Sovereign Risk in the Eurozone debt crisis

A thesis submitted for the degree of Doctor of Philosophy

By

Spyridoula Tzima

Economic and Finance, School of Social Sciences

Brunel University

London, United Kingdom

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Abstract

Concerns about the state of public finances in the main advanced economies have increased as a result of the global financial and economic crisis that started in late 2007 – 2008. The fiscal solvency of several euro area peripheral countries has been put under the spotlight of the market participants who started to believe that a sovereign default was likely to happen in an advanced economy member of the euro area. This thesis seeks to investigate the sovereign risk in the euro area countries during the period before, during and after the crisis by focusing on the sovereign bond and credit default swaps spreads and the factors that drive them.

In Chapters 2, we investigate the determinants of the government bond yields and sovereign credit default swaps. In our analysis for the government bond yields we find that the macroeconomic fundamentals used in our analysis are highly significant for the periphery countries, while they are less or not significant at all for the core euro area countries. We also find evidence that during the crisis the fluctuations of the government bond yields are not only explained by the macroeconomic fundamentals but also explained by factors related to the uncertainty in the euro area.

In Chapter 3, we employ the panel cointegration approach in order to investigate the macroeconomic and financial indicators that impacted the sovereign credit default swaps in the crisis period using data from October 2008 until December 2014. We provide fresh evidence that the financial indicators, proxied by the iTraxx index as well as liquidity indicators, proxied by the bid-ask had a dominant role in explaining the CDS in almost all countries.

In Chapter 4, in regard to the study of the price discovery relationship between the government bond yields and sovereign CDS, we suggest the use of cointegration methodology and also test for a structural break using the Gregory and Hanson approach to investigate the linkages between the two instruments. The structural break test suggests that the relation changed during the crisis and that the price discovery took place in the CDS market.

Finally, in Chapter 5, we investigate the main factors causing the sovereign defaults. We use a panel of 99 countries to assess the impact that various macroeconomic and political risk indicators have on sovereign defaults on foreign currency bank loans, foreign currency bonds and local currency debt, utilizing an extended database constructed by the Bank of Canada. Our results suggest that the favorable economic indicators, lower debt levels, and higher political stability all reduce the likelihood of default. We also find that the capital outflows restrictions are positively associated with higher probability of default.

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Declaration

I hereby declare that the thesis is based on my original work, except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Brunel University or other institutions.

Name: ……

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Chapter One

Introduction

In the last decade, many euro area countries were affected by the most severe financial crisis since the Great Depression. The euro area debt crisis started in Greece in late 2009 when the authorities admitted that its debt rose to €262bn euros from €168bn and its budget deficit was revised from 6 per cent to 15.8 per cent of GDP. The euro area sovereign debt crisis soon after that spread to the other periphery countries Spain, Italy, Portugal, Ireland and Cyprus.

The crisis came on the background of a period of stability and convergence in the sovereign bond market for the euro area member states that followed the introduction of the euro in 1999. The sovereign bond spreads, which represent the financing costs of public sector debt in the market, converged among the EMU countries during this period. In 1996 the Italian debt to GDP ratio was almost 120 per cent and the government 10-year bond yields almost 12 per cent, while the German bond yields were at 5.6 per cent when the public debt was at 55% of GDP. Ten years later in 2005 with the Italian debt at 102 per cent of GDP and the German at 67 per cent, the bond yields were at 3.56 and 3.35 per cent respectively. Ehrmann et al (2007) conclude that there is no single day after 1999 when the yields on government notes diverged significantly between Germany, France, Spain and Italy. Baele et al. (2004) in an early contribution find also convergence in the euro area bond yields. However, Manganelli and Wolswijk (2007) find that due to the different credit ratings of the underlying bonds, some heterogeneity remained between the government bond yields across countries.

Following the collapse of the Lehman Brothers on September 2008 the government bond yields came under pressure and started rising to unprecedented levels. The market participants became less inclined to keep or purchase bonds from peripheral countries, in particular Greece, Ireland and Portugal. On May 2010 Greece reached an agreement[1] with the International Monetary Fund, the European Commission and the European Central Bank on a programme to stabilize

[1] Available at https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-financial-assistance/which-eu-countries-have-received-assistance/financial-assistance-greece_en#first-programme-for-greece

the economy and restore market confidence. The Eurogroup[2] agreed to provide bilateral loans pooled by the European Commission for a total amount of €80 billion to be released over the period from May 2010 to June 2013. The financial assistance agreed by the euro area countries was part of a joint package with the IMF participating with additional €30 billion under a stand-by arrangement (SBA). The European Financial Stability Facility (EFSF) was then introduced as a temporary financing mechanism in the euro area. Ireland and Portugal had also to be supported by the EU and the IMF.[3] The European Commission and the International Monetary Fund agreed to provide financial assistance of €85 billion to Ireland from 2011 until the end of 2013. Portugal asked for assistance on 7 April 2011 from the EU, euro area countries and the IMF. An agreement was officially adopted on 17 May 2011 covering a period from 2011 until mid- 2014 and included a joint financing package of €78 billion, provided by the EU/EFSM, the EFSF and the International Monetary Fund.

However, the Greek crisis was deeper than initially thought. The Greek bond yields in 2012 reached record high levels at 20 per cent. Other euro-area government bonds- Italian and Spanish bonds- came also under pressure and reported severe losses. In August 2012 the funding cost for Italian and Spanish public debt reached almost the 600bps. In 2012 and in order to ease the stress in the markets, Greece and its partners agreed to the second adjustment programme[4], which included the largest debt restructuring in the history of sovereign defaults. The bond swap agreed was part of the second bailout package. Unlike the first programme, the euro area countries agreed to a programme, which would be financed entirely by the European financial stability facility (EFSF). The euro area agreed to contribute €144.7 billion (to be provided via the EFSF) and the IMF committed to contribute €19.8 billion.

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[2] The Eurogroup is an informal body where the ministers of the euro area member states discuss matters relating to their shared responsibilities related to the euro (http://www.consilium.europa.eu/en/council-eu/eurogroup/)

[3] Available at https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-financial-assistance/which-eu-countries-have-received-assistance/financial-assistance-ireland_en and https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-financial-assistance/which-eu-countries-have-received-assistance/financial-assistance-portugal_en

[4] Available at https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-financial-assistance/which-eu-countries-have-received-assistance/financial-assistance-greece_en#secondeconomicadjustmentprogrammeforgreece

Nearly 97 per cent of privately held Greek bonds (about 197 billion euros) participated in the exchange of the Greek government bonds. They took a 53.5 per cent cut of the face value of the bond, reducing the Greek debt by around 107 billion euros. Following this event the Greek government activated the collective action clauses (CACs) to force the remaining bondholders to participate. As a result the International Swaps and Derivatives Association (ISDA) ruled that a credit event occurred and subsequently that triggered CDS payment to investors.

The Credit Default Swaps – introduced in the 1990s – are credit derivatives, which are used as a hedge or insurance against the risk of default on debt by governments, banks or non-financial corporations. In order to understand how the sovereign credit default swaps work we will give an example similar to the one given by Berg and Streitz (2012). Consider two market participants X and Y that want to trade the Z country's CDS. X will buy 100 million euros protection from Y. The gross notional amount outstanding is now 100 million euros, which is equivalent to the gross amount. Y now also buys 100 million euros protection from X. That makes the gross notional amount outstanding to 200 million euros, but the net notional outstanding amount is now zero, because both contracts cancel each other out. The sovereign CDS were a small part of the sovereign debt market until 2008. The interest in them has been growing rapidly since the beginning of the global financial crisis.

The increasing importance given into the sovereign credit default swaps at the beginning of the European debt crisis led the European authorities to propose specific regulations aiming to increase transparency and reduce risks to the stability of sovereign debt markets by banning uncovered, or "naked" purchases of sovereign credit defaults swaps of European member States, when there is no offsetting position in the underlying debt. Overall, the regulations were aiming to address the three main risks of short selling, namely the lack of transparency of the short selling, the risk of negative price spirals and the risks of settlement failure associated with uncovered or naked short selling.[5] Taking into consideration similar concerns the European Commission Regulation also proposed the ban of the naked sovereign CDS. According to the European Authorities the naked CDS can destabilize the markets in a similar way to short selling. The uncovered or naked CDS refers to the case where a buyer acquires the CDS not to

[5] Available at http://europa.eu/rapid/press-release_MEMO-11-713_en.htm

hedge against the risk of default or the risk of a decline of the value of the sovereign debt but for speculative reasons.

This thesis collects three empirical chapters investigating the sovereign risk dynamics during the financial and economic crisis in euro area.

Chapter 2 attempts to shed light on the factors driving the rising EMU bond spreads during the Euro area debt crisis. Existing studies on EMU spreads and their spreads against Germany are covering both the period prior and after the global financial crisis which started in August 2007. A common practice followed in the majority of the literature entails focusing on three variables when investigating the movements of the government bond yields. First, a common international risk factor: Codogno et al (2003), Longstaff et al. (2007), Manganelli and Wolswijk (2009), Favero et al. (2010), proxied this by the spreads of US corporate bonds over Treasury bonds. Second, the credit risk, which aims to capture the risk that investors assume by holding sovereign bonds in the likelihood of partial or total default of the country and is measured by past macroeconomic performance. Third, the liquidity risk whose significance has shrunk with the introduction of the common currency in the Euro area is also investigated widely in the literature with mixed results. Codogno et al. (2003), Bernoth et al. (2004) and Pagano and Von Thadden (2004) find limited liquidity effect on government bond spreads, while others Beber at al. (2009) and Manganelli and Wolswijk (2009) argue that the liquidity premia is a significant factor in explaining the EMU government bond yields. This chapter attempts to address the question to which extent the bond pricing reflects the economic fundamentals in an appropriate manner. We examine the determinants of the sovereign spreads of ten euro area countries – Austria, Belgium, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal and Spain – relative to a safe haven government bond (German bonds). We find evidence that the macroeconomic fundamentals used in the analysis, namely debt to GDP ratio, fiscal balance as a percentage of GDP, unemployment rate and real GDP growth are significant in explaining the sovereign bond spreads. A contribution of this paper is the attempt to capture the effect that the Outright Monetary Transaction programme announcement had on the sovereign yields and also other various events that occurred during the sovereign debt crisis. We also find a significant relation between the euro area bond yields and the political risk indicator as proxied by the World Governance Indicators.

As mentioned above the interest in the sovereign credit default swaps increased rapidly with the outbreak of sovereign debt crisis in the euro area. In the third chapter, we investigate the

fundamental factors that drove the sovereign CDS in the EMU members during the crisis period. Several studies monitor the market perception of sovereign risk by focusing on the information contain in the CDS spreads (Longstaff, Pan, Pedersen and Singleton, 2011). According to these studies the CDS spreads are more accurate in measuring the credit default risk than the government bond spreads. During the euro area debt crisis, the sovereign CDS were subject to large fluctuations. In our analysis, we investigate whether a long run relationship exists between the sovereign credit default swaps of Eurozone crisis and the debt-to-GDP ratio, real GDP growth rates, bid-ask spreads and the iTraxx index. We employ a time series and panel integration and cointegration analysis for eight Eurozone countries using monthly data from October 2008 until December 2014. The long run relationship is estimated using dynamic OLS and fully modified OLS. Our findings support the existence of a long-run relationship between the sovereign credit default swaps and the macroeconomic and financial indicators used in our analysis.

The global financial crisis that started in August 2007 has had an unprecedented impact on the euro area government bond yield markets. In the fourth chapter, we attempt to ascertain the pattern of information transmission between the CDS and the corresponding bond markets. In this study, we perform a comprehensive analysis of the relationship between the sovereign CDS market and the sovereign bond market over the period 2008 to 2015 across 9 euro area countries. We use the Johansen's (1988) multivariate cointegrated method to test the cointegration relation between the CDS and bond spreads. However, the macroeconomic series could be affected by exogenous shocks due to various economic events. Therefore, we test for changes in the regime between the CDS and bond spreads during the period of the financial crisis by using two kinds of structural break tests, Hansen (1992) and Gregory and Hansen (1996) tests. The results indicate that the CDS premia and sovereign bond spreads are related to a certain relationship and that during the financial crisis, price discovery takes place in the CDS market.

The fifth chapter explores the determinant factors of the sovereign defaults. Using an extended sovereign defaults database constructed by the Bank of Canada we attempt to capture the macroeconomic factors causing the sovereign defaults in sample of 99 countries. The contribution of our research is the introduction to the model of four indicators, which capture the political risk and the impact that the political uncertainty has on a country's ability to repay its debts. The political indicators used are the International Country Risk Index (ICRG), the

Polity IV, the World Governance Indicators and economic freedom index. Similar to Hatchondo et al. (2007) we find that the political stability, as measured by higher level of democracy and freedom, together with consistent political regimes lowers the probability of default. We also find evidence that the capital control restrictions on outflows are positively associated with the sovereign default probability, when combined with high indebtedness and volatility.

Finally, the seventh chapter concludes and proposes several future research issues.

Chapter Two

The EMU crisis and the Sovereign Bond Yields

Abstract: The aim of this paper is to assess the determinants of the long-term government bond spreads in the euro area. We employ a panel of ten euro area countries (Austria, Belgium, Finland, France, Greece, Ireland, Italy, Portugal and Spain) over the period 2002 Q1 until 2013 Q3. We assess the role of an extended set of potential spreads' determinants, namely macroeconomic, fiscal and political indicators. The main contribution of this research paper to the existing literature is that it investigates not only the impact of the announcement of the Outright Monetary Transactions by the European Central Bank on the government spreads, but also the importance of the institutional performance on the sovereign risk. Moreover, we explore whether the financial assistance programmes provided to three euro area countries – Greece, Ireland, Portugal - in 2010, 2011 and 2012 led to a shift in market pricing behaviour.

2.1 Introduction

The last four years have been years of turbulence for the European Monetary Union. For the first time since its introduction, the common currency has been under question. The economies of the periphery have been placed under pressure and are still struggling to return their macroeconomic fundamentals and public finances back to stable ground. After an 18-month period of recession, the euro area real GDP increased by 0.3 per cent in the second quarter of 2013 followed by an increase of 0.1 per cent in the third quarter as announced by the Statistical Office of the European Union. Euro area has experienced the worst crisis since its introduction and its viability is being still questioned. The beginning of the crisis was signalized by the rapid increases of the government bond yields of Greece, followed by Irish, Portuguese, Spanish and Italians spreads. After several creditworthiness downgrades and strong austerity measures passed by the countries' parliaments, bailout packages were approved for Greece (1st bailout package in May 2010 and the second bailout package in March 2012), Ireland (November 2010), Portugal (April 2011), Cyprus (June 2012) and Spain (July 2012)[6].

The government spreads fluctuations reflect the changes in market perceptions. The weak macroeconomic fundamentals raised the market participants' concerns about the countries' ability to finance their debts and pay their obligations to the creditors. The markets' concerns reflected the enormously high levels of financing costs (measured by the difference between a country's financing cost and the perceived 'risk-free' benchmark rate i.e. the German bund of comparable maturity, the 10- year government bond issues). The purpose of this analysis is to identify the determinants of the 10 - year government bond yield differentials. In our analysis, several macroeconomic variables as well as a number of events that took place during the euro

[6] Available at https://ec.europa.eu/info/business-economy-euro-0/euro-area/financial-assistance-euro-area-countries_en

area crisis are taken into consideration in order to investigate the drivers of the government bond yields.

The remainder of this paper is organized as follows. Section two provides a brief timeline of the euro area crisis and the related literature on the determinants of euro area and global sovereign spreads; section three presents and discusses the methodology, the dataset and the empirical results and finally section four concludes.

2.2 Literature review

2.2.1 Euro Area

The European Council took the decision on the creation of the single currency among European Union members in the Dutch city of Maastricht[7] in December 1991. The aim of the common currency was to strengthen the European Union and make it more competitive and stable both as a whole and for each individual member. As it is described by the European Commission, the aim of the European Monetary Union is to support sustainable economic growth and high employment for the member states. The main economic activity of the common currency is the implementation of an effective monetary policy in order for price stability to be accomplished. The European Central Bank is responsible to control money supply and the interest rates. The Maastricht Treaty was signed in February 1992 by the members of the European Community and led to creation of euro. It imposes an obligation on the members to abide by particular fiscal rules described in the Treaty: the member states have to keep sound fiscal policies, with debt up to 60 per cent of GDP and deficit not above 3 per cent of GDP, and price stability as expressed by inflation not more than 1.5 percentage points above the rate of the three best performing countries and long term interest rates should not be more than 2 percentage points above the rate of the three best performing member states. Finally, the exchange rate stability should be secured by the participation of each member state in the exchange rate mechanism (ERMII) under the European Monetary System for two consecutive years without severe tensions. As also stated by the European Commission "the framework under which the euro is

[7] Available at https://www.ecb.europa.eu/explainers/tell-me-more/html/25_years_maastricht.en.html

managed underpins its stability, contributes to low inflation and encourages sound public finances".

When the euro was launched on January 1 1999, eleven countries joined the new currency, namely Austria, Belgium, Germany, Ireland, Italy, France, Luxembourg, Netherlands, Portugal and Spain, followed by Greece in 2001. First, the euro was introduced as an accounting currency, then, on 1 January 2002, the new currency was circulated in physical form, as banknotes and coins. Among the eleven countries that first adopted the euro, eight had government debt to GDP ratio above 60 per cent, violating the convergence criteria. Italy at that time reported figures for the debt to GDP ratio almost double the convergence criterion. When Greece joined the euro in 2001 many market participants were worried about this decision: they had doubts whether Greece was sufficiently prepared to join the common currency. On November 2004 Eurostat published a report with revised data for the Greek government debt and deficit. According to the report the government deficit for 2003 was revised to 4.6 from 1.7 per cent of GDP. The deficit figures from years 2000, 2001 and 2002 were also revised upwards by approximately two percentage points of GDP. The government debt figures, furthermore, were revised by more than 7 percentage points. It is noteworthy that according to Eurostat report on 22 November 2004 on the revision of the Greek government deficit and debt figures "the reliability of Greek deficit and debt statistics has been the object of particular attention by Eurostat in the past. Statistical issues in this field were debated with the Greek statistical authorities far more frequently than with any other Member State."

2.2.2 Euro area debt crisis

At this point it would be useful to present a timeline of the crisis and discuss the main cause of the euro area debt crisis. A great importance has been placed on the issue of the sovereign bond yields when the yield spreads started rising significantly in September of 2007. The collapse of the Lehman Brothers on September 15, the fourth largest investment bank, marked the beginning of the global financial crisis with enormous consequences for the global economy. At this point it would be useful to make a brief mention on the causes and consequences of the global financial crisis. After the collapse of the technology stock bubble the Federal Reserve Bank and other central banks adopted low interest rate policies (Adrian and Shin (2009), Brunnermeier (2009), Greenlaw et al. (2008), and Taylor (2008)). Moreover, the large disparities between savings and investment in China (surplus) and in the United States (deficit)

caused large differences between exports and imports so that the large current account surpluses were accumulating in China and large deficits in America. McKibbin and Stoeckel, 2009 mention the key events that led to the global recession:

- First, the Asian financial crisis of 1997-98. The Asian economies generated large current account surpluses that had to be invested offshore to keep their nominal exchange rates low. As a result the capital flowed out of Asia into US technology stocks driving up equity prices.
- The technology stock bubble.
- The US Federal Reserve eased the monetary policy in 2001 in a series of steps until 2004.
- The above factors led to a dramatic increase in house prices in the US and several European countries such as Spain and Ireland.
- The monetary authorities had to tighten policy from mid-2004 to June 2006 due to the rising prices and inflation.

According to Schwartz (2008) there are three main factors contributing to the financial crisis in 2008. First of all the expansive Monetary Policy followed by the FED, which led to the asset price bubble. Secondly, the complexity of the investment instruments that were adopted. The rating agencies without having a formula to price the securities, examined them, as if they were ordinary corporate bonds underestimating the complexity of these securities and underestimated the underlying risk. And finally, a third factor that led to the financial crisis in 2008 was the collapse of the market for some financial instruments. The consequences of the recession in the global economy were severe. Swagel (2010) mention some of the consequences such as massive job losses, increasing unemployment rate, reduced wages and a huge number of foreclosures around the United States of America.

Although the financial crisis erupted in the US, it served to reveal the structural weaknesses of the euro area. When the crisis first started in Greece in 2010, the leading Eurozone countries seemed not to understand the severity of the problem. The lack of political integration made the euro area more vulnerable than ever. Furthermore, the lack of a liquidity crisis management mechanism meant that speculative attacks by the markets could not be prevented (Soares (2012)). The market participants priced the differences among the eurozone countries and as a result interest rates on sovereign debts of Greece, Ireland, Portugal, Spain and Italy began to rise. The Greek economy, which was more closed than other peripheral Eurozone countries,

seemed at the beginning of the global financial crisis not be influenced much. In 2008 Greece's real GDP had growth was 1.3 per cent when the Eurozone as a whole reported 0.4 per cent.

However, the severity of the crisis made it obvious that the weakest link of the Eurozone would soon start to experience severe financial difficulties. Hardouvelis (2011) presents a descriptive analysis of the chronicle of the global financial crisis and the consequent Greek and euro area debt crisis. According to his account, in the first half of 2009 the markets did not seem to take into account the fiscal and current account imbalances of the Greek economy.

However, the national elections in October 2009 revealed the depth of the problem. The Greek Minister of Finance presented the revised data regarding the deficit and debt. In 2010, the revised statistical data by the European Statistical Agency confirmed the extreme imbalances in Greek public finances. Both deficit and debt were revised upwards, increasing the concern that the country would soon lose access to private capital markets and seek international assistance.

According to Eurostat[8], "the revision in the Greek government debt statistics are due to two different but in some instances linked set of problems: problems related to statistical weaknesses and problems related to failures of the relevant Greek institutions in a broad sense". Greece's budget deficit was revised up to 15.4 percent of GDP from 13.6 per cent and the debt was revised to 126.8 percent of GDP up from its April estimate of 115.1 percent after "severe irregularities in the Excessive Deficit Procedure (EDP) notifications of April and October 2009, including unreliability of data, non-respect of accounting rules, and timing of the notification."(European Commission, Report on Greek Government deficit and debt statistics, November 2010).

What caused the sovereign debt crisis in the euro area? What were the causes of the crisis in Ireland, Spain, Portugal and Greece? We attempt to answer these questions in the below short description of the structural problems each of the countries requested financial assistance had.

[8] Available at http://ec.europa.eu/eurostat/documents/4187653/6404656/COM_2010_report_greek/c8523cfa-d3c1-4954-8ea1-64bb11e59b3a

Ireland

What went wrong in Ireland? Why one of the most developing economies in the last two decades, the so –called Celtic Tiger collapsed? Murphy (2000) in his analysis of economic growth of Ireland states that 1994 started a period marked by sustained growth in the Gross National Product (GNP) and significant decrease in the unemployment rate. Ireland, a country that traditionally was running deficits in its budget and reported very high levels of unemployment, transformed into one of the fastest growing economies. The Gross National Income (GNI) increased by 6.3 per cent in 1994, reaching 9.0 per cent in 1997 and 6.5 per cent in 1999. Similarly, the GDP growth rate reached the 10.7 per cent in 1997.[9]

Starting from the mid-1990s, the Irish economy has experienced enormous improvement in its macroeconomic indicators. The unemployment rate fell, the productivity increased and the fiscal position was stronger than ever. However, starting from 2002 onwards the picture began to change. The collapse of the Lehman Brothers, an event that marked the beginning of the global crisis in 2008, changed things fundamentally in the global economy. Despite the boom in the Irish economy and the high levels of labour productivity the Irish economy built up several imbalances. The increased housing demand due to the growing population and the rising disposable income contributed to the property boom becoming a bubble (O'Sullivan and Kennedy, 2010).

The results were devastating with the general government deficit growing to reach 32 percent of GDP in 2010, after the rescue of the banking system. Lane (2011) summarizes the causes of the Irish crisis as the boom in the property market, which was financed by the Irish banking system, the decline in the property prices and the dramatic fall of the construction activity. This has resulted in huge losses for the banking system and caused a deep fiscal deterioration.

[9] For most countries, it makes little difference whether one uses GDP or GNP. For Ireland, the post-1994 period was characterized by large inflows of foreign direct investment, which has led to GDP exceeding GNP by a significant margin.

In November 2010 borrowing cost for Ireland reached approximately 9 percent. It was clear that the international bond market lost the confidence that the country would be able to fulfill its obligations to repay its debts. On 29 November 2010, the Irish government requested assistance from the EU/IMF mechanism being unable to borrow in order to finance its deficits. The aid package totaling €85 billion (including a 17.5 billion contribution from Irish sources) made Ireland the second euro area member asking for EU/IMF funding.

Portugal

Portugal is the third member of the eurozone to receive an aid package after Greece and Ireland. What are the problems of the Portuguese economy that led the country to the rescue mechanism? Andrade and Duarte (2011) in their study of the Portuguese financial distress present the main problems of the economy. Stagnation in output, low productivity, loss of competitiveness and high unemployment rate can in short describe the main issues of the Portuguese economy.

On 16 May 2011, the European authorities approved a 78$ billion bailout package to Portugal. The European Financial Stabilization Mechanism, the European Financial Stability Facility and the International Monetary Fund are equally involved to the bailout loan. The Portuguese government introduced austerity measures in order to achieve fiscal consolidation.

Spain

Ortega and Penalosa (2012) stress that understanding the collapse in housing investment is a significant factor of understanding the fundamentals of the crisis is Spain. The international economic crisis started in 2008 highlighted the imbalances of the Spanish economy caused mainly by the disproportional construction activity. Carballo-Cruz (2011) mentions that the excessive exposure of the banking industry to the property and construction sectors had the result that the crisis in Spain turned into a banking crisis.

The Spanish 10-year government bond yields reached 7.27 per cent in July 2012, however the financial collapse was avoided. On 28 November 2012 a rescue plan for three major Spanish

banks (Bankia, NCG Banco and Catalunya Banc) has been approved. Another major problem for Spain was the unemployment rate, which increased enormously after 2007 and in March 2012 reached 24.4%. Regarding the youth unemployment, 50 per cent of labour force under 25 are jobless. This could be explained by the dependence in the construction sector, which collapsed and second by the lack of flexibility in the Spanish labour market.

Greece

The Great recession of 2008 revealed the weaknesses of the public finances of several Eurozone countries starting from the weakest link, Greece. The crisis that erupted in Greece revealed macroeconomic imbalances and structural problems of the Greek economy which remained hidden for several years and even decades prior to the crisis. Hardouvelis (2011) points that the Greek economy can be summarized in a few words: the lack of competitiveness and the mismanagement of the Greek public sector. Kouretas and Vlamis (2010) concur that running consistently widening public deficits together with declining external competitiveness played a decisive role in the deteriorating fiscal stance of the Greek economy.

Another major problem for the Greek State is tax evasion. According to the Hellenic Foundation for European and Foreign Policy, Greek state is losing 13 billion Euros in tax evasion and corruption of the public administration. The Corruption Perceptions Index ranks countries and territories according to their perceived levels of public sector corruption. It is an aggregate indicator that combines different sources of information about corruption, making it possible to compare countries. According to the corruption index developed by Transparency International in 2012 Greece ranks 94th among 174 countries, an indication that a country is perceived as highly corrupt having the same levels of corruption with Colombia and Senegal.

Haliasos and Vayanos (2011) in a speech they gave at the 15th Economist Roundtable with the Government of Greece mention that the Greek crisis is not a consequence of the global financial crisis, but it is due to the deeply rooted structural problems of the Greek economy. They stress the importance of several reforms that need to be taken towards market liberalization and regulatory bodies, the justice system, and stress the necessity of an increase of productivity in the public sector.

Figures 2.1 and 2.2 show the government revenues and government expenditures as a percentage of GDP are presented for the years 2002 and 2009. In 2002 in Greece one can notice the biggest difference between the revenues and the expenditures of the government, 15.6 per cent, followed by Ireland with 13.9 per cent. The government expenditures in Greece increased from 2002 until 2009 by approximately 20 per cent and the government revenues for the same period declined by about 2.1 per cent. Greece's budget deficit in 2009 reached 15.4 per cent as a percentage of GDP, the highest in the eurozone. The general government gross debt as a percentage of GDP amounted to 127.1 per cent in 2009 and 142.7 per cent in 2010 increased by 15.6 per cent, something that raised the concerns that the country will not be able to finance its debt.

On May 2010, the eurozone countries and IMF agreed on a €110 billion aid package for Greece. In exchange, Greece agreed to implement austerity measures to achieve fiscal consolidation. The austerity plan had taken the aim to decrease Greece's public deficit to less than 3 per cent of GDP by 2014. However, the difficulties with the implementation of the Economic Adjustment Programme resulted to a new bailout loan on 14 March 2012. In total, according to the European Commission, the second programme reached 164.5 billion until the end of 2014. Furthermore, the involvement of the private sector (PSI) was agreed aiming to increase the sustainability of Greek debt.

Figure 2. 1 General Government Revenues and Expenditure as a percentage of GDP in 2002.

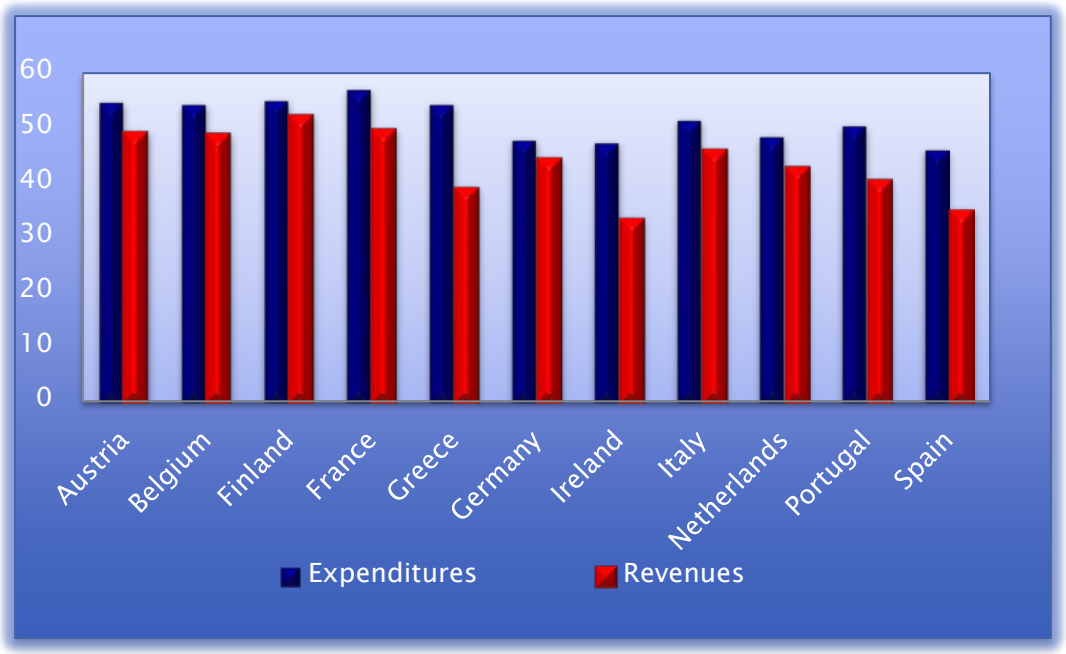
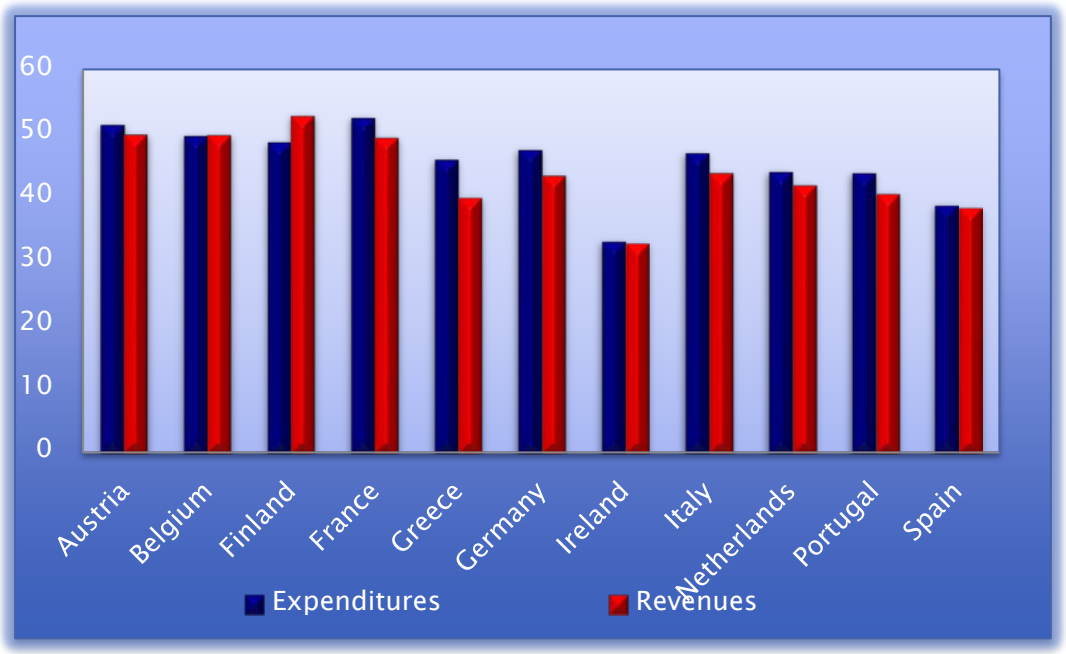


Figure 2. 2 General Government Revenues and Expenditure as a percentage of GDP in 2009



2.2.3 Theory

During the euro area crisis as well as during the global financial crisis we observed the government bond yields to widen radically. This had as a result to trigger the interest in the investigation of the determinants on the government bond yield spreads. Figure 2.3 and 2.4 show the behavior of ten-year government bond yield differentials of ten Eurozone countries from 2002: Q1 through 2013: Q3. There are three major phases of the bond yields development. First, the Greek spreads began to diverge from the rest of sample in early 2010. Second, the Portuguese and Irish spreads started to move upwards during 2010 and the first half of 2011. Third, in November 2011 the yield on 10-year Italian bonds jumped to 6.37 per cent and the Spanish yields rose to 5.58 per cent and remained at elevated levels thereafter. Highly indebted countries with fiscal imbalances and unsound banking sectors were penalized the most.

