes significantly to the model when compared to the base model and increases the adjusted R^2 from 0,37 to 0,46 for SEZ countries. In contrary, it has less effect on the GIIPS countries where it increases the R^2 from 0,523 to 0,526. It has a positive sign since the VIX is a stress variable. The higher the VIX, the more stress and risk adversity there is in the market. Before continuing let's take a closer look, because while in the SEZ countries model the Euribor is only responsible for a small contribution to this R^2 increase, is this not the case in the GIIPS model where the Euribor variable contributes roughly every increase in the R^2. The Euribor is the liquidity variable in the panel data which has an adverse sign in both models. This negative sign can be explained as follows: when the Eurozone becomes more liquid as a whole, since Germany contributes more than the other countries, the Germany government bond yields decreases more than other countries and therefore the spreads increases. This liquidity effect has a greater effect on the GIIPS countries than on the SEZ countries. Furthermore the liquidity effect dominates the international risk effects. Both results are in line with previous literature[19]. From now on the VIX model will be used as the base model and every next regression in table 7 only introduces one extra behavioural variable. The VIX factor stays significant for all models which makes it a good variable for explaining the international risk behaviour.

The first behavioural variable is the Economic Sentiment Indicator (ESI). This is the only behavioural factor conducted by the European Union. This additional variable is significant in both GIIPS and SEZ countries and increases the R^2 drastically for both groups of countries. The variable has a negative sign meaning that a rise in the Economic Sentiment Indicator leads to a smaller government bond yield spread over Germany. The entry of this variable also alters some of the results of the coefficients. The liquidity variable in the SEZ countries model becomes now completely insignificant while it loses half of its power in the GIIPS countries model.

The next two models are based on the OECD business and confidence variables. Both variables contribute to the models with a growth of R^2 from respectively 0,46 till 0.49 and 0.55 for SEZ countries and from 0,53 to 0,67 and 0,7 for the GIIPS countries. The impact is thus stronger in the GIIPS countries. When comparing the OECD statistics with the other behavioural factors we see that these variables have the highest coefficients in both models.

The IFO variable is the first behavioural factor that has a positive sign. A higher IFO means better economic prospects. The reason why the IFO coefficient shows a positive sign lays in the origin of the variable. The IFO Institute for Economic Research is a German institution, so it may be that positive results from this institution has a larger effect on the German economy than it has on the other European economies, yielding a positive relationship. In other words; a higher score from the IFO leads to a lower government bond yield in Germany. This lower yield in Germany leads to a higher spread with the other countries. Irrespectively on the sign, this variable still contributes significantly to the model.

The final behavioural factor is the Michigan variable. This variable has the smallest coefficient number and contributes the least to the model with an increase in the R^2 of 0,47 to 0,48 and 0,53 to 0,54. The Michigan variable is in line with the ESI and the OECD variables and has a negative sign.

From the long run relationship it can be concluded that both the international risk factor and the behavioural factors have a large and significant influence on the government bond yield spreads. Moreover, the coefficient of the international risk factor and the behavioural factors in the GIIPS countries are larger than those in the SEZ countries, with an exception of the OECD business confidence index.

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[19] See Gomez-Puig, (2006) Beber et al. (2009). and Favero et al. (2010)

4.2.2: F-test for a collection of Regression of coefficients

To test whether or not the Market Sentiment variables significantly contribute to the model of explaining government bond yield spreads, I use the following F-test:

$$F = \left(\frac{n-p-1}{q}\right) * \left(\frac{R_1^2 - R_2^2}{1 - R_1^2}\right) \quad (11)$$

where n is the number of observations, p is the number of variables used in full model, q is the variables left out of the model, R_1^2 is the R squared of the full model and R_2^2 is the R squared of the base model. The Null hypothesis is HO: Model x = Model y with the alternative hypothesis HA: Model x ≠ Model Y (2 tailed).

The results of this test are showed in Table 8 A model consisting of 7 variables the 5% and 1% critical values are 2,31 and 2.94, for a model with 8 variables the 5% and 1 % critical values are 2.21 and 2.788 and for a model with 9 variables 2,14 and 2.66. The N of the model is the total observations and we see that we can reject every null hypothesis of no explaining power of the new variable. This implicates that every variable added contribute significantly to the model.

4.2.3: Fixed panel model including Dummy variables for the Crisis

Figure 1 presents the evolution of the Government bond yield spread and shows that the time period can be divided into roughly two periods. The period before the crisis where government bond yield convergence to each other and the differences between countries almost entirely disappeared and the period after 2007, the credit crisis. In this period government debt increased drastically, high deficits occur in almost all countries and the spread between Germany and the other EMU countries increased significantly. To test if the model has a structural break, it is possible to conduct the Chow test on a structural break. The Chow Test is conducted with the following F-test (Verbeek, 2015):

$$F = \frac{(S_C - (S_1 + S_2))/(k)}{(S_1 + S_2)/(N_1 + N_2 - 2k)} \quad (12)$$

with k and $N_1 + N_2 - 2k$ degrees of freedom. Where S_C is the residual sum of squares for the complete model, S_1 is the residual sum of squares for the model period prior to the crisis and S_2 is the residual sum of squares of the model after the crisis. Furthermore, k is the number of regressors in the restricted models (which is 2 for the Vix model and 3 for the other 5 models) and N1 & N2 are the number of observations in the two models. Table 9 shows the results of the Chow test on structural break. For both groups, the Chow test on structural break is highly significant and is rejected on a two tailed 1% significant level. These results implies that there is indeed a structural break and the model can be divided into two periods.

4.2.4: Fixed panel model with dummies

The next model takes the effect of the crisis into account by introducing a crisis dummy. This dummy appears as 1 after 2007 month 8 (start of the great recession with the subprime mortgage crisis in the USA and the fall of the Lehman Brothers). Table 10A and Table 10B present the outcome of coefficients of the behavioural factors and the interaction effects between the crisis dummy and the behavioural variables and the international risk factor. Since the focus lies on these variables and not the fundamentals, this paper does not estimate interaction effect between the crisis dummy and the liquidity and country specific risk variables.

The two tables reveal a mixed result. Table 10A, which consists of the SEZ countries, shows that prior to the crisis the Vix variables and the behavioural factors have a small coefficient with an exception of the OECD Consumer Confidence variable. The coefficient of the VIX variable, when interacted with the crisis dummy, is highly significant in all the models. However, in the IFO and Michigan models, the VIX reveals a minus sign which is counter intuitive but could imply that the effect of the international risk factor is smaller when these behavioural factors are present. This result is namely offset by a change of the sign of the corresponding behavioural factors, which could be due to a correlation between those variables. Table 12A and Table 12B presents the bilateral correlation between the VIX variable and the behavioural factors. The VIX has a negative and relatively high correlation with the IFO and Michigan and that could explain the switch of the signs in the model.

