THE LINK BETWEEN SOVEREIGN CDS AND STOCK INDEXES IN THE LIGHT OF GREEK DEBT CRISIS

Master Thesis in Finance

Student name: Giedre Lenciauskaitė

Student number: u1246601

Date: 9th October, 2012

Faculty: TiSEM

Department: Finance

Supervisor: Prof. J.J.A.G. Driessen

EXECUTIVE SUMMARY

In this study the link between weekly sovereign CDS spread changes and stock indexes' returns for 10 European Union countries (Germany, France, Austria, Netherlands, Belgium, Portugal, Ireland, Italy, Greece, Spain) during the period of January 2007 – June 2012 is analyzed. The contemporaneous co-movement was measured by Spearman correlation coefficients, while the lead-lag relationship was identified by a Vector Autoregressive model and Granger causality test. The analysis confirms the leading role of stock market over sovereign CDS market in general, which is in line with similar previously performed studies. It also reveals that during tranquil pre-crisis period (January 2007-August 2008) the sovereign CDS market led stock market, the relationship became mixed during financial crisis (September 2008-December 2009) whereas the leading role of stock market was observed during the recent European debt crisis. Moreover, the relationship is different for countries with higher perceived credit risk (PIIGS: Portugal, Ireland, Italy, Greece, Spain) and strong economy countries (Germany, France, Austria, Netherlands, Belgium). While during the pre-crisis period the sovereign CDS market took a lead over stock market for both type of countries, it remained mixed for strong economy countries during the upcoming financial crisis and European debt crisis, while sovereign CDS market kept leading during financial crisis and the relationship reversed the other way around during the recent European debt crisis. What is more, the relationship is also different for different sectors. In general, no clear relationship was observed between sovereign CDS market and both financials and consumer staples market, while in case of non-financials and industrials the stock market took a lead more often than the other way around.

TABLE OF CONTENTS

I. INTRODUCTION

Recent financial and European debt crises changed the perception of common linkages within financial system and credit riskiness of the European countries. Started by Lehman Brother collapse in September 2008, the wave of shocks increased and involved many countries in Europe, especially those with a high level of sovereign debts. After this, “the world is no longer what we thought” (Oldani (2011)).

Several unusual effects were observed. First of all, sovereign CDS spreads reached unprecedented heights, signaling about the increase in the perception of the governments’ credit riskiness. Secondly, reasoned suspicions about the “bankruptcy” of one of the European Union and European Monetary Union member – Greece – started to arise. Thirdly, the spillover effects were observed to emerge from Greece to other European Union member countries, especially to the ones that were in high indebtedness.

In the light of these changes, it is important for financial economists, traders and regulators to understand which market tends to incorporate credit risk related information more quickly and takes a lead over the other one. To achieve this, the study seeks to find what is the relationship between sovereign CDS market, which measures the default risk of the government, and stock market, which is a litmus paper of the economic health of the country. The insight of this lead-lag relationship may give “an early warning of large shocks in asset prices”. Additionally, an awareness of the transmission mechanism of credit risk information across markets and over time helps to understand the relative efficiency of the markets and how their functioning may change with changing market conditions (Avino et al. (2011)).

The first question to be answered is which market tends to lead the other, that is, whether the change in sovereign CDS market affects the change in the stock market or vice versa? Both of these markets signal about the economic health of the country, however they are also very different in terms of market organization, participants and liquidity, and it may affect the speed of incorporating new information. Majority of studies performed found a leading role of the stock market over CDS market more often than the other way around (Bystrom (2005), Forte and Pena (2009), Coronado et al. (2011)). By applying a Vector Autoregressive model I analyze the relationship between 10 European Union member countries and their stock indexes and I also found that country’s stock market took a lead over sovereign CDS market more often than in an opposite direction.