Figure 2. 3 10-Year Government Bond Yields of periphery euro area countries and Germany.

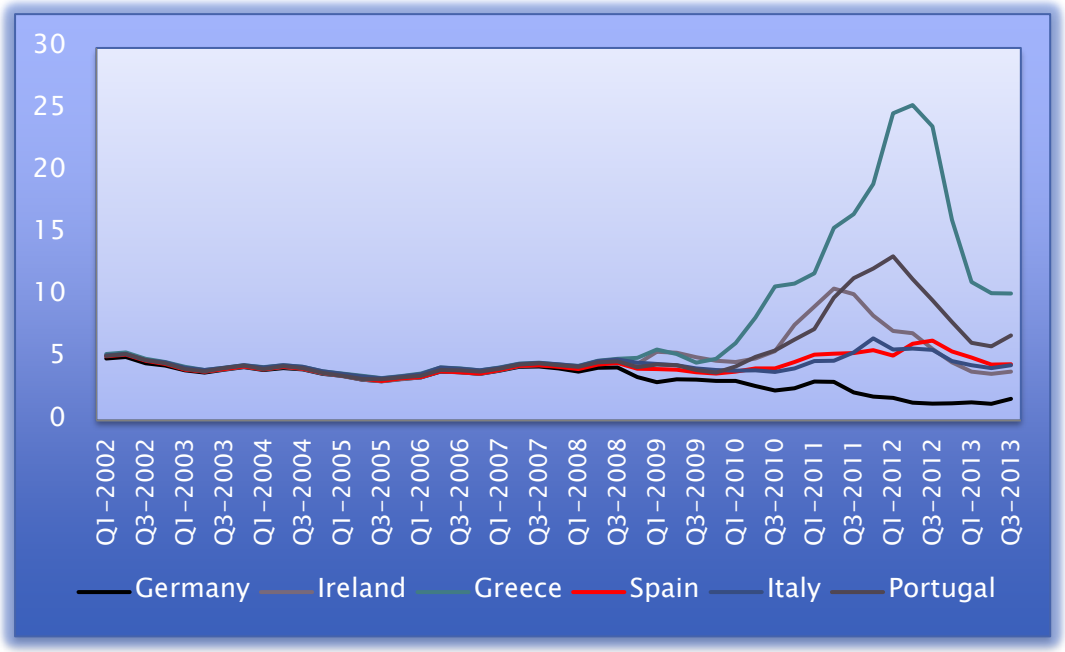
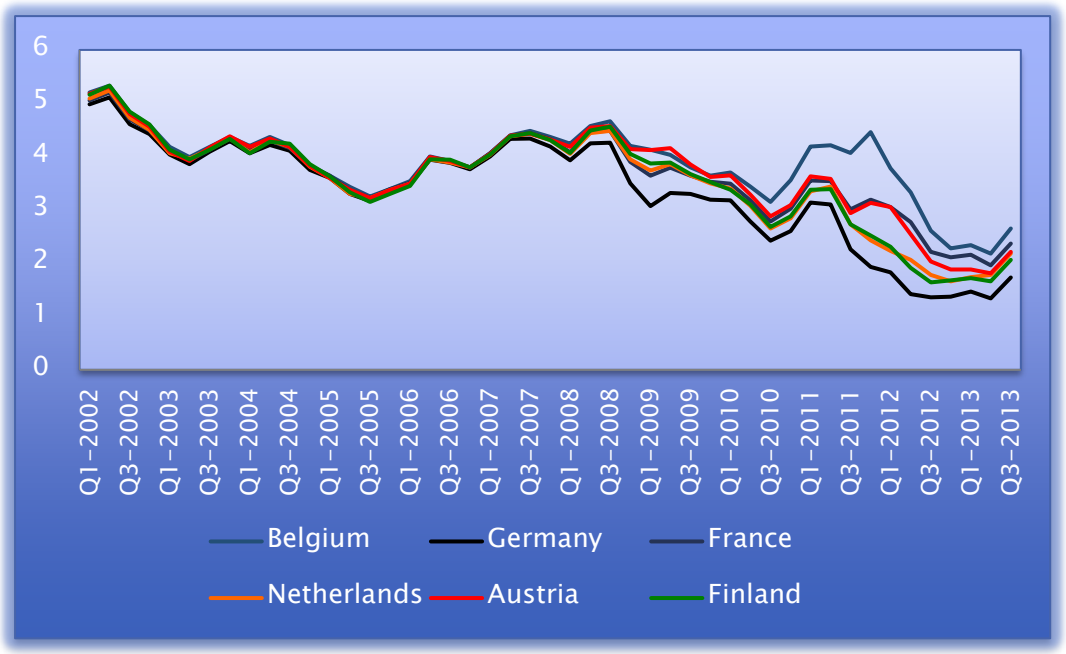


Figure 2. 4 10-Year Government Bond Yields of core euro area countries



The introduction of the common currency eliminated the exchange rate risks among the eurozone currencies and the government bond yields converged. The difference among the yield spreads even in countries rated identically occurs for several reasons. Before the introduction of the European Monetary Union, four main factors seem to play the most important role in driving the yield differentials (Codogno (2003)). The first one, which is the exchange rate risk due to changes that can occur to the exchange rate environment, was eliminated after the introduction of the common currency. Another major factor that influenced the spreads were the different tax treatments and controls on capital movements. However, the previous factor was harmonized long before the monetary union.

Credit risk is one of the determinants of the government bond yields. It captures the capability of a country to pay its obligation against its creditors. It depends crucially on whether a country's debt is sustainable enough in order for the debtor to fulfill the loan obligation. The final major factor is the liquidity risk, which is defined as the difficulty an asset or security to be traded in a time period in order to prevent losses. Regarding the spreads liquidity relies on the maturity the size and the secondary bond markets.

Codogno et al (2003) in their study investigate the determinants of the euro area government bond yields. Among several factors they are using a variable in order to capture the

significance of the international risk. Their findings, using monthly data, suggest the importance of the international risk factors, measured by the US swap and the corporate bond spreads relative to US treasury yields. They conclude that the liquidity components seem to play minor role as opposed to credit risk factors in explaining the euro are bonds. They find evidence that the impact of international risk on yield differentials in Italy, Austria and Spain is explained by the debt to GDP ratios relative to Germany. For all other countries, the international risk factors affect also the yield differentials, although independently from the debt to GDP ratio.

Schuknecht et al (2010) look at the determinants of the government bond yield spreads denominated in DM/euros and US dollars relative to the benchmark, the German and the US government securities. Their findings suggest that the markets seem to penalize the fiscal imbalances more after the Lehman Brothers collapse. Their findings suggest that during the crisis, the bond yield differentials can still be explained by the economic fundamentals. Since the collapse of the Lehman Brothers the increase in the government bond yields in the European Monetary Union is due to the shift in the behavior of the markets which starting to discriminate between weak and strong fiscal performance. In a previous study, Schuknecht et al (2009) stress the significance of the fiscal fundamentals on the government bond spreads over a sample period from 1991 to the beginning of 2005 and conclude that increased government debts and deficits give signals to the markets with regard to the sustainability of the fiscal policy.

Manganelli and Wolswijk (2009) in a rich data set from January 1999 to April 2008 find evidence that there is a positive relation between euro area government bond yields and short-term interest rates. Their empirical analysis finds that movements in the bond yield differentials are closely related to the level of the short-term interest rates as set by the Eurosystem. An increase in the short-term rates results in the bond yields widening and on the contrary, a tight monetary police leads to a reduction in the spreads of the government bond yields in the euro area. Their findings are consistent to the research findings that the investors are more willing to bear risks in periods of low interest rates.

Bernoth et al (2006) examine the central government bonds of 14 EU countries from 1993 until the beginning of 2005. They use a new dataset, which includes yield-at-spreads between DM denominated bonds and US denominated bonds for the US government. In that way, they treat the Euro denominated bonds of the Eurozone countries as a foreign currency. Moreover, an

additional contribution of their study is that they use data from the period before and after the introduction of the common currency. They use three fiscal variables and conclude that the debt service ratio has a greater importance compared to debt to GDP and deficit to GDP ratios after the introduction of the EMU. In total, their results show that the sovereign bond yield differentials respond in a significant way to the government indebtedness in both pre and post crisis period.

In a more resent study Bernoth and Erdogan (2010) contribute to the literature by applying to their research a time-varying coefficient fixed effect panel model. Using quarterly frequency data from 1999 until 2010 they attempt to identify to what extent the macroeconomic fundamentals are causing the government yield spreads or whether the spread movements are due to price changes. They find that the increase in government bond yields during the crisis is due to the three reasons: firstly, it is due to the increasing investors' risk aversion, secondly, due to the deterioration in the fiscal position and, thirdly, due to the increase of the price of risk. They stress that at the beginning of the EMU the fiscal imbalances and the international risk aversion seem to have a significant impact on sovereign bond spreads. However, they notice that in the following years and until the Lehman Brothers collapse, the investors turn to more safe assets rather than paying attention to fiscal fundamentals.

Geyer et al (2004) attempt to analyze the dynamics of the government bond yields of several eurozone countries. In their analysis, they use weekly data for short maturity yields and long maturity yields and find strong evidence for the presence of a global factor in explaining the long term yield spreads. They run several regressions in order to address the relationship between the government spreads and three types of variables: firstly, the variables related to default risk, secondly, variables that measure the credit risk in the corporate bond market and third variables directly related to liquidity. They conclude that the joint variation of EMU spreads is explained by a set of common factors, rather than by each country's specific factor.

Attinasi et al (2009) using a panel data analysis and a dataset spanning from 31 Jul 2007 until 25 March 2009 find, in line with the existing literature that the higher expected deficits and government debt among the eurozone countries have as a result higher government bond yield spreads. In this study, which captures the period of the global financial crisis, the findings show that the fiscal imbalances seem to play an important role in spreads development. In addition

to the government creditworthiness measures they also include in their research the impact that the announcements of bank rescue packages had on the government bond yield differentials.

Beber et al (2009) in their study argue that credit quality and liquidity are accounted by investors. The sample period that they use is from April 2003 until December 2004. During this period, significant events took place in order for the authors to study sufficiently the behavior of the European fixed-income markets. They conclude that in periods of large flows, liquidity seems to play a significantly more important role than quality. That means that the investors in times of financial stress demand liquidity and not credit quality.

Bellas et al (2009) aim to investigate the sovereign bond spreads for a selected number of emerging countries using a rich set of macroeconomic and financial stress variables. The data set covers 14 countries between the first quarter of 1997 until the second quarter of 2009. They stress that in the long run, fundamentals appear to be highly significant while in the short term financial fragility seems to be a more important determinant of the emerging market sovereign bond spreads. Bellas et al (2010) also stress the importance of other factors such as the political stability, corruption and the asymmetry of information. Their findings suggest that the political risk an important long-term determinant of sovereign bond yield differentials.

Sgherri and Zoli (2009) in their research attempt to investigate the degree to which government bond yield spreads in the euro zone are driven by each country's specific characteristics. A simple panel model of the ten-year government bond yield differentials for ten euro area countries is estimated over a period from January 2003 until March 2009 using monthly frequency data. Since the beginning of the global financial crisis it seems that solvency of the fiscal fundamentals affects in a greater degree the spread movements.

On the same line Caceres et al (2010) conclude that before the global crisis international risk aversion had a significant impact on spreads while in the period that followed the crisis the investors turn their attention to each country specific characteristics. They investigate the behavior of bond spreads in four different periods: the first period of the global financial crisis from July 2007 until September 2008, the second period from October 2008 until March 2009, third period between April 2009 until September 2009 and finally the period since October 2009. The authors stress the importance of debt sustainability in avoiding fiscal stability concerns regarding the state of the economy.

Mody (2009) investigate the surge of sovereign bond yield differentials among the euro area countries. They use high-frequency data and conclude to the following: Firstly, the global financial instability after 2007 pushed the euro area bond spreads upwards, while the investors moved to “risk free” assets. Jaramillo et al (2013) shed light with their research at which degree the fiscal variables affect the domestic bond yields. Their findings show that in times of calm in global financial markets the fiscal imbalances do not seem to explain in a sufficient degree the movements of domestic bond yields. However, in times of turmoil in the global financial market the investors turn to safer assets looking in particular at the specific fiscal fundamentals of each country.

Barrios et al (2009) in their research about the government bond yields in the euro area focus in particular on developments during the financial crisis started in 2007. Their findings are in line with the literature. They stress that international risk factors have a major impact on the sovereign bond yields. However, factors such as liquidity and credit risk become more significant during the recent financial crisis. More specifically, countries with large fiscal imbalances and high debts experience significantly increases in borrowing costs as expressed by the bond yields.

Moving on Baldacci et al (2010) reexamine the effect of fiscal imbalances on the long term interest rates in a period spanning from 1980 until 2008 for 31 advanced and emerging economies. Their empirical analysis suggests that the fiscal deterioration has a significant impact on the long term interest rates which robust but nonlinear. They also find that the degree of fiscal deterioration in particular for the advanced economies, could lead to various differences in bond spreads movements.

Favero et al (2010) construct a simple model in order to identify the relation between the yield differentials, fundamental risk and liquidity. They test their model based on daily bond yields observation in the euro area from 2002 until 2003. Their findings suggest that the aggregate risk factor is priced consistently, while liquidity is priced for 9 countries out of a total of 16 countries used in the sample and that the interaction between the liquidity and risk factor is negative when significant.

In a recent paper De Santis (2012) is looking at the determinants of the government yields relative to the German Bund and their findings imply that three major factors affected the sovereign bonds in the euro area. Firstly, an aggregate risk factor, secondly the credit risk of each country and finally the contagion from Greece. In particular, De Santis (2012) suggests that downgrading in sovereign bonds of Greece, Ireland, Portugal and Spain have a significant effect on other sovereign bond yields. Overall, De Santis (2012) implies that the control of contagion and the reduction of default risk in the euro area would be a crucial factor for the stability in the Eurozone to the achieved.

Afonso (2009) is looking at the effect of macroeconomic fundamentals and fiscal forecasts according to macro and fiscal estimations made by the European Commission. Using a panel of 14 European Union countries Afonso (2009) finds evidence that the long term government bond yields increase with positive growth forecasts and on the contrary decrease when higher deficits are anticipated.

Barbosa et al (2010) stress, in line with the literature, the effect of the deteriorating macroeconomics in the government bond yields of euro area countries especially after the Lehman Brother's collapse in September 2008. Barbosa et al (2010) note that before the collapse of Lehman Brothers the risk premium in financial markets was the main component influencing the government bond yields.

However, since September 2008 each country's specific characteristics started to play an important role in the development of spreads. Kilponen et al (2012) investigate the impact of the monetary policy and the decision taken towards the European crisis resolution on the long-term government bond yields. They conclude that in the short term these decisions have had a different impact depending on the country. According to authors' results the Security Market Programme (SMP) decision had a negative effect on all the countries used in the analysis. The SMP is the Eurosystem programme to purchase bonds, sovereign in particular, on the secondary markets. The programme was launched in May 2010.

Arghyrou and Kontonikas (2011) argue that the crisis is likely to be the result of the macroeconomic imbalances of the Greek economy and a shift in the market participants perception about the commitment to Greece's EMU participation.

Poghosyan (2014) is looking at the long run and short run determinants of government bond yields in 22 advanced economies from 1980 until 2010 using panel cointegration methodology. In order to investigate the long run effect variables such as debt to GDP ratio and potential growth are being used and on the other hand the short run effects are being captured with variables such as inflation and short-term interest rates.

Maltritz (2012) points the general idea that before 2007 even if the countries had significant differences in their fiscal condition the government bond yields were very similar across the euro area countries. Once the euro debt crisis erupted the scenic changed dramatically especially for the periphery countries, however the author stresses the importance that the decision taken by the Eurosystem had on the stability of the common currency.

Adding to the government bond yields literature, Dewachter et al. (2015) using a sample of five Eurozone countries over the period 2005 – 2013 attempts to identify the factors driving the spreads. Overall, the findings show that the economic fundamentals are main drivers of the sovereign bond yields.

2.3 Data and Methodology

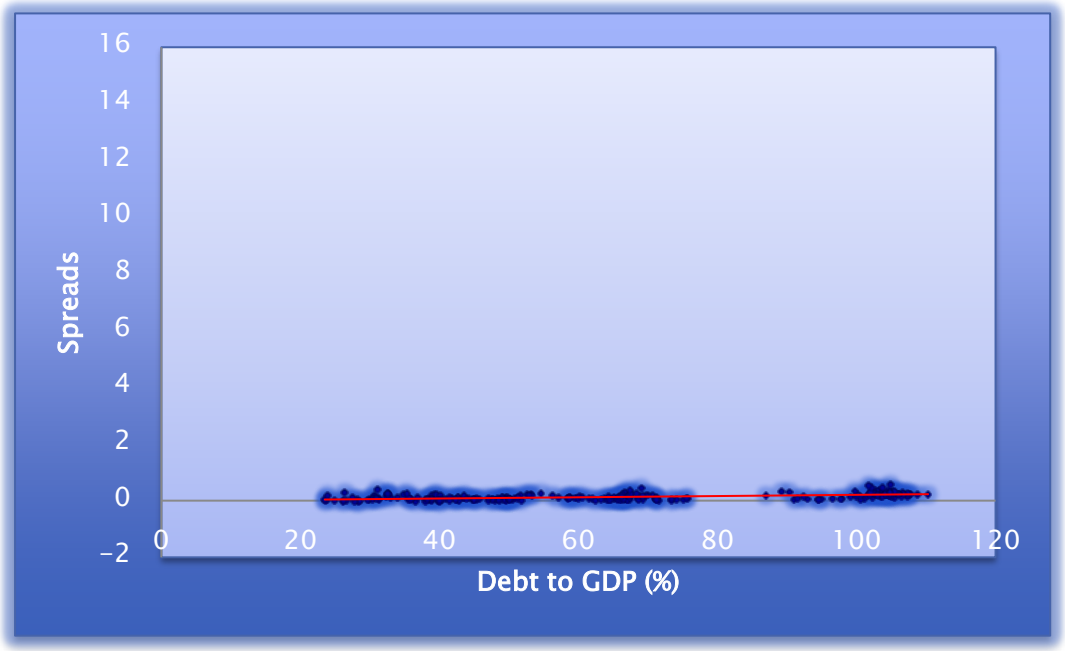
2.3.1 Data

Our dataset covers the period from 2001 Q1 until 2013 Q3. We use data for ten euro area countries from various sources: International Monetary Fund, European Commission and European Statistical Office. At this point it is vital to introduce the set of variables that are used in this analysis and the expected impact on the spreads based on the theoretical background. The charts for each variable are presented in order to observe changes among this examined period.

Figure 2.5 and 2.6 show the spreads versus the debt-to-GDP ratio before and after the beginning of the crisis. We are using the same range for both figures to make them comparable. The spreads are shown in the vertical axis while the debt to GDP ratio in the horizontal axis. Each

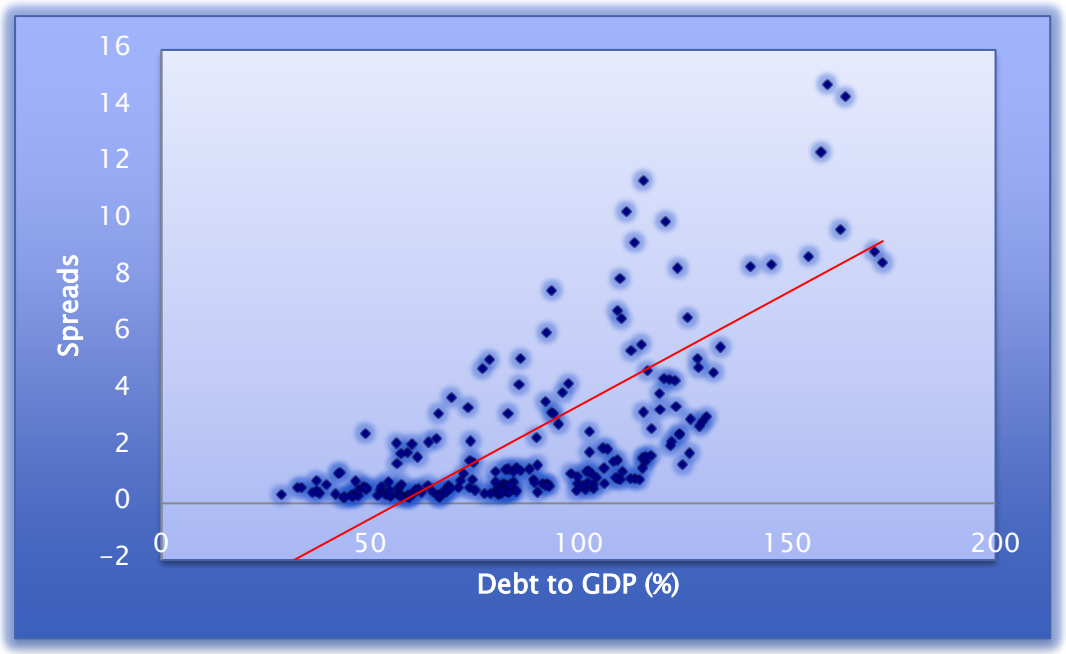
point represents the spread and the respective debt-to-GDP ratio in a particular quarter starting from 2000 up to 2008 for each country. The red line shows the trend of the spread versus the debt-to GDP ratio for this particular period. As it is observed from the figure 3.1 the differences between the debt to GDP ratios between EMU countries are not reflected in the spreads.

Figure 2. 5 Sovereign bond spreads and debt to GDP ratios prior 2008.



Moving on, the beginning of the debt crisis in the Eurozone changed things dramatically as observed in Figure 2.6 Large deviations from the regression line are observed fact that implies that the markets seem to punish the highly indebted economies.

Figure 2. 6 Sovereign bond spreads and debt to GDP ratios since 2008.



In order to capture the effect of public indebtedness on spreads we use the government debt to GDP ratio. A higher level of debt to GDP ratio is closely associated with greater possibility of default. We therefore expect the debt to GDP ratio and spreads to be positively associated. Figures 2.7 and 2.8 show the debt stock levels of eleven Euro area countries in 2002 Q1 and in 2013 Q1.

Figure 2. 7 Government debt to GDP ratios in 2002 Q1.

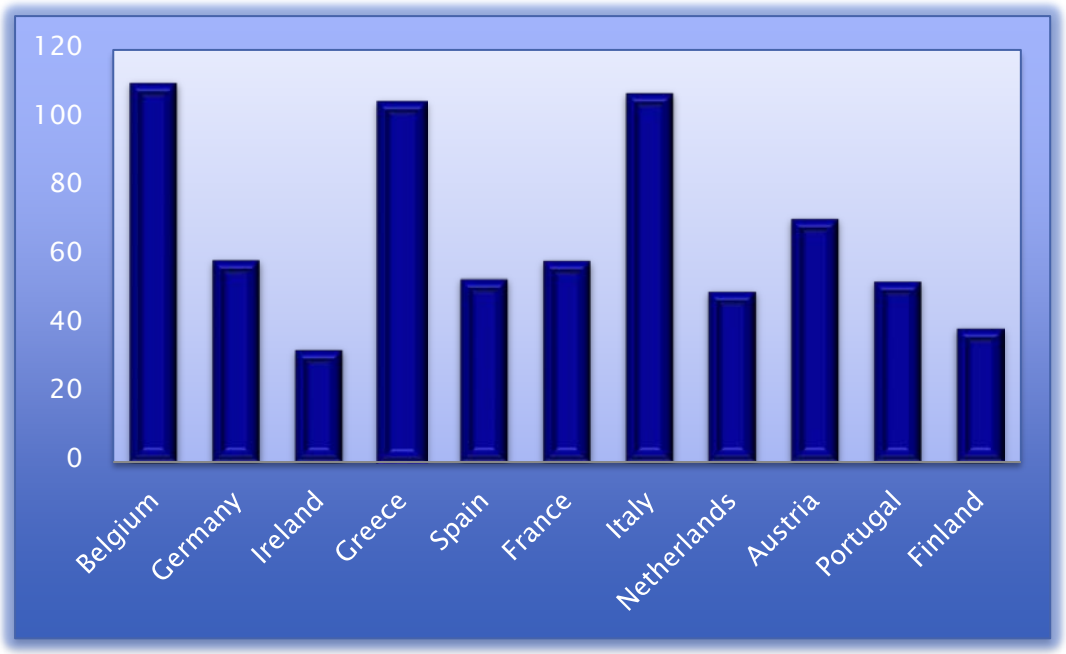
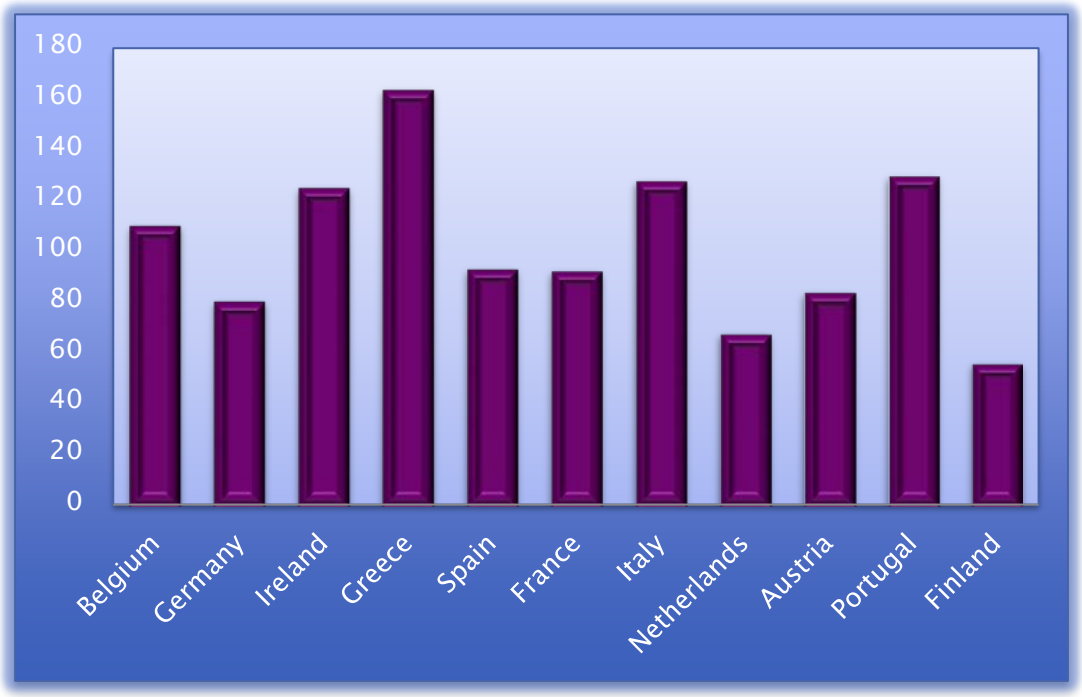


Figure 2. 8 Government debt to GDP ratios in 2013 Q1.



Another variable used in the analysis is the real GDP growth rate, which is the rate of change of the gross domestic product at constant prices. The growth rate captures the competitiveness

and the health of the economy. The higher the growth the lower we expect to be the long-term interest rates. The increasing levels of GDP growth strengthens the country's credibility and the markets confidence. We expect a negative relation between the government bond yield differentials and the real GDP growth rate.

In the graph presented below we can see the real GDP growth rates for the periphery countries (Portugal, Ireland, Italy, Greece, Spain). Both Ireland and Greece recorded the highest rates GDP growth during for the period until 2008. As it can be observed all countries showed rapid decreases on the GDP levels with Greece in 2013 presenting recession for the sixth consecutive year. The crisis had also affected the core euro area countries as it is observed in Figure 2.9.

Figure 2. 9 Real GDP growth rates of periphery euro area countries.

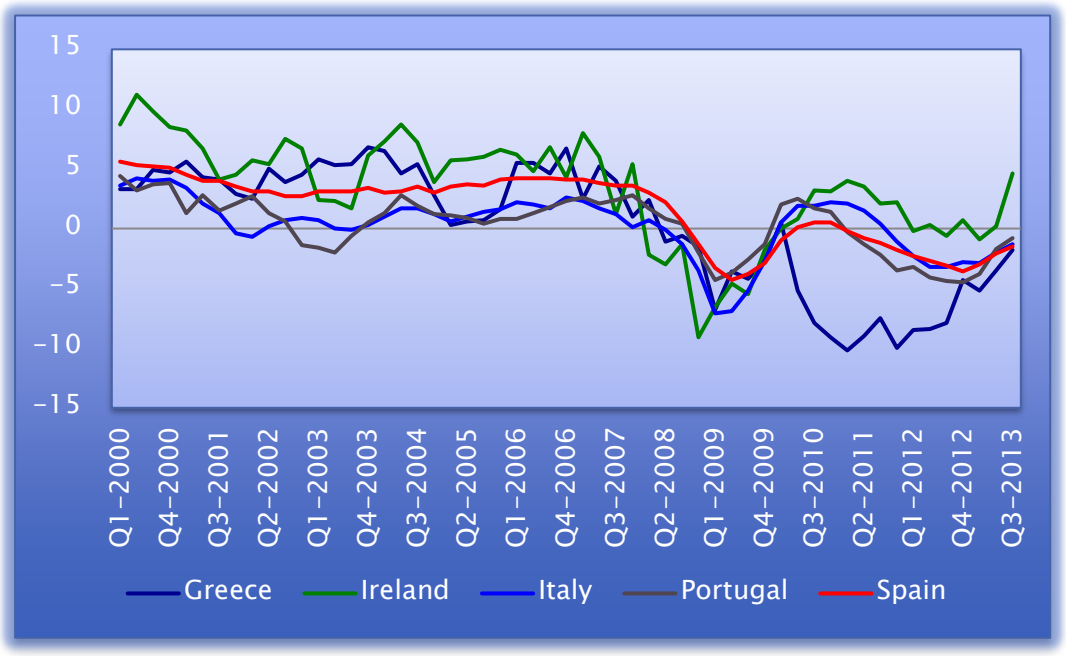
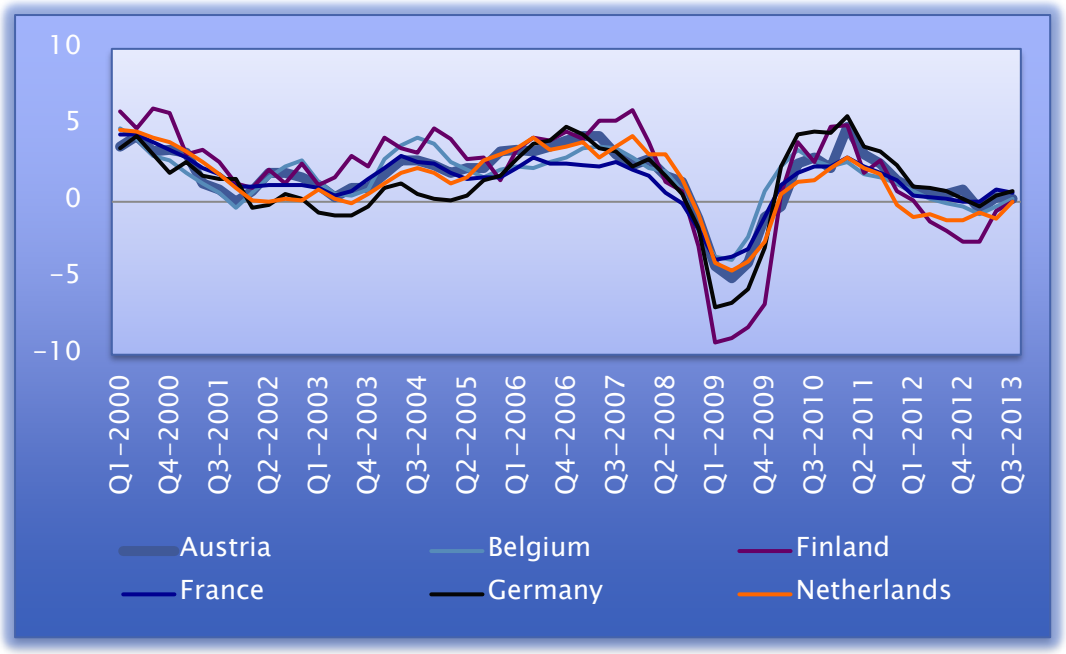


Figure 2. 10 Real GDP growth rates of core euro area countries.



Furthermore, it is also important to investigate the effect of fiscal imbalances on the yield differentials. Higher fiscal imbalances will lead to higher borrowing costs as a result we expect a positive relation between these two variables.

Figure 2. 11 General Government Balance as a percentage of GDP of euro area counties in 2002.