In Table 10B (GIIPS countries) the difference in the coefficients of the behavioural factors is 4 to 5 times as high as the coefficients for the whole sample. However, the effect of the international risk factor (VIX) decreased after the Crisis. None of the VIX variables interacted with the dummy effects is significant in the GIIPS countries when a behavioural factor is present in the model, which implies that during the crisis the behavioural factors completely take over the effect of the International risk factor.

The most striking results which can be concluded from these tables is that for the SEZ countries the influence of the International risk factors increased during the crisis and there is a smaller role for the behavioural factors while this is complete the other way around for the GIIPS countries.

4.2.5: Z-test on the equality of coefficients

The final test I conduct on the long run relationship is the Z-test on the equality of the coefficients in the two groups of countries: GIPPS and SEZ. The results can be found in the appendix in Table 11. The coefficients of the behavioural factors show some differences between the two groups. However, a Z-test to test whether these coefficients differ significantly from each other has to be conducted (Clogg, Petkova, & Harito, 1995). This test takes the following form:

$$Z = \frac{b_1 + b_2}{\sqrt(SEb_1^2 + SEb_2^2)} \qquad (13)$$

Where b_1 is the coefficient of SEZ countries and b_2 the coefficient of the GIIPS countries. The critical values are 1,96 for 5% significance level and 2,575 for a 1% significance level.

The first variable to check is the international risk factor VIX. It can be seen that within the two VIX models the international risk factor does not significantly differ in the GIIPS and the SEZ Countries. Second, when adding an additional behavioural factor the effect of the VIX differs between the two groups on a 5% level in the OECD models and on a 1% significance level in the ESI and IFO models. For the Michigan model, the VIX stays insignificant. The effect of the VIX is larger in all of the GIIPS models meaning that these countries bond yields are more influenced by international risk factors then the SEZ countries.

The Z-test on the individual behavioural factors show somewhat differ results, namely all of the null hypothesis of no equality between the coefficient are rejected. In fact, all of the behavioural factors have a higher coefficient in the GIIPS panel data. From this result, it can be concluded that the market sentiment has a stronger effect in the GIIPS countries on the government bond yield spread.

4.2.6: Pooled model in first differences.

The final model in this paper is the pooled regression in first differences. This model is presented in Table 13A and Table 13B and shows the short run relationship between the government bond yield spread and the fundamentals and behavioural factors. Table 13A and 13B presents the results of the short-run model for respectively the SEZ countries and the GIIPS countries. Table 10a shows that the fundamental variables in the first difference model are a poor predictor to explain the the change in government bond yield spread in the SEZ countries. None of the fundamentals in the models are significant. Only the lag of the change in spread is significant on a 5% level. The variable which was the most influence on the change in the government bond yield spread is the international risk factor (VIX). This variable is highly significant in all the models, which means that the change of the spread in the SEZ countries is highly influenced by the change in the international risk factor and not the country-specific variables. This result is in line with the paper by Csonto & Ivaschenko, 2013 who found that in the long run both country-specific variables as international factors are important but that in the short run the International factor is a better estimator. Also, the sentiment variables are not that decisive as the where in the long run model. Only the IFO and Michigan are significant on a 1% and 5% level and the OECD business confidence on a 10% level. Furthermore, none of the dummy variables has any power since they are not significant implying that the crisis does not have a very large effect on these group of countries.

The short run model of the GIIPS countries in Table 13B shows some different results. The two lags of the spread are significant just as the SEZ countries model. Some of the fundamentals have some explanation power. At first the deficit variable is highly significant in 7 of the 8 models highly at a 1% level. This is in line with previous papers which describes that the deficit/GDP variable is a good explanatory variable for the spread (Baldacci & Kumar, 2010) and (Gibson et al., 2015). Furthermore, the liquidity variable country debt over European Union debt is highly significant in all the pooled panel models of the GIIPS countries. This is an opposite result of Table 13A where the liquidity variable is not significant at all. The paper by Beber et al. (2009) found that a large part of the government bond yield spread is explained by credit quality. However, during times of market stress and especially in low credit risk countries such as the GIIPS countries liquidity tend to be a crucial variable. The VIX variable, which is the most important variable in table 10A, does not have any explanatory power which indicates that for the GIIPS countries the change in the international risk factor is less important. In contrary the sentiment variables show some mixed results. 2 out off 5 variables are significant at a 5% level and 2 out of 5 variables are significant at an 1% significance level. Finally, in this model the Dummy variable for the years 2013 and 2014 is significant and negative. The reason for this could be derived from Figure 1. This figure shows a sharp decline in the Government bond yield spread after 2012 which continues for most of the countries in 2013 and 2014. The market stress seems to return to its ‘normal level’ and therefore this dummy has this negative sign in this period.

5 Conclusion

In this paper I analyse the effect of the behavioural factors on the 10 year sovereign bond yield spread between two groups of Eurozone countries, GIIPS and SEZ, versus Germany. I split the Eurozone into two groups of countries, because of the dichotomy I have found in part 4.1.

I use an unbalanced dataset containing of monthly data from March 2000 to February 2014. To answer my research question I build several fixed effect long run models (with and without crisis dummies) and short run pooled mean group regressions (with time dummies). These models consist of fundamental variables, the international risk factor and an additional behavioural variable.

As shown in the different long run models I conclude that the behavioural factors have a large significant influence on the yield spread. This is especially true during time of heighted market stress such as the latest European sovereign debt crisis. The effect of the behavioural factors also differs significantly in the two groups. The sentiment variables have a 2 to 10 times larger impact on the sovereign bond yield spread in the GIIPS countries than in the SEZ countries. This implies that the investors react more strongly in countries with deteriorated fundamentals. In the short run the explanation power of the behavioural factors are smaller and some are not significant at all. In the SEZ countries the spread is mainly driven by the international risk factor, while the liquidity risk has the greatest impact on the GIIPS countries.

However, not studied in this paper, it is possible that the investor sentiment and the international risk factor were extremely low prior to the crisis and that the crisis has led to a more extreme reaction of investors. This could partially explain the extreme movements in the European yield spread. The behavioural data reveals that most of the sentiment levels are not yet back to their pre-crisis level. Therefore, the complete aftermath of the crisis should be explored in future research, when more data is available. For example, it is worthwhile to study whether the international risk factor and the behavioural factors will go back to their long run level and whether the long run levels have changed since the crisis.