The second question flows from the first one: how does the relationship between sovereign CDS and stock market change over time? Because of the recent significant changes in financial systems and countries' economies in general, the relationship is expected not to be constant over time but instead exhibit diversity (Corzo et al. (2011), Coronado et al. (2012)). During turbulent times, the expectations of market participants may change, which could result in "private-to-public" (Dieckmann and Plank (2011)) or "public-to-private" (Corzo et al. (2012)) risk transfer. As explained in Corzo et al. (2011), "public-to-private" risk transfer appears when increasing government's revenue part towards external debt deteriorates future growth of the economy, which in turn leads to declining profits and expected payoffs of the companies. However, the opposite relationship is also possible: worsening situation in the country's companies is supposed to affect the credit quality of the government ("private-to-public" risk transfer). I analyzed three non-overlapping sub-periods to answer this question: pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and the recent European debt crisis (January 2010-June 2012) periods. As all these periods possess certain characteristics and effects, it is expected that the relationship between sovereign CDS and stock market will vary throughout them. Indeed, the findings reveal the changing patterns. In the tranquil pre-crisis period, sovereign CDS market exhibited a leading role over stock market for most of the sample countries. However, when disturbances in the markets appeared during financial crisis period, the relationship became mixed and not unidirectional: in some countries sovereign CDS market continued to lead the stock market while in others the relationship changed into an opposite direction. During the recent European debt crisis the relationship stabilized for most of the sample countries where the stock market was observed to lead sovereign CDS market.

However, this relationship should be expected to change not only during different periods but also across different countries. Indeed, the sample countries could be categorized into two groups: strong economy countries (Germany, France, Austria, Netherlands, Belgium) that are less vulnerable to internal and external shocks, and PIIGS, an abbreviation used to describe Portugal, Ireland, Italy, Greece and Spain – countries that are considered to be less stable and more vulnerable to unusual circumstances. The results reveal that in general the stock market tend to lead CDS market to both types of countries. However, during financial crisis in most strong economy countries the relationship was mixed, while in PIIGS sovereign CDS market led the stock market. In the light of recent European debt crisis, in strong economy countries the relationship remained mixed, but in PIIGS stock market took a lead over CDS market for most of the countries.

Additionally, the relationship between sovereign CDS and different sectors stock markets, namely, financials, non-financials, consumer staples and industrials, is analyzed. This section contributes to the current state of the literature which does not include different sectors in their analysis. As different sectors react differently to changes in the economy, their relationship with sovereign CDS are also expected to exhibit diversity. The important difference between financial and non-financial sectors arises due to their different level of impact to the country's economy. During recent crises, extraordinary measures were taken by central banks and governments in order to prevent a potential collapse of the financial sector that threatened the entire economy (Alter and Schüler (2011)). Crisis in financial system can induce a contraction of the entire economy, which in turn weakens public finances and transfers the distress to the government. The negative effect is amplified when state guarantees exist for the financial sector. In contrast, disturbances in non-financial sector are supposed to have less effect on the country's economy due to their more isolated nature. In this study, two particular non-financial industries are examined: industrials and consumer staples. They both are considered to be less cyclical during the business cycle, however industrials stocks are the most attractive during expansion, while consumer staples – during the economy contraction (Figure 2). The results obtained indicate the different relationship between sovereign CDS and different sector stock indexes. During the whole period, the relationship between sovereign CDS and financials and consumer staples was mixed, whereas for non-financials and industrials stock market took a clear lead. In the pre-crisis period, CDS market led all four sectors' stock markets, whereas during financial crisis this relationship remained only for financials. For non-financials this relationship was mixed, however for consumer staples and industrials stock market took a lead over sovereign CDS market. In the light of European debt crisis, the relationship was mixed for all sectors, where the leading market varied over the countries, except for industrials, where stock market clearly led sovereign CDS market.

These findings are supposed to be useful for various market participants. First of all, the results should be of particular importance to policymakers, who are concerned about the stability of the whole financial system. The analysis of lead-lag relationship would help them to understand better how sovereign CDS and stock markets are linked during both tranquil and crisis periods as it is important to provide timely responses to systematic crises. Also, it would help regulators and policymakers to formulate effective policies and to be aware of the risk transferred from the stock market, either country's stock market or specific sector, to governments (Alter and Schüler (2011)). Additionally, speculators, hedgers and arbitrageurs should also exhibit an interest in understanding these lead-lag relationships between the two markets as it would help them to receive the earliest possible signals about the credit risk reversals.

II. THE IMPORTANCE OF SOVEREIGN CDS AND STOCK MARKETS TO THE COUNTRY'S ECONOMY

Recently the sovereign CDS market has attracted a considerable attention and there has been an unprecedented re-pricing of credit risk in the credit market. The collapse of Lehman Brothers in September 2008 resulted in enormous losses for many financial institutions that in turn damaged investors' confidence and determined the decline in the availability of credit. The public sector deficits increased and sovereign debt reached the high levels as a result of massive support for the banks and other stimuli.