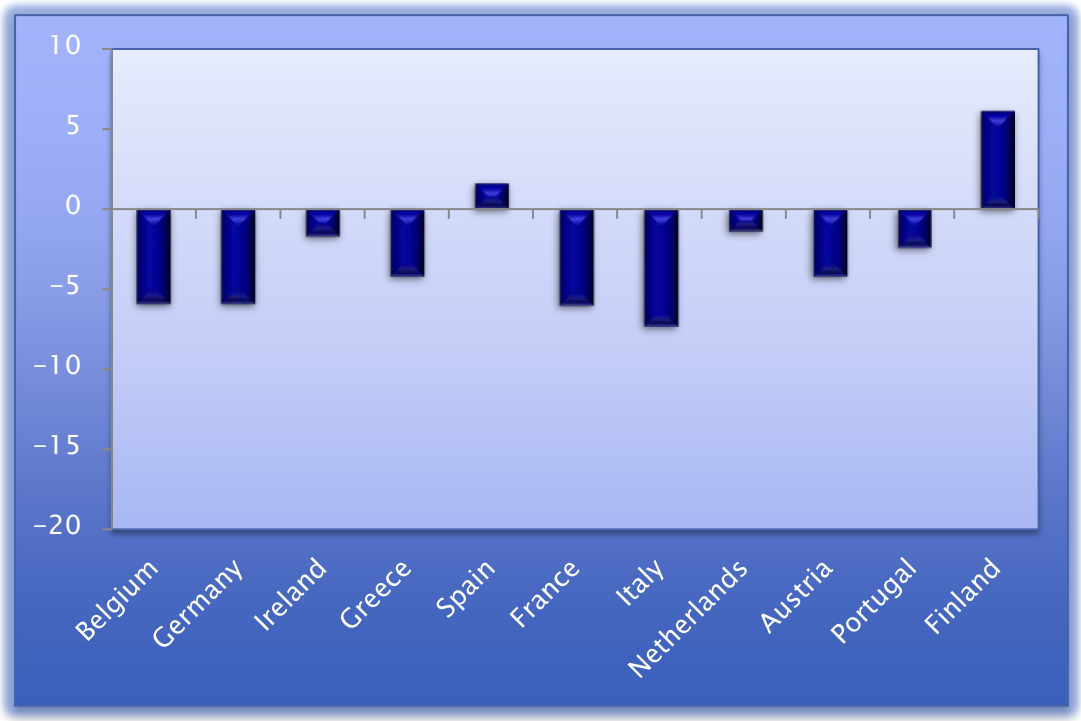
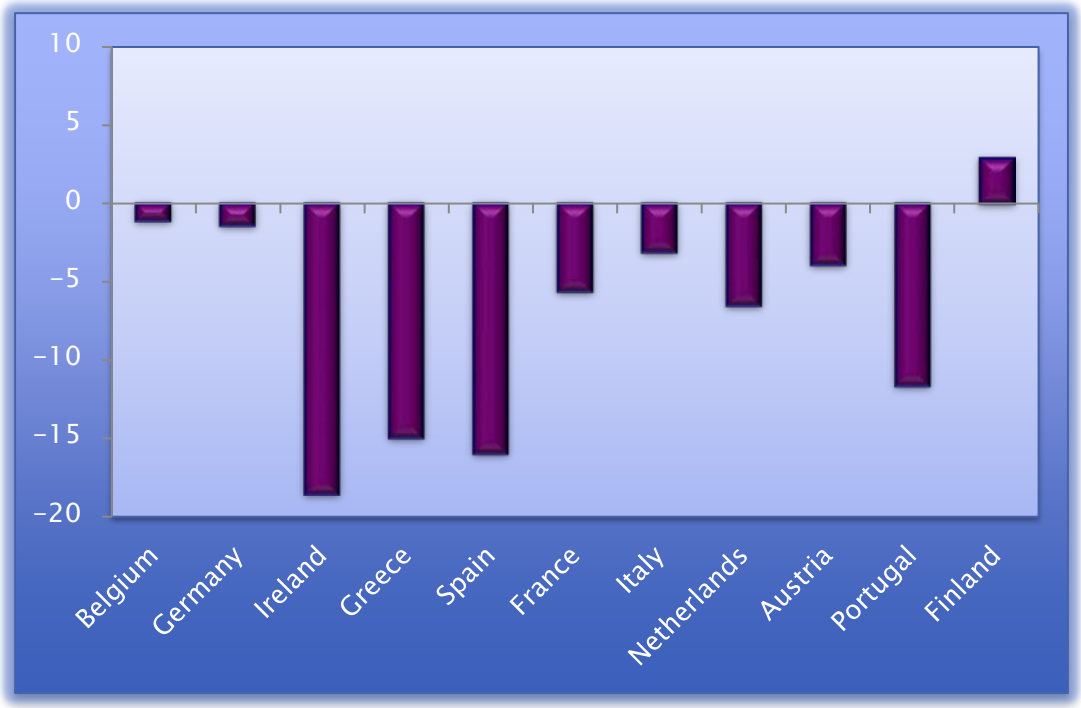


Figure 2. 12 General Government Balance as a percentage of GDP of euro area counties in 2009.



In order to measure the country's external solvency, the net current account to GDP ratio is used. The higher the net current account ratio the less the economy relies on external capital flows. Therefore, we expect a negative relation between the two variables.

Moreover, in order to capture the effect of the labor market on spreads we include the unemployment rate in the model. The unemployment rate is a factor, which is significantly related to the economic growth. The lower the unemployment the more prosperous the economy is. We expect a positive correlation between unemployment rate and spreads.

Figure 2. 13 Unemployment rates of core euro area countries.

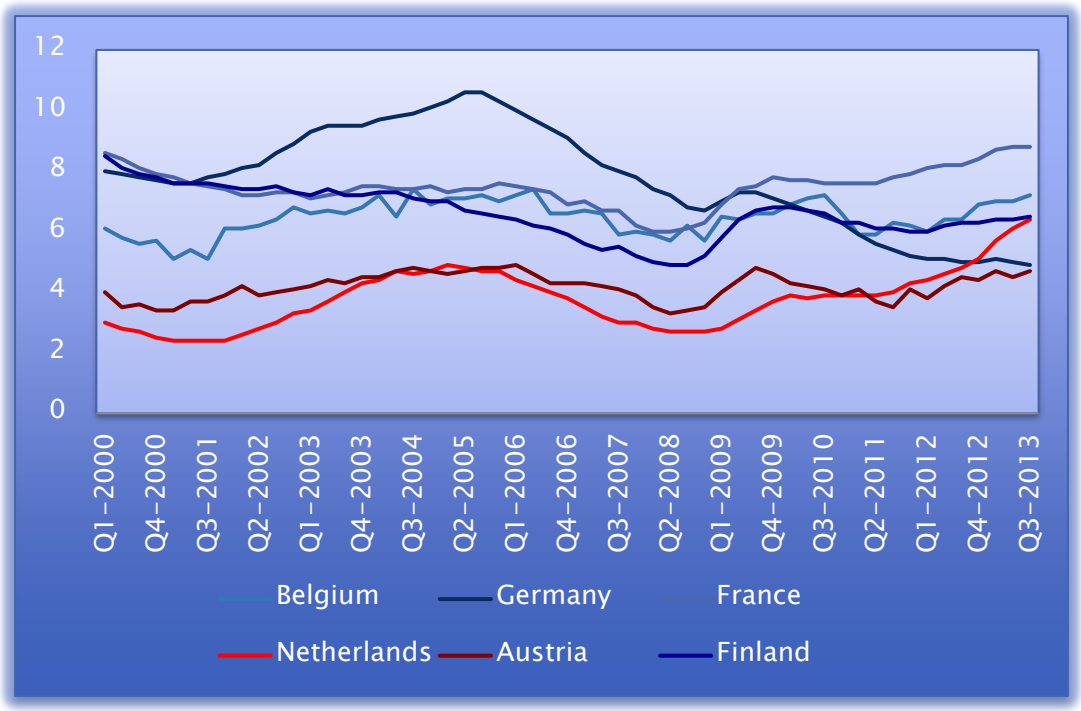
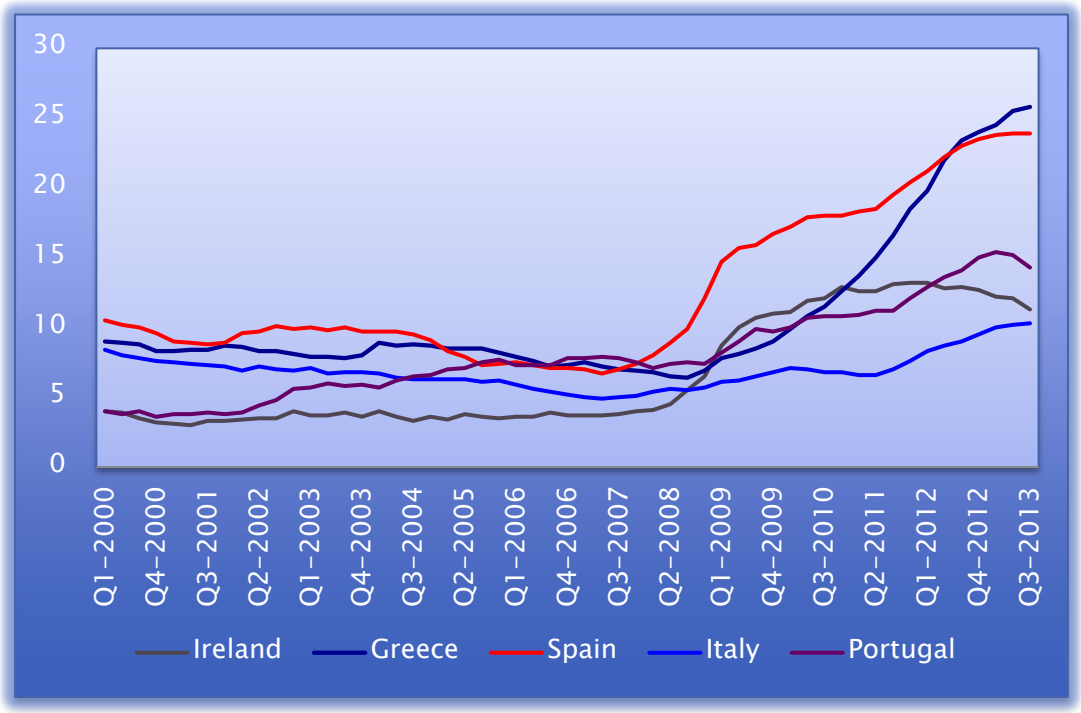


Figure 2. 14 Unemployment rates of periphery euro area countries.



Finally, five dummy variables are used in this model so as to capture the impact of four major events that took place during the crisis on government bond yield differentials. Firstly, the date

on which Greece asked for the first bailout package (May 2010) and the date at which the banks agreed to a write off the 50 per cent of the debt was decided (October 2011), are taken into consideration. Another dummy variable used is the rescue package required by Ireland in November 2010. In May 2011, an aid package for Portugal is agreed and this significant event is represented by a fourth dummy variable. Finally, the date at which the Lehman Brothers collapsed, on September 2008, and signalized the beginning of the global financial crisis is considered as the fifth dummy variable in the model.

2.3.2 Methodology

The data set covers ten countries of the Eurozone (Austria, Belgium, Finland, France, Greece, Ireland, Italy, Netherlands, Spain, Portugal) and spans over the period from the first quarter of 2002 until the second quarter of 2013 capturing the pre-crisis period as well as the crisis period. Panel data analysis is used for the analysis of the model. Government bond yields differentials, which are calculated as the difference between the yield of a 10years maturity government bond issue of country *i* in time *t* and the corresponding German *bund* of the 10year government bond used as the dependent variable. The government debt to GDP ratio, the GDP growth rate, the net current account to GDP ratio, the fiscal balance to GDP ratio and the unemployment rate are included as explanatory variables. Furthermore, several other forms of the model are presented. We use five dummy variables aiming to capture the effect of four major events among these years are used as the independent variables of the model. Finally, we presume that a changing point for the Euro zone crisis is the decision of the European Central Bank for the Outright Monetary Transaction. Thus, one way to test the significance of this announcement is to estimate the model by including the OMT as a time dummy. Below the first form of the model is presented.

$$S_{i,t} = \alpha + \beta Debt_{i,t} + \gamma * Growth_{i,t} + \delta * FIS_{i,t} + \lambda * UNE_{i,t} + \rho * CA_{i,t} + \varepsilon_t \qquad \textbf{(1)}$$

Where the $S_{i,t}$ is the difference between the 10-year government bond yield of each of the countries used in the analysis against the German 10-year government bond yield. On the right-

hand side of the equation, the Debt $_{i,t}$ represents the government debt-to-GDP ratio of country i for the period t, Growth is the real GDP growth ratio , FIS is the fiscal deficit –to GDP-ratio , UNE is the unemployment rate of each country and CA is the current account-to-GDP ratio. We use panel data analysis with fixed effects after having performed the Hausmann test, which showed that the random effect model is not appropriate for our analysis. We also present two alternative forms of equation 1 by using the Debt-to-GDP ratio in a non-linear form and as a difference from the German debt to GDP ratio. The form of the equation using the non-linear term is presented below.

2.4 Empirical Results

2.4.1 Macroeconomic Fundamentals

Table 2.1 below illustrates the results of the regression in three different forms. In the first regression, all the independent variables are significant in 1 per cent level of significant apart from the current account as a percentage of GDP. Starting from the debt to GDP ratio, it is significant and positive implying that the increase of debt levels has an effect on the government bond yields. The results are consistent with the existing literature. Engel and Hubbard (2204), Reinhart and Sack, (2000) measuring the magnitude of the effect conclude that an increase in the debt to GDP ratio of 1 percentage point is associated with an increase in interest rates between 2 and 7 basis points.

Table 2. 1 The determinants of the sovereign bond spreads

Spreads in the Euro area				
	(1)	(2)	(3)	(4)
Debt to GDP ratio	0.0400***			0.0263***
	(0.0072)			(0.0034)
Debt to GDP ratio squared		0.0004***		
		(0.0000)		
Debt Difference			0.0258***	
			(0.0086)	
Fiscal Balance	0.0832***	0.0610***	0.0773***	0.02690
	(0.0159)	(0.0149)	(0.0162)	(0.1259)
Current account (% GDP)	0.0006	-0.0001	-0.0004*	0.0120
	(0.0016)	(0.0014)	(0.0016)	(0.0154)
Real GDP growth rate	-0.2094***	-0.1709***	-0.2203***	-0.2247***
	(0.0289)	(0.0276)	(0.0294)	(0.0356)
Unemployment rate	0.4000***	0.2608***	0.5000***	0.3210***
	(0.0122)	(0.0398)	(0.0399)	(0.0263)
VIX				-0.0081**
				(0.0110)
Constant	-4.0891***	-2.8034***	-1.9164***	-2.7230***
	(0.4173)	(0.2480)	(0.3073)	(0.4369)
Observations	470	470	470	470
No. Countries	10	10	10	10
Period	2001Q1-2013Q3	2001Q1-2013Q3	2001Q1-2013Q3	2001Q1-2013Q3

Note 1. The debt difference indicator is calculated by the difference between each country's debt to GDP level minus the German debt to GDP ratio.

Note 2. *** p<0.01, ** p<0.05, * p<0.10

The real GDP growth rate is highly significant and with a negative sign confirming the inverse correlation with government spreads. The high levels of growth imply the prosperity of the economy and are reflected in the lower borrowing costs. Similar to Balduzzi, Corsetti and Foresi (2007) the fiscal deficit is significant and positive, showing that when the fiscal deficit is increasing, the government bond yields are also increasing. Furthermore, the current account balance as a percentage of GDP is not significant. Finally, the unemployment rate is significant

and has a positive sign implying that higher unemployment is a negative indicator for the economy and it is reflected to the borrowing costs.

The second regression shows the equation with a non-linear debt to GDP indicator. All the variables apart from the current account balance as a percentage of GDP are significant and with the expected sign. The squared debt to GDP ratio is significant showing that the increases in debt levels have a proportionally higher effect on the government bond yield differentials. Moving on, we calculate the differences of the debt-to-GDP ratio of each country from the German debt to GDP ratio in order to capture whether or not it has an effect on the bond yield differentials. The results show that the deviation of the debt levels from the German debt levels have a positive effect on spreads implying that the higher deviation the higher the spreads are. All other variables, except for the current account balance, are significant and with the expected sign. In the final regression with include in our analysis the CBOE Volatility Index, known by its ticker symbol VIX to capture the effects of international risk. The VIX indicator is significant but not with the expected sign.

2.4.2 The Effect of the Outright Monetary Transactions

On 2 August 2012, the European Central Bank announced the implementation of the Outright Monetary Transactions Program in order to face successfully the turmoil from the Eurozone debt crisis. The technical features of the OMT were announced on 6 September 2012. The President of the European Central Bank Mario Draghi described the OMT as “probably the most successful monetary-policy measure undertaken in recent time” (ECB Press Conference, 6 June 2013). In the Table 2.2 below we present the equation by adding the OMT as a dummy variable in order to capture the effect of this decision in the long-term government bond yields.

Table 2. 2 The determinants of the sovereign bond spreads and the Outright Monetary Transactions.

Spreads in the Euro area			
	(1)	(2)	(3)
Debt to GDP ratio	0.0518***		
	(0.0074)		
Debt to GDP ratio squared		0.0005***	
		(0.0000)	
Debt Difference			0.0320***
			(0.0086)
Fiscal Balance	0.0993***	0.0734***	0.0874***
	(0.0156)	(0.0142)	(0.0161)
Current account (% GDP)	-0.0002	-0.0008	-0.0010*
	(0.0015)	(0.0014)	(0.0016)
Real GDP growth rate	-0.2153***	-0.1722***	-0.2280***
	(0.0279)	(0.0260)	(0.0289)
Unemployment rate	0.4018***	0.2915***	0.5000***
	(0.0409)	(0.0378)	(0.0402)
Outright Monetary Transactions	-1.6532***	-1.9201***	-1.1990***
	(0.2786)	(0.2537)	(0.2778)
Constant	-5.0360***	-3.2723***	-2.0401***
	(0.4329)	(0.2420)	(0.3029)
Observations	470	470	470
No. Countries	10	10	10
Period	2001Q1-2013Q3	2001Q1-2013Q3	2001Q1-2013Q3

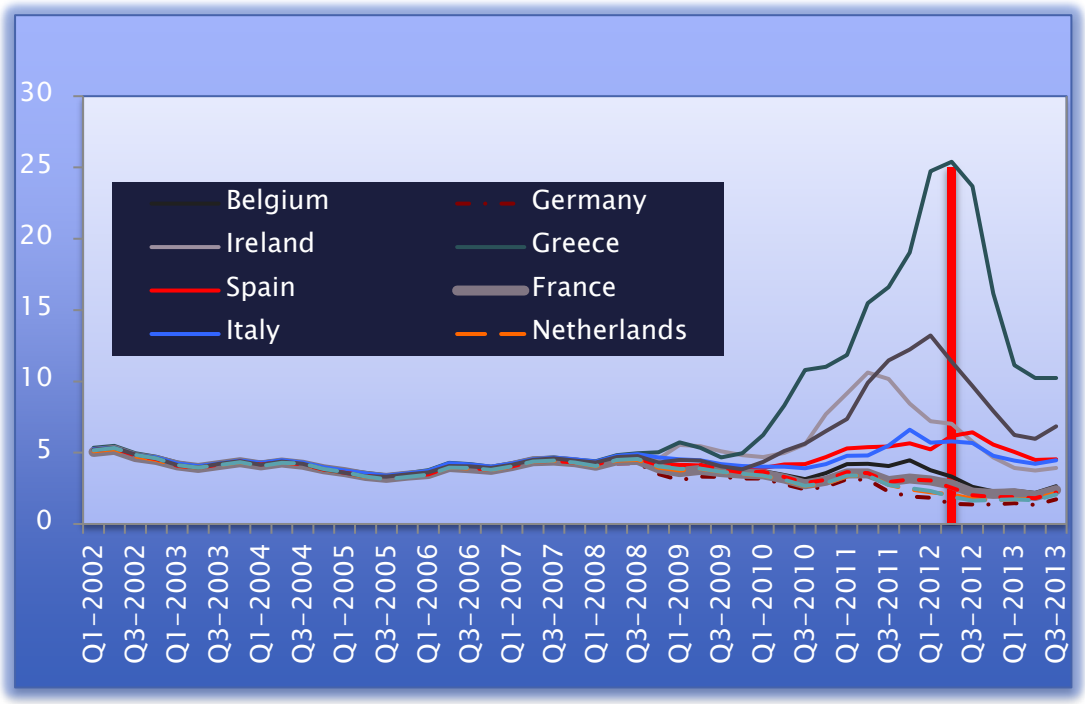
Note 1. The debt difference indicator is calculated by the difference between each country's debt to GDP level minus the German debt to GDP ratio.

Note 2. *** p<0.01, ** p<0.05, * p<0.10

The dummy variable representing the Outright Monetary Transactions is significant and with a negative sign implying that the ECB's decision had as a result the decrease of the borrowing costs in the Eurozone. The graph below shows the government spreads of each country and the announcement of the OMT in the second quarter of 2012 depicted in a vertical red line. The debt-to-GDP ratio in all three forms is positive and significant, the real GDP growth rate is also significant with the expected negative sign, the unemployment rate is positive and highly

significant all three regressions as well as the fiscal deficit variable which is also positive and significant. The current account-to-GDP ratio is significant at 10 per cent only in equation 3. As it is also observed from Figure 2.15 the sovereign bond spreads are on a declining trend after the announcement of the OMT.

Figure 2. 15 Sovereign Bond Yields and the introduction of the Outright Monetary Transactions.



2.4.3 Core vs. Periphery

Moving on with our analysis, we investigate whether the indicators we include in our analysis have a different effect on two different subgroups, the core euro area countries (Austria, Belgium, Finland, France, Netherlands) and the periphery countries (Greece, Ireland, Italy, Portugal and Spain). Driven by the regression described in the previous section we also incorporate the impact of the Outright Monetary Transactions announcement on these two groups.

In Table 2.3 we present the correlation matrix between the 10-year government bond yields of eleven Eurozone countries. The core Eurozone countries, German, Austria, Finland, Belgium

and the Netherlands show the highest corrections to each other and the lowest with the periphery countries. The correlation between German and Greek bond yields is -0.77.

.

Table 2. 3 Correlation Matrix of Sovereign Bond Yields of euro countries.

	Belgium	**Germany**	**Ireland**	**Greece**	**Spain**	**France**	**Italy**	**Netherlands**	**Austria**	**Portugal**	**Finland**
Belgium	1.00										
Germany	0.83	1.00									
Ireland	0.15	-0.33	1.00								
Greece	-0.38	-0.77	0.67	1.00							
Spain	-0.02	-0.43	0.67	0.82	1.00						
France	0.93	0.97	-0.18	-0.63	-0.25	1.00					
Italy	0.26	-0.24	0.63	0.71	0.88	-0.02	1.00				
Netherlands	0.87	0.99	-0.27	-0.74	-0.37	0.98	-0.16	1.00			
Austria	0.93	0.96	-0.16	-0.64	-0.29	0.99	-0.04	0.98	1.00		
Portugal	-0.17	-0.65	0.78	0.95	0.83	-0.48	0.80	-0.60	-0.49	1.00	
Finland	0.88	0.98	-0.25	-0.73	-0.36	0.98	-0.15	1.00	0.99	-0.59	1.00

The results of the regression are presented in the Tables below.

Table 2. 4 Sovereign Bond Spread Determinants of core and periphery euro area countries.

Spreads of Core Euro area members		Spreads of Periphery Euro area members	
Debt-to-GDP	0.0281***	Debt-to-GDP	0.0600***
	(0.0032)		(0.0108)
Real GDP growth rate	-0.0412***	Real GDP growth rate	-0.2734***
	(0.0084)		(0.0483)
Unemployment rate	-0.1440***	Unemployment rate	0.4467***
	(0.0328)		(0.0681)
Current account balance	-0.0013*	Current account balance	0.0436
(%GDP)	(0.0071)	(%GDP)	(0.0430)
Fiscal Deficit (%GDP)	0.001	Fiscal Deficit (%GDP)	0.1523***
	(0.0051)		(0.0264)
Outright Monetary	-0.0973	Outright Monetary	-3.3638***
Transactions	(0.0775)	Transactions	(0.616)
Constant	-0.6414***	Constant	-5.3010***
	(0.2329)		(0.8054)
Observations	235	Observations	235
No. Countries	5	No. Countries	5
Period	2001Q1-2013Q3	Period	2001Q1-2013Q3

The results of the regression show that the OMT had no effect on the core Eurozone countries, while on the periphery countries the OMT is highly significant at 1 per cent level of significance. The fiscal balance as a percentage of GDP remains significant in the periphery countries, while it has no effect on core countries' bond spreads. Another important finding is that the debt to GDP ratio is more than twice larger in the periphery compared to the core countries. All the other indicators, apart from the current account balance, remain significant. Our results are similar to De Grauwe and Ji (2013), that the decision by the ECB in 2012 to support the government bond markets was a game changer. Similarly, Altavilla et al. (2014) argue that the OMT announcement had a significant impact on the European bond market, reducing the Italian and Spanish 2-year bond yields by about 200 basis points.

2.4.4 Did the events matter?

Having tested the fundamentals, it is now useful to investigate whether or not various events that took place during the period of the crisis had an effect on the government bond yields. In January 2010, the Greek-German bond yield spreads surpassed the 300 basis points. In the months that followed the Greek government announced austerity measures in an effort to convince the markets of its ability to serve its obligations. In April 2010, the Greek Prime Minister requested an international aid package. At the end of the same month the Greek spreads surpasses 1000 basis points. On 2 May 2010, the €110 billion bailout package agreed with participation of the European Union, the European Central Bank and the International Monetary Fund. We capture the effect of this agreement by adding a dummy variable in our model representing the 1st Greek bailout. Similarly, we use dummy variables for the Irish bailout (November 2010), the Portuguese bailout (May 2011) and the second Greek bailout (October 2011).

Table 2. 5 Determinants of the Sovereign Bond Spreads and the effect of major events in the euro area

Spread in Eurozone countries						
	(1)	(2)	(3)	(4)	(5)	(6)
Debt (%GDP)	0.0400***	0.0188**	0.0197**	0.0264***	0.0373***	0.0264***
	(0.0080)	(0.0085)	(0.0084)	(0.0083)	(0.0080)	(0.0080)
GDP growth rate	-0.2156***	-0.2211***	-0.2134***	-0.2049***	-0.2089***	-0.2948***
	(0.0324)	(0.0286)	(0.0285)	(0.0288)	(0.0291)	(0.0327)
Fiscal Balance (%GDP)	0.0816***	0.0836***	0.01571***	0.0747***	0.0825***	0.0783***
	(0.0164)	(0.0157)	(0.0157)	(0.0161)	(0.0163)	(0.0152)
Unemployment rate	0.3769***	0.3770***	0.0415***	0.3742***	0.3787***	0.3734***
	(0.0427)	(0.0415)	(0.0415)	(0.0419)	(0.0424)	(0.0388)
Current account (%GDP)	0.0004	0.0018	0.0016	0.0014	0.001	0.0020
	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0014)
Lehman Brothers collapse	-0.0978					-1.0496***
	(0.2302)					(0.2628)
1st Greek bailout		0.9674***				1.1906***
		(0.2368)				(0.3978)
Irish Bailout			0.9902***			0.6662
			(0.2435)			(0.4566)
Portuguese Bailout				0.7182***		0.6332
				(0.2541)		(04586)
2nd Greek Bailout					0.0525	0.3521
					(0.2639)	(0.4200)

OMT						-2.7164*** (0.3366)
Cons	-4.1278*** (0.4275)	-3.0010*** (0.4891)	-3.0706*** (0.4807)	-3.4383*** (0.4738)	-4.0504*** (0.4608)	-3.2013*** (0.4641)
Observations	470	470	470	470	470	470
No. Countries	10	10	10	10	10	10
Period	2001Q1-2013Q3	2001Q1-2013Q3	2001Q1-2013Q3	2001Q1-2013Q3	2001Q1-2013Q3	2001Q1-2013Q3

Table 2.5 above shows the results of the regressions. Our findings suggest that the Lehman Brothers collapse dummy is insignificant. The macroeconomic indicators seem to have a more significant role in determining the borrowing costs. Moving on to the dummy variables representing the bailout agreements for the periphery countries of the Eurozone we observe that the decisions towards the rescuing of troubled countries were taken the market participants seemed to have discounted the fact that the exit of a member country from the euro area is now possible. The results show that in times of economic turmoil various events make the markets more vigilant and influence their perceptions in a greater degree. Apart from the 2nd Greek Bailout dummy all other variables are significant with a positive sign, indicating that other factors not reflected in the economic fundamentals drove up the bond spreads.

2.4.5 The World Governance Indicators

In this step, and in order to incorporate the political uncertainty, we include the World Governance Indicators (WGI) adopted from the World Bank database analyzed in detail by Kaufmann (2012). We include in our analysis the average of the six indicators, Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption.

It should be expected that higher levels of the average value of the world governance indicators are associated with lower sovereign financing costs. The higher the composite World Governance Indicator is, the more stable a country is, which increases its capacity to pay its debts. Thus, we expect to have a statistically significant and negative correlation with spreads. The results are presented in Table 2.6.

Table 2. 6 Determinants of the Sovereign Bond Spreads and the World Governance Indicators.

Spread in Eurozone countries	
Debt to GDP ratio	0.0307***
	(0.0069)
Real GDP growth rate	-0.1563***
	(0.0281)
Unemployment rate	0.3115***
	(0.0471)
Current account to GDP ratio	-0.0009
	(0.0015)
Fiscal deficit	0.0735***
	(0.0151)
Average WGI	-6.7784***
	(0.8816)
Cons	5.2569***
	(1.2775)
Observations	470
No. Countries	10
Period	2001Q1-2013Q3

The results confirm that high quality levels of governance and stable political environment enhance the confidence in the country's economy and therefore reduces the borrowing costs. It is also interesting to note that the coefficients of the remaining variables change little, suggesting that their effect are not dependent on institutional quality.

2.5 Conclusion

This paper presented a detailed empirical investigation of the European sovereign debt market. The purpose of this study is to explain the sovereign government bond yields fluctuation over the period prior and post the euro area debt crisis. We employ a panel of ten euro area countries (Austria, Belgium, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal and Spain) using quarterly data over the period 2001:Q1 – 2013: Q3. In our analysis we incorporate an extended set of macroeconomic, fiscal, financial and political indicators to disentangle the main drivers of the sovereign spreads.

Our empirical findings indicate that there is a strong relationship between the government bond yield differentials and the debt to GDP ratio. Highly indebted countries send a negative signal to the investors about their ability to finance the debt and make timely and full payments of interest and principal in the future could be disrupted. Fiscal imbalances (public deficit) also tend to be penalized by the market participants. The current account balance, in contrast, has an ambiguous effect on sovereign spreads ambiguous (Eichler and Maltritz, 2013). The government's debt servicing capacity is also affected by the labor market as expressed by the unemployment rate, which is statistically significant and positive in all cases. The overall state of the economy as measured by the real GDP growth explains the country's ability to generate wealth and is associated with the reduction in sovereign risk.

The study also indicates that the introduction of the Outright Monetary Transactions (OMTs) by the European Central Bank in the third quarter of 2012 was an effective strategy in reducing the yields among the Euro area countries. However, this favorable effect only applies to the periphery countries, whereas the OMT had no measurable effect on the core Eurozone countries.

We believe that the political risk assessment is of great importance for the market participants when making their investment decisions. Therefore, and to enhance the explanatory value and robustness of our model we incorporate the World Governance Indicators constructed by the World Bank as an average. Our results that lower political risk and level of corruption, stronger regulatory framework, and stronger institutions are associated with tighter spreads are in line with the literature (Baldacci, 2011).

Chapter Three

Sovereign Credit Default Swaps and their determinants

Abstract: The paper examines whether a long run relationship exists between the sovereign credit default swaps of Eurozone countries and their debt-to-GDP ratios, GDP per Capita, bid-ask spreads and the iTraxx Europe index. We employ a time series and panel integration and cointegration analysis for eight Eurozone countries using monthly data from October 2008 until December 2014. The long run relationship is estimated using dynamic OLS and fully modified OLS. Our findings support the existence of a long-run relationship between the sovereign credit default swaps and the macroeconomic and financial indicators used in our analysis.

3.1 Introduction

The aim of this paper is to study the determinants of sovereign credit default swaps (CDS) in the euro area. Credit default swaps were developed by employees of Banker Trust, later bought by Deutsche Bank and JP Morgan, as a way to protect banks from the exposure to corporate loans. The collapse of the Lehman Brothers completely changed the way the market participants evaluate the sovereign default risk of developed countries. The volume of credit default swaps has increased dramatically since the beginning of the financial crisis in late 2007. The CDS market exploded after 2007, reaching $62.2 trillion at the end of 2007

CDS spreads are generally considered in the literature as a significant metric of the default risk. The higher the spread the greater the risk for a country to default. The financial crisis since 2008 has resulted in the rise of the CDS spreads in all Eurozone countries and in particular in the peripheral countries. In this way, the market participants showed their doubts in the countries' ability to service their debt obligations. This culminated in the decision by the Determinations Committee for Europe of the International Swaps and Derivatives Association (ISDA), on March 9th 2012, that a credit event took place with respect to the Greek debt exchange program. This, in turn, triggered the credit default swap contracts and heightened attention on the debt burdens of other periphery countries: Ireland, Italy, Spain and Portugal.

This paper addresses the link between the CDS spreads and macroeconomic and financial fundamentals for eight euro area countries; Austria, Belgium, Germany, France, Italy, Ireland, Portugal and Spain. Since the credit event that took place on March 9, 2012, Greek CDS spreads have remained constant. Therefore, we exclude Greece from our empirical analysis. We first investigate, using monthly data from October 2008 to December 2014, the drivers of sovereign credit default swaps for each of the eight countries we include in our analysis. Our dependent variable is the 5-year CDS spreads. We use (country-specific) macroeconomic fundamentals such as the debt-to-GDP ratio and GDP per Capita, liquidity indicators such as the bid ask spreads, and finally the iTraxx Europe index (used as a proxy of the general risk perception). We use the Fully Modified OLS methodology which accounts for serial correlation and for endogeneity in the regressors that arises from the cointegration relationship (Phillips and Hansen, 1990).