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7 Appendix

Table 1: Data Description

Table 1A: Data Information

	Group	Variables	Definition	Frequency	Source
0	Independent variable	$\text{Spread}_{i,t}$	Difference between the 10-year government bond yield of country i and Germany	Monthly	Eurostat
1	Country specific risk variable	$\text{Gov debt}_{i,t}$	Government Debt as percentage of the country's GDP	Quarterly	Eurostat
2	Country specific risk variable	$\text{Deficit}_{i,t}$	Countries deficit(-)/surplus(+) as percentage of the country's GDP	Quarterly	Eurostat
2	Country specific risk variable	$\text{GDP Growth}_{i,t}$	Countries GDP growth	Quarterly	Eurostat
3	Country specific risk variable	$\text{Inflation}_{i,t}$	Countries Inflation (HICP = 2005)	Monthly	Federal Reserve Bank of St. Louis
4	Country specific variable	$\text{Current Account}_{i,t}$	Differences between export and imports over GDP	Quarterly	Eurostat
5	Liquidity risk variable	$\text{Eurodebt17}_{i,t}$	Total outstanding debt divided by the EU17 total debt	Quarterly	ECB
6	Liquidity risk variable	Euribor_{t}	3-month Euribor	Monthly	ECB
7	International risk variable	Vix_{t}	CBOE Volatility Index	Monthly	CBOE
8	Sentiment variable	$\text{ESI}_{i,t}$	Economic Sentiment Indicator	Monthly	Eurostat
9	Sentiment variable	$\text{OECD Business}_{i,t}$	OECD Business Confidence	Monthly	OECD
10	Sentiment variable	$\text{Oecd Consumer}_{i,t}$	OECD Consumer Confidence	Monthly	OECD
11	Sentiment variable	IFO_{t}	German IFO Business Climate Index	Monthly	IFO
12	Sentiment variable	Michigan_{t}	University of Michigan Consumer Sentiment Index	Monthly	www.sca.isr.unimc.edu

Notes: The subscripts t and i apply to time and country. All the country specific variables are subtracted from the German counterpart, hence $Variable = X_{i,t} = \text{Country specific variable}_{i,t} - \text{Country specific variable}_{Germany,t}$

Table 1B: Descriptive statistics country specific variables

		Countries											
Variables	**Statistics**	Austria	Belgium	Spain	Finland	France	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	All countries
Spread	**10%**	0,04	0,07	0,04	0,03	0,05	0,22	0,01	0,21	-1,01	0,02	0,11	0,04
	mean	0,32	0,50	0,98	0,22	0,29	3,89	1,36	1,05	0,03	0,20	1,88	0,97
	90%	0,66	1,08	3,26	0,45	0,69	12,11	5,08	2,96	0,57	0,45	6,01	2,42
	obs	192	192	192	192	192	192	192	192	192	192	192	2112
Gov Debt	**10%**	1,72	24,20	-27,43	-32,91	-0,42	38,00	-40,65	36,63	-60,54	-20,37	-6,16	-40,64
	mean	5,90	34,30	-11,57	-25,32	4,23	63,41	-10,04	42,45	-56,07	-13,63	11,79	2,18
	90%	11,14	52,27	12,35	-16,49	14,55	97,85	43,32	51,03	-51,73	-6,12	52,13	46,72
	obs	178	178	178	178	178	106	178	178	168	178	178	1876
Deficit	**10%**	-5,46	-7,84	-11,39	-2,89	-5,93	-13,95	-11,91	-5,32	-1,10	-5,84	-9,18	-8,34
	mean	-0,51	-0,25	-1,63	3,42	-2,09	-5,80	-2,59	-1,51	3,21	-0,02	-3,31	-1,01
	90%	3,98	6,84	7,15	9,58	2,36	0,84	7,05	1,55	7,92	3,44	2,12	6,34
	obs	192	192	192	192	192	192	192	192	192	189	192	2108
GDP Growth	**10%**	-2,22	-8,00	-9,17	-5,38	-6,13	-7,65	-5,10	-6,45	-6,24	-8,85	-5,73	-6,55
	mean	0,23	0,37	0,53	0,31	0,15	0,29	0,72	0,10	1,09	0,30	0,10	0,38
	90%	2,58	8,44	7,96	6,15	5,51	7,73	6,52	7,98	8,72	7,64	5,64	7,14
	obs	182	182	182	182	182	182	182	182	182	182	182	2002
Inflation	**10%**	-0,20	-0,50	-0,60	-1,00	-0,60	-1,81	-1,81	-0,40	-0,20	-0,80	-1,10	-0,70
	mean	0,34	0,45	0,97	0,37	0,12	0,98	0,56	0,56	0,94	0,55	0,68	0,59
	90%	0,90	1,50	2,11	1,51	0,81	2,70	3,40	1,50	2,10	2,51	2,50	2,00
	obs	192	192	192	192	192	192	192	192	192	192	192	2112

Table 1B continues: Descriptive statistics

Variables	Statistics	Austria	Belgium	Spain	Finland	France	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	All countries
Debteu17	**10%**	-0,24	-0,22	-0,08	-0,25	-0,26	-0,20	-0,23	-0,02	-0,26	-0,22	-0,25	-0,70
	mean	-0,23	-0,21	-0,06	-0,24	-0,24	-0,18	-0,22	0,00	-0,26	-0,21	-0,24	0,59
	90%	-0,22	-0,20	-0,03	-0,23	-0,23	-0,15	-0,21	0,02	-0,24	-0,20	-0,22	2,00
	obs	171	171	171	171	168	171	171	171	171	168	171	1875
Ext Balance	**10%**	-5,12	-8,87	-15,75	-7,94	-8,82	-19,98	-11,65	-9,29	-3,35	-1,43	-17,48	-12,70
	mean	-2,31	-2,61	-8,73	-0,74	-4,34	-11,55	-4,67	-5,37	4,03	1,77	-12,13	-4,29
	90%	0,43	5,51	-2,48	7,65	3,09	-3,89	0,89	1,36	13,89	4,63	-7,14	3,86
	obs	185	185	185	185	185	185	185	185	173	185	185	2023
ESI	**10%**	-7,10	-5,76	-12,51	-8,31	-8,91	-25,50	-12,10	-12,62	-13,31	-11,22	-18,85	-11,50
	mean	1,14	1,75	1,03	1,71	2,53	-1,19	-0,15	0,87	-0,62	-0,06	-1,76	0,48
	90%	9,10	9,14	15,55	11,12	11,61	14,72	10,68	12,15	9,84	7,63	9,17	11,00
	obs	192	192	192	192	192	192	192	192	192	192	192	2112
OECD Bus Conf	**10%**	-0,70	-1,00	-1,61	-2,01	-1,20	-5,01	-2,30	-1,21	-3,30	-1,10	-1,21	-1,70
	mean	-0,01	-0,07	-0,10	-0,38	0,01	-0,59	-0,27	0,07	-0,72	0,00	-0,32	-0,21
	90%	0,70	0,90	1,40	1,30	1,20	2,30	2,70	1,40	1,30	1,10	0,60	1,30
	obs	192	192	192	192	192	192	112	192	192	192	192	2032
OECD Cons Conf	**10%**	-1,31	-1,30	-2,51	-1,50	-2,10	-5,50	-2,80	-3,20	-2,70	-1,90	-3,61	-2,60
	mean	0,13	0,34	-0,26	0,81	-0,32	-0,91	0,04	-0,16	0,07	0,06	-0,96	-0,11
	90%	1,51	1,81	1,70	2,70	1,20	1,81	2,52	2,31	2,57	1,50	1,00	2,00
	obs	192	192	192	192	192	192	192	192	156	192	192	2076

Table 1C: Descriptive statistics: Common variables

Variables	Statistics	3 month Euribor	Vix	IFO	Michigan
All countries	**10%**	0,23	12,62	92,66	67,26
	Mean	2,37	21,17	102,48	84,10
	90%	4,64	31,93	111,32	104,68
	Obs	192	192	191	192

Notes: This table gives a brief overview of both the country specific data and common data used in this paper. It notes the 10% and 90% variable to exclude outliers, the mean value and the total number of observations.