Not long time after the financial crisis shook the world, it transformed into "the novel version of ancient tragedy" (Apergis et al. (2011)). The Greek economy, being one of the fastest growing in the Euro-zone over the last decade, showed the first signs of the tragedy in the second half of 2007 when the sub-prime crisis shook the financial markets - the event which was the first trigger of the current Greek sovereign debt crisis. After the 2008 financial crisis the Greek economy took a turn for the worse since "its two primary growth engines, namely tourism and shipping, were suffering from declining returns" (Atrissi and Mezher (2010)), and it burst in December 2009, leading the spreads of credit default swaps to unprecedented levels. Moreover, in early 2010 it appeared that Greece has paid much for investment banks, including Goldman Sachs, in fees since 2001 in order to hide the actual borrowing level of the country by arranging fake transactions. The Greek government was spending far beyond their limits – the action that made Greece particularly vulnerable to both external and internal shocks. As William Cobbett wrote in his letter in 1804:

"Nothing is so well calculated to produce a death-like torpor in the country as an extended system of taxation and a great national debt."

What is more, in early 2010 it appeared that the tragedy originating in Greece will spread out to other Member States of the Euro-area, such as Portugal, Ireland, Italy and Spain that all together were given a common name as PIIGS. In short, the Greek problem has become an EMU-wide problem (Arghyrou and Kontonikas (2011)).

Credit default swaps and their principles

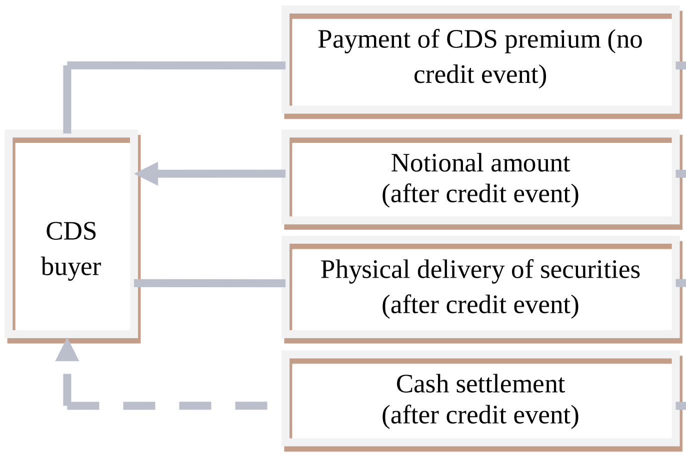
One of the first credit default swaps (CDS) provided protection on Exxon by the European Bank for Reconstruction and Development to JP Morgan (Stulz (2010)). Since then, the CDS market has grown enormously: in 1998 the total size of the market was $180 billion and by the December 2011 it reached $28 trillion[1] (notional amounts outstanding).

Credit default swap (CDS) is a bilateral contract in which the protection buyer pays the CDS premium to the protection seller and in return gets the right to deliver the defaulted debt obligation to the seller. Sellers can be banks, insurance companies and financial and non-financial institutions. The CDS premium, also known as CDS spread, is quoted in basis point of the notional value of the contract. A CDS is essentially an insurance contract providing protection against losses arising from a credit event. International Swaps and Derivatives Association (ISDA) specify six possibilities that may constitute credit events in CDS contracts:

- Failure to pay (subject to a materiality threshold and a grace period).
- Bankruptcy (reference entity becoming insolvent or unable to meet its debts; not applicable for the cases when the reference entity is the government).
- Repudiation/Moratorium (the borrower declaring a moratorium on servicing the debt or repudiating the debt).
- Obligation acceleration (the obligation becoming due on account of non-financial default).
- Obligation default (the obligation becoming capable of being due and immediately payable).
- Restructuring (reduction or postponement of interest or principle payable, a change in the priority of the reference obligation or in currency of payment; it is "soft" credit event).

The scheme showing how the CDS operate is presented in the Figure 1:

Figure 1: The CDS working scheme



(source: AIMA Research Note (2011))

The reference entity could be either the corporate or the government, thus generally CDS contracts can be categorized into two groups accordingly: the corporate CDS and the sovereign CDS. A

[1] http://www.bis.org/statistics/otcder

difference between corporate CDS and sovereign CDS is that with a latter the country's credit risk will be transferred between CDS buyers and sellers. Moreover, unlike a corporate CDS, bankruptcy as credit event is not applicable in the case of sovereign CDS, given that there is no operable international bankruptcy court that applies to sovereign issuers.

The use of CDS in the sovereign market is a useful risk management tool and provides benefits for markets participants (AIMA Research Note (2011)). Among other benefits, Fontana