We also perform a panel cointegration analysis to examine whether a long run relationship exists between the sovereign credit default swaps and the aforementioned macroeconomic fundamentals. Having established the presence of a long run relationship between our variables, we apply the Fully Modified OLS (FMOLS) and dynamic OLS (DOLS) estimators developed by Pedroni (2004).

Our main finding is that the repricing of the sovereign credit default swap in the periphery countries is strongly linked to specific macroeconomic fundamentals and specifically to the debt–to–GDP ratio. In case of the core euro area countries the iTraxx index is the indicator with the highest significance. Our findings thus confirm the results of Heinz and Yan Sun (2014) who also find evidence that the sovereign CDS spreads are driven by macroeconomic fundamentals, liquidity factors and global investor sentiment in a sample of several European countries.

The paper is structured as follows. Section 2 discusses the CDS theory and empirical evidence on the euro area. In Section 3, we provide a brief review of the developments in the CDS market and in particular the decision of the ISDA about the CDS of the Hellenic Republic (Greek CDS) in 2012. Section 4 presents the description of the data and methodology used in the cointegration analysis for both country-by-country analysis and panel cointegration. Section 5 presents the results linking the CSS with the macroeconomic and financial fundamentals over the period October 2012 and December 2014.

3.2 Credit Default Swaps

3.2.1 Literature review

The credit default swaps are the most common form of credit derivatives. The buyer of the contract makes payments to the seller of the swap until the maturity date of the contract. However, in the event that the debt issuer defaults[10] the seller will pay the buyer the premium as well as the interest payments until the maturity date. The CDS therefore serves as insurance against the risk of default. The credit default swaps were originally created in the mid-90s. The credit derivative market has increased enormously in the recent years: after the collapse of the Lehman Brothers their use among financial institutions has surged dramatically. Later on, the cost of borrowing of sovereigns has also increased significantly.

The International Swaps and Derivatives Association (ISDA 2014) reported that the overall size of the OTC derivatives market reached the amount of $710 trillion in notional outstanding at the end of 2013. The bulk of this is CDS, the market value of which was $593 billion at the end-September 2014 in gross terms and $136 billion in net terms.

The academic interest in sovereign CDS rose in line with their increasing prominence in the financial markets. Longstaff et al. (2011) and Pan and Sigleton (2008) investigate the determinants of credit risk by using the credit default swaps of a large number of developed and emerging countries. They show that the main drivers for the CDS spreads are global financial factors such as the US equity and high yield markets and treasury yields rather than local factors such as the exchange rate, stock returns and foreign reserves. Also their results suggest that the sovereign spreads are significantly related to the VIX index. Since the eruption of the Eurozone debt crisis in late 2009 the economists have turned their attention to the European CDS market.

A large number of empirical literature has attempted to shed light on the sovereign risk in the Euro area. Alter and Schuler (2012) investigate the relationship between the sovereign risk of

[10] According to ISDA (2003) credit events considered to be the following cases: (1) bankruptcy, (2) failure to pay, (3) repudiation/moratorium, (4) obligation acceleration, (5) obligation default, and (6) restructuring.

several Eurozone countries (France, Germany, Italy, Ireland, the Netherlands, Portugal and Spain) and the bank CDS market covering a period from June 2007 until May 2010. They examine the differences between the period before and after the bank bailouts. Their empirical evidences show that before the government rescue intervention the contagion spreads from the banking sector to the sovereign CDS market, whereas in the period after the intervention the sovereign CDS spreads largely determine the banks' CDS series. Furthermore, the authors highlight the short-term impact of the financial sector shocks on the sovereign CDS spreads, while the impact becomes insignificant in the long-term.

Acharya et al. (2013) examine the link between the bank bailouts and sovereign credit risk. They investigate the period between 2007 until 2011 using European bank and sovereign credit swap data and conclude that there is a strong direct two-way feedback.

Ejsing and Lemke (2010) study the relationship between the bank and sovereign CDS market for ten euro area countries for a period from January 2008 until June 2009. They find that both bank and CDS premia are explained in a great degree by a common factor which is the iTraxx index of non-financial CDS premia. They also show that after the bailout packages the sensitivity of sovereign risk premia has increased significantly and at the same time it led to a decrease in the CDS spreads of the banking sector.

Dieckmann and Plank (2011) examine also the European sovereign credit default swap market for eighteen countries; eleven of which are members of the EMU. The data span from January 2007 until April 2010 and their analysis shows a private-to-public risk transfer and especially in a larger degree in the EMU countries that show more sensitivity to the state of the financial system compared to the non-EMU countries.

One strand of the empirical literature examines the relationship between the sovereign CDS market and the economic fundamentals. Amato (2005), covering the period 2002-2005, estimates the measures of risk premia and risk aversion in credit markets. He finds evidence that both are related to macroeconomic factors such as the real interest rate gap as a monetary

policy indicator and other technical market factors such as the global funded and unfunded synthetic CDO[11] issuance.

Cecchetti et al. (2010) stress the dramatically increased public debt levels for advanced economies. They use CDS data from several advanced economies and find that there is correlation between countries with substantial heterogeneity, implying that there are also other factors with similar importance.

Berndt and Obreja (2010) state that approximately half of the variation in the European CDS market is explained by the "economic catastrophe risk" which increased significantly. Parker et al. (2005) find that contractual terms matter in the pricing of the CDS spreads. However, they also note the important role that the regional factors play in CDS pricing.

Remolona et al. (2007), using 5-year CDS market data of 24 emerging markets from the regions of Latin America, Central and Eastern Europe, Asia and the Middle East and Africa, find evidence that the sovereign risk and risk premia are driven by different factors. Country specific fundamentals are the drivers of the sovereign risk while global investors' risk aversion drives time variation in the risk premia.

Aizenmann et al. (2011) investigate the determinants of the sovereign credit default swaps for several countries over the period from 2005 until 2010, focusing on five European periphery countries (Greece, Ireland, Italy, Portugal and Spain) and emphasizing in particular the fiscal space (debt/tax, deficit/tax) and other economic fundamentals. They find evidence that the fiscal space and other economic determinants such as inflation, external debt-to GDP ratio, trade (%GDP), and real GDP growth are both statistically and economically significant over the examined period. They also show that the default risk for the periphery Eurozone countries is priced much higher than for other countries with similar economic fundamentals. This is explained mostly by the negative expectations of the markets.

The IMF's Global Financial Stability Report (April 2013) is an extended analysis about the sovereign CDS spreads in a wide range of countries. They use macroeconomics variables such

[11] CDO is the collateralized debt obligation is a type of structured asset-backed security (ABS)

as debt-to-GDP ratio, real GDP growth rates and international reserves, market microstructure indicators such as bid-ask spreads and global variables such as the VIX index.

There is also evidence that CDS spreads may also be driven by credit rating announcements. Micu et al. (2006) using daily data on CDS spreads and rating announcements covering a period from 1 January 2001 to 31 March 2005 show that all types of rating announcements (outlooks, reviews and rating changes), whether they are positive or negative, influence significantly the CDS prices.

A more recent paper by Ismailescu (2010) examines the impact of the changes in emerging economies' creditworthiness. The find that positive announcement have a direct impact on sovereign CDS prices while negative credit rating announcements have no impact. This may be due to the reason that the anticipation of a negative credit rating effect may have already been absorbed by the CDS markets before the announcement.

Dooley and Hutchison (2009) find also evidence that US financial and real news disperse to emerging markets over a period from 1 January 2007 until 19 January 2009 as expressed by the 5 Year CDS spreads on sovereign bonds. Fender et al. (2012) examine the determinants of daily spreads of emerging market sovereign credit default swaps over the period April 2002 until December 2011. They split the sample in two sub periods in order to compare the influence of domestic and international variables before and after the global financial crisis. They find that the global and regional factors are driving the CDS spreads in a greater degree than the country-specific risk factors. This is clearer in the period of the financial crisis where the international variables are more important for the determination of CDS spreads. During the same period the country-specific risk factors become economically insignificant.

The aim of this paper is to investigate the determinants of the CDS premia. In order to identify the driving forces of the CDS market for periphery and core Eurozone countries we perform our analysis on a period spanning from October 2008, after the global financial crisis, until December 2014. This study thus contributes to the empirical literature by providing fresh evidence using sovereign CDS market data until 2014, covering the period of the Eurozone debt crisis. The CDS data used in this paper are provided by Thomson Reuters Datastream. The contracts are denominated in US dollars with a 5-year maturity. In our research paper we analyse the CDS spreads for 8 Eurozone countries, 4 periphery – Portugal, Ireland, Italy and

Spain- and 4 core Eurozone countries, Germany, Belgium, France and Austria. We select these core Eurozone countries due to data availability. We exclude Greece from our analysis due to lack of data after the declaration of a credit event in March 2012.

3.2.2 The Greek case

A few months after the first European Union/International Monetary Fund bailout package valued EUR 110 billion was given to Greece in May 2010, it became clear that it would not be enough to ensure the final resolution of the Greek crisis. In June 2011 the EU/IMF provided a new financial aid package to Greece and the largest debt restructuring in the history of sovereigns took place with the involvement of the private sector. On 23 February 2012, private holders were given the possibility to exchange bonds for the new securities issued by the Greek government. The offer was officially launched on 24 February 2012. The Greek Ministry of Finance announced that holders of EUR 152 billion face amount of Greek-law bond (representing 85.8% of the total outstanding notional of such PSI-eligible bonds) agreed to the bond exchange and consented to proposed amendments to the terms of these bonds (Eurobank EFG, March 2012). The International Swaps and Derivatives Association announced on March 9, 2012 that a Restructuring Credit Event had occurred with respect to the Hellenic Republic (Greece) under Section 4.7(a) of the ISDA 2003 Credit Derivatives Definitions.

As a result, the decision to trigger the Greek default insurance contracts had been taken. However, Coudert and Gex (2013) state that besides the fact that the Greek CDS triggered in March 2012, the Greek CDS settlement did not lead to a meltdown because of three main reasons. Firstly, the settlement involved only holder's net positions. The gross notional amount of CDS was USD 69.3 billion in March 2012, while the net notional was only USD 3.2 billion. Secondly, the Greece's default was anticipated and as a result the participants had already made provision for the expected loss. And finally, the auction procedure ensured that the recovery rate for the restructured bonds and the newly issued was consistent to the market prices for Greek sovereign bonds. Accordingly, the Greek CDS triggered in March 2012 and Greek CDS premia ceased to be quoted thereafter. Due to that fact Greece will be excluded from our analysis.

3.3 Methodology and Data

3.3.1 Variables

The objective of this paper is to conduct a thorough empirical examination of the relationship between the sovereign credit default swaps and several economic fundamentals. To investigate this relationship, we use the following model

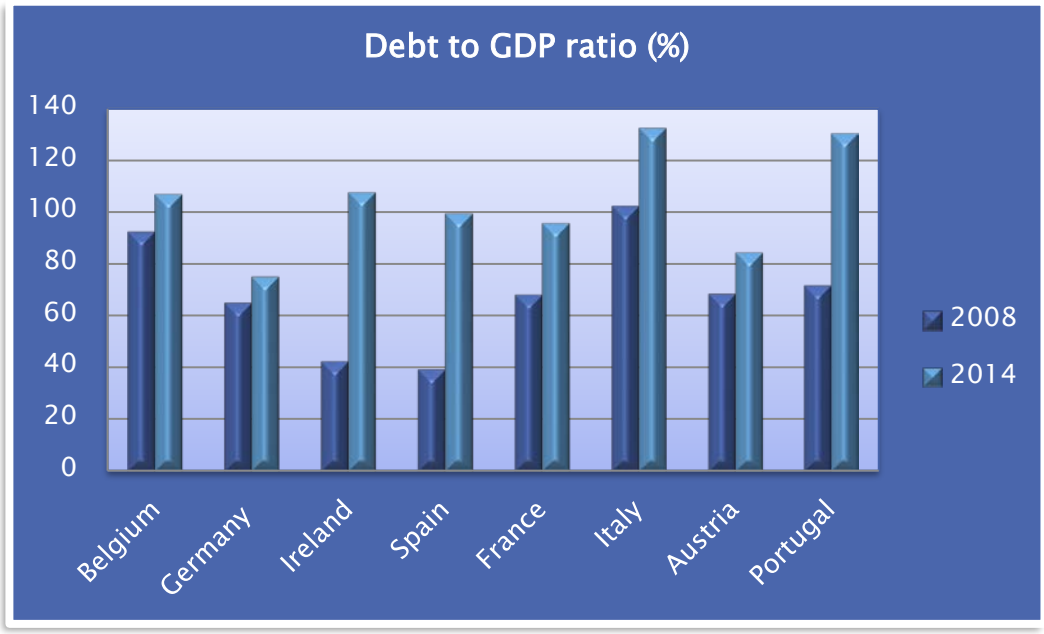
$$CDS_{it} = b_0 + b_{1i}\, Debt_{it} + b_2\, GDP_{it} + b_3\, BA_{it} + b_4\, iTraxx_t + \varepsilon_t$$

where CDS_{it} is the CDS premium in basis points charged per annum at time t for country i, GDP is the ratio of the GDP per Capita in time t and that in time t-1 for country i, Debt is the gross debt-to-GDP ratio, BA is the bid-ask spread relative to each benchmark bond and iTraxx is the iTraxx Main Investment Grade index,the corporate CDS premium. Our sample comprises 8 Eurozone countries. We use 5-year sovereign CDS default swap (CDS) spreads sourced from Thomson Reuter's database due to the fact that they are most liquid and most actively traded CDS. We obtain the rest of the variables from several sources such as Eurostat, OECD database, and Bloomberg.

- *Debt to GDP ratio*

We use the debt to GDP ratio as a proxy for the country's credit risk. The greater the debt a country has to repay, the higher the risk of default. A higher probability of default, in turn, should cause the credit default swaps to increase. We therefore expect a positive relationship between the debt-to-GDP ratio and the CDS premia. Figure 3.1 shows the debt –to–GDP ratio for all countries for the starting and final year of our analysis. The ratio has increased in all countries, with the greatest increases observed in Ireland, Spain and Portugal.

Figure 3. 1 Debt to GDP ratio



- *GDP per Capita*

In order to understand the degree in which the growth potential affects the credit default swaps premia we use the GDP per capita. Positive economic growth should make it easier or a country to service its debt obligations. We therefore expect a negative relationship between the GDP per capita ratio and credit default swap premia.

- *Bid-ask spread*

We calculate the monthly average of daily observations of spread between the bid and ask quotations from Bloomberg. We use the bid-ask spread as a proxy for liquidity. The larger the bid ask spreads for sovereign credit default swaps the higher the level of spreads for CDS. The expected sign for our analysis is positive.

- *iTraxx*

The family of iTraxx indices consists of several indexes of the most liquid CDS contracts in Europe and Asia. We use the iTraxx Europe that consists of 125 equally weighted European companies. Unlike all preceding variables, the iTraxx index is Europe-wide, not country

specific. Therefore, it can also be interpreted as a proxy for Europe-wide market sentiment. Fontana and Scheicher (2011) stress in their analysis that although the iTraxx index has a close relationship with both CDS spreads and bond yield spreads, the relationship is stronger for the CDS than the bond yields. We expect the iTraxx variable to have a positive relationship with the CDS premia. Figure 3.2 show the iTraxx index from October 2008 until end of 2014.

Figure 3. 2 iTraxx index

Monthly 5-year CDS premia are plotted for the countries under consideration in Figure. 3.3. The evolution of monthly average of sovereign credit default swaps contracts for each country separately from October 2008 until December 2014 is presented in Figure 3.4. Observing the CDS spreads we can conclude that there was a significant increase in the CDS premia until mid-2009 because of the financial stress of the global markets that started in early 2008 but became more dramatic in late 2008.

For the periphery countries (Portugal, Ireland, Italy, and Spain) the CDS premia continued to move upwards also after 2009. The upward movement of the CDS spreads implies negative perceptions of the market participants toward the peripheral Eurozone countries. For Ireland, the CDS spreads were widening sharply after 2010 and started to subside in 2011 after the EU/IMF bailout given to Ireland. The Portuguese CDS spreads followed a similar pattern to

that of Ireland however, continued to rise until 2011 before starting to move downwards in late 2011, after the EUR 78 billion rescue package requested by the Portuguese government in the first half of 2011.

On the other hand, the sovereign CDS remained relatively low in the case of Germany. In cases of France, Austria and Belgium spreads were higher than the German ones but significantly lower than those of the periphery countries. Significant declines in all CDS spreads are observed after July 2012, when the President of the European Central Bank announced the Outright Monetary Transactions program.

Figure 3. 3 5 -Year CDS spreads

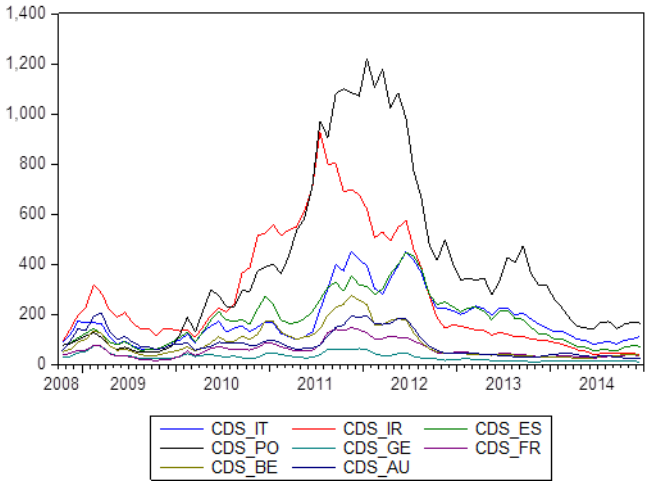
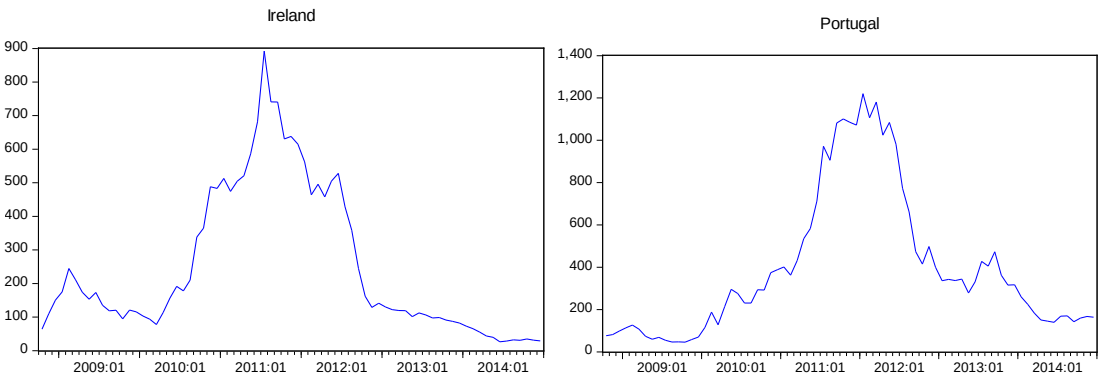


Figure 3. 4 CDS spreads evolution. 5-year CDS premia in basis points



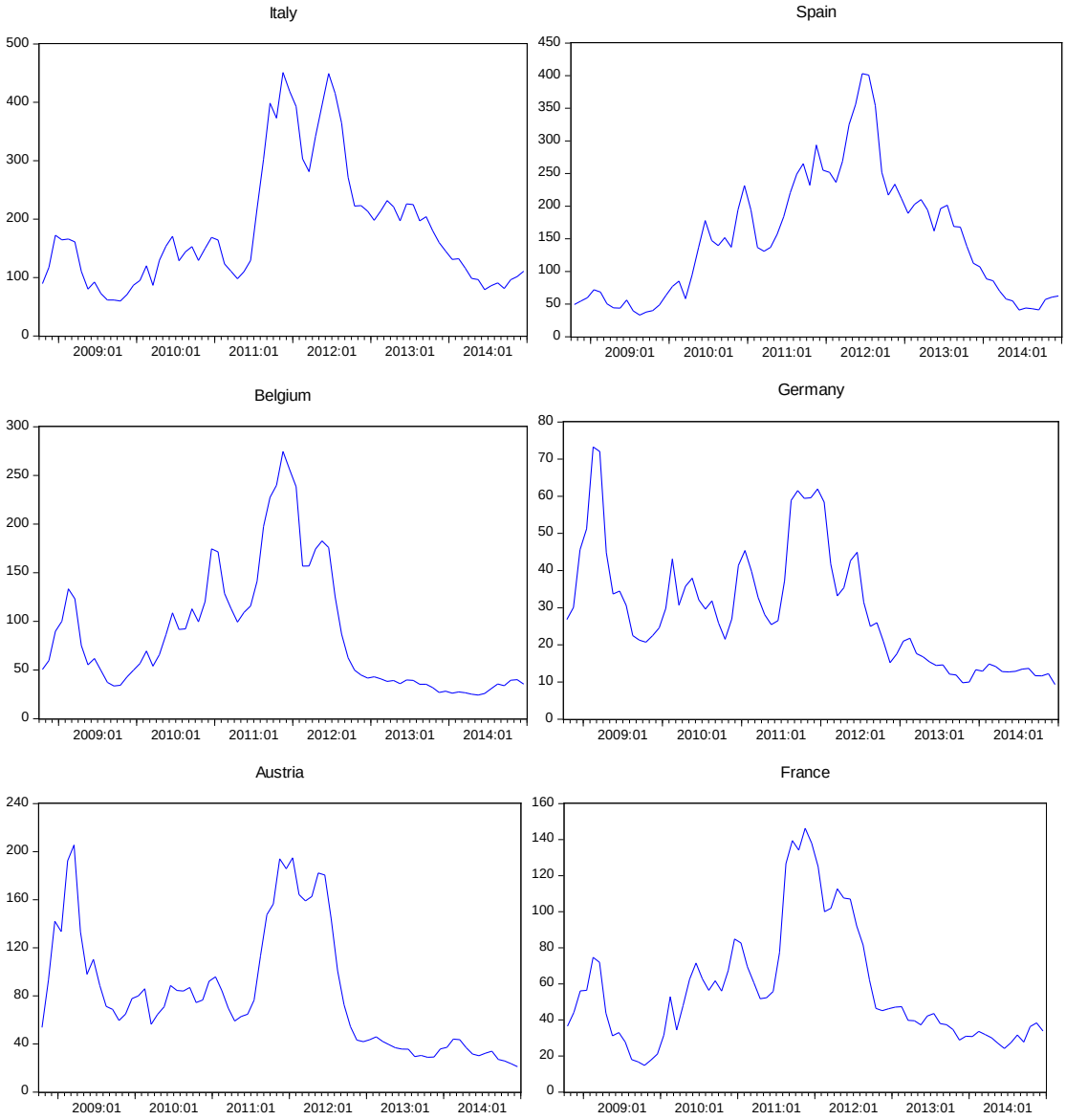


Table 3.1 provides the descriptive statistics of the series. Among the countries the highest variances in the majority of the variables are observed in Portugal, Ireland and Spain.

Table 3. 1 Descriptive statistics

Portugal	CDS	DEBT	GDP	BIS ASK	ITRAXX
Mean	5.6	91.6	10.2	0.2	4.4
Median	5.7	86.8	10.2	0	4.3
Maximum	7.1	131.3	10.2	1.2	5.4
Minimum	3.8	64	10.1	0	3.5
Std. Dev.	0.9	21	0	0.3	0.5
Skewness	-0.1	0.4	-0.1	1.8	0.1
Kurtosis	2.2	1.8	1.7	5.4	2.3
Jarque-Bera	2.3	6.5	5.5	57.1	1.8
Probability	0.3	0	0.1	0	0.4
Sum	420	6871.5	762.8	15	327.5
Sum Sq. Dev.	61.9	32693.1	0	5.4	18.3
Observations	75	75	75	75	75

Ireland	CDS	DEBT	GDP	BIS ASK	ITRAXX
Mean	5.3	83.2	10.7	0.1	4.4
Median	5.1	77.5	10.7	0	4.3
Maximum	6.8	126.1	10.8	0.5	5.4
Minimum	3.6	40.5	10.7	0	3.5
Std. Dev.	0.9	24.3	0	0.1	0.5
Skewness	0	0.2	0.9	2.4	0.1
Kurtosis	2	1.8	3.3	7.4	2.3
Jarque-Bera	2.9	5.1	10.4	135.3	1.8
Probability	0.2	0.1	0	0	0.4
Sum	395.9	6242.3	802.4	4.7	327.5
Sum Sq. Dev.	56.7	43638.1	0.1	1.2	18.3
Observations	75	75	75	75	75

Spain	CDS	DEBT	GDP	BIS ASK	ITRAXX
Mean	5	66.9	10.4	0	4.4
Median	5.1	69.3	10.4	0	4.3
Maximum	6.1	92.3	10.4	0.1	5.4
Minimum	4	37.8	10.3	0	3.5
Std. Dev.	0.6	13.9	0	0	0.5
Skewness	-0.1	-0.3	0.5	1.4	0.1
Kurtosis	1.9	2.3	2.8	4.1	2.3
Jarque-Bera	4.1	2.5	3	28.6	1.8
Probability	0.1	0.3	0.2	0	0.4
Sum	375.8	5013.9	777.8	1.7	327.5
Sum Sq. Dev.	26.6	14237.4	0	0	18.3
Observations	75	75	75	75	75

Germany	CDS	DEBT	GDP	BIS ASK	ITRAXX
Mean	3.2	75.7	10.6	0	4.4
Median	3.3	77.3	10.6	0	4.3
Maximum	4.3	80.7	10.6	0	5.4
Minimum	2.2	64.8	10.5	0	3.5
Std. Dev.	0.5	4.1	0	0	0.5
Skewness	0	-1.1	-0.9	0.9	0.1
Kurtosis	2	3.5	2.4	3.1	2.3
Jarque-Bera	3	16.3	11.3	10.1	1.8
Probability	0.2	0	0	0	0.4
Sum	242.7	5681.2	795.4	0.2	327.5
Sum Sq. Dev.	22	1230.8	0.1	0	18.3
Observations	75	75	75	75	75

Belgium	CDS	DEBT	GDP	BIS ASK	ITRAXX
Mean	4.2	103.4	10.6	0	4.4
Median	4.1	103.3	10.6	0	4.3
Maximum	5.6	109.1	10.6	0.1	5.4
Minimum	3.2	90.7	10.6	0	3.5
Std. Dev.	0.7	4.2	0	0	0.5
Skewness	0.3	-0.9	-1.1	2.2	0.1
Kurtosis	1.9	3.8	3.4	8.8	2.3
Jarque-Bera	5.3	11.2	17	167.4	1.8
Probability	0.1	0	0	0	0.4
Sum	316.5	7756.3	793.4	1.1	327.5
Sum Sq. Dev.	35.6	1328.5	0	0	18.3
Observations	75	75	75	75	75

France	CDS	DEBT	GDP	BIS ASK	ITRAXX
Mean	3.9	85.3	10.5	0	89
Median	3.8	85.1	10.5	0	74.2
Maximum	5	95.7	10.5	0	221.6
Minimum	2.7	67.2	10.5	0	32.1
Std. Dev.	0.5	7.7	0	0	45.7
Skewness	0.2	-0.6	-1	1.6	1
Kurtosis	2.5	2.6	2.5	5.4	3.3
Jarque-Bera	1.1	5.1	14	51.5	12.7
Probability	0.6	0.1	0	0	0
Sum	291.9	6401	787.1	0.6	6677.1
Sum Sq. Dev.	21.8	4397.1	0	0	154403.7
Observations	75	75	75	75	75

3.3.2 Correlation Matrix

Table 3.2 shows the correlation matrix between the sovereign CDS for the countries used in our analysis. Two observations can be made. First, most of the correlation coefficients are high. The highest correlation is observed between Spain and Italy 0.92, and between France and Belgium 0.96. Second, not surprisingly, countries that are similar to each other tend to have higher bilateral correlations. Portugal shows the highest correlation with Italy 0.87, followed by Spain and France 0.86 and Ireland 0.80 and the lowest with Germany and Austria 0.44 and 0.57 respectively. Austrian CDSs show the highest correlations with Germany, Belgium and France. Italy presents high correlation with Spain and Portugal and low correlation with Germany and Austria. On the other hand, the Irish CDSs are highly correlated with those of Belgium and France and less correlated with those of Austria followed by the Spanish CDSs.

Table 3. 2 Sovereign CDS correlation matrix

	Portugal	Ireland	Italy	Spain	Germany	Belgium	France	Austria
Portugal	1.00							
Ireland	0.80	1.00						
Italy	0.87	0.61	1.00					
Spain	0.86	0.71	0.92	1.00				
Germany	0.44	0.67	0.47	0.43	1.00			
Belgium	0.79	0.89	0.72	0.71	0.82	1.00		
France	0.86	0.84	0.85	0.83	0.76	0.96	1.00	
Austria	0.57	0.64	0.62	0.56	0.89	0.83	0.79	1.00

3.4 Econometric Analysis

3.4.1 Testing for integration - Unit root tests

The first step in investigating the determinants of the sovereign CDS is to test for stationarity among the series. The tests for unit root are performed using Phillips and Perron (1988). In order to avoid serial correlation in the residuals of the Dickey Fuller tests we also use the

Augmented Dickey Fuller test (Dickey and Fuller, 1981): the latter uses enough lagged dependent variables to avoid serial correlation in the residuals. We use the Akaike Information Criterion for the lag selection in the ADF test and the Phillips and Perron the Newey-West bandwidth is applied. The null hypothesis is that the series have unit roots. Model with a constant trend is considered in the analysis. The results of unit root tests are presented in Table 3.3

Table 3. 3 Phillips and Perron (1988) and ADF (1981) unit root test results at level and first difference

	Portugal		Ireland		Italy		Spain	
Variables	PP	ADF	PP	ADF	PP	ADF	PP	ADF
logCDS	0.0886 (0.7078)	-1.3594 (0.5976)	-0.5091 (0.4927)	-0.8199 (0.3574)	-0.0866 (0.6505)	-0.0281 (0.6702)	-0.1878 (0.6153)	-0.1757 (0.6196)
GDP	-0.9621 (0.2973)	-2.1881 (0.2125)	0.5413 (0.8307)	2.0463 (0.9897)	-1.8414 (0.3580)	-0.7415 (0.3915)	-1.4343 (0.1402)	0.3622 (0.7865)
debt	-0.3888 (0.5407)	-1.3077 (0.6221)	-0.1356 (0.6336)	-0.1024 (0.6451)	0.1088 (0.7141)	0.1089 (0.7141)	1.2454 (0.9446)	1.3375 (0.9534)
ba	-1.1644 (0.2209)	-1.3718 (0.1566)	-2.1131 (0.5299)	-2.3371 (0.4089)	-1.2062 (0.2068)	-1.4852 (0.1277)	-1.0257 (0.2770)	-1.1300 (0.2330)
logiTraxx	-1.0989 (0.2443)	-1.1832 (0.2145)	-1.0989 (0.2443)	-1.1832 (0.2145)	-1.0989 (0.2443)	-1.1832 (0.2145)	-1.0989 (0.2443)	-1.1832 (0.2145)
ΔlogCDS	-7.1292*** (0.0000)	-6.9522*** (0.000)	-6.3172*** (0.0000)	-6.3168*** (0.0000)	-6.6299*** (0.0000)	-6.6721*** (0.0000)	-6.6952*** (0.0000)	-6.7312*** (0.0000)
ΔGDP	-2.3549** (0.0189)	-2.2579** (0.0241)	-3.6929*** (0.0003)	-1.9814** (0.0462)	-2.8105*** (0.0055)	-4.2302*** (0.0067)	-1.8051** (0.0478)	-2.7491*** (0.0066)
Δdebt	-8.2158*** (0.0000)	-8.1601*** (0.0000)	-7.9381*** (0.0000)	-7.9392*** (0.0000)	-8.2225*** (0.0000)	-8.2225*** (0.0000)	-7.7530*** (0.0000)	-7.7414*** (0.0000)
Δba	-6.2546*** (0.0000)	-6.3417*** (0.000)	-5.5612*** (0.0001)	-5.4991*** (0.0001)	-9.5999*** (0.0000)	-9.0530*** (0.0000)	-6.58261*** (0.0000)	-7.1060*** (0.0000)
ΔlogiTraxx	-6.9445*** (0.0000)	-6.9797*** (0.0000)	-6.9445*** (0.0000)	-6.9797*** (0.0000)	-6.9445*** (0.0000)	-6.9797*** (0.0000)	-6.9445*** (0.0000)	-6.9797*** (0.0000)

Note: Model with a constant is considered. ***, ** and * denote significance in 1%, 5% and 10% level, respectively.