Table 2: Correlation Matrix 10 year government bond yield

A: 1999M01-2014M12

	Aus	Bel	Fin	Fra	Ger	Gre	Ire	Ita	Lux	Net	Por	Spa
Aus	1,0000											
Bel	0,9710	1,0000										
Fin	0,9916	0,9440	1,0000									
Fra	0,9953	0,9713	0,9903	1,0000								
Ger	0,9752	0,945	0,9917	0,9798	1,0000							
Gre	-0,4521	-0,2677	-0,5368	-0,4396	-0,5824	1,0000						
Ire	0,1889	0,3772	0,1078	0,1774	0,0438	0,5887	1,0000					
Ita	0,5151	0,6723	0,4322	0,5306	0,3668	0,4513	0,6650	1,0000				
Lux	0,9310	0,8995	0,9254	0,9174	0,8885	-0,4237	0,2044	0,4952	1,0000			
Net	0,9905	0,9416	0,9988	0,9905	0,9934	-0,5378	0,1045	0,4316	0,9216	1,0000		
Por	-0,2059	0,0107	-0,3000	-0,1907	-0,3565	0,9171	0,7665	0,6579	-0,2038	-0,3016	1,0000	
Spa	0,3823	0,5385	0,3092	0,4054	0,2543	0,5484	0,7020	0,9327	0,3824	0,3129	0,6928	1,0000

Notes: This table reports the bilateral correlation of the 10 year government yields between the different Eurozone countries in the period 1991M01-2014M12.

B: 1999M01-2008M08

	Aus	Bel	Fin	Fra	Ger	Gre	Ire	Ita	Lux	Net	Por	Spa
Aus	1,0000											
Bel	0,9990	1,0000										
Fin	0,9966	0,9967	1,0000									
Fra	0,9982	0,9976	0,9974	1,0000								
Ger	0,9950	0,9929	0,9953	0,9977	1,0000							
Gre	0,8630	0,8709	0,8746	0,8608	0,8524	1,0000						
Ire	0,9965	0,9969	0,9964	0,9968	0,9923	0,8696	1,0000					
Ita	0,9950	0,9947	0,9916	0,9942	0,9886	0,8439	0,9939	1,0000				
Lux	0,9028	0,9080	0,9053	0,9031	0,8878	0,8463	0,9168	0,9161	1,0000			
Net	0,9977	0,9970	0,9981	0,9991	0,9976	0,8643	0,9963	0,9927	0,9012	1,0000		
Por	0,9968	0,9967	0,9941	0,9959	0,9902	0,8668	0,9960	0,9967	0,9244	0,9956	1,0000	
Spa	0,9986	0,9991	0,9978	0,9976	0,9935	0,8737	0,9964	0,9944	0,9098	0,9976	0,9970	1,0000

Notes: This table reports the bilateral correlation of the 10 year government yields between the different Eurozone countries prior to the crisis in the period 1991M01-2008M08.

C: 2008M09-2014M12C

	Aus	Bel	Fin	Fra	Ger	Gre	Ire	Ita	Lux	Net	Por	Spa
Aus	1,0000											
Bel	0,9297	1,0000										
Fin	0,9787	0,8658	1,0000									
Fra	0,9895	0,9510	0,9627	1,0000								
Ger	0,9550	0,8285	0,9883	0,9434	1,0000							
Gre	-0,1756	0,1134	-0,3349	-0,1077	-0,3682	1,0000						
Ire	0,5253	0,7477	0,4343	0,5727	0,4160	0,5281	1,0000					
Ita	0,3944	0,6466	0,2443	0,4652	0,1833	0,7194	0,7038	1,0000				
Lux	0,9634	0,8177	0,9887	0,9394	0,9766	-0,3861	0,3513	0,1957	1,0000			
Net	0,9761	0,8635	0,9966	0,9639	0,9892	-0,3240	0,4405	0,2562	0,9900	1,0000		
Por	0,0350	0,3582	-0,1224	0,1122	-0,1666	0,9087	0,7204	0,8348	-0,1965	-0,1143	1,0000	
Spa	0,2394	0,4831	0,1134	0,3229	0,0882	0,7692	0,7086	0,9016	0,0670	0,1386	0,8106	1,0000

Notes: This table reports the bilateral correlation of the 10 year government yields between the different Eurozone countries during the crisis in the period 2009M09-2014M12.

TABLE 3: Principal components of Eurozone 10 year Government bond yields

	Full sample			1999M01-2008M8			2008M08-2014M12		
Principal component	EigenValue	Percent Explained	Total	EigenValue	Percent Explained	Total	EigenValue	Percent Explained	Total
Panel A. Absolute values									
First	7,4754	0,623	0,623	1,1577	0,9647	0,9647	7,2873	0,6073	0,6073
Second	3,8234	0,3186	0,9416	0,2508	0,0209	0,9856	4,0425	0,3369	0,9441
Third	0,3608	0,0301	0,9716	0,1449	0,0121	0,9977	0,326	0,0272	0,9713
Fourth	0,1412	0,0118	0,9834	0,0117	0,001	0,9987	0,1691	0,0141	0,9854
Fifth	0,0982	0,0082	0,9916	0,0046	0,0004	0,999	0,0986	0,0082	0,9936
Panel B. First differences									
First	7,7306	0,6442	0,6442	1,1284	0,9403	0,9403	6,4299	0,5358	0,5358
Second	1,6512	0,1376	0,7818	0,3918	0,0326	0,973	2,3088	0,1924	0,7282
Third	0,7458	0,0621	0,844	0,1862	0,0155	0,9885	1,0039	0,0837	0,8119
Fourth	0,6968	0,0581	0,902	0,0351	0,0029	0,9914	0,7575	0,0631	0,875
Fifth	0,4128	0,0344	0,9364	0,0225	0,0019	0,9933	0,4864	0,0405	0,9155

Notes: This table present the statistics of the first principal component analysis based on the correlation matrix of the Government bond yield absolute values and first differences presented in table 2. The correlation matrices are based on twelve sovereign countries within the Eurozone. The sample period is from January 1991 till December 2014.