	Austria		Germany		Belgium		France	
Variables	PP	ADF	PP	ADF	PP	ADF	PP	ADF
logCDS	-0.6095	-1.0324	-0.7528	-1.1403	-0.3890	-0.5388	-0.2890	-0.2523
	(0.4501)	(0.2694)	(0.3870)	(0.2293)	(0.5406)	(0.4802)	(0.5781)	(0.5920)
GDP	-0.0079	1.0553	0.6578	1.3027	0.0875	1.1215	-0.0672	1.6427
	(0.6769)	(0.9223)	(0.8560)	(0.9499)	(0.7075)	(0.9307)	(0.6571)	(0.9746)
debt	1.7113	0.6315	1.0798	0.4205	1.4279	1.3979	3.5440	1.2969
	(0.9782)	(0.8503)	(0.9257)	(0.8016)	(0.9608)	(0.9582)	(0.9999)	(0.9494)
ba	-1.5719	-1.3889	-1.3001	-1.2724	-1.3678	-1.3246	-0.7908	-0.9188
	(0.1085)	(0.5823)	(0.1772)	(0.1855)	(0.1578)	(0.1700)	(0.3702)	(0.3152)
logiTraxx	-1.0989	-1.1832	-1.0989	-1.1832	-1.0989	-1.1832	-1.0989	-1.1832
	(0.2443)	(0.2145)	(0.2443)	(0.2145)	(0.2443)	(0.2145)	(0.2443)	(0.2145)
ΔlogCDS	-6.2110***	-6.2110***	-5.8777***	-6.6095***	-5.5699***	-5.5880***	-6.4630***	-6.4628***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
ΔGDP	-2.8913***	-2.2058**	-2.5199**	-2.2902**	-4.4836***	-3.0213***	-3.1294***	-3.3202***
	(0.0044)	(0.0274)	(0.0123)	(0.0224)	(0.0000)	(0.0030)	(0.0022)	(0.0012)
ΔDebt	-2.2305**	-1.6485**	-3.3804	-2.6350***	-3.3138***	-3.3105***	-2.5350**	-2.0957**
	(0.0257)	(0.0934)	(00010)	(0.0091)	(0.0012)	(0.0013)	(0.0118)	(0.0356)
Δba	-16.4319***	-11.5751***	-16.4641***	-8.5736	-6.6089***	-6.8272***	-7.6901***	-7.2198***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
ΔlogiTraxx	-6.9445***	-6.9797***	-6.9445***	-6.9797***	-6.9445***	-6.9796***	-6.9445***	-6.9790***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Note: Model with a constant is considered. ***, ** and * denote significance in 1%, 5% and 10% level, respectively.

At the levels of series both the Phillips and Perron and Augmented Dickey Fuller tests show that the null hypothesis of a unit root cannot be rejected at 1% confidence level. For the first difference of the series on the other hand the null hypothesis is rejected. The results indicate that all series are I (1) for all the countries under consideration. Once the non-stationarity of

the series has been confirmed, the next step is to investigate the relationship between the CDS premia and various macroeconomic and financial fundamentals.

3.5 Empirical Results

3.5.1 Fully Modified OLS

In this section, the results of the analysis are presented. The results of the fully modified OLS regression are shown in Table 3.5. The estimation period is October 2008 until December 2014. For each country, we start by reporting the full model with all explanatory variables included.

Table 3. 4 Fully Modified OLS regression

CDS	Ireland	Spain	France
GDP per Capita	0.09081	0.6287*	0.3666***
Debt/GDP	0.0149***	0.0395***	0.0454***
Bid-Ask	0.5177***	0.0733	1.1567***
IiTraxx	1.0799***	1.8162***	0.5119
Constant	-1.0934	-5.3822***	-5.2563***
R-squared	0.7364	0.626	0.6769

CDS	Portugal	Germany	Belgium	Austria	Italy
GDP per Capita	-0.2067	0.0586	0.6457***	0.1264	-0.0558
Debt/GDP	0.0232***	0.0338	0.0087	0.0338	0.0818
Bid-Ask	0.6617***	0.2047	0.7003**	-0.0012	0.0369***
IiTraxx	-0.8029***	0.8245***	1.3779***	1.2620***	0.9437***
βo	6.2307***	-1.0486	-2.9854	-4.889	0.9485
R-squared	0.6167	0.6997	0.6335	0.7184	0.6382

The sample includes 8 Eurozone countries that joined the Eurozone simultaneously in 1999. The countries used are both core and periphery Eurozone countries. As the main long-run determinants of sovereign credit default swaps the model includes the government debt to GDP

ratio (that shows the probability of default and subsequently the higher the debt the higher the credit default swaps), the GDP per Capita (reflecting the dynamic of the country's economy), the bid-ask spread as a measure of liquidity and finally the iTraxx index which represents the aggregate credit market developments (Fontana and Scheicher, 2010).
Regarding the core Eurozone countries (Austria, Belgium, Germany and France), starting the interpretation of our results with Austria the only significant variable is the iTraxx index. Similarly, the German CDS spreads seem to be influenced only by the iTraxx index. In case of Belgium the two factors affecting the sovereign credit default swaps are the bid-ask spreads and the iTraxx indicator.

The GDP per Capita is significant but not with the expected sign. Finally, in the last of the core Eurozone countries used in our analysis, France, the debt-to-GDP ratio and iTraxx are both positive and significant in 1% significance level. Again, the real GDP growth rate is significant but not with the expected sign. We use the general-to-specific methodology. Overall, we could conclude that the iTraxx which reflects the market condition of the CDS market is highly significant and positive in all the core countries implying that the changes in the iTraxx index are incorporated into CDS spreads.

On the other hand, looking at the results of the periphery countries we can observe that the debt-to-GDP ratio and bid-ask spreads are both positive and significant in all cases. The iTraxx indicator is positive and significant only in cases of Ireland and Spain. The debt-to-GDP ratio and the bid-ask spread are the significant variables for Italy, and after excluding the growth and iTraxx index the variable that remains significant is the bid ask spreads. Overall, we can observe that in the periphery countries the factors affecting the most the CDS spreads are the debt-to-GDP ratio and the bid-ask spreads as a measure of liquidity.

3.5.2 Panel Analysis

3.5.2.1 Panel Integration Analysis

We also attempt to investigate the long run relationship between the sovereign credit default swaps and macroeconomic and financial variables by means of panel unit root tests and panel cointegration analysis. We estimate the long run relationship by using the fully modified and dynamic OLS regression. Before testing for cointegration we need to check whether the variables in our model are stationary or non-stationary. We perform the panel unit root tests according to Im et al. (1997) and Maddala and Wu (1999). The null hypothesis of a unit root versus the alternative hypothesis of no unit root is being tested.

Im, Pesaran and Shin test (2003) uses separate unit root tests for each cross section with individual effect and no time trend. The test statistic is the cross-section average on individual Dickey-Fuller unit root tests.

Maddala and Wu (1999) test is based on the p-values of the individual statistic as proposed by Fisher (1932). Maddala and Wu (1999) and Maddala et.al (1999) find evidence that the MW test is more powerful than the IPS test. Christopoulos and Tsionas (2004) suggest that MW test has an advantage compared to the IPS test which is the fact that its value does not depend on different lag lengths in the individual ADF regressions.

The results presented in Table 3.6 show for both tests support the null hypothesis in levels for all the variables, and reject the null hypothesis of unit root in first differences.

Table 3. 5 Panel unit root tests

Variables				
	Levels		First differences	
	IPS	MW	IPS	MW
logCDS	0.9852	21.623	-16.895***	183.863***
Debt	18.936	38.254	-11.009***	388.97***
GDP per Capita	5.994	22.56	-9.763***	65.38***
Bid ask	-1.514	24.13	-34.137***	2042.73***
logiTraxx	1.844	4.985	-18.407***	248.15***

*significant in 10%; **significant in 5% and * significant in 1%

3.5.2.2 Panel Cointegration Analysis

Our next step in our analysis after having identified the order of integration is to apply the panel cointegration methodology. We will apply two panel cointegration methodologies, the first one developed by Pedroni (1999) and a more recent one developed by Westerlund (2007).

Pedroni (1999) puts forward seven statistics: four for the use in panels and three group panel statistics. The null hypothesis of no cointegration is tested against the alternative hypothesis of cointegration. Pedroni (1999) describes the seven statistics, "The first of the simple panel cointegration statistics is a type of non-parametric variance ratio statistic.

The second is a panel version of a non-parametric statistic that is analogous to the familiar Phillips and Perron rho-statistic. The third statistic is also non-parametric and is analogous to the Phillips and Perron t-statistic.Finally the fourth of the simple panel cointegration statistics is parametric statistic which is analogous to the familiar Dickey-Fuller t-statistic. The other three panel cointegration statistics are based on a group mean approach. The first of these is analogous to the Phillips and Perron rho-statistic, and the last two are analogous to the Phillips and Perron t-statistic and the augmented Dickey-Fuller t-statistic respectively."

Westerlund (2007) proposes an error correction-based test for panel data. In particular Westerlund (2007) "propose four new cointegration tests that are designed to test the null hypothesis of no cointegration by testing whether the error correction term in a conditional error term model is equal to zero. If the null hypothesis of no error correction is rejected, then the null hypothesis of no cointegration is also rejected." Westerlund (2007) also concludes that the new tests are more powerful and accurate than the residual based tests developed by Pedroni (2004).

3.6 Results

In order to test for the long run relationship between the credit default swaps and a set of macroeconomic and financial fundamentals we conduct firstly the panel cointegration test according to Pedroni (1999). Table 3.7 shows the outcome of Pedroni's (1999) cointegration tests.

As discussed previously Pedroni (1999) uses four within-group and three between-group tests to estimate whether the panel data are cointegrated. The results for the PP and ADF within group tests show that the null hypothesis of no cointegration is rejected in 5% and 1% respectively. Also in the between dimension group tests the null hypothesis of no cointegration is rejected for the ADF test in 10% statistical significance level.

Table 3. 6 Panel cointegration tests.

Pedroni residual cointegration tests	
Null Hypothesis: No cointegration	
Included observations	600
Cross-sections included	8
Alternative hypothesis: common AR coefs. (within-dimension)	
Panel-v	-0.69
Panel-rho	-1.03

Panel-PP	-1.84**
Panel-ADF	-2.18***
Alternative hypothesis: individual AR coefs. (between-dimension)	
Group rho	0.36
Group PP	-0.88
Group ADF	-1.48*

*Significant in 10%; **significant in 5% and * significant in 1%

Table 3. 7 Panel cointegration tests

Westerlund Panel Cointegration Test			
Statistic	Value	Z-value	p-value
Gα	-3.159	-2.295	0.011
Ga	-11.418	-0.433	0.333
Pt	-6.655	-2.7	0.004
Pα	-11.778	-1.549	0.061

In Table 3.8 we present the results of the Westerlund test. According to three of the four test statistics we can reject the null hypothesis of no cointegration at the 5% level for the two and at 10% for the one of them, while one of them is insignificant.

3.7 Panel Cointegration Estimator

Having found the existence of a long run relationship between the sovereign credit default swaps and our variables we can proceed to test for the long-run estimators for our model. We perform the group-mean FMOLS and DOLS estimators which have been produced by Pedroni (2004). Kao, Chiang and Chen (1999) investigate the relationship between research and development expenditure and growth using a panel of FMOLS and DOLS estimator

considering the estimation methods with cointegration discussed by Kao and Chiang (1999), Phillips and Moon (1999) and Pedroni (1996).

Kao and Chiang (1999) in their research provide a comparison between the OLS, fully modified OLS (FMOLS) and DOLS estimators in panel cointegration regression models. Their findings show that the dynamic OLS estimator is more powerful that the FMOLS estimator. In Table 3.9 we provide group-mean DOLS and FMOLS results for our model. In case of FMOLS estimator originally introduced by Pedroni (1996a) we provide the results for the group mean estimator.

Pedroni (1996a) suggests that the group mean estimator performs better than the pooled panel FMOLS estimator because of the t-statistic which allows for a more flexible alternative hypothesis. Furthermore, Pesaran and Smith (1995) argue that the group mean estimators provide consistent point estimates of the sample mean of the heterogeneous cointegrating vectors, while the pooled FMOLS estimators do not.

Table 3. 8 FMOLS and DOLS estimators

DOLS Estimates		FMOLS Estimates	
Dependent variable: logCDS		Dependent variable: logCDS	
All countries		All countries	
Debt	0.009***	Debt	0.0153***
GDP per Capita	0.165***	GDP per Capita	0.1214***
Bid ask	0.6874***	Bid ask	0.5731***
logiTraxx	0.7612***	logiTraxx	0.7421***
periphery countries		periphery countries	
Debt	0.0163***	Debt	0.0195***
GDP per Capita	-0.052	GDP per Capita	-0.0167

Bid ask	0.7704***	Bid ask	0.6924***
logiTraxx	0.2693**	logiTraxx	0.3563***
core countries		core countries	
Debt	0.0046	Debt	0.0112
GDP per Capita	0.2595***	GDP per Capita	0.2594***
Bid ask	0.4987*	Bid ask	0.4539**
logiTraxx	1.1177***	logiTraxx	1.1280***

*significance in 10%,**significance 5% and ***significance in 1%

The results from the DOLS and FMOLS estimators are presented in three different panels of Table 3.9. The first panel includes all eight countries, the second includes the periphery Eurozone countries (Portugal, Ireland, Italy and Spain) and the third one the core Eurozone countries (Germany, Belgium, France and Austria).

The results support a positive and significant relationship between the sovereign credit default swaps and the debt-to-GDP ratio, bid ask spread and the iTraxx index. In case of the GDP per Capita the coefficient is significant but not with the expected sign. In the case of periphery countries the debt-to GDP ratio, the bid ask spread and the iTraxx index are all positive and significant, however the GDP per Capita is insignificant. The bid ask coefficient in both FMOLS and DOLS methodologies is the indicator with the higher impact on the sovereign credit default swaps over the period 2008M08 – 2014M12 similar to Badaoui (2013) who argues that the liquidity risk has a significant impact on the CDS spreads.

The results differentiate in the analysis of the core Eurozone counties. The debt-to-GDP ratio is insignificant implying that had no impact on determining the sovereign credit default swaps in the core Eurozone countries. The rest of the variables are all positive and significant, however the GDP per Capita has not the expected sign. Among the other two indicators the impact of the iTraxx index is found to be stronger compared to the bid ask spreads in both FMOLS and dynamic OLS methodologies.

The results indicate that the fiscal stability indicators had an impact on the CDS during the crisis period in the periphery countries, while in the core Eurozone countries had no impact at all. However, the findings suggest that the iTraxx Europe CDS index is the variable with the strongest predictive ability to describe variation in CDS spreads. Given that this variable is the only one that is measured at the Europe-wide rather than country level, this finding suggests that European (common) factors are the most important determinant of CDS spreads of European countries. This holds, rather surprisingly, for the core and periphery countries alike, despite the important differences between these two groups.

3.8 Conclusion

Taking into consideration the euro debt crisis period, this paper studies the effects of long run debt-to-GDP, GDP per Capita, bid ask spread and iTraxx index on the credit default swaps of eight euro area countries.

From the country-by-country analysis we can make different conclusions for the impact that the variables had on the sovereign credit default swaps for each euro area country. In all countries the iTraxx index has an impact on the CDS spreads during the crisis period except for Italy. In case of Portugal the iTraxx is significant but not with the expected sign. The bid ask spread variable is significant and positive, apart from the cases of Austria and France, which seem not be influenced by the bid ask spread variable which is used as a proxy for liquidity. The debt-to GDP ratio is significant and with the expected sign driving the German, French, Irish, Italian and Portuguese CDS spreads leaving the Austrian, Belgian and Spanish spreads unaffected. The GDP per Capita is significant and with the expected sign only in case of Italy.

This paper also uses panel unit root and cointegration techniques in order to investigate the long run relationship of the CDS spreads of a panel of eight euro area countries and macroeconomic and financial indicators. The results indicate a strong relationship between the credit default swaps and the iTraxx index similar to Attinasi et al (2009), Kim et al. (2010).

The debt-to GDP ratio is also significant and with the expected sign when the full sample and the periphery euro area countries are under investigation, while in the case of the core countries seems to have no impact on determining the CDS spreads. Liquidity factors as proxied by the bid ask spreads seem also to be driving factors of the CDS spreads in all three cases examined (Longstaff, (2007) in the panel cointegration analysis.

The results of this paper suggest that the sovereign credit risk as expressed by the CDS spreads is driven mostly by financial market and liquidity indicators and in a smaller degree by local economic fundamentals. Our empirical results advance the idea that the CDS surge during the Eurozone debt crisis was mainly due to market indicators as expressed by the iTraxx index and the bid ask spreads as a proxy for liquidity. We can also observe that the public debt sustainability as expressed by the debt to GDP ratio, which proxies sovereign default risk is explaining the CDS spreads of the periphery countries. This can be explained by the fact that the periphery countries have higher debt to GDP ratios compared to the core euro area countries.

Chapter Four

The relationship between Credit Default Swaps and Government Bond Yields during the Euro area debt crisis

Abstract: In this study, we perform an analysis on the relation between the CDS and bond spreads. We use the Johansen's (1988) multivariate cointegrated method to test the cointegration. In order to capture the effect of exogenous shocks due to various economic events, we test for changes in the regime between the CDS and bond spreads during the period of the financial crisis by using two kinds of structural break tests, Hansen (1992) and Gregory and Hansen (1996) tests. The results indicate that the CDS premia and sovereign bond spreads are related to a certain relationship and that during the financial crisis, price discovery takes place in the CDS market.

4.1 Introduction

Credit default swaps (CDS) are financial contracts used as a protection by the investors against losses arising from credit events such as defaults or debt restructuring. The CDS purchaser pays fees to the seller and is compensated on the occurrence of a credit event. The CDS spreads are significant measures of sovereign default risk and indicators of the markets perception of sovereign risk.

The onset of the financial crisis in 2008 stimulated the interest in the credit default swaps of sovereign debt. The volume of CDS was about $6 trillion at the end of 2004 and reached $58 trillion by the end of 2007. The increasing indebtedness of several Eurozone countries attracted the attention of market participants and as a result the CDS spreads rose to unprecedented levels. In 2008 the public debt to GDP ratio of Greece, the most indebted euro area was 109.4%, and Italy's debt to GDP ratio reached 102.4%. The financial crisis in 2007, which deepened in 2008 after the collapse of the Lehman Brothers, had increased the interest in the CDS market.

In this study, we perform a comprehensive analysis of the relationship between the sovereign CDS market and the sovereign bond market over the period 2008 to 2015 across 9 euro area countries. We use the Johansen's (1988) multivariate cointegrated method to test the cointegration relation between the CDS and bond spreads. However, the macroeconomic series could be affected by exogenous shocks due to various economic events. Therefore, we test for changes in the regime between the CDS and bond spreads during the period of the financial crisis by using two kinds of structural break tests, Hansen (1992) and Gregory and Hansen (1996) tests.

The paper is organised as follows. In the next section, we discuss key concepts in the literature on CDS and bond yields relationship and the data used. The third section discusses the econometric method and the empirical findings of the paper are presented. Finally, the conclusions of the analysis are given in the fourth section.

4.2 Bond and CDS Spreads: What Do We Know

There is a large number of papers analysing the relation between the CDS and corresponding bond markets especially after the bankruptcy of Lehman Brothers. Delatte et al. (2011) investigate the relation between the CDS and bond market using the 5-year maturity CDS and a sample of developed European Union countries. They use panel data analysis for ten countries and for a period from January 2008 until 2010. Delatte et al. (2011) find evidence that in periods of financial turbulences the CDS market seems to have a dominant role in the information transmission between the CDS and bond markets. Moreover, in their country-specific analysis of Belgium and Greece, they find that the CDS market dominates also is high yield economies.

In a previous paper, Delatte et al (2010) adopt a non-linear approach and present results based on eleven European countries from 2008 to 2010. They show, first, that there is a nonlinear relation between CDS and bond spreads, second, that the CDS market leads the bond market in periods of economic turmoil and, third, that intense changes in CDS premia imply turbulences in the euro area economy.

Palladini (2011) also studies the relation between the sovereign CDS spreads and the government bond yields using daily data from January 2004 until March 2011 for a sample of six euro area countries. They find evidence that the two prices are equal in the long-run equilibrium.

Similarly, Acre et al (2012) using a sample of eleven European Monetary Union countries from January 2004 to October 2011 attempt to investigate whether the CDS and bond market prices reflect the same information. They show that there are persistent deviations between CDS and bond spreads during the subprime crisis but not before.

Hull et al. (2004) examined the relationship between the credit default swap spread and bond yields and also explore the extent to which the credit rating announcements affect the CDS premia.

Alexopoulou et al. (2009) analyse the pricing dynamics in two credit markets, the European financial and non-financial firms over the period January 2004 to October 2008. The find evidence of a co-integration relationship in the long-run between the CDS spreads and corporate bond spreads. Their findings also suggest that the European CDS markets absorb information faster than the corporate bond markets.

Coudert and Gex (2010) in their analysis attempt to determine the links between credit default swaps and bonds and which is the leader in the price discovery process is. According to their results the CDS market leads the bond market for corporate bonds.

Fontana et al (2010) use a sample of ten euro area countries and for a period from January 2006 until June 2010. Their results show that the driving factors are similar for CDS and bond spreads. They also show that in the majority of countries the CDS spread exceeds the bond spreads except for Portugal, Ireland and Greece. They observe also that since the beginning of the global financial crisis there is a linkage between the CDS market and the cost of borrowing confirming also that the specific country characteristics have changed the market participant's behaviour against the default risk of euro area economies.

Ammer and Cai (2006) in their research investigate the relation between the CDS premiums and bond spreads in nine emerging countries using daily data from February 2001 until March 2005. According to their findings for the majority of the countries a linear relation between the CDS spreads and bond spreads is observed. They find also evidence that the more liquid market seems to lead the other, the CDS markets lead the bond markets in some cases, while in others the lag bond prices lead the CDS markets.

Kalbaska et al (2012) examine the long-term dynamics of the CDS market of several Eurozone countries for a period starting from 2005 until 2010 covering the period of the crisis. They find changes in the correlations of the CDS premia in the sample after August 2007, after the collapse of the Lehman Brothers, after the sovereign risk increased in Europe in November 2009 and shortly after the EU-IMF Greek bailout in May 2010. Their results indicate contagion between the Eurozone countries; however it is not possible to clearly answer the question of the possible next weakest link in case of default of some country.

Badaoui et al. (2012) using a factor model attempting to decompose the CDS spreads into components attributable to the risk of default, liquidity, systematic liquidity and correlation. Overall, their results show that liquidity has a higher impact on sovereign credit default swaps and that the sovereign bond yields are less influenced by liquidity factors. Finally, they conclude using data spanning from November 2005 to September 2010 that both CDS and bond spreads are subject to global liquidity shocks.

Another group of studies focuses on the relationship between CDS and bond spreads in the corporate markets. Zhu (2004) finds that the bond spreads and CDS spreads move together in the long run, although in the short run the CDS market often moves ahead of the bond market in price discovery. Blanco et al. (2005) study the relationship between the CDS premium and the credit spreads using a sample of 16 US and 17 European investment grade firms. They find that for the majority of the companies the CDS prices are substantially higher than the credit spreads for long periods of time

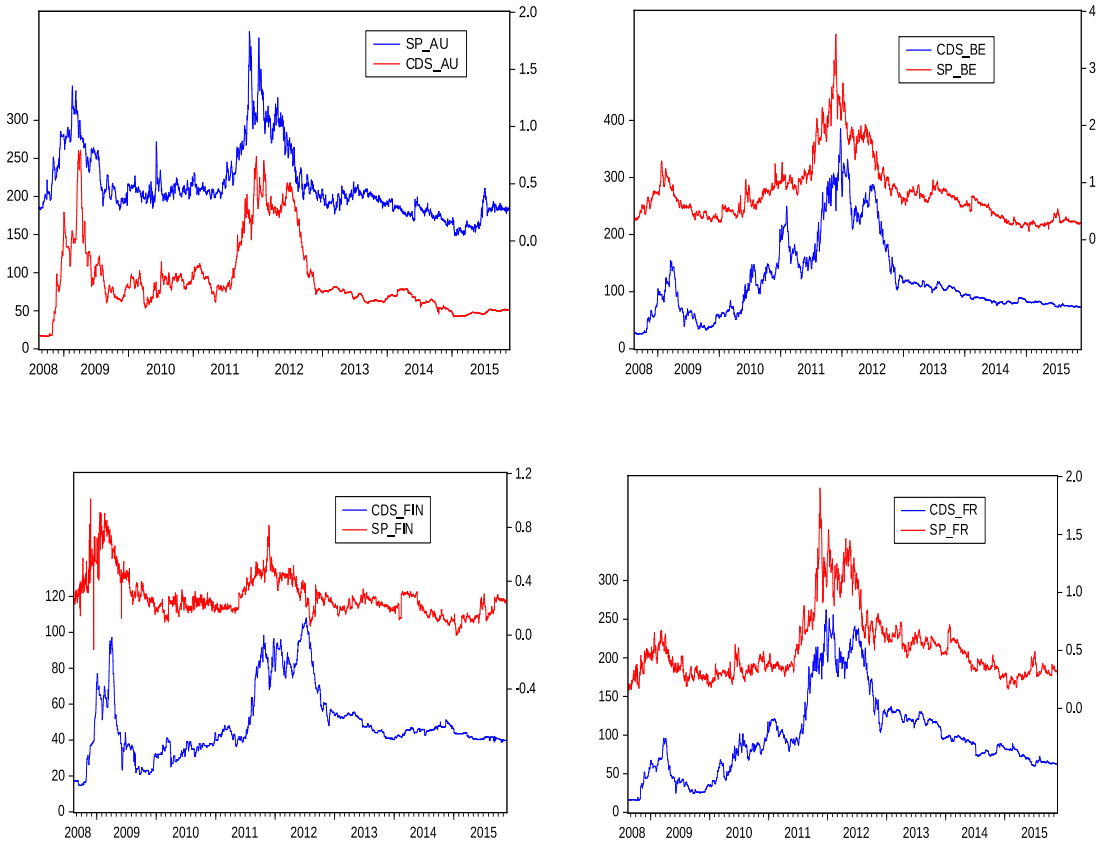
4.3 Data

In our research, we investigate whether changes CDS spreads are causing changes in the relevant bond yields or vice versa. The countries considered in our analysis are Belgium, France, Finland, Ireland, Italy, Portugal, the Netherlands and Spain. The data consist of daily time series of CDS premia from November 2008 until November 2015 obtained from Thomson Reuters Datastream database. The maturity of these contracts is 10 years in order to have same maturity as the government bond yields. For the calculation of the bond spread the difference between the 10 Year government bond yield of each country under consideration and the German 10 Year government bond yield is considered.

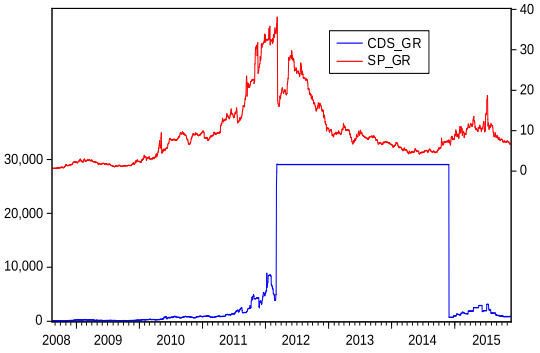
Figure 4.1 shows the evolution of the CDS premia and the spreads of the 10-year government bond yields for all the countries in our analysis. We can observe from the graphs that both the government bond spreads and the credit default swaps move in the same direction. Both increased after the global financial crisis started in 2007 and started declining after 2009.

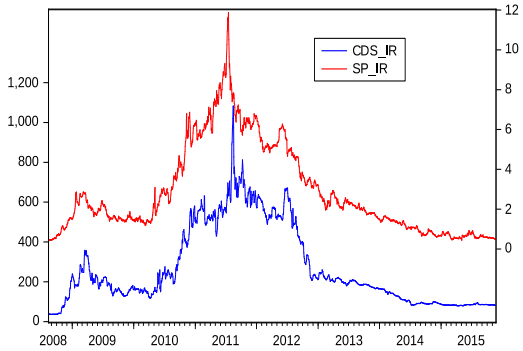
However, after the beginning of the euro area debt crisis, the CDS and bond spreads stared increasing dramatically again. In our graph presentation, we also present the Greek credit default swaps. According to the International Swaps and Derivatives Association, "the Determinations Committee determined that the invoking of the collective action clauses by Greece to force all holders to accept the exchange offer for existing Greek debt constituted a credit event under the 2003 ISDA Credit Derivatives Definitions"[12]. As a result, after March 9, 2012 the credit default swaps for Greece were not calculated.

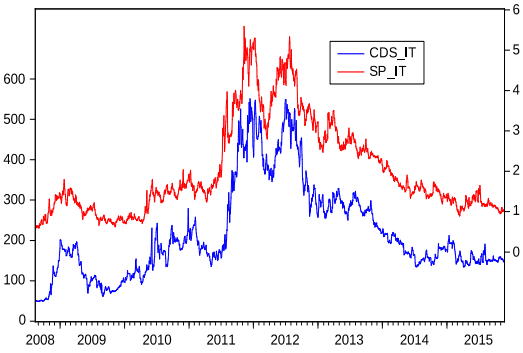
Figure 4. 1 The evolution of the CDS premia and the government bond yield differentials in all the countries under consideration.



[12] According to ISDA (2003) credit events considered to be the following cases: (1) bankruptcy, (2) failure to pay, (3) repudiation/moratorium, (4) obligation acceleration, (5) obligation default, (6) restructuring.


CDS_GR
SP_GR
40
30
20
10
0
30,000
20,000
10,000
0
2008
2009
2010
2011
2012
2013
2014
2015


CDS_IR
SP_IR
12
10
8
6
4
2
0
1,200
1,000
800
600
400
200
0
2008
2009
2010
2011
2012
2013
2014
2015


CDS_IT
SP_IT
6
5
4
3
2
1
0
600
500
400
300
200
100
0
2008
2009
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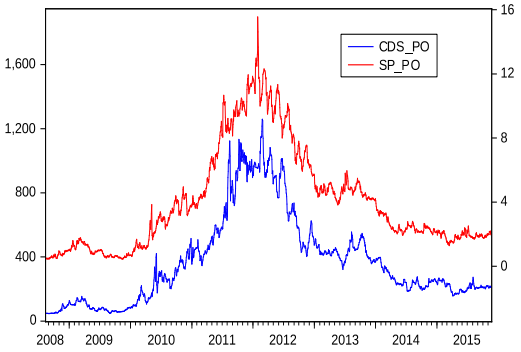
2012
2013
2014
2015


CDS_PO
SP_PO
16
12
8
4
0
1,600
1,200
800
400
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2008
2009
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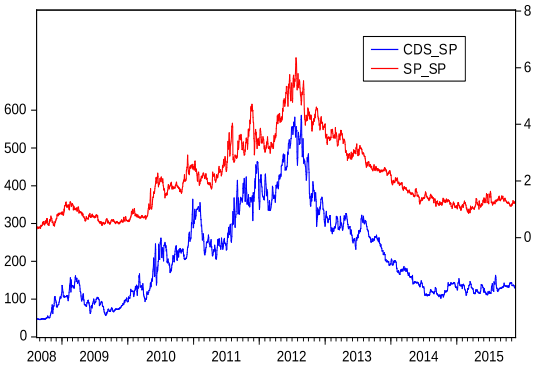
2012
2013
2014
2015


CDS_SP
SP_SP
8
6
4
2
0
600
500
400
300
200
100
0
2008
2009
2010
2011
2012
2013
2014
2015

4.4 Methodology and empirical results

4.4.1 Unit root tests

The first step in order to investigate the long run relationship between credit default swaps and government bond yield differentials is to test for stationarity. The tests for unit roots were performed using the Augmented Dickey-Fuller test. The null hypothesis is that the series have a unit root, against the alternative that they do not. The models that are used in the analysis include a constant term. The Akaike information criteria (AIC) is used for the determination of the lag length. The results of the unit root tests for the CDS and Spreads are presented in Tables 4.1 and 4.2.

Table 4. 1 Augmented Dickey-Fuller unit root test in levels for CDS and SPREADS.

Augmented Dickey-Fuller test (CDS)				
	t-statistic	Critical t of Mackinnon (t)		
		1%	5%	10%
France	-2.1671	-3.4365	-2.8634	-2.5378
Greece	-0.6002	-3.4365	-2.8634	-2.5378
Ireland	-2.125	-3.4365	-2.8634	-2.5378
Italy	-1.9702	-3.4365	-2.8634	-2.5378
Portugal	-1.717	-3.4365	-2.8634	-2.5378
Belgium	-1.6876	-3.4365	-2.8634	-2.5378
Finland	-1.9047	-3.4365	-2.8634	-2.5378
Spain	-2.1748	-3.4365	-2.8634	-2.5378

Augmented Dickey-Fuller test (SPREAD)				
	t-statistic	Critical t of Mackinnon (t)		
		1%	5%	10%
France	-2.5452	-3.4365	-2.8634	-2.5378
Greece	-1.7199	-3.4365	-2.8634	-2.5378
Ireland	-1.5113	-3.4365	-2.8634	-2.5378
Italy	-1.5577	-3.4365	-2.8634	-2.5378

Portugal	-1.2131	-3.4365	-2.8634	-2.5378
Belgium	-2.2666	-3.4365	-2.8634	-2.5378
Finland	-1.7724	-3.4365	-2.8634	-2.5378
Spain	-1.4828	-3.4365	-2.8634	-2.5378

Table 4. 2 Augmented Dickey-Fuller unit root test in first difference for CDS and SPREADS.

Augmented Dickey-Fuller test (CDS(-1))				
	t-statistic	Critical t of Mackinnon (t)		
		1%	5%	10%
France	-7.535502	-3.4365	-2.8634	-2.5378
Greece	-9.06015	-3.4365	-2.8634	-2.5378
Ireland	-10.36859	-3.4365	-2.8634	-2.5378
Italy	-8.073723	-3.4365	-2.8634	-2.5378
Netherlands	-7.267991	-3.4365	-2.8634	-2.5378
Portugal	-9.710806	-3.4365	-2.8634	-2.5378
Finland	-21.576	-3.4365	-2.8634	-2.5378
Belgium	-7.172324	-3.4365	-2.8634	-2.5378
Spain	-9.691945	-3.4365	-2.8634	-2.5378

Augmented Dickey-Fuller test (SPREAD(-1))				
	t-statistic	Critical t of Mackinnon (t)		
		1%	5%	10%
France	-8.287181	-3.4365	-2.8634	-2.5378
Greece	-10.32284	-3.4365	-2.8634	-2.5378
Ireland	-12.41894	-3.4365	-2.8634	-2.5378
Italy	-7.557808	-3.4365	-2.8634	-2.5378
Netherlands	-10.58128	-3.4365	-2.8634	-2.5378
Portugal	-11.60647	-3.4365	-2.8634	-2.5378
Finland	-21.576	-3.4365	-2.8634	-2.5378

Belgium	-15.49297	-3.4365	-2.8634	-2.5378
Spain	-15.70235	-3.4365	-2.8634	-2.5378

All series contain unit root in levels according to ADF test: the null hypothesis of a unit root in levels cannot be rejected at 1%, 5% or 10% confidence level. However, there is no evidence of unit root in first differences: the null hypothesis of unit root is rejected at 1%, 5% and 10% confidence level. The series are all are I(1) and are thus stationary in first differences.