Table 4: Unit Root Test

A: Common Unit root test (Levin, Lin, Chu & Breitung t-test)												
Test	H0	Variable	**Spread**	**Gov Debt**	**Deficit**	**GDP growth**	**Inflation**	**CA**	**DebtEu17**	**ESI**	**Bus_conf**	**Cons Conf**
Panel A1: Country Specific variables in levels												
SEZ	Unit Root	*Statistics*	-0,172	2,883	6,361	-4,956	-3,534	-0,708	1,767	-4,002	-1,883	-0,996
LLC		*P-value*	0,432	0,998	1,000	0,000	0,000	0,240	0,961	0,000	0,030	0,160
SEZ	Unit Root	*Statistics*	-2,062	3,264	-0,199	0,000	-1,695	-2,683	-0,475	-0,738	-3,652	-2,761
Breitung		*P-value*	0,020	1,000	0,421	0,500	0,045	0,004	0,318	0,230	0,000	0,003
GIIPS	Unit Root	*Statistics*	-0,669	-0,724	2,471	-3,333	-3,847	0,424	1,885	0,344	-0,288	-0,791
LLC		*P-value*	0,252	0,235	0,993	0,000	0,000	0,664	0,970	0,634	0,387	0,215
GIIPS	Unit Root	*Statistics*	-0,209	3,052	-1,907	-0,900	-2,359	1,762	0,753	-0,601	-1,934	-1,822
Breitung		*P-value*	0,417	0,999	0,028	0,184	0,009	0,961	0,774	0,274	0,027	0,034
Panel A2: Country Specific variables in first differences												
SEZ	Unit Root	*Statistics*	-27,867	-25,534	-11,226	-80,034	-48,854	-31,803	-46,112	-47,913	-19,681	-20,320
LLC		*P-value*	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
GIIPS	Unit Root	*Statistics*	-4,267	-23,680	-17,824	-34,005	-50,088	-31,692	-33,321	-36,074	-14,371	-12,455
LLC		*P-value*	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
SEZ	Unit Root	*Statistics*	-10,500	-3,540	-2,294	-4,182	-9,492	-14,987	-30,524	-25,785	-8,413	-12,037
Breitung		*P-value*	0,000	0,000	0,011	0,000	0,000	0,000	0,000	0,000	0,000	0,000
GIIPS	Unit Root	*Statistics*	-3,618	-4,675	-3,145	-8,704	-20,581	-13,724	-18,455	-18,039	-7,480	-9,696
Breitung		*P-value*	0,000	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Note: For each test the lag length is automatic selected based on Akaike information criterion.

B: Stationarity test (Augmented Dickey-Fuller test)

Panel B1: Common factors in levels

Test	H0	Variable	Vix	IFO	Michigan	Euribor
SEZ	Unit Root	*Statistics*	-5.22221	-5.40663	-2.68667	0.55959
ADF		*P-value*	0.0000	0.0000	0.0036	0.7121
GIIPS	Unit Root	*Statistics*	-4.76720	-4.93555	-2.45258	0.51083
ADF		*P-value*	0.0000	0.0000	0.0071	0.6953

Note: For each test the lag length is automatic selected based on Akaike information criterion

Panel B2: Common factors in first differences

Test	H0	Variable	Vix	IFO	Michigan	Euribor
SEZ	Unit root	*Statistics*	-21.3364	-9.47754	-19.5024	-6.87677
ADF		*P-value*	0.0000	0.0000	0.0000	0.0000
GIIPS	Unit root	*Statistics*	-19.4773	-8.65177	-17.8032	-6.27761
ADF		*P-value*	0.0000	0.0000	0.0000	0.0000

* Note: For each test the lag length is automatic selected based on Akaike information criterion

Table 5 Cointegration test

Test	H0	Variable	**Base**	**Euribor**	**Vix_model**	**ESI_model**	**OECD Bus**	**OECD Cons**	**IFO**	**Michigan**
SEZ	Unit Root	*Statistics*	**-5,751**	**-5,622**	**-6,296**	**-7,016**	-6,305	**-6,761**	**-6,894**	**-6,293**
ADF		*P-value*	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
GIIPS	Unit Root	*Statistics*	-4,645	-5,473	-5,567	-5,889	-7,355	-5,711	-5,148	-5,980
ADF		*P-value*	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Notes: This test is based on the Engle-Granger residual approach (Granger & Engle, 1987). When a unit root is present you rejected the H0 of cointegration and the long run relationship is not efficient. If the statistic is rejected it means it is integrated of at least order (1) and therefore has a unit root.

Table 6: Fixed effects versus Random effects

SEZ countries		Base	Euribor	Vix_model	ESI_model	OECD Bus	OECD Cons	IFO	Michigan
Hausman test	*Statistics*	224,8212	227,4498	157,1967	109,7848	166,6013	143,2899	113,9221	131,2493
Chi-sq	*P-value*	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
Likelihood ratio	*Statistics*	18,4827	18,7262	7,9195	4,5457	4,2131	11,2943	5,8788	6,2078
F-test	*P-value*	0,0000	0,0000	0,0000	0,0004	0,0009	0,0000	0,0000	0,0000
GIIPS countries		**Base**	**Euribor**	**Vix_model**	**ESI_model**	**OECD Bus**	**OECD Cons**	**IFO**	**Michigan**
Hausman test	*Statistics*	177,8976	152,8374	159,4715	97,3308	85,4812	49,4542	102,1796	156,0049
	P-value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
Likelihood ratio	*Statistics*	47,5182	34,3473	34,1233	42,6856	37,7251	39,0940	34,0421	34,5992
	P-value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000

Notes: This table shows the outcome of the Hausman and Likelihood ratio test. When HO is rejected in both the Hausman and the Likelihood ratio test, it is strongly suggested that the fixed effect model is used above random effects model.

Table 7: Long run fixed panel estimates of Sovereign spreads determinants

Panel A: SEZ Countries

	Models							
Long run Coefficients	**Base**	**Euribor**	**Vix_model**	**ESI_model**	**OECD Bus**	**OECD Cons**	**IFO**	**Michigan**
Gov debt	-0.0088***	-0.0121***	-0.0055**	0.0006	-0.0029	-0.0003	-0.0012	0.0009
Deficit	-0.0080***	-0.0086***	-0.0089***	-0.0008	-0.0069***	-0.0022	-0.0059**	-0.0087***
GDP Growth	-0.0027	-0.0027	-0.0050**	-0.0031*	-0.0044**	-0.0034*	-0.0054***	-0.0051**
Inflation	-0.0047	-0.0086	-0.0378***	-0.0398***	-0.0362***	-0.0475***	-0.0356***	-0.0336***
Current Account	-0.0206***	-0.0211***	-0.0213***	-0.0164***	-0.0162***	-0.0129***	-0.0169***	-0.0162***
DebtEu17	0.1937***	0.2362***	0.1254***	0.0024	0.0942***	0.0517**	0.0966***	0.0874***
Euribor		0.0303***	-0.0276**	-0.0226**	-0.0244**	-0.0526***	-0.050561***	-0.0253**
Vix			0.0161***	0.0175***	0.0170***	0.0177***	0.0227***	0.0115***
ESI				-0.0255***				
OECD Business					-0.8903***			
Oecd Consumer						-1.0583***		
IFO							0.0129***	
Michigan								-0.0070***
R^2	0.3806	0.3858	0.4672	0.5646	0.4952	0.5609	0.4948	0.4808
Adjusted R^2	0.3737	0.3784	0.4602	0.5584	0.4880	0.5545	0.4876	0.4734
DW	0.0945	0.1011	0.1345	0.21336	0.1352	0.1573	0.1678	0.1323
Observations	999	999	999	999	999	986	999	999