However, the conventional unit root tests, such as the Augmented Dickey Fuller and Philips and Perron (1989) fail to reject the unit root hypothesis when the sample under consideration incorporates economic events which many have caused changes in the regime. Perron (1989) recognising this flaw proposed allowing for a known or exogenous break in the Augmented Dickey Fuller (ADF) tests. Zivot and Andrews (1992), in turn, developed a new methodology, which allows an endogenous structural break in the analysis. We notice from the results of Zivot Andrews (1992) in Table 4.3 that breakpoints occur in nearly all countries. According to the ZA tests, all variables are I(1) and the series are integrated of order I(1) at the 5 % level of significance.

Table 4. 3 ZA (1992) unit root tests

Variable				
	Levels	Break	First differences	Break
CDS_BE	-3.395(5)	6/11/2012	-22.193 (4)***	11/24/2011
CDS_AU	-4.106 (6)	6/29/2011	-16.564 (5)***	11/24/2011
CDS_FIN	-3.984 (5)	6/3/2011	-15.612 (6)***	6/11/2012
CDS_FR	-2.905 (6)	4/8/2011	-22.115 (4)***	11/24/2011
CDS_IT	-3.758 (6)	6/6/2011	-18.574 (6)***	11/14/2011
CDS_ES	-3.006 (5)	3/16/2010	-23.234 (4)***	6/15/2012
CDS_PO	-3.161 (6)	8/2/2010	-17.403 (6)***	1/26/2012
CDS_IR	-4.467 (5)	8/2/2010	-17.776 (6)***	7/18/2011

Variable	

	Levels	Break	First differences	Break
SP_BE	-3.395 (5)	3/11/2011	-22.462 (4)***	10/27/2011
SP_AU	-4.296 (6)	5/5/2011	-20.172 (5)***	10/18/2011
SP_FIN	-4.331 (6)	4/20/2011	-21.819 (5)***	10/27/2011
SP_FR	-5.062 (6)	5/5/2011	-18.905 (6)***	10/18/2011
SP_IT	-3.757 (4)	3/14/2011	-18.377(6)***	12/12/2011
SP_ES	-2.978 (4)	3/1/2013	-19.876 (6)***	6/25/2012
SP_PO	-2.722 (4)	6/29/2010	-24.299 (3)***	12/30/2011
SP_IR	-4.176 (6)	6/29/2010	-18.155 (6)***	6/17/2011

The numbers in parenthesis are the lag order based on the AIC. *** indicates significance at the 1% level.

Table 4. 4 Lee and Strazicich LM Unit root test

Lee Strazicich LM Unit root test - CDS (Levels)				
	t-statistic	Critical t of Mackinnon (t)		
		1%	5%	10%
France	-2.9903	-4.571	-4.0432	-3.7669
Austria	-3.5168	-4.5749	-4.0478	-3.7717
Ireland	-3.4786	-4.5827	-4.0553	-3.7797
Italy	-3.0236	-4.5777	-4.0506	-3.7747
Portugal	-3.4509	-4.56	-4.0311	-3.574
Finland	-2.8298	-4.5771	-4.05	-3.7741
Belgium	-2.723	-4.5834	-4.056	-3.7804
Spain	-3.7566	-4.5757	-4.0487	-3.7726

Lee Strazicich LM Unit root test SPREADS (Levels)				
spreads	t-statistic	Critical t of Mackinnon (t)		
		1%	5%	10%
France	-3.8003	-4.5665	-4.0382	-3.7615
Austria	-3.5451	-4.584	-4.0566	-3.781
Ireland	-2.9054	-4.5572	-4.0285	-3.7512
Italy	-3.022	-4.5618	-4.0328	-3.7558
Portugal	-3.0811	-4.5542	-4.0257	-3.7482

Finland	-3.0654	-4.5542	-4.0257	-3.7482
Belgium	-2.84	-4.5575	-4.0228	-3.7516
Spain	-3.0551	-4.5883	-4.0605	-3.7853

Lee Strazicich LM Unit root test - CDS (1st Difference)				
	t-statistic	Critical t of Mackinnon (t)		
		1%	5%	10%
France	-15.0283	-4.5613	-4.0324	-3.7663
Austria	-16.5605	-4.4641	-3.9254	-3.6491
Ireland	-13.7577	-4.5743	-4.047	-3.7709
Italy	-14.6478	-4.5154	-3.9843	-3.704
Portugal	-13.7348	-4.5876	-4.0599	-3.7846
Finland	-20.0353	-4.4584	-3.9224	-3.6426
Belgium	-14.5608	-4.5473	-4.0192	-3.7413
Spain	-21.2352	-4.51913	-3.9886	-3.7084

Lee Strazicich LM Unit root test - SPREADS (1st Difference)				
	t-statistic	Critical t of Mackinnon (t)		
		1%	5%	10%
France	-12.3725	-4.5648	-4.0362	-3.7594
Austria	-24.1053	-4.5822	-4.0548	-3.7792
Ireland	-13.7577	-4.5742	-4.0471	-3.7709
Italy	-14.6478	-4.5154	-3.9844	-3.7041
Portugal	-12.4051	-4.5583	-4.0296	-3.7523
Finland	-14.6051	-4.4627	-3.9253	-3.6477
Belgium	-18.3855	-4.5388	-4.0101	-3.7315
Spain	-10.1791	-4.4632	-3.9257	-3.6481

Table 4.4 and 4.5 provide the descriptive statistics for the series. Among the series the Greek bond spread and the Greek CDS have the highest variation followed by all the other countries.

Table 4. 5 Descriptive statistics for CDS

	CDS_AU	CDS_BE	CDS_FIN	CDS_FR	CDS_GR	CDS_IR	CDS_IT	CDS_PO	CDS_SP
Mean	92.2513	121	49	99	11701	269	218	372	216
Median	77.75	100	44	89	1842	194	181	279	185
Maximum	260	386	108	262	29118	1083	551	1259	586
Minimum	16.25	26	15	16	60	37	49	47	46
Std. Dev.	48.63683	70	19	53	13565	198	115	277	121
Skewness	1.308777	1	1	1	0	1	1	1	1
Kurtosis	4.121913	4	4	3	1	3	3	3	3
Jarque-Bera	640.3737	552	378	270	314	325	325	365	200
Probability									
Sum	174816.2	230235	92888	187991	22173496	510337	413991	704160	409256
Sum Sq. Dev.	4480335	9266434	696179	5407856	3.48E+11	74283625	25205352	145000000	27726462
Observations	1895	1895	1895	1895	1895	1895	1895	1895	1895

Table 4. 6 Descriptive statistics for bond spreads

	SP_AU	SP_BE	SP_FIN	SP_FR	SP_GR	SP_IR	SP_IT	SP_PO	SP_SP
Mean	0.494	0.844	0.286	0.515	9.704	2.895	2.015	4.05	2.08
Median	0.416	0.712	0.251	0.419	8.114	2.075	1.558	2.981	1.748
Maximum	1.832	3.603	1.009	1.902	38.062	11.896	5.579	15.557	6.341
Minimum	0.046	0.149	-0.109	0.151	0.635	0.447	0.586	0.433	0.314
Std. Dev.	0.293	0.557	0.151	0.285	7.76	2.244	1.153	3.198	1.289
Skewness	1.378	1.594	1.448	1.659	1.419	1.077	1.024	1.023	0.811
Kurtosis	4.907	5.611	5.595	5.569	4.639	3.33	3.059	3.036	2.856
Jarque-Bera	887	1341	1194	1390	849	375	331	330	209
Probability									
Sum	936	1599	542	977	18388	5487	3818	7676	3942
Sum Sq. Dev.	163	588	43	154	114064	9533	2519	19372	3147
Observations	1895	1895	1895	1895	1895	1895	1895	1895	1895

4.4.2 Cointegration and causality

In order to investigate the long run relationship between CDS and bond yield spreads in the Eurozone countries under consideration, the Johansen test is performed. In this test, the null hypothesis of no cointegration is tested against the alternative hypothesis of cointegration. Before that we apply the Bai and Perron (1998, 2008) procedure in order to test for multiple break points in our model for all the countries under investigation.

For each country we estimate the following model:

$$CDS_{it} = a + bBY_{it}$$

CDS_{it} and bBY_{it} are the CDS and bond yield spreads of country *i* at time *t*. The sample period runs from 31 October 2008 through 19 November 2015. The novelty of our paper is that we consider in our analysis the period of the recent crisis in the European Monetary Union. Daily estimates of 10 year government bond yields and CDS quotes were obtained from DataStream. Data for Greece were only obtained until 22 February 2012.

Table 4.6 shows trace tests and p-values of Johansen tests. The hypothesis of no cointegration is rejected in all cases. The basis of Johansen test is an unrestricted VAR model. The optimal lag length of the VAR model is selected based on information criteria such as the Akaike Information Criterion (AIC), the Schwarz information criterion (SIC) and the Hannan-Quinn Information criterion. However, if the VAR model is found the have serial correlation we add sufficient lags to remove such misspecification from our model (Dimitraki and Menla Ali (2013)).

Table 4. 6 Johansen's cointegration test (CDS-BOND SPREADS)

	Null Hypothesis No co-integration	p value	Null Hypothesis At most 1 co-integration	p value
Belgium (k=9)	47.45	0.0000*	2.29	0.1303
Finland (k=9)	17.95	0.0209*	5.22	0.0223*
France (k=8)	37.42	0.0000*	2.48	0.1153
Greece (k=8)	21.82	0.0049*	5.94	0.0148
Ireland (k=8)	62.63	0.0000*	1.66	0.198
Italy (k=8)	71.71	0.0000*	1.98	0.1584
Austria (k=9)	73.35	0.0000*	4.06	0.0438*
Portugal (k=5)	71.21	0.0000*	1.31	0.2508
Spain (k=7)	56.88	0.0000*	1.82	0.1778

Note: *Rejection of the null hypothesis at 5% level, MacKinnon-Haug-Michelis (1999) p-values , [1] since March 9, 2012 the credit default swaps for Greece are not being calculated.

4.4.2.1 Granger Causality Test

In order to have better evidence of the cointegration between the two variables we perform Granger Causality test. That means that if the bond yield spreads cause the CDS spreads then past bond yield differential values contain information that helps predict the CDS spreads. We consider the following model:

$$CDS_t = a_1 + a_2 cds_{t-1} + \dots + a_{t-p}\, cds_{t-p} + b_1 BY_{t-1} + \dots + b_{t-p} BY_{t-p} + u_t$$

$$BY_t = c_1 + c_2 cds_{t-1} + \dots + c_{t-p}\, cds_{t-p} + d_1 BY_{t-1} + \dots + d_{t-p} BY_{t-p} + u_t$$

Where p is the lag length

Table 4. 7 Causality test of Granger- Long –run

	the premia of the CDS do not cause the spreads of the bonds	prob.	the spreads of the bonds do not cause the premia of the CDS	prob.
Belgium	-0.024812	0.0000***	4.65E-05	0.2425
Finland	-0.005266	0.0006***	6.86E-05	0.1293
France	-0.012835	0.0000***	0.000115	0.0005***
Greece	-0.002507	0.0806*	-1.75E-06	0.1071
Ireland	-0.037149	0.0000***	1.23E-06	0.9781
Italy	1.160757	0.0000***	0.0001	0.6643
Austria	-0.02829	0.3924	7.81E-05	0.0313**
Portugal	-0.037976	0.0000***	0.000296	0.0000***
Spain	-0.033565	0.0000***	0.000341	0.0000***

The Granger causality test show that the CDS premia precede the bond spreads in most of the countries. The Granger causality test for Belgium, Finland, Greece Ireland and Italy show an one way Granger causality whereby bond yield differentials are driven by the cds premia. In contrast, in cases of France, Portugal and Spain displays Granger causality in both directions. Only in the case of Austria the bond spreads cause the CDS premia. Overall, the results indicate that the cds premia in periods of turbulences are better estimators of the sovereign credit risk.

4.4.2.2 Parameter stability and structural break

Hansen Parameter stability test

The estimation period in his study covers a volatile period of the euro area. Therefore, it is important to check cointegration between the governmen5t bond yields and CDS spreads for structural breaks. Hansen (1992) proposes a test of the null hypothesis of cointegration against the alternative of no cointegration. Under the alternative hypothesis of no cointegration one should expect to see evidence of parameter instability. In this context, Hansen (1992) proposes the L_c test statistic to evaluate the stability of parameters. We present the results in Table 4.8.

Table 4. 8 Hansen Instability test

Model	(CDS-SPREADS) Lc	(SPREADS-CDS) Lc
Austria	0.86 (0.01)	1.67(0,01)
Belgium	1.38 (0.01)	1.69 (0.01)
Finland	6.21(0.01)	0.44(0.05)
France	0.85 (0.01)	0.75(0.01)
Ireland	0.55(0.03)	1.20 (0.01)
Italy	0.43 (0.06)	0.71(0.01)
Portugal	0.62 (0.02)	0.94(0.01)
Spain	0.71 (0.01)	0.76 (0.01)

Note: The probability of parameter stability is in parenthesis. Stable relationship is probability > 20%. We exclude the Greek CDS from this analysis because of the credit event on 9 March 2012.

The results of the Hansen test show sign of instability. Our sample covers an unstable period for the euro area something that explains the results of Hansen (1992).

Gregory and Hansen structural break test

In the absence of equilibrium in the system, standard cointegration tests could produce poor results. Therefore, we perform Gregory and Hansen (1996) cointegration test which allow for a endogenous structural break in the cointegration vector. We use three alternative models: a level shift (C), a level shift with trend (C/T) and a regime shift that allows the slope vector to shift model as well (C/S)

Table 4. 9 Gregory and Hansen test

	ADF*	Estimated breakpoint	Zt*	Estimated breakpoint	Za*	Estimated breakpoint
Austria						
C	-7.06(4.61)***	27-Aug-2009	-7.88 (-4.61) ***	20-Aug-2009	-92.04(-40.48) ***	20-Aug-2009
C/T	-7.11(-4.99)***	1-Mar-2013	-7.96 (-4.99) ***	20-Aug-2009	-92.86 (-47.96) ***	20-Aug-2009
C/S	-7.21 (-4.95) ***	20-Aug-2009	-8.08 (-4.95) ***	19-Aug-2009	-96.34 (-47.04) ***	19-Aug-2009
Belgium						
C	-6.62 (-4.61) ***	30-Apr-2010	-7.52 (-4.61) ***	5-May-2010	-90.00 (-40.48) ***	5-May-2010
C/T	-6.92(-4.99) ***	12-Apr-2011	-7.83 (-4.99) ***	11-Apr-2011	-98.37 (-47.96) ***	11-Apr-2011
C/S	-6.60 (-4.95) ***	30-Apr-2010	-7.50 (-4.95) ***	5-May-2010	-89.72 (-47.04) ***	5-May-2010
Finland						
C	-3.95 (-4.61)	26-Nov-2009	-3.35 (-4.61) ***	9-Nov-2009	-47.49 (-40.48)	9-Nov-2009
C/T	-4.22(-4.99)	15-Jul-2011	-3.71 (-4.99) ***	13-May-2013	-54.03 (-47.96) ***	13-May-2013
C/S	-4.25 (-4.95)	13-Jul-2011	-3.60 (-4.95) ***	9-Nov-2009	-46.36 (-47.04)	9-Nov-2009
France						
C	-7.01 (-4.61) ***	4-Jan-2010	-7.20 (-4.61) ***	4-Jan-2010	-96.12 (-40.48) ***	4-Jan-2010
C/T	-7.08(-4.99) ***	5-May-2010	-7.32 (-4.99) ***	5-May-2010	-96.99 (-47.96) ***	5-May-2010
C/S	-6.99 (-4.95) ***	4-Jan-2010	-7.24 (-4.95) ***	4-Jan-2010	-95.30 (-47.04) ***	4-Jan-2010
Ireland						
C	-7.04 (-4.61) ***	20-Jul-2011	-8.26 (-4.61) ***	18-Jul-2011	-88.42 (-40.48) ***	18-Jul-2011
C/T	-8.04 (-4.99) ***	20-Jul-2011	-9.59 (-4.99) ***	18-Jul-2011	-112.73 (-47.96) ***	18-Jul-2011
C/S	-8.77 (-4.95) ***	24-Jun-2011	-10.35(-4.95) ***	28-Jun-2011	-137.61 (-47.04) ***	28-Jun-2011
Italy						
C	-8.18 (-4.61) ***	30-Apr-2010	-8.93 (-4.61) ***	17-Sep-2014	-135.24 (-40.48) ***	17-Sep-2014
C/T	-9.02 (-4.99) ***	29-Mar-2011	-9.65 (-4.99) ***	28-Mar-2011	-156.65 (-47.96) ***	28-Mar-2011

C/S	-8.33 (-4.95) ***	2-Aug-2012	-9.10 (-4.95) ***	24-Jan-2011	-140.44 (-47.04) ***	24-Jan-2011
Portugal						
C	-8.51 (-4.61) ***	28-Jun-2013	-9.95 (-4.61) ***	26-Jun-2013	-138.40 (-40.48) ***	26-Jun-2013
C/T	-8.54 (-4.99) ***	2-Jul-2012	-9.98 (-4.99) ***	12-Jun-2012	-139.28 (-47.96) ***	12-Jun-2012
C/S	-8.64 (-4.95) ***	2-Jul-2012	-10.08(-4.95) ***	13-Jun-2012	-141.76 (-47.04) ***	13-Jun-2012
Spain						
C	-9.81 (-4.61) ***	22-Aug-2012	-9.83 (-4.61) ***	21-Aug-2012	-157.36 (-40.48) ***	21-Aug-2012
C/T	-10.34(-4.99) ***	14-Sep-2012	-10.45(-4.99) ***	13-Sep-2012	-175.06 (-47.96) ***	13-Sep-2012
C/S	-10.28(-4.95) ***	14-Sep-2012	-10.35(-4.95) ***	13-Sep-2012	-172.21 (-47.04) ***	13-Sep-2012

Table 4.9 presents the results of Gregory and Hansen test, showing clearly the evidence of cointegration is found even if we allow for a structural break. The test suggests that a structural break should be taken into account in the specification of CDS and bond yields spreads.

A series of events that took place starting from 2009 could explain the results. The period was marked by great turmoil for the euro area. The global financial crisis transformed into a sovereign debt crisis in the euro area, starting from Greece in 2009 and moving to Ireland in 2010 and followed by Portugal a few months later.

Following the period after the collapse of the Lehman Bothers the periphery yields started rising, while the 10-year German government bond yields moved in the opposite direction, a sign that the investors were moving to the safety of the German bonds. With the Greek bond yields increased by almost 15% at the end of 2009 and Greek debt at 130% of GDP, in May 2010 Greek government and the EU/IMF agreed to an unprecedented (110 billion euros) three year aid package.

In November 2010 with the Irish bond yields rising rapidly the Irish government agreed to a total amount of €85 billion bailout agreement with the EU and IMF to deal with the banking crisis. Moving on with the euro area timeline, on 17 May 2011 Portugal, followed by pressures in the government bond yields, agrees with the other Euro area members and the IMF to a 78 billion bailout package. The Greek debt crisis continued to intensify in 2012 and in March 2012 the Greek government agreed to a second bailout package amounting to €130 billion, followed by a third in July 2015 (€85 billion).

4.5 Conclusion

This study investigates the presence of unit root, cointegration and causality tests to shed light on the relationship between the CDS premia and the government bond spreads for nine euro area (Austria, Belgium, Ireland, Italy, France, Greece, Portugal and Spain) countries from September 2008 until November 2015. Both the CDS premia and bond spreads are measures of the sovereign risk.

The sovereign CDS and the underlying bond offer similar exposure to the risk, therefore the basis, which is the difference between them, should be zero. However, since the onset of the global financial crisis and even more during the euro area crisis the no arbitrage relation has not held. The basis could be either positive or negative due to short-term relative value opportunities or long lasting ones. We perform this analysis in order to examine the relation between the 10 – Year CDS premia and bond spreads of eight euro area countries of fixed-coupon government bond of the same maturity over the German Bund. The results of our analysis indicate that a relationship between the two measures of sovereign risk is found in all countries apart from Austria.

On analysing the causality the main evidence is that the CDS are better measures of the sovereign risk in periods of stress because they react more rapidly in changes in the markets. However, the aim of this paper is additionally to capture the relationship between the CDS premia and bond spreads in a period of turbulence of the euro area.

The GH (1996) test suggests that the structural break in the cointegration vector is important and need to be taken into account in our analysis. In summary, the results indicate that the CDS premia and sovereign bond spreads are related to a certain relationship and that during the financial crisis, price discovery takes place in the CDS market.

Chapter Five

Sovereign Defaults: Economy vs. Politics

Abstract: The aim of this study is to investigate the main factors causing the sovereign defaults. We use a panel of 99 countries to assess the impact that various macroeconomic and political risk indicators have on sovereign defaults on foreign currency bank loans, foreign currency bonds and local currency debt, utilizing an extended database constructed by the Bank of Canada. Our results suggest that the favorable economic indicators, lower debt levels and political stability all reduce the likelihood of default. We also find that the capital outflows restrictions are positively associated with higher probability of default

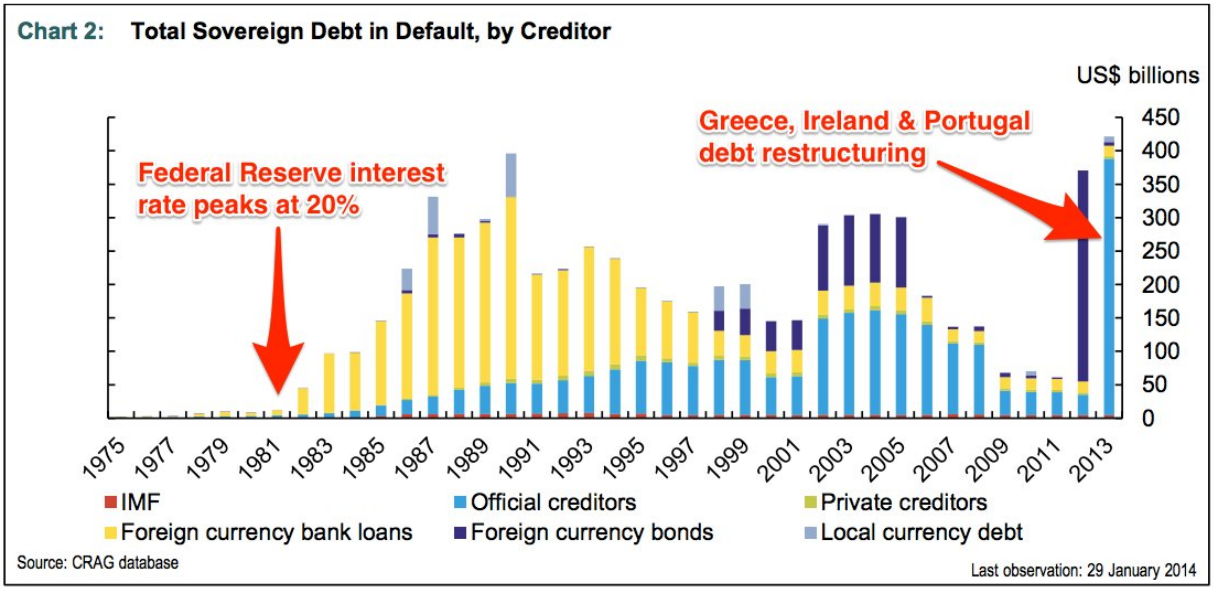
5.1 Introduction

Sovereign defaults are defined as a country's failure to repay its debts. In case of such an event, the results for the defaulted country can be disastrous not only in the short term but also in the medium and long term as it will be difficult and expensive to borrow. During the last 35 years, sovereign defaults have become common. . In Europe in the late 1980s several Eastern European countries (Romania, Poland, Hungary and Yugoslavia), experienced severe debt crises. The same decade In the 1980s,, the oil price shock caused widespread defaults in South America followed by the Mexican default in 1994 which affected other Southern American economies. Its impact is also known as the "tequila effect". Three years later the East Asian crisis, which started in Thailand, spread very quickly to Indonesia, Korea and other East Asian countries. Russia followed soon after (1998) and more recently Iceland (2008) and Greece (2012). In the case of Greece more specifically, in March 2012, the International Swaps and Derivatives Association announced that it has triggered a restructuring "credit event" under credit default swap contracts. Approximately 97 per cent of privately held Greek bonds took a 53.5 per cent cut of the bond principal, about €107 billion reduction in Greece's debt stock.

Moody's (2013) in an extended analysis of sovereign defaults records 24 such incidents since 1997. Nine of the defaults were on both local and foreign currency government bonds, 8 were on local currency government bonds only and 7 affected foreign currency government bonds. At this point it should be stressed that these defaults have been observed at different debt levels. There are countries that have endured debt levels of more than 100% of GDP and have not experienced a default while others defaulted while maintaining lower debt levels. This suggests that other reasons besides economic factors play a role on the sovereign's decision to default. An example would be the case of Hungary compared to Russia. Just after the collapse of the former Soviet Union, Hungary was on the verge of defaulting many times between the period of 1990 to 1994 while experiencing negative GDP growth. From fear on the impact of a default to the support that received from Western countries, it managed to find different ways to deal with this problem. On the other hand, Russia in 1998 decided to default. The use of the word decided was carefully chosen, as its government continued making domestic currency debt payments and only defaulted on foreign denominated bonds. Nonetheless, the examples demonstrated above show that a country can end up not repaying its debt either due to deteriorated economic fundamentals or due to political reasons. Below is a graph from Bank

of Canada that depicts the sovereign debt in default by six creditors. The spike that is observed according to the Bank of Canada is attributed to Greece's, Ireland's and Portugal's debt restructuring.

Figure 5. 1 Total Sovereign Debt in Default, by Creditor



Source: Bank of Canada

What has led all these countries mentioned above to default? Are there any common characteristics with respect to their economies and politics? There is a large number of research papers, which attempt to explain the sovereign risk, observed sovereign bond yields and credit default swaps prices. Favero and Missale (2012) find evidence that the fluctuations in the euro area bond spreads are driven by fundamentals. In the line with the above, Di Cesare at al. (2012) suggests that the levels of sovereign bond yields after the global financial crisis reached levels that can be explained by fiscal and macroeconomic fundamentals.

In this paper we consider to which extent macroeconomic fundamentals and political indicators explain the sovereign defaults. We use the Sovereign defaults database (CRAG) constructed by the Bank of Canada, which includes defaults on debt in different subcategories of creditors; International Monetary Fund, International Bank for Reconstruction and Development, Paris Club, other official creditors, private creditors, foreign currency bank loans, foreign currency bonds and local currency debt, from 1960 until 2015. We analyse the effect of macroeconomic indicators for a set of 99 countries from 1985 until 2015 on sovereign defaults. Consistent with

the literature, we find evidence that the debt to GDP ratio and the real GDP growth volatility are statistically significant in explaining the sovereign defaults. The innovation of this paper is that we also examine the explanatory power of indicators associated with the political risk on sovereign defaults. We incorporate four different indictors – the World Governance Indicators, the International Country Risk Guide (ICRG), the Polity IV and Economic Freedom- and find that the political risk captures a significant part in explaining the sovereign defaults.

The paper is structured as follows. Firstly, we will review the relevant literature and then we will present the data and the method that we will use to examine the dependent variable. In the third section we will present and discuss the results. The final section will offer a summary of the paper and the concluding remarks.

5.2 Literature Review

There is a vast literature discussing sovereign defaults, their causes and determinants. Eaton and Gersovitz (1981) were the first ones to separate between bankruptcy of an individual economic agent in a national economy and a default by a government. When it comes to sovereign defaults they distinguish their willingness to pay their debt and whether they can actually repay. It can be argued that the latter is dependent on the economic situation of the country whereas the former is more linked to political factors. In line with the above, Verma (2002) used both structural and political variables, to explore what affects a country's decision to default. He concluded that political factors affect a sovereign's decision to default using a multivariate probit model. More specifically, countries with more democratic regimes tend to default more than others.

The literature thus examines both economic and political variables as possible determinants of sovereign defaults. We will firstly discuss papers that examine macroeconomic variables and then move on to the ones that investigate political factors and their effects. To start with, Arellano and Kocherlakota (2014) attempt to investigate the link between domestic debt default risk and sovereign debt in 18 emerging markets. Using temporal and country specific evidence they found that domestic defaults result in sovereign defaults and that this relationship is not

causal. They argue that non-fundamental shocks lead to domestic defaults, which in turn result in fiscal pressures that may cause defaults on foreign loans.

Catao and Sutton (2002), try to explain the variations in sovereign default probabilities by examining the role of macroeconomic volatility. They break down the latter into externally induced volatility, considering this to be linked to the trade, and policy induced volatility that is linked to foreign exchange, monetary and fiscal policies. Their sample consists of twenty-five emerging economies over a period of thirty-one years from 1970 to 2001. Their findings suggest that countries that demonstrated higher policy induced volatility are more likely to default. Sharp decreases of GDP growth and fiscal balances mostly precede these defaults as expected. However, they also find that there is a gradual deterioration of some other indicators, such as ratio of debt service to export.

Hilscher and Nosbusch (2010) in their analysis of the determinants of sovereign risk find that the volatility of terms of trade has statistically and economically significant impact on sovereign yield spreads. As noted by Bulow and Rogoff (1989) any dollar revenues generated by the country's trade activity could increase its ability to pay its external dollar denominated debt. Similarly, Eicher and Maltriz (2013) argue that the terms of trade are significant in explaining the sovereign risk because they affect the country's ability to generate foreign currency revenues which can be used for foreign currency denominated debt.

Bi (2012), introducing an endogenous and stochastic fiscal limit, which measures the country's ability to pay its debts, argues that it relies on economic fundamentals, such as the fiscal policy, the size of the government, economic diversity and political uncertainty. Baldacci et al. (2008) using a panel of 30 emerging market economies investigate the determinants of country risk premiums. Measured by the sovereign bond spreads they argue that the credit risk is driven by fiscal and political factorsfiscal and political factors drive the credit risk.

Beirne (2013) analyses the drivers of sovereign risk as expressed by the sovereign yields and sovereign credit default swaps, shows that deterioration in countries' fundamentals has a significant impact on both of them. The linkage between the macroeconomic fundamentals and the sovereign credit risk is investigated for six euro area countries by Yahya et al (2013). They conclude that the creditworthiness of the studied countries is affected by macroeconomic fundamentals such unemployment, debt to GDP ratio and gross fixed capital formation.

Clark and Kassimatis (2015) using a new set of macroeconomic variables, which reflect investors expectations, find them significant in explaining and forecasting the sovereign credit spreads, expressed as proxy for the sovereign risk. According to Min (1998) inflation is another important factor in explaining the government borrowing cost for a sample of Asian and Latin American countries. On the contrary, Diaz and Gemmill (2006) who examine the factors affecting the creditworthiness of four Latin American economies find no connection between inflation and the sovereign risk as expressed by the government bond spreads.

Defaults episodes are more likely to occur in periods of recession. Tomz and Wright (2007) investigating whether there is a relationship between sovereign defaults and economic activity in the defaulting country. Covering 169 defaults for 175 sovereign entities they conclude that 62 per cent of these defaults occurred in periods of economic recession.

Cantor and Parker (1996) exploring the criteria underlying sovereign ratings conclude that factors such as the GDP growth and GDP per capita income are statistically significant in explain the rating decision by two leading ratings agencies, Moody's Investors Service and Standard and Poor's.

In another study Mellios and Paget-Blance (2006) examine what are the factors that the three major rating agencies, Fitch Ratings, Moody's and Standard and Poor's consider when assigning their rating. Using a principal component analysis they find that the sovereign ratings are mainly determined by per capita income, government income, real exchange rate changes, inflation rate and default history.

Similarly, Afonso et al. (2007) in a European Union focused empirical analysis over a period from 1995 to 2005 conclude that the GDP per capita, real GDP growth, government debt, government effectiveness, external debt and external reserves, sovereign default indicator as well as being member of European Union are the main indicators that the three largest rating agencies consider for the rating decisions.

In the body of literature, we found several papers trying to identify the determinants of sovereign defaults using variables that are indicators of defaults instead of using the variable per se. Below, we will provide an overview of the most interesting and relevant ones. We will

start with Maltritz (2012) who uses a Bayesian Model Averaging (BMA) in his attempt to identify the determinants of default risk in countries of the European Union.

As an indicator for risk he uses government yield spreads in all EMU member states from 1999 until 2009. What he finds, after having tested various variables, is that government debt to GDP, budget balance to GDP and more specifically the deficit significantly affect the dependent variable.

Alesina et al (1995), examined the borrowing rates and the debt of OECD countries. They find a significant relationship in both the sovereign yield spreads, which is often an indicator of default, and public debt in countries where the debt to GDP ratio is not stable. Lastly, another paper that uses an untraditional way to examine the sovereign default risk is the one of Alfonso (2003). Using data from S&P and Moody's he tries to identify the determinants of sovereign credit ratings. He argues that GDP per capita, external debt as a percentage of exports, inflation and real growth rate are significant in the determination of the credit ratings.

Moving on to the literature focused on the political risk, Hatchondo et al. (2007), identify the political factors, borrowing costs and resources as the factors that determine whether a country will default or not, based on the existing literature.

Empirical studies suggest that countries have greater probabilities to default in periods where the available resources in a country are low (Tomz and Wright (2007) and Cantor and Packer (1996)) and when borrowing costs for a country are high (Arora and Cerisola (2001) and Lambertini (2001)).

Finally, different political factors seem to play a role on whether a country will default or not. Political instability has been found statistically significant by Citron and Nickelsburg (1987) and Balkan (1992). The latter also reports that democracy plays a role in defaults. In line with that Kohlscheen (2003) finds that countries with parliamentary democracies have a lower probability of default than compared to countries with presidential systems. Alesina and Tabellini (1990) also show that political instability increases the probability of a default.

In a bit more detail, Balkan (1992) examines if and how the level of democracy and political instability affect the country's probability to repay its debt. The method adopted in the paper is a probit regression run in 33 countries over a period of 13 years, starting in 1971. The choice

of the countries was based on the criteria of them being developing nations with an external debt of hight that one billion dollars. In line with others in the literature he states that democracy decreases the default probabilities whilst high level of political instability increases them. On the note of political stability, Manasse and Roubini (2005)) amongst other variables that have examined is whether a country has presidential elections in less than five years which is considered a sign of instability. Using a Classification and Regression Tree Analysis (CART) find that these countries have increased probability to default when international capital markets are tight.

Cuadra and Sapriza (2008), in their attempt to test the interaction of political factors with defaults use a neoclassical open economy model. The model has two types of political parties, each period one of the two in power and foreign lenders. They also assume that the only asset traded in financial markets is a noncontigent one period bond. This bond is available only to ruling political. The results of the model reinforce the vast literature that politics play indeed a role in a sovereign's likelihood to default. What they find is that unstable and more polarised economies lead in both higher default rates and volatility of interest rate spreads.

Yu (2016) has also tried to understand whether political factors affect the probability of a country to default. He examines 68 countries, a mix of developed and emerging economies, from 1970 until 2010 using a panel logit model. What Yu argues is that apart from economic reasons, political associated variables play a role in a country's probability to default. For example, Tabellini and Ozler (1991) report that when two types of government with multiple equilibria alternate in power, defaults are more probable.

Also, Sapriza and Cuadra (2008) prove that a government can choose to default when election results are uncertain by taking excessive debt, as a preventive move. Coming back to Yu, his main findings suggest that political stability is a significant factor that determines this probability. More specifically, more democratic countries that are political stable will less likely default whereas higher chances of political turnover along with younger political regimes have the opposite effect.

Baldacci et al (2011), focus on emerging markets only in their attempt to understand the determinants of sovereign defaults. They study bond spreads as a spike in them is translated as a higher probability to default. Their sample consists of 46 countries over a period of 11 years

from 1997 to 2008. They find that both political and fiscal factors affect the credit risk of these countries. More precisely, in periods of economic downturn the markets are less tolerant in institutional risk asking for an extra premium to lend them by increasing the spreads.

Rijckeghem and Weder (2008) show that to explain defaults in both domestic and external obligations, the political institutions of a country should be examined. Using a non- parametric technique, to exploit the advantage of identifying patterns in the data that this technique offers compared to a standard logit, prove that indeed political factors matter in defaults. For example, when economic fundamentals are sufficiently strong, democracies with a parliament system assure that a default on an external debt will be avoided. In dictatorships on the other side, assuming the same as above, high stability and tenure guarantee that the country will not default on its domestic debt.

Finally, Eichler and Plaga (2016) take a different approach to the issue. They examine the links between sovereign bond holdings and political factors, as these can be an indicator of a default. They focus on US investors that hold bonds in 60 countries between 2003 to 2013. US investors seem to reduce their investment in bonds when there is political uncertainty. In cases, where the default risk is high or a country has already experienced one, they prefer to invest to country bonds with higher political constraints. However, when none of these two exist they prefer sovereigns with few political constraints on the government.

5.3 Methodology and Data

5.3.1 Data and Variables

In our analysis, we use the Bank of Canada Sovereign defaults database constructed by Beers and Mavalwalla. Consistent with the literature and the rating agencies, Beers and Mavalwalla (2017) consider a default event has occurred when debt is service is not paid on the due date or within a specific time frame in any of the following circumstances[13]:

- Agreements between governments and creditors that reduce rates and/or extend maturities on outstanding debt.
- Government exchange offers to creditors where existing debt is swapped for new debt on less-economic terms.
- Government purchases of debt at substantial discounts to par.
- Government redenomination of foreign currency debt into new local currency obligations on less-economic terms.
- Swaps of sovereign debt for equity (usually relating to privatization programs) on less-economic terms.
- Retrospective taxes targeting sovereign debt service payments.
- Conversion of central bank notes into new currency of less-that-equivalent face value.

GRAG's sovereign database[14] presents data for sovereign defaults from 1960 to 2016 for the creditors' categories listed below:

- International Monetary Fund (IMF)
- International Bank of Reconstruction and Development (IBRD)
- Paris Club

[13] Bank of Canada, Database of Sovereign Defaults 2015, page 2.

[14] Available at https://www.bankofcanada.ca/wp-content/uploads/2016/06/r101-revised-june2017.pdf

- Other official creditors
- Private creditors
- Foreign currency bank loans
- Foreign currency bonds
- Local currency debt

The analysis used in this paper is in line with the practices followed by credit rating agencies. Their method is based in measuring the probability of missed payments of the government and central bank bills, notes, bonds and bank loans, not the probability of missed payments of loans contracted from the IMF, the multilateral lending institutions and other official creditors. Moody's Investor Services (2008) in a survey about the post-1960 history of sovereign defaults presents 38 case of sovereign bond defaults. Moody's survey unveils that 45 per cent of defaults have been on foreign currency bonds, while 34 per cent affected local currency bonds and 21 per cent were on a joint basis.

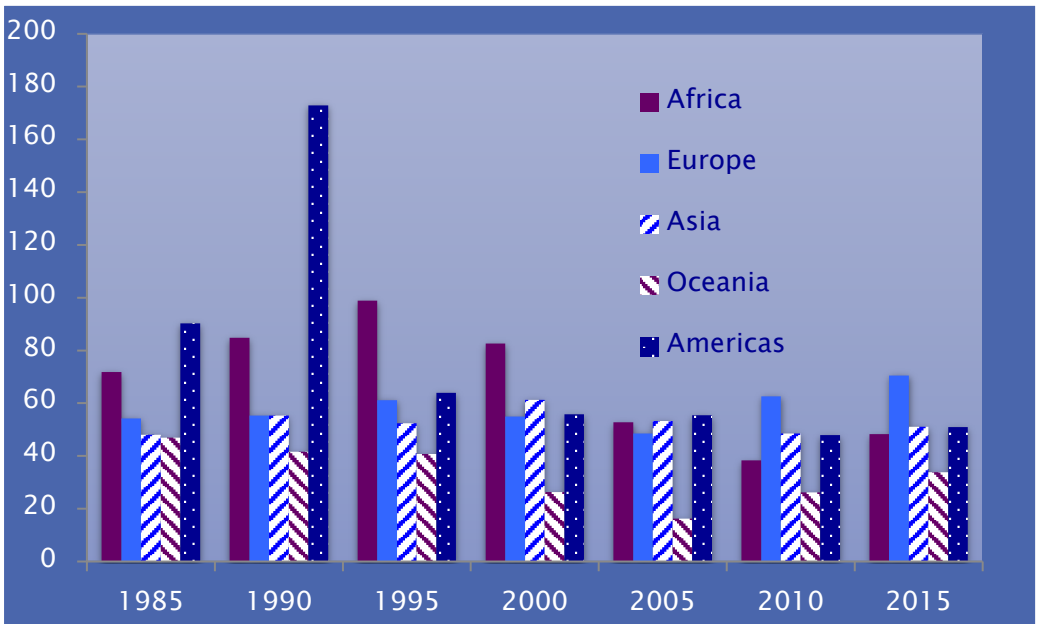
We attempt to investigate the relationship between the sovereign default and the imposition of capital restrictions over a period of 20 years for 99 countries. To achieve this, we use the dataset of capital restrictions constructed by Fernandez et. al (2015). For the construction of the dataset Fernandez et al (2015) based on the methodology developed by Schindler (2009), but including more countries, more years and more asset categories. The most important feature of this dataset is the fact that it disaggregates the information of the capital restriction on inflows or outflows. The sample covers the period 1985 to 2015 and the following ten asset categories:

- Money market instruments, which includes securities with original maturity of one year or less.
- Bonds or the other debt securities with original maturity of more than one year.
- Equity, shares or other securities
- Collective investment securities such as mutual funds and investment trusts.
- Financial credit and credits other than commercial credits granted by all residents to nonresidents and vice versa.
- Derivatives.
- Commercial credits for operations linked with international trade transactions.

- Guarantees, Sureties and Financial Back-Up Facilities provided by residents to nonresidents and vice versa.
- Real Estate transactions representing the acquisition of real estate not associated with direct investment.
- Direct investment accounts for transactions made for the purpose of establishing lasting economic relations both abroad by residents and domestically by residents.

The empirical investigation concentrates on explaining the sovereign defaults across a diverse set of countries and time range. To try to achieve that we use two different groups of variables; economic and political. The first group of variables that we use include several macroeconomic fundamentals. The debt to GDP ratio is a proxy used to determine whether a country can repay its obligation. A higher the debt to GDP ratio is associated with a higher probability of default. We also incorporate in our analysis the output volatility, as a proxy for the country's capacity to absorb shocks and adapt to changes. In Figure 5.1 we calculated its average based on the countries in the analysis and we present the average per continents. The same for figures 5.2 to 5.8 that follow.

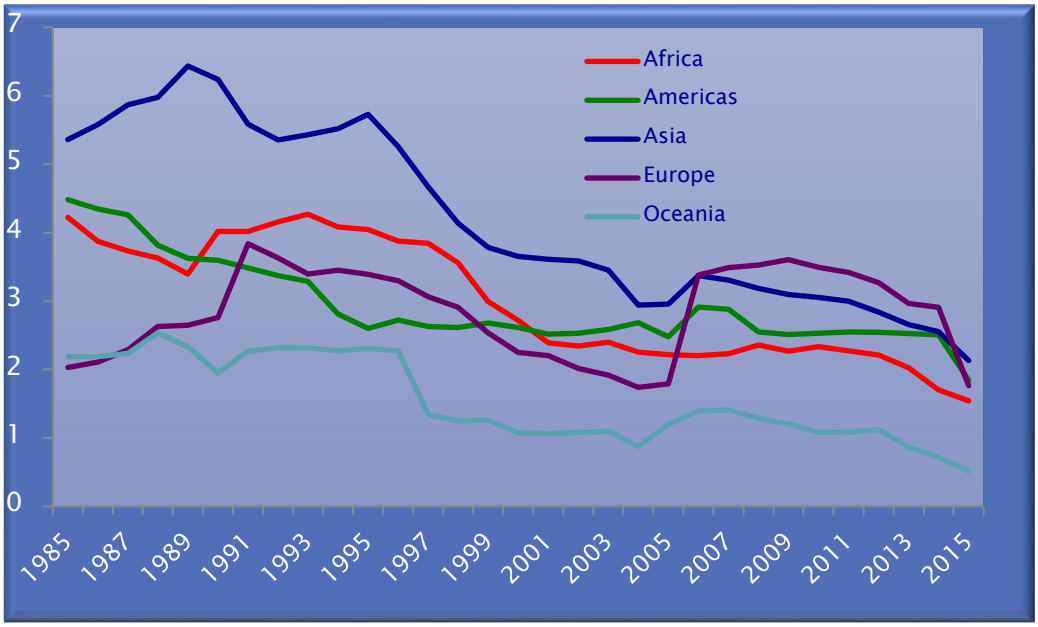
Figure 5. 2 General Government Debt (as a percentage of GDP)



Real GDP growth (figure 5.2), which is defined as year on year percentage change of real GDP, is an indicator of how solid economic performance makes the economy stronger and less likely

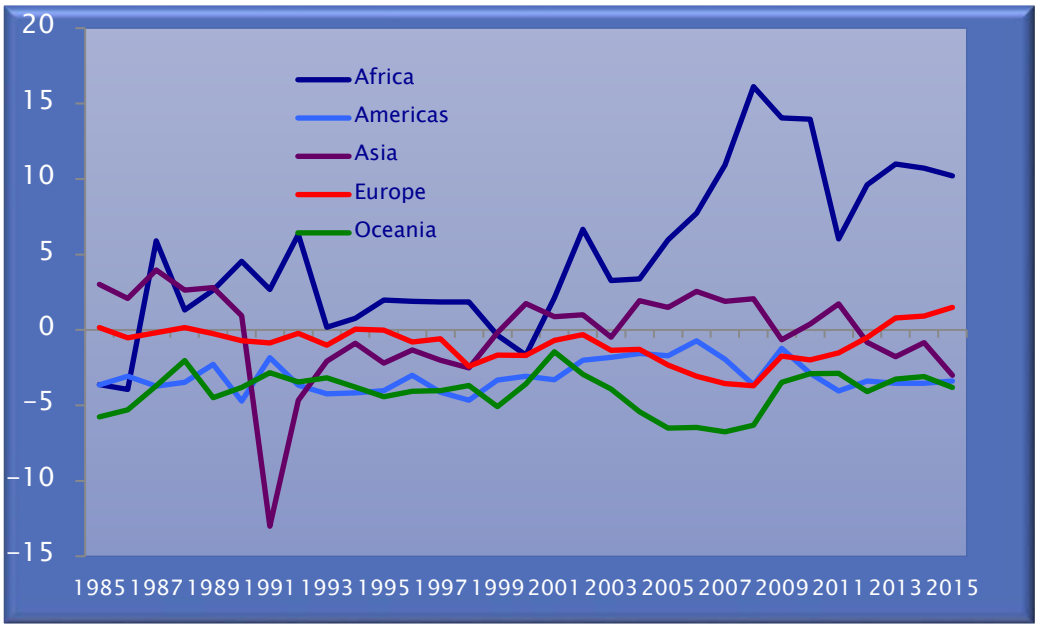
to default on its debts. We calculate the standard deviation of the real GDP growth rate over 4 years of historical data, plus projected output over the next 3 years. Higher output volatility implies higher likelihood of default.

Figure 5. 3 Real GDP growth rate



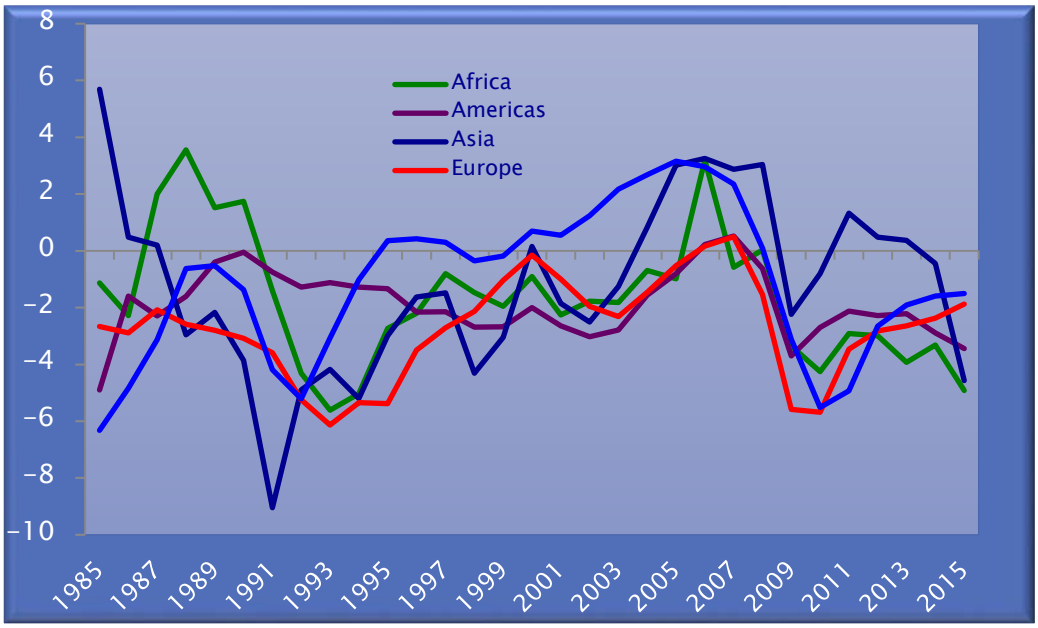
We use the current account balance (as a percentage of GDP) (Figure 5.3) as a proxy for the country's external solvency, which is linked with its level of external indebtedness. In the event of a sudden stop in financing, countries with large current account imbalances can be forced to undertake sharp macroeconomic adjustment. Therefore, we expect the current account to have negative sign.

Figure 5. 4 Current account balance (as a percentage of GDP)



Another variable, which characterizes the country's financing needs is the fiscal balance (Figure 5.5). A country with a stronger fiscal position should have less probability of default. Therefore, we expect this indicator to have a negative sign.

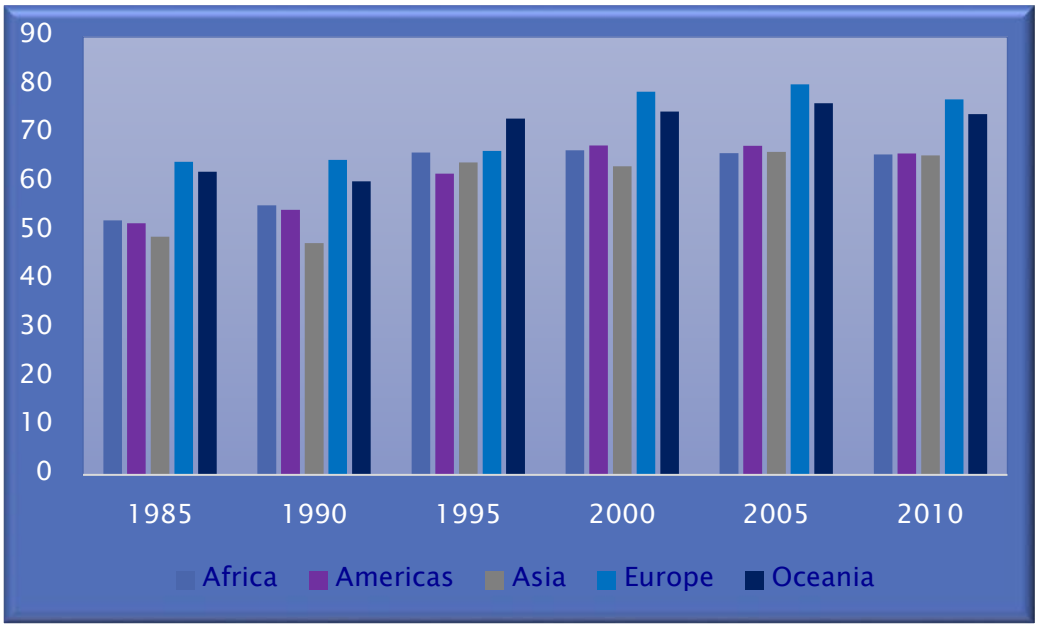
Figure 5. 5 General government fiscal balance (as a percentage of GDP)



Moving on to the political variables, we will start with the International country risk guide (ICRG) (Figure 5.6). The ICRG reports three subcategories of risk: the political, financial and economic, which are updated monthly for 140 countries. For the above three, a separate index is created with a 100 points as a maximum for the political risk and 50 points for the other two. The scores to the indices are given by a business oriented model.

The model quantifies a risk by examining country specific elements considering 22 variables. For the 22 variables 30 metrics are used to assess them. In this paper, we will only use the political risk index. This index comprises of 12 variables which exhibit both social and political traits. Some examples are internal conflict, socioeconomic conditions, corruption and bureaucratic quality. These 12 then get points with the maximum ranging from 4 to 12 that attribute to the total of the 100 points. ICRG is used as a proxy of political stability.

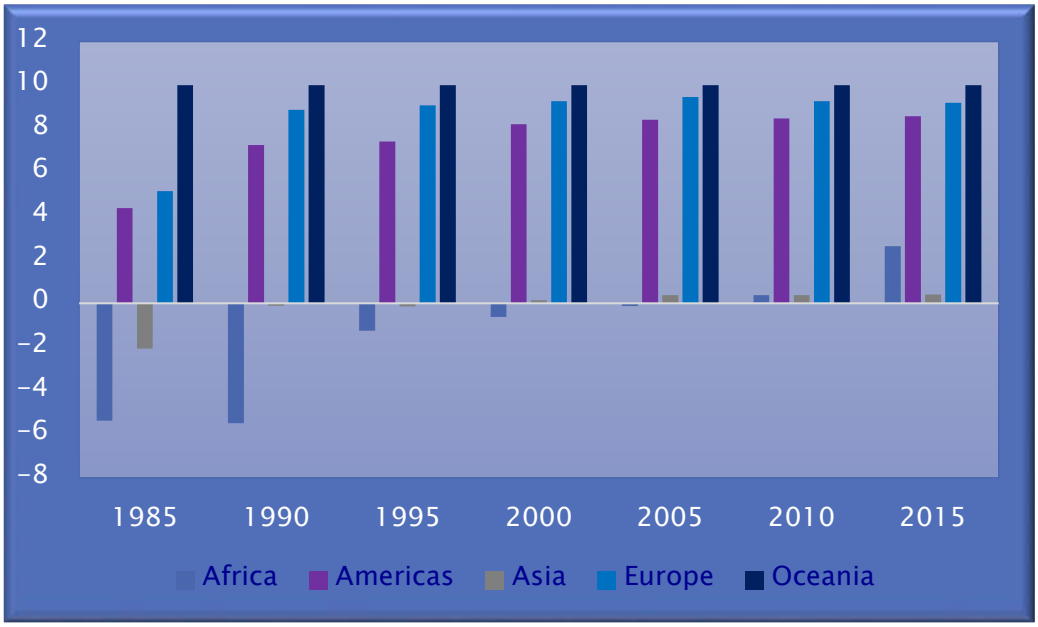
Figure 5. 6 International country risk guide indicator



The next variable that we thought might be worth to examine is democracy. Polity IV (Figure 5.7) is a research project that measures democracy from 1800 until present and it is commonly used in the political science research. We chose this data source as compared to other databases as polity provides data for a greater range of both years and countries. The database covers 167 countries as it only covers states of a population of 500,000 and more. The score that is assigned

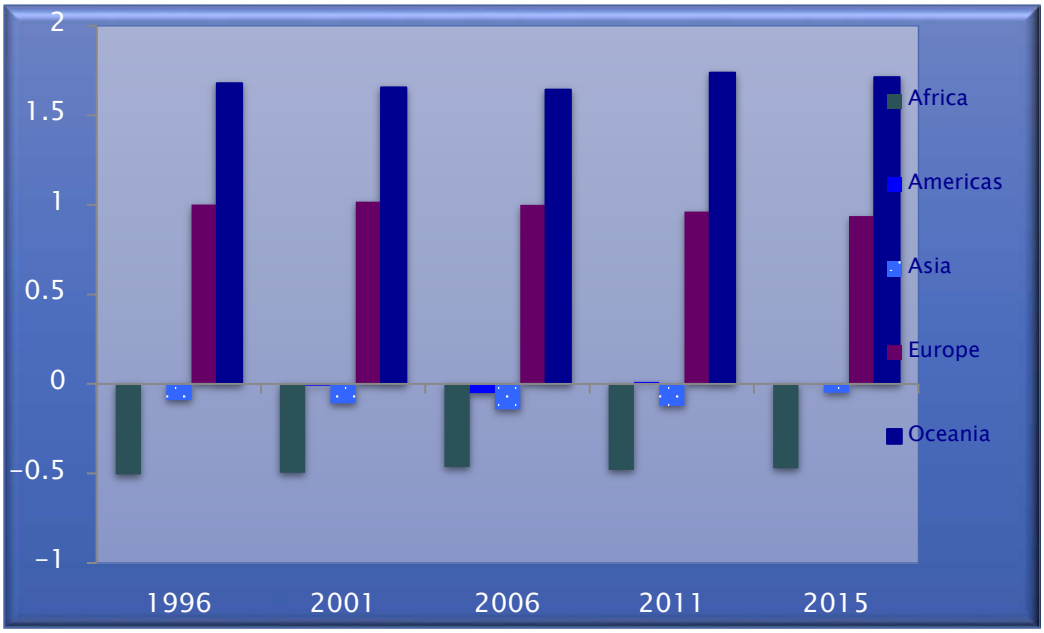
to them ranges between -10 to 10. The two extremes represent hereditary monarchy and consolidated democracy respectively. From -10 to -6 autocracies , +6 to +10 democracies and the middle range from -5 to +5 anocracies.

Figure 5. 7 Polity IV



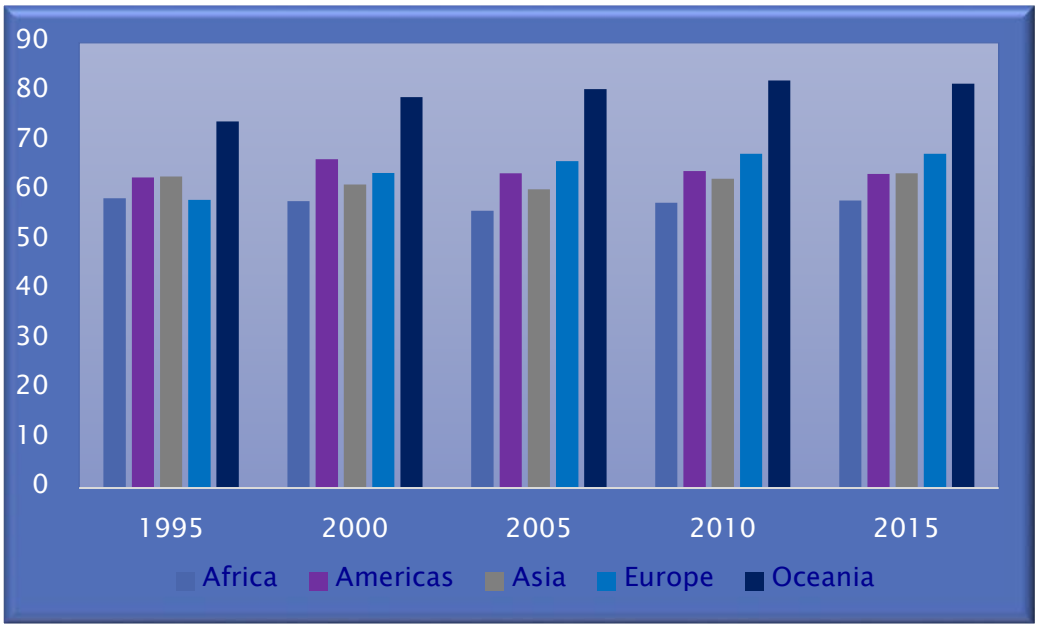
Another source of data widely used by researchers is the worldwide governance indicators (WGI) (Figure 5.8). WGI report both individual and aggregate governance indicators from 1996 until 2015 (at the moment that this paper is written it has been announced that 2016 will soon be released) for over 200 countries. The way that authority in a country is exercised via its traditions and institutions is what defines governance. To measure it in every country, the following six dimensions, that are informed by 30 underlying sources are used: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality rule of law and control of corruption. In this paper, we use all six indicators, individually, as an average and as a principal component.

Figure 5. 8 World Governance Indicator (average)



The last index that we use to as an independent variable is the economic freedom index (Figure 5.9). The Index has been created by the Heritage Foundation and the Wall street Journal yearly since 1995. It reports the relationship between economic freedom and various other positive economic and social goals in 186 countries. It is measured based on twelve freedoms that form four categories: the rule of law, government size, regulatory efficiency and open markets. The index gets a score of a maximum 100 that is calculated by averaging the score that is given to the twelve freedoms. It is available from the Heritage Foundation web site.

Figure 5. 9 Economic Freedom Index



5.3.2 Empirical model

The dependent variable, as mentioned in the previous section, is sovereign defaults. The values that it takes is 1 in case of a reported default in a country and zero otherwise. Since we are dealing with a binary variable, the most appropriate model to use is either a probit or a logit. The advantage of these two models compared to a simple linear OLS model is that they produce an S-shaped curve that respects the dependent variable boundaries of 0 and 1. The difference between them two is the assumption on the distribution of errors. Logit assumes that distribution is logistic whilst the probit that it is a standard normal distribution.

As we have a panel dataset we need to account for any country specific effects leading us to use fixed effects (fe) model rather than random effects (re). To make sure that this is the best approach, we run a Hausman test which confirms that fe is the model we need to use (see table x for results). Debt and current account balance have been lagged one year as their impact is more likely to be visible a year after.

In this paper we perform both probit and logit analysis in our sample. The intention is to better understand if and how both sets of variables affect the independent one. To begin with, in the tests that we perform we include only macroeconomic variables (eq 5.1).

$$y_i = \beta_i + \beta_d\, d_i + \beta_v\, v_i + \beta_g\, g_i + \beta_c\, c_i + \varepsilon_i \quad \text{(eq 2.11)}$$

where y_i sovereign defaults, d_i debt to GDP ratio ,v_i GDP growth volatility, g_i general government balance , $c_i$current account balance

Then we run all the regressions again with more than one macroeconomic variables but only one political variable at the time. (eq 5.2), (eq 5.3), (eq 5.4), (eq 5.5).

$$y_i = \beta_i + \beta_d\, d_i + \beta_v\, v_i + \beta_g\, g_i + \beta_c\, c_i + \beta_w w_i + \varepsilon_i \quad \text{(eq 5.2)} \ ,$$
$$y_i = \beta_i + \beta_d\, d_i + \beta_v\, v_i + \beta_g\, g_i + \beta_c\, c_i + \beta_z z_i + \varepsilon_i \quad \text{(eq 5.3)}$$
$$y_i = \beta_i + \beta_d\, d_i + \beta_v\, v_i + \beta_g\, g_i + \beta_c\, c_i + \beta_p\, p_i + \varepsilon_i \quad \text{(eq 5.4)}$$
$$y_i = \beta_i + \beta_d\, d_i + \beta_v\, v_i + \beta_g\, g_i + \beta_c\, c_i + \beta_f\, f_i + \varepsilon_i \quad \text{(eq 5.5)}$$

where y_i sovereign defaults, d_i debt to GDP ratio ,v_i GDP growth volatility, g_i general government balance , $c_i$current account balance and w_i world governance indicators (eq 5.2), z_i is the international country risk guide (ICRG) (eq 5.3), p_i democracy as in polity IV (eq 5.4), f_i economic freedom (eq 5.5)

Finally, we add in the both sets of regressions the overall outflow restriction variable. once with only economic variables (eq 5.6) and then with one political variable at the time (eq 5.7), (eq 5.8), (eq 5.9),(eq 5.10) as above. All the regressions are firstly run with the fixed effects logit model and then the probit.

$$y_i = \beta_i + \beta_k\, k_i + \beta_d\, d_i + \beta_v\, v_i + \beta_g\, g_i + \beta_c\, c_i + \varepsilon_i \quad \text{(eq 5.6)}$$
$$y_i = \beta_i + \beta_k\, k_i + \beta_d\, d_i + \beta_v\, v_i + \beta_g\, g_i + \beta_c\, c_i + \beta_w w_i + \varepsilon_i \quad \text{(eq 5.7)}$$
$$y_i = \beta_i + \beta_k\, k_i + \beta_d\, d_i + \beta_v\, v_i + \beta_g\, g_i + \beta_c\, c_i + \beta_z z_i + \varepsilon_i \quad \text{(eq 5.8)}$$
$$y_i = \beta_i + \beta_k\, k_i + \beta_d\, d_i + \beta_v\, v_i + \beta_g\, g_i + \beta_c\, c_i + \beta_p\, p_i + \varepsilon_i \quad \text{(eq 5.9)}$$
$$y_i = \beta_i + \beta_k\, k_i + \beta_d\, d_i + \beta_v\, v_i + \beta_g\, g_i + \beta_c\, c_i + \beta_f\, f_i + \varepsilon_i \quad \text{(eq 5.10)}$$

where y_i sovereign defaults, k_i capital restriction outflow index, d_i debt to GDP ratio, v_i GDP growth volatility, g_i general government balance , $c_i$current account balance and w_i world governance indicators (eq 5.7), z_i is the international country risk guide (ICRG) (eq 5.8), p_i democracy as in polity IV (eq 5.9), f_i economic freedom (eq 5.10)

5.3.3 Interaction term

To expand and enhance the results we have decided to include an interaction term. Its introduction in the regression will help in a better understanding of the explanatory variables and its effects on the dependent one. The interaction term is simply the product of two explanatory variables and its interpretation is the effect of one explanatory variable for different values of another explanatory variable. The interaction terms included in our regression is the product of one political variable with one political at a time, resulting in twenty regressions run. One example below is equation (eq 5.11).

$$\mathcal{Y}_i = \beta_i + \beta_k k_i + \beta_d d_i + \beta_v v_i + \beta_g g_i + \beta_c c_i + \beta_w w_i + \beta_{wd} w_i * d_i + \varepsilon_i \quad \text{(eq 5.11)}$$

where $\mathcal{Y}_i$ sovereign defaults, k_i capital restriction outflow index, d_i debt to GDP ratio, v_i GDP growth volatility, g_i general government balance, c_i current account balance, w_i world governance indicators and $w_i * d_i$ the interaction term of world governance indicators with the debt to GDP ratio

Needless to say that the main effects are still thought the coefficients of the main variables.
At this stage, a couple of things should be noted before demonstrating the results that will help us understand them better. Firstly, there are cases where the significance or the coefficients of the variables that form the interaction term give very different results to the main regression. The reason behind it is likely to be that when the term is included, the coefficient for the variable demonstrates its effect when the other variable of the term is zero also called the conditional effect.