Notes: This table presents the estimates of the fixed panel model with interaction terms between a crisis dummy and the behavioural factors for the SEZ countries $Sp_{it} = a_i + Z_{it}\beta_i' + F_t V_i' + M_{it}\chi_i' + S_t\gamma_i' + \varepsilon_{it}$

The ***, ** and * indicate the level of significance of a specific variable at the 1%, 5% and 10% level.

Panel B: GIIPS countries

	Models							
Long run Coefficients	**Base**	**Euribor**	**Vix_model**	**ESI_model**	**OECD Bus**	**OECD Cons**	**IFO**	**Michigan**
Gov debt	0.0906***	0.0739***	0.0736***	0.0321***	0.1065***	0.0187***	0.0470***	0.0647***
Deficit	0.0078	0.0096	0.0171	0.068851***	0.0261	0.0713***	0.0299*	0.0247
GDP Growth	-0.0282	-0.0221	-0.0245	-0.0086	-0.0066	-0.0025	-0.0212	-0.023
Inflation	-0.0797	0.0044	-0.0239	-0.3113***	-0.3199***	-0.1424**	-0.0817	0.0015
Current Account	-0.0538**	-0.0434	-0.0399	0.1698***	0.0403	0.1566***	0.0691**	0.0592
DebtEu17	0.3130***	0.2330***	0.2080**	0.043	-0.0763	0.1451**	0.2124***	0.1614***
Euribor		-0.4779***	-0.5191***	-0.2709***	-0.2367***	-0.5853***	-0.6956***	-0.3853***
Vix			0.0245**	0.0543***	0.0347***	0.0391***	0.0940***	-0.0155
ESI				-0.1732***				
OECD Business					-1.0505***			
Oecd Consumer						-0.9276***		
IFO							0.1368***	
Michigan								-0.0572***
R^2	0.5051	0.5304	0.5336	0.6859	0.6803	0.7023	0.5709	0.5438
Adjusted R^2	0.4986	0.5236	0.5262	0.6804	0.6743	0.6972	0.5636	0.5359
DW	0.0603	0.0635	0.0645	0.1504	0.0958	0.1371	0.0942	0.0759
Observations	768	768	768	768	768	768	768	768

Notes: This table presents the estimates of the fixed panel model with interaction terms between a crisis dummy and the behavioural factors for the GIIPS countries $Sp_{jt} = a_j + Z_{jt}\beta_i' + F_tV_j' + M_{jt}\chi_j' + S_t\gamma_j' + \varepsilon_{jt}$

The ***, ** and * indicate the level of significance of a specific variable at the 1%, 5% and 10% level.

Table 8: F-test for a collection of Regression of coefficients

	N	Base-Euribor	Euribor - VIX	Base -Vix	Vix-ESI	VIX-OECDBUS	VIX-OECDCONS	VIX-IFO	VIX - Michigan
SEZ	999	7,3547	149,2838	78,8723	218,9363	53,51555	205,6862	52,77036	24,80163
GIIPS	768	39,65151	4,108948	21,96187	363,4539	342,3093	425,1838	64,44466	15,79114

Notes: This table shows the results of the F-test for a collection of coefficients. The critical values for 7 variables the 5% and 1% critical values are 2,31 and 2.94, for a model with 8 variables the 5% and 1 % critical values are 2.21 and 2.788 and for a model with 9 variables 2,14 and 2.66.

Table 9: Chow Test on structural break

		Vix_model	ESI_model	OECD Bus	OECD Cons	IFO	Michigan
SEZ	F-statistic	501,766	120,236	214,478	212,258	298,027	193,936
	P-value	0	0	0	0	0	0
GIIPS	F-statistic	520,912	212,477	220,460	240,650	339,320	261,902
	P-value	0	0	0	0	0	0

Notes: This table shows the Chow test on structural break in the model. The critical values two tailed 1 % is 5,3265.

Table 10: Fixed panel model with dummies

Panel A: SEZ Countries

	Models					
Coefficients	**Vix_model**	**ESI_model**	**OECD Bus**	**OECD Cons**	**IFO**	**Michigan**
Vix	-0,0008	0,0083***	0,0013	0,005**	0,0083***	0,0106***
Vix*dummy	0,0160***	0,0088***	0,0147***	0,0118***	-0,0080***	-0,0053**
ESI		-0,0208***				
ESI*dummy		-0,0025				
OECD Business			0,0056			
OECD Business*dummy			-0,1185***			
Oecd Consumer				-0,0938***		
Oecd Consumer*dummy				0,0002		
IFO					-0,0076***	
IFO*dummy					0,0101***	
Michigan						-0,0037***
Michigan*dummy						0,0125***
R^2	0,5133	0,5758	0,5414	0,5847	0,6060	0,6042
Adjusted R^2	0,5063	0,5689	0,5339	0,5779	0,5995	0,5977
Sum squared resid	90,2942	78,6823	85,0775	76,6408	73,0963	73,4252
DW	0,1289	0,1842	0,1365	0,1474	0,1802	0,1739

Notes: This table presents the estimates of the fixed panel model with interaction terms between a crisis dummy and international risk factors and the behavioural factors for the SEZ countries $Sp_{it} = a_i + Z_{it}\beta_i' + F_t V_i' + M_{it}\chi_i' + S_t\gamma_i' + V_i VIX * dummy + M_{it}\chi_i' * dummy + S_t\gamma_i' * dummy + \varepsilon_{it}$.

Dummy = 0 before 2008m08 and 1 after this date.

The ***, ** and * indicate the level of significance of a specific variable at the 1%, 5% and 10% level.

Panel B: GIIPS Countries

	Models					
Coefficients	**Vix_model**	**ESI_model**	**OECD Bus**	**OECD Cons**	**IFO**	**Michigan**
Vix	-0,0591***	0,0428**	0,0071	0,0242	0,0410*	-0,0601**
Vix*dummy	0,0750***	0,0087	0,0217	0,0088	-0,0209	0,0199
ESI		-0,0403**				
ESI*dummy		-0,2074***				
OECD Business			-0,3450***			
OECD Business*dummy			-1,2148***			
Oecd Consumer				-0,2185**		
Oecd Consumer*dummy				-0,9557***		
IFO					0,0834***	
IFO*dummy					0,0286***	
Michigan						-0,0449***
Michigan*dummy						0,0287***
R^2	0,5460	0,7229	0,7068	0,7339	0,5866	0,5620
Adjusted R^2	0,5381	0,7174	0,7003	0,7286	0,5783	0,5533
Sum squared resid	4731,1370	2886,9860	2917,0980	2772,4340	4308,0380	4563,9430
DW	0,0725	0,1668	0,1023	0,1453	0,0909	0,0856

Notes: This table presents the estimates of the fixed panel model with interaction terms between a crisis dummy and international risk factors and the behavioural factors for the SEZ countries $Sp_{jt} = a_i + Z_{jt}\beta_j' + F_tV_j' + M_{jt}\chi_j' + S_t\gamma_j' + V_jVix * dummy\ M_{jt}\chi_j' * dummy + S_t\gamma_j' * dummy + \varepsilon_{jt}$

Dummy = 0 before 2008m08 and 1 after this date.

The ***, ** and * indicate the level of significance of a specific variable at the 1%, 5% and 10% level.

Table 11: Z-test on the equality of coefficients

			Vix	ESI	OECD Business	Oecd Consumer	IFO	Michigan
Test	H0	Variable						
Z-test	$\beta_1 = \beta_2$	*Statistics*	-0,8522	-3,4810	-2,1499	-2,1825	-5,0369	1,4726
Vix		*P-value*	0,3942	0,0005	0,0316	0,0291	0,0000	0,1409
Z-test	$\beta_1 = \beta_2$	*Statistics*	-0,8522	15,0988	14,4022	17,7180	-7,2471	3,3077
Variable		*P-value*	0,3942	0,0000	0,0000	0,0000	0,0000	0,0009

Note: This table present the Z-test ($Z = \frac{b_1 + b_2}{\sqrt{(SEb_1^2 + SEb_2^2)}}$) statistics and the corresponding P value.

Table 12: Correlation matrix behavioural variables

A: SEZ Countries

	VIX	ESI	BUS_CONF	CONS_CONF	IFO	MICHIGAN
VIX	1,0000	0,0781	0,1444	0,0624	-0,5505	-0,3544
ESI	0,0781	1,0000	0,6640	0,7205	-0,4114	0,3463
BUS_CONF	0,1444	0,6640	1,0000	0,5896	-0,4388	0,4094
CONS_CONF	0,0624	0,7205	0,5896	1,0000	-0,4821	0,3140
IFO	-0,5505	-0,4114	-0,4388	-0,4821	1,0000	-0,0187
MICHIGAN	-0,3544	0,3463	0,4094	0,3140	-0,0187	1,0000

Notes: This table shows the bilateral correlation between the different behavioural variables and the VIX in the SEZ countries.

B: GIIPS Countries

	VIX	ESI	BUS_CONF	CONS_CONF	IFO	MICHIGAN
VIX	1,0000	0,1597	0,1518	0,0919	-0,5421	-0,3034
ESI	0,1597	1,0000	0,7076	0,8631	-0,6451	0,4614
BUS_CONF	0,1518	0,7076	1,0000	0,6601	-0,4235	0,4527
CONS_CONF	0,0919	0,8631	0,6601	1,0000	-0,6212	0,4664
IFO	-0,5421	-0,6451	-0,4235	-0,6212	1,0000	-0,0338
MICHIGAN	-0,3034	0,4614	0,4527	0,4664	-0,0338	1,0000

Notes: This table shows the bilateral correlation between the different behavioural variables and the VIX in the GIIPS countries.

Table 13: Short run pooled panel estimates of Sovereign spreads determinants

Panel A: SEZ Countries

	Models							
Short run Coefficients	**Base**	**Euribor**	**Vix_model**	**ESI_model**	**OECD Bus**	**OECD Cons**	**IFO**	**Michigan**
D_SPREAD(-1)	0,0692**	0,0688**	0,0560*	0,0595*	0,0589*	0,0586*	0,0495	0,0638**
D_SPREAD(-2)	0,0677**	0,0662**	0,0686**	0,0685**	0,0707**	0,0665**	0,0632**	0,0690**
D_GOVDEBT	0,0018	0,0017	0,0016	0,0016	0,0015	0,0018	0,0018	0,0020
D_DEFICIT	-0,0001	-0,0002	-0,0002	-0,0002	-0,0002	-0,0001	-0,0002	0,0000
D_GROWTH	0,0005	0,0005	0,0002	0,0002	0,0002	0,0003	0,0002	0,0003
D_INFLATION	0,0012	0,0014	-0,0015	-0,0015	-0,0015	-0,0039	-0,0023	-0,0007
D_INFLATION(-1)	-0,0015	-0,0012	-0,0046	-0,0049	-0,0056	-0,0048	-0,0040	-0,0052
D_Current account	-0,0015	-0,0016	-0,0014	-0,0015	-0,0016	-0,0015	-0,0014	-0,0014
D_DEBT_EU17	0,0054	0,0052	0,0054	0,0056	0,0053	0,0054	0,0022	0,0034
D_EURIBOR		-0,0133	-0,0338	-0,0344*	-0,0376*	-0,0417**	-0,0162	-0,0367
D_VIX			0,0038***	0,0037***	0,0038***	0,00394***	0,0031***	0,0044***
D_ESI				-0,0006				
D_OECD Business					-0,0259*			
D_Oecd Consumer						-0,0054		
D_IFO							-0,0060***	
D_MICHIGAN								0,0015**
DUMMY08_09	0,0035	-0,0001	-0,0061	-0,0063	-0,0062	-0,0084	-0,0011	-0,0085
DUMMY10_12	-0,0010	-0,0013	-0,0014	-0,0016	-0,0019	-0,0026	0,0001	-0,0022
DUMMY13_14	0,0021	0,0021	0,0021	0,0020	0,0016	0,0015	0,0062	0,0005
Intercept	0,0011	0,0012	0,0015	0,0015	0,0013	0,0022	0,0010	0,0023
R^2	0,0142	0,0147	0,0454	0,0458	0,0488	0,0498	0,0527	0,0504
Adjusted R^2	0,0021	0,0016	0,0318	0,0311	0,0342	0,0350	0,0382	0,0358
DW	2,0169	2,0152	2,0449	2,0455	2,0455	2,0454	2,0409	2,0498
Observations	993	993	993	993	993	980	993	993

Notes: This table presents the estimates of the autoregressive short run pooled panel model for the SEZ countries $\Delta Sp_{it} = a + \theta_i \Delta Sp_{it-k} + \Delta Z_{it-h}\beta_i' + \Delta F_t V_i' + \Delta M_{it}\chi_i' + \Delta S_t \gamma_i' + dummy_{it} + \varepsilon_{it}$

The ***, ** and * indicate the level of significance of a specific variable at the 1%, 5% and 10% level.