However, in a regression without an interaction term it shows its connection with the dependent averaged over all the levels of the rest explanatory variables. Secondly, apart from the coefficients the constant can also change. The change stems from the fact that the variables now are centered at the mean compared to before when they were uncentered.

5.4 Regression Results

5.4.1 Empirical Results

In this section we will present the estimation analysis results. We will start by presenting and discussing the logit results with only the macroeconomic variables, then the ones with one political variable at a time but excluding the overall outflow restriction index and then the set of results when it is included.

The analysis begins by examining the impact of the general government balance to GDP ratio, the GDP volatility, the one-year lagged debt to GDP ratio and the one-year lagged current account balance as a percentage to GDP. All the variables are positive and significant at the 1 per cent level apart from the lagged current account balance that does not have any effect on the dependent variable. What the results indicate is that when debt, fiscal deficits and GDP volatility increase the probability of sovereign default increases.

This is what we expected as deteriorated macroeconomic variables can result in a country's inability to repay its debts and could lead in a default. However, we felt that maybe the effect of the current account balance result it is visible on the same year (Table 1). So we re-run the regression but this time with the variable not lagged. The results remain the same as before.

The next step is to try and understand the effect of political variables on the defaults. As explained above, one political variable at a time will be used in conjunction with the macroeconomic variables.

A brief reminder of the variables that we use at this point will be useful: Polity IV as a measure of democracy, the average World Governance Indicators, the overall economic freedom index and finally the international country risk guide index (ICRG). Increase in debt and GDP volatility in all four cases increases the sovereign default probability whilst current account balance (lagged or no) is insignificant. When it comes to the fiscal balance to GDP ratio the results are not very consistent. The fiscal balance as a percentage of GDP when the level of democracy and the ICRG are included, result in a significant and positive effect but once

overall economic freedom and the average of WGI are introduced it becomes insignificant. The political variables in all cases are significant and negative. Meaning that the higher is the level of democracy, the economic freedom, the WGI and the higher the political stability (higher ICRG) the lower the risk for a sovereign to default (Table 5.1).

Table 5. 1 Sovereign Defaults and their determinants (Logit)

Sovereign Defaults	(1)	(2)	(3)	(4)	(5)
Debt to GDP ratio (lagged)	0.0010*** (0.0002)	0.0009*** (0.0002)	0.0010*** (0.0002)	0.0009*** (0.0002)	0.0011*** (0.0002)
Volatility	0.0037*** (0.0038)	0.0036*** (0.0009)	0.0034*** (0.0007)	0.0046*** (0.0010)	0.0029*** (0.0008)
General Gov Balance	0.0006*** (0.0006)	-0.0001 (0.0002)	0.0005*** (0.0001)	-0.0001 (0.0002)	0.0004*** (0.0001)
Current account (lagged)	0.00015 (0.0002)	-0.0002 (0.0002)	0.0002 (0.0002)	0.0000 (0.0003)	0.0003 (0.0002)
WGI		-3.1446*** (0.8073)			
Polity IV			-0.1270*** (0.0311)		
Economic Freedom				-0.0800*** (0.0251)	
ICRG					-0.0881*** (0.0145)
Number of countries	45	38	45	45	86
Number of observations	1177	681	1117	648	2146

Table 5. 2 Sovereign Defaults and the World Governance Indicators (Logit)

Sovereign Defaults	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Debt to GDP ratio (lagged)	0.0009*** (0.0000)	0.0010*** (0.0002)	0.0009*** (0.0002)	0.0009*** (0.0002)	0.0009*** (0.0002)	0.00088*** (0.0002)	0.0009*** (0.0002)	0.0009*** (0.0002)
Volatility	0.0039*** (0.0009)	0.0037*** (0.0009)	0.0033*** (0.0010)	0.0040*** (0.0009)	0.0037*** (0.0009)	0.0041*** (0.0009)	0.0036*** (0.0009)	0.0036*** (0.0010)
General Gov Balance	-0.0001*** (0.0002)	-0.0001 (0.0002)	-0.0002 (0.0002)	-0.0002 (0.0002)	-0.0001 (0.0002)	-0.0002 (0.0002)	-0.0001 (0.0002)	-0.0001 (0.0002)
Current account lagged	0.0001 (0.0002)	-0.0010 (0.0002)	-0.0000 (0.0002)	-0.0002 (0.0002)	-0.0000 (0.0002)	-0.0002 (0.0002)	-0.0002 (0.0002)	-0.0002 (0.0002)
Voice and Accountability	-1.2831** (0.4872)							
Political Stability		-0.8304** (0.3193)						
Government Effectiveness			-1.7877** (0.7319)					
Regulatory				-1.4636*** (0.4872)				
Control of Corruption					-1.1285* (0.6146)			
Rule Of Law						-2.1057*** (0.6439)		
Avg WGI							-3.1446*** (0.8073)	
PCA								-1.2651*** (0.3227)
Number of countries	38	38	38	38	38	38	38	38
Number of observations	681	681	681	681	681	681	681	681

In the regression we also add the overall outflow restriction index. The index has a significant positive effect on defaults, similar to debt to GDP ratio and GDP growth volatility. The current account balances, both lagged and current, are insignificant. Compared to before though the introduction of the restriction index changes the government balance to become insignificant.

We then add the political variables and re run the model. The outflow restriction index is positively significant when we include ICRG, polity and the average WGI; only at the 10% significance level in the latter. It is insignificant however when the overall economic index is included. Debt to GDP ratio, GDP growth volatility and current account (current or lagged) balance as a percentage of GDP behave the same as before; the first two increase the probability of a sovereign to default whereas the third has no effect. The last one when it comes to the economic explanatory variables is the fiscal balance as a percentage of GDP which is found insignificant in all cases. Lastly, all the political variables apart from the level of democracy have negative significant effects on defaults (Table 5.3).

Table 5. 3 Sovereign Defaults and the Political Indicators and Capital Controls

Sovereign Defaults	(1)	(2)	(3)	(4)	(5)
Kao Index	2.4380***	1.6923*	2.1830***	1.0693	1.720**
	(0.7811)	(0.9226)	(0.7389)	(0.8011)	(0.7987)
Debt to GDP ratio (lagged)	0.0010***	0.0010***	0.0010***	0.0009***	0.0012***
	(0.0010)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Volatility	0.0029***	0.0032***	0.0033***	0.0046***	0.0029***
	(0.0029)	(0.0010)	(0.0008)	(0.0010)	(0.0010)
General Gov Balance	-0.0002	-0.0002	-0.0002	-0.0002	-0.000
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Current account (lagged)	0.0001	-0.0001	0.0000	-0.0000	0.0003
	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0003)
WGI		-2.4913***			
		(0.8959)			
Polity IV			-0.0426		
			(0.0477)		
Economic Freedom				-0.0649**	
				(0.0273)	

ICRG					-0.0406*** (0.0136)
Number of countries	39	38	39	35	32
Number of observations	734	681	734	648	575

All the results that were reported above seem to have similarities. Debt to GDP ratio and GDP growth volatility were always found to be positively significant something that we have expected, whereas the current account balance, either current or lagged, did not have any effect on the defaults whatsoever. The general government balance as a percentage of GDP gives very inconsistent results. It is positive and significant in the cases where in the regression we have only the macroeconomic indicators and in the ones where polity and ICRG are included. In all other cases, both including the outflow restrictions or not is insignificant. To continue, when the overall outflow restrictions index increases, the probability of sovereign default increases every time except for the time that in the regression the overall economic freedom index is included. In that case the explanatory variable becomes insignificant. Finally, all the political indicators have a negative impact on sovereign defaults apart from the level of democracy that loses its significance when the overall outflow restriction index is included.

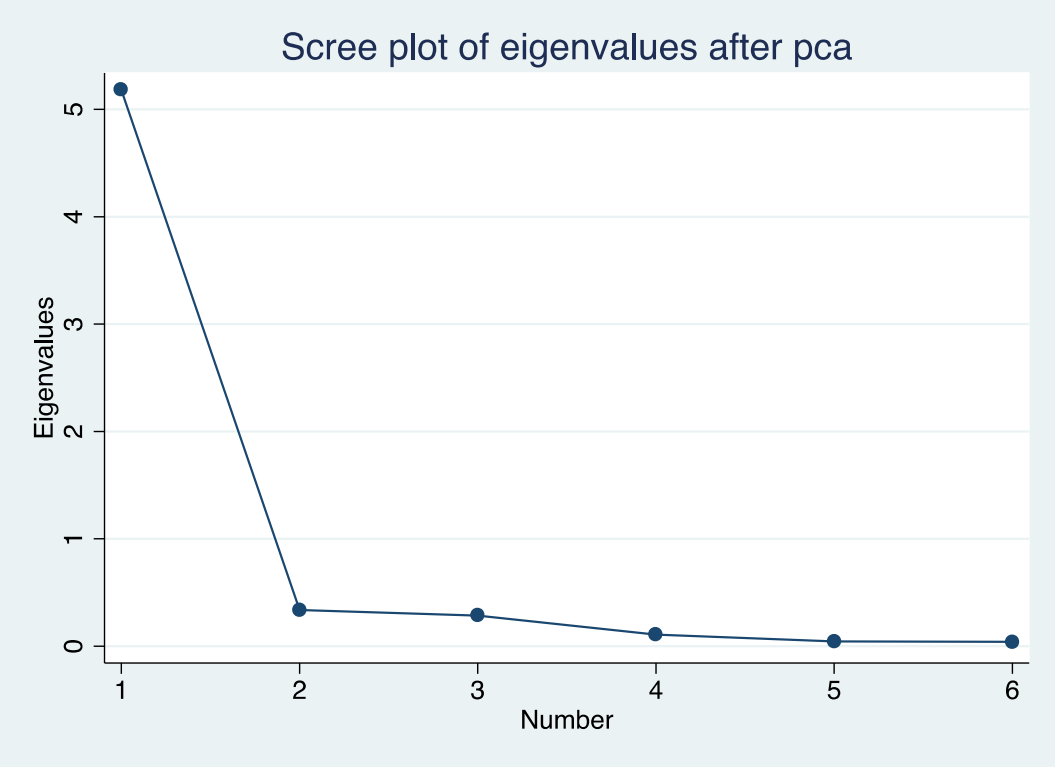
In order to deal with multi-collinearity problems between the World Governance Indicators we use the Principal Components Analysis (PCA)[15]. PCA can be used to reduce the dimension of a data set and extract the significant information from the table. In Table 3 we have computed the new variables, namely principal components, which are the lineal combinations of the original variables.

As we can observe from Table 5.4 the Component (1) explains 86.38 per cent of the total variance. Moreover, the scree plot of the eigenvalue suggests that Component (1) is higher than 1. Therefore, we choose to retain Component 1 in our analysis.

[15] The principal component analysis is performed using STATA.

Table 5. 4 Principal Component Analysis

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	5.1825	4.84471	0.8638	0.8638
Comp2	0.337797	0.052224	0.0563	0.9201
Comp3	0.285573	0.177195	0.0476	0.9676
Comp4	0.108378	0.0629611	0.0181	0.9857
Comp5	0.0454165	0.00508507	0.0076	0.9933
Comp6	0.0403314	.	0.0067	1



5.4.2 Robustness check

The robustness of the results is an important issue. To ensure that the results are robust, we run the same regression using the probit model now instead of the logit and we also introduce the interaction terms, as was discussed in the methodology section. Finally, using a three year

moving average for debt, we run the logit regression again to examine whether the results will change.

5.4.3 Probit Regression

Using the same variables and running exactly the same regressions as above we find that the results do not differ from before. The only change that we can report is that the overall outflow restrictions from a 10% significance level become insignificant when the WGI is included. (Table 5.5 and 5.6).

Table 5. 5 Sovereign Defaults and the Political Indicators (Probit)

Sovereign Defaults	(1)	(2)	(3)	(4)	(5)
Debt to GDP ratio (lagged)	0.0006*** (0.0001)	0.0005*** (0.0001)	0.0006*** (0.0001)	0.0005*** (0.0001)	0.0006*** (0.0001)
Volatility	0.0022** (0.0004)	0.0018 *** (0.0005)	0.0020*** (0.0004)	0.0027*** (0.0005)	0.0017*** (0.0005)
General Gov Balance	0.0003*** (0.0001)	-0.0001 (0.0001)	0.0003*** (0.0001)	-0.0001 (0.0001)	0.0002*** (0.0001)
Current account (lagged)	0.0001 (0.0001)	-0.0001 (0.0001)	0.0001 (0.0001)	-0.0001 (0.0001)	0.0001 (0.0001)
WGI		-2.2444*** (0.2456)			
Polity IV			-0.0748*** (0.0162)		
Economic Freedom				-0.0664*** (0.0139)	
ICRG					-.0534701*** (0.0072)
Number of countries	99	98	95	93	86
Number of observations	2559	1743	2479	1707	2146

Table 5. 6 Probit: Sovereign Defaults and the Capital Controls

Sovereign Defaults	(1)	(2)	(3)	(4)	(5)
Kao Index	1.3073***	0.4685	1.2670***	0.5143	0.9836***
	(0.3712)	(0.3805)	(0.3687)	(0.3976)	(0.4021)
Debt to GDP ratio (lagged)	0.0005***	0.0004***	0.0005***	0.0005 ***	0.0007***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Volatility	0.0020 ***	0.0019***	0.0019***	0.0026***	0.0016***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0006)
General Gov Balance	-0.0001	-0.0001	-0.0001	-0.0001	-0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Current account (lagged)	-0.0001	-0.0001	0.0001	-0.0001	0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
WGI		-2.1465***			
		(0.2662)			
Polity IV			-0.0297		
			(0.0237)		
Economic Freedom				-0.0584**	
				(0.0149)	
ICRG					-0.0325***
					(0.0001)
Number of countries	98	98	94	93	85
Number of observations	1830	1743	1768	1707	1504

5.4.4 Interaction term results

To understand better the effect of the political explanatory variables to sovereign defaults we introduced the interaction term. The interaction terms are formed using one of the economic variables, apart from the current account balance that is always insignificant, along with one political indicator at a time. We then run all the regressions again and discuss the results below. Before we move to the presentation of the results it is worth reminding that from the tests above we find that, all the political variables had a negative effect whereas all the economic variables a positive effect on sovereign defaults.

The first term created contains the overall economic freedom index. When it interacts with the GDP volatility and the fiscal balance, is negative, but when with the debt is insignificant. This means that the political variables have a stronger effect on defaults than GDP volatility and government balance but not stronger than debt. The World Governance Indicators and the economic stability (ICRG) generate very similar results. Both their impact is stronger, when interacting with the GDP volatility, as the term has a negative sign, but not with debt and government balance where it is insignificant. Finally, the effect of the level of democracy is lower than debt, as we find the term to be positive and no effect with the rest. The same procedure as above was followed again with the addition of the overall outflow restrictions. What we find is that only the overall economic freedom index has a stronger effect compared to overall outflow and all the rest are insignificant. In Table 5.7 the combination of the columns with each row represent the interaction terms.

Table 5. 7 Logit interaction term results

Sovereign Defaults	WGI	Polity IV	Overall Economic Freedom	ICRG
Debt to GDP ratio (lagged)	0.0001 (0.0002)	0.0005** (0.0002)	-0.1239*** (0.0375)	0.0004 (0.0001)
Volatility	-0.0035** (0.0015)	-0.0005 (0.0001)	-0.0053 (0.0414)	-0.0001** (0.0006)
General Gov Balance	-0.0001 (0.0002)	0.0002 (0.0001)	-0.0299 (0.0332)	-0.0001 (0.0001)
Current account (lagged)	0.0006* (0.0003)	0.0009 (0.0001)	-0.134**** (0.0346)	-0.0001 (0.0001)
Kao Index	0.5736 (1.2449)	0.1371 (0.1054)	-0.1136* (0.0664)	0.0173 (0.0425)

5.4.5 Three-year moving average on debt

Finally, we test how the variables behave when instead of using one year debt lagged, we use its three year moving average. Table 5.8 and 5.9 depict the results of the logit regression when excluding and including the outflow restriction index respectively.

Table 5. 8 Logit Regression using a three year moving average on debt

Sovereign Defaults	(1)	(2)	(3)	(4)
3 years moving average Debt to GDP ratio	0.0679***	0.0377***	0.0660 ***	0.0356***
	(0.0099)	(0.0049)	(0.0097)	(0.0054)
Volatility	0.0022**	0.0020***	0.0027 ***	0.0018**
	(0.0010)	(0.0007)	(0.0012)	(0.0009)
General Gov Balance	-0.0002	0.0004***	-0.0002	0.0002
	(0.0002)	(0.0001)	(0.0002)	(0.0001)
Current account lagged	-0.0003	0.0001	-0.0002	0.0003
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
WGI	-1.2831**			
	(0.8374)			
Polity IV		-0.1131***		
		(0.0323)		
Economic Freedom			-0.0342	
			(0.0253)	
ICRG				-0.0906***
				(0.0142)
Number of countries	38	45	35	37
Number of observations	720	1233	685	956

What we can observe from the table above is that the results are the same as before with the debt having a positive significant impact on defaults whereas all the political variables a negative, with the only exception of the index of overall economic freedom.

Table 5. 9 Logit Regression using a three year moving average on debt including kao

Sovereign Defaults	(1)	(2)	(3)	(4)
Kao Index	0.8206	1.0767	0.2765	0.5346
	(0.9372)	(0.8019)	(0.9179)	(0.9304)
3 years moving average Debt to GDP ratio	0.0670***	0.0602***	0.0658***	0.0693***
	(0.0099)	(0.0087)	(0.0097)	(0.0109)
Volatility	0.0023**	0.0018*	0.0027***	0.0012
	(0.0010)	(0.0009)	(0.0010)	(0.0011)
General Gov Balance	-0.0002	-0.0002	-0.0002	-0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Current account lagged	-0.0003	-0.0001	-0.0002	0.0003
	(0.0002)	(0.0002)	(0.0002)	(0.0003)
WGI	-1.8285**			
	(0.8602)			
Polity IV		-0.0403		
		(0.0489)		
Economic Freedom			-0.0342	
			(0.0279)	
ICRG				-0.0342***
				(0.0128)
Number of countries	38	39	35	32
Number of observations	720	776	685	576

However, the introduction of the three year moving average on debt, instead of the lagged debt seems to weaken the impact of the capital restriction outflow index where it becomes insignificant. On the political indices side, the only change compared to before is the economic freedom which again becomes insignificant.

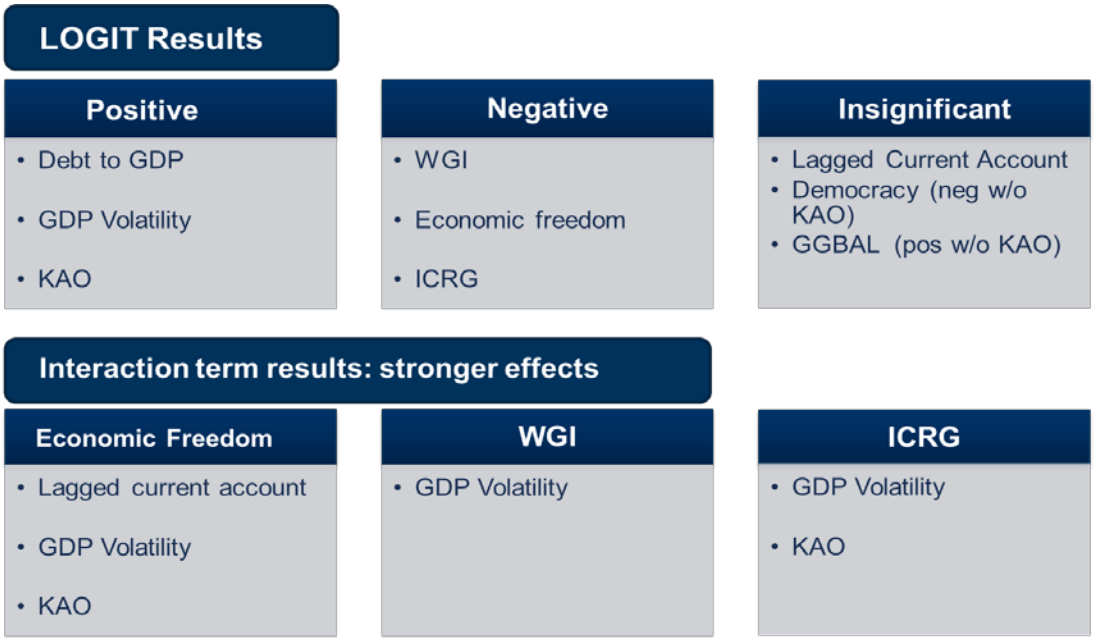
5.5 Conclusions

The purpose of our empirical investigation is to analyze the determinants of the sovereign defaults. We employ a panel of 99 countries using annual data over the period 1985 – 2015. Our analysis is based on the Bank's Credit Rating Assessment Group (CRSG) default's database constructed by the Bank of Canada.

This paper contributes to the literature not only by examining the impact of both macroeconomic and political indicators on the sovereign defaults, but emphasizing on the quality of the political institution and the capital controls.

Our results indicate that the sustainability of a government's debt is a fundamental consideration in sovereign risk analysis. Higher debt ratio might be interpreted by the market participants as a warning signal about the country's future ability to repay its debts. The default risk is also positively affected by the fiscal imbalances. We show that higher fiscal deficits are associated with increased likelihood of default. We also incorporate the real GDP growth volatility in our analysis and provide evidence that increased output volatility weakens the government ability to repay its outstanding debt obligations. As a measure of country's external solvency and its ability to generate foreign revenues, we introduced in our empirical analysis the current account balance as a percentage of GDP. The results indicate an insignificant relationship between the current account and the incidence of sovereign defaults. We can argue that the current account imbalances (deficits) do not necessarily imply higher risk, as well-managed countries run current account deficits in cases of a country's expansion.

Table 5. 10 Summary of findings



However, we believe that sound macroeconomic fundamentals are not the only factors to assess a country's creditworthiness. Therefore, four different political indicators are included to investigate the effect of political risk on sovereign defaults. We use the International Country Risk Index, the Polity IV, the average WGI and the economic freedom index. We find that these are all significant in explaining the probability of sovereign defaults. This is consistent with the results of Yu (2016) and Hatchondo et al. (2007) who also conclude that the political stability, as measured by higher level of democracy and freedom, together with consistent political regime lowers the probability of default.

Another contribution of our research is that we incorporate in our analysis a new dataset of capital control restrictions on outflows constructed by Fernandez et al. (2015). This dataset includes an extended sample of countries, years and asset categories on both capital controls on inflows and outflows. We find evidence that the capital controls outflows index is positively associated with the sovereign defaults with the macroeconomic fundaments remaining statistically significant. This is in contrast with Moody's Investor Services (2008) survey on Sovereign defaults and Interference, which finds that deposit freezes occurred outside of government defaults and therefore the relation between deposit controls with sovereign defaults is not perfect. Further work could explore in more depth the association between the capital control restrictions and the sovereign defaults.

Appendix A5

The countries use in the analysis are presented in the table below

Countries			
Algeria	Ethiopia	Malaysia	South Africa
Angola	Finland	Malta	Spain
Argentina	France	Mauritius	Sri Lanka
Australia	Georgia	Mexico	Swaziland
Austria	Germany	Moldova	Sweden
Bahrain	Ghana	Morocco	Switzerland
Bangladesh	Greece	Myanmar	Tanzania
Belgium	Guatemala	Netherlands	Thailand
Bolivia	Hong Kong SAR	New Zealand	Togo
Brazil	Hungary	Nicaragua	Tunisia
Brunei Darussalam	Iceland	Nigeria	Turkey
Bulgaria	India	Norway	Uganda
Burkina Faso	Indonesia	Oman	Ukraine
Canada	Islamic Republic of Iran	Pakistan	United Arab Emirates
Chile	Ireland	Panama	United Kingdom
China	Israel	Paraguay	United States
Colombia	Italy	Peru	Uruguay
Costa Rica	Jamaica	Philippines	Uzbekistan
Cote d'Ivoire	Japan	Poland	Venezuela
Cyprus	Kazakhstan	Portugal	Vietnam
Czech Republic	Kenya	Qatar	Zambia
Denmark	Korea	Romania	
Dominican Republic	Kuwait	Russia	
Ecuador	Kyrgyz Republic	Saudi Arabia	
Egypt	Latvia	Singapore	
El Salvador	Lebanon	Slovenia	

Appendix A6 Sovereign Defaults

Countries																																
Algeria						1990	1991	1992	1993	1994	1995	1996	1997	1998														2012			
Angola					1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Argentina	1985	1986	1987	1988	1989	1990	1991	1992	1993								2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Bangladesh	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Bolivia	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009						
Brazil	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000			2003				2007	2008	2009	2010	2011	2012	2013		
Bulgaria					1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002		2004											
Burkina Faso	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Chile	1985	1986	1987	1988	1989	1990																									
Colombia	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003												
Costa Rica	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007								
C™te d'Ivoire	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Cyprus																													2013		
Dominican Republic	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008							
Ecuador	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Egypt	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009						
El Salvador	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999																
Ethiopia	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Georgia								1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Ghana	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Greece																												2012	2013		
Guatemala	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005								2013		
Hungary																									2009						
India								1992	1993																						
Indonesia	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994				1998	1999	2000	2001	2002	2003	2004	2005										
Ireland																													2013		
Islamic Republic of Iran	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999												2011	2012	2013		
Jamaica	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Kazakhstan									1993	1994	1995			1998	1999																
Kenya	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Korea	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Kuwait						1990	1991																								
Kyrgyz Republic									1993	1994	1995	1996	1997		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Lebanon	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995																				
Mauritius				1988		1990	1991	1992	1993	1994	1995	1996															2011	2012	2013	2014	
Mexico	1985	1986	1987	1988	1989	1990																									
Moldova									1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Morocco	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008							
Myanmar	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Nicaragua	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Nigeria	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005								2013	2014	
Pakistan					1989	1990	1991	1992						1998	1999		2001														
Panama	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001														
Paraguay	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Peru	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010					
Philippines	1985	1986	1987	1988	1989	1990	1991	1992		1994				1998	1999	2000	2001	2002	2003		2005	2006	2007	2008							
Poland	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002													
Portugal																													2013		
Romania		1986											1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Russia						1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011				
Slovenia								1992	1993	1994	1995	1996																			
South Africa	1985	1986	1987		1989				1993																						
Sri Lanka				1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002			2005								2013	2014	
Swaziland		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Tanzania	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Thailand																								2008	2009	2010	2011	2012			
Togo	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Tunisia	1985	1986	1987		1989	1990	1991	1992	1993	1994	1995																		2013		
Uganda	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Ukraine								1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Uruguay	1985	1986		1988		1990	1991												2003												
Uzbekistan														1998	1999	2000	2001	2002	2003	2004	2005		2007	2008	2009	2010	2011				
Venezuela	1985	1986	1987	1988	1989	1990		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Vietnam	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005			2008		2010					
Zambia	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	

Chapter Six

Conclusions

This thesis investigates the main drivers of the sovereign risk during the euro area debt crisis, focusing on the determinants of the sovereign bonds yields and credit default swaps. The main conclusions of this thesis could be summarized as follows.

First, in Chapter 2, we attempt to explain the driving factors of the sovereign bond spreads of ten euro area countries. We find that macroeconomic variables such as the debt to GDP, real GDP growth, fiscal balance as a percentage of GDP and the unemployment rate are consistently significant in explaining the government bond yield differentials. The announcement of the Outright Monetary Transaction by the European Central Bank in August 2012 was significant effort to calm the markets and increase the liquidity and confidence in the euro area markets. Therefore, we propose the OMT variable in our model to capture the effect that had in the sovereign bond spreads.

The empirical results confirm that after its introduction the bonds spread started to fall substantially. Moving on, we re-examine the determinants of the sovereign spreads by splitting our countries into two different sub groups, the core euro area countries; Austria, Belgium, Finland, France and the Netherlands, and the periphery countries; Greece, Ireland, Italy, Portugal and Spain. We find that the OMT dummy variable has no impact on the core countries, while on the periphery is highly significant. Another interesting finding is that the effect of the debt to GDP ratio is more than twice larger in the periphery countries compared to the core countries.

Another contribution of our research is our attempt to explain the impact of several events, which took place during the crisis period on the sovereign bond spreads. The events taken under consideration are the Lehman Brother's bankruptcy and the bailout packages provided to Greece (2010 and 2012), Ireland (2010) and Portugal (2011). Our findings show that apart from the second bailout package provided to Greece, all other dummy variables are significant with positive, indicating that there are other factors not reflected in the economic fundamentals that we control for, which drove up the bond spreads. Finally, and to capture the effect of the non-macroeconomic variables, we incorporate in the analysis the World Governance Indicators. We calculate the average of all six indicators and find that together with the debt to GDP ratio, the real GDP growth, the fiscal balance and the unemployment rate are significant in causing the sovereign bond spreads.

Second, in Chapter 3, we re-examine the evolution of the sovereign risk during the euro area debt crisis but this time from a different angle and having incorporated more recent data. We investigate the factors affected the sovereign default swaps from October 2008 until December 2014. We also differentiate in our methodological approach by using cointegration techniques. We find that the debt to GDP ratio is significant in driving the CDS spreads mainly in the periphery euro area countries; Ireland, Portugal and Spain. We also incorporate in our analysis the iTraxx indicator as a proxy for Europe-wide market sentiment. We show that the iTraxx indicator remains significant in all countries apart from France.

We also use two different subgroups of countries, the core; Austria, Belgium, Germany and France and the periphery countries; Ireland, Italy, Portugal and Spain to find whether the explanatory factors have different impact on them. We show evidence that the debt to GDP ratio has a significant impact in the periphery countries while, loses its significance in the core countries. Interestingly, we notice that the real GDP growth has no impact for the periphery countries but remains significant in the core countries.

Third, in Chapter 4 we investigate the relationship between the sovereign bond yields and the sovereign credit default swaps during the euro area crisis. We perform cointegration techniques and propose the introduction in our analysis of two structural break tests, Hansen (1992) and Gregory and Hansen (1996). We find that the CDS premia precede the bond spreads in most countries, with the exception of Austria, where the bond spreads cause the CDS premia. Our findings are in line with the literature (Fontana and Scheicher (2010), Blanco et al. (2005). We also find evidence of cointegration even if we allow for a structural break in our analysis. In summary, our results indicate that the CDS premia and sovereign bond spreads are related to a certain relationship and that during the euro area crisis, price discovery took place in the CDS market.

Fourth, in Chapter 5, we provide a more focused analysis of the sovereign risk by looking for actual sovereign default cases from a broad dataset constructed by the Bank of Canada. This time we expand our sample of countries by incorporating default cases from all over the world. The main contribution of our analysis is that we consider different political indicators to capture the impact they have on sovereign defaults. The model we propose incorporates four different sets of political risk indicators, the International Country Risk Index, the Polity IV, the World

Governance Indicators and the Economic Freedom Indicator. We find that all indicators together with a set of macroeconomic indicators are significant in explain the sovereign defaults, consistent with the results of Yu (2016) and Hatchondo et al. (2007). Another contribution of our research is that we also incorporate a new dataset of capital outflows restrictions constructed by Fernandez et al. (2015). We find evidence that the capital controls outflows index is positively associated with the sovereign defaults with the macroeconomic fundaments remaining statistically significant.

This thesis in an attempt to provide a better understanding of the factors driving the sovereign risk as expressed by the sovereign bond yields and sovereign credit default swaps during the euro area debt crisis. We find that the deterioration of the macroeconomic fundamentals led to a sharp rise in the yields and CDS initially, but is not enough to explain the fluctuations during the crisis period.

This thesis has several limitations. First, in Chapter 2, the use of additional political and social indicators could provide more accurate results on the impact they might have in explaining the sovereign risk. The constantly rising bond spreads and CDSs during the crisis period indicate that other factors, which are not captured by the macroeconomic fundamentals used in the analysis, were driving them upwards. In our analysis we seek to estimate the impact of the World Governance Indicators as an average. However, as these six indicators are correlated to each other it would be more appropriate to perform a principal component analysis.

Another interesting point would be to investigate the impact of the fiscal policy measures announced by the European countries affected by the crisis and not only the impact of the bailout packages as we did in our analysis. In Chapter 3, the inclusion in our model of a non-macroeconomic and financial indicator could generate interesting conclusions, however the limitation that exists in this case is a political indicator with high frequency data (monthly). Future work might examine the impact of political risk on the sovereign risk as measured by the sovereign CDS. In Chapter 4, we are focusing on the relationship between the sovereign bond spreads and CDSs during the crisis and for limited number of euro area crisis. Although the author believes that it covers this topic in a satisfactory and complete way, using advanced quantitative techniques, it also has several limitations.

One of the main limitations is the number of countries used. Future work is needed to explore and further develop the findings on the relationship between these two measures of sovereign risk by including more countries in the analysis and in a longer period. Moving on, in Chapter 5, our findings confirm the strong relationship between the sovereign risk and macroeconomic fundamentals such as the debt to GDP ratio and the real GDP growth.

However, it fails to explain the relationship between the sovereign defaults and the external imbalances as measured by the current account balance as a percentage of GDP. Therefore, the introduction of other indicators such as the trade balance, the net international investment position or the share of global trade could be used in future research. Another interesting finding of our research that needs to be further investigated is the relationship between the capital outflows restrictions and the sovereign defaults. It may be useful to explore it by looking at it in a case-by-case basis, and find whether or not sovereign defaults were accompanying by restriction in capital outflows. To achieve a more comprehensive analysis, it would be also interesting to look at each case of sovereign defaults individually and investigate different country specifics or other qualitative factors that led to the default. Sovereign risk is complex and difficult to be measured, however the author hopes that this thesis covers a broad research area and sheds some light to this topic.

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