Panel B: GIIPS countries

	Models							
Short run Coefficients	**Base**	**Euribor**	**Vix_model**	**ESI_model**	**OECD Bus**	**OECD Cons**	**IFO**	**Michigan**
D_SPREAD(-1)	0,1671***	0,1672***	0,1674	0,1627	0,1455	0,1455***	0,1679	0,1714***
D_SPREAD(-2)	-0,1492***	-0,1495***	-0,1491***	-0,1465***	-0,1397***	-0,1397***	-0,1493***	-0,1468***
D_GOVDEBT	0,1441***	0,1443***	0,1443***	0,1438***	0,1826***	0,1826***	0,1445***	0,1451***
D_DEFICIT	0,0175***	0,0175***	0,0176***	0,0177***	0,0087	0,0087	0,0176***	0,0177***
D_GROWTH	-0,0087	-0,0087	-0,0091	-0,0095	-0,0054	-0,0054	-0,0091**	-0,0087**
D_INFLATION	-0,0036	-0,0031	-0,0058	-0,0060	-0,0250	-0,0250	-0,0057	-0,0056
D_INFLATION(-1)	0,0187	0,0200	0,0218	0,0195	0,0205	0,0205	0,0211	0,0135
D_Current account	0,0033	0,0028	0,0040	0,0024	-0,0137	-0,0137	0,0042	0,0055
D_DEBT_EU17	-0,4028***	-0,4039***	-0,4052***	-0,3915***	-0,5267***	-0,5267***	-0,4047***	-0,4082***
D_EURIBOR		-0,0456	-0,0826	-0,1574	-0,1557	-0,1557	-0,0924	-0,0944
D_VIX			0,0062	0,0072	0,0085	0,0085	0,0066	0,0091*
D_ESI				-0,02303***				
D_OECD Business					-0,2249***			
D_Oecd Consumer						-0,2249***		
D_IFO							0,0033	
D_MICHIGAN								0,0077
DUMMY08_09	-0,0372	-0,0499	-0,0608	-0,0821	-0,0729	-0,0729	-0,0638	-0,0740
DUMMY10_12	-0,0170	-0,0185	-0,0194	-0,0231	0,0058	0,0058	-0,0205	-0,0252
DUMMY13_14	-0,2738***	-0,2741***	-0,2736***	-0,2702***	-0,3316***	-0,3316	-0,2760***	-0,2815***
Intercept	0,0230	0,0237	0,0244	0,0237	0,0258	0,0258	0,0248	0,0285
R^2	0,2461	0,2462	0,2477	0,2544	0,3150	0,3150	0,2478	0,2499
Adjusted R^2	0,2340	0,2331	0,2336	0,2394	0,2998	0,2998	0,2327	0,2348
DW	1,7482	1,7472	1,7482	1,7570	1,6812	1,6812	1,7486	1,7512
Observations	763	763	763	763	693	763	763	763

Notes: This table presents the estimates of the autoregressive short run pooled panel model for the GIIPS countries

$$\Delta Sp_{jt} = a + \theta_i \Delta Sp_{ij-k} + \Delta Z_{jt-h}\beta_i' + \Delta F_t V_j' + \Delta M_{jt}\chi_j' + \Delta S_t \gamma_j' + dummy_{jt} + \varepsilon_{it}$$

The ***, ** and * indicate the level of significance of a specific variable at the 1%, 5% and 10% level.

Figure 2: Individual weighting factors of the Principal Component Analysis

Figure A: Weighting factors PCA 1

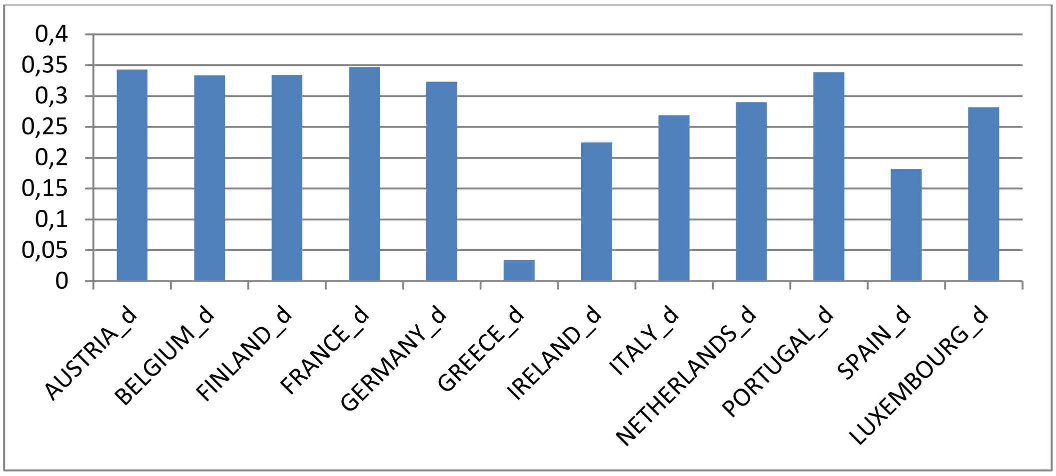

Figure B: Weighting factors PCA 2

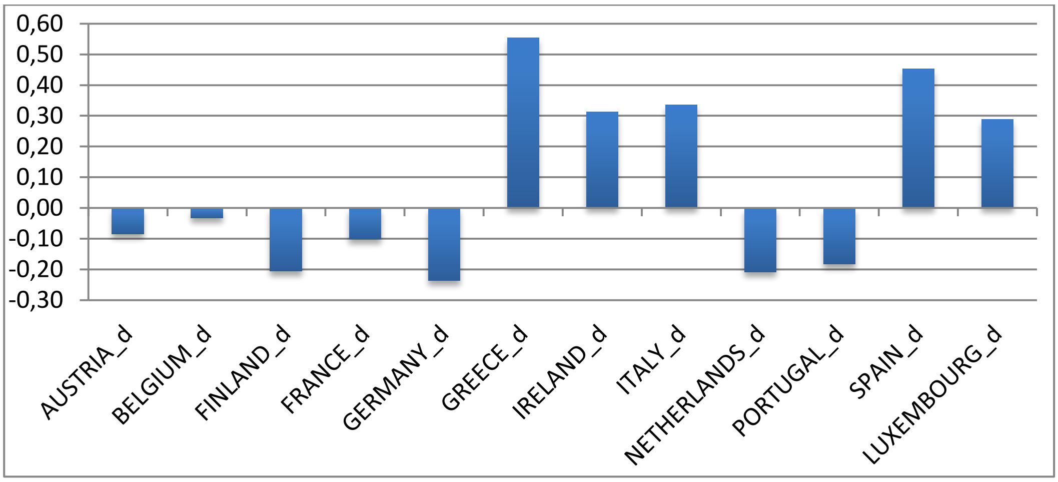

Figure C: Weighting factors PCA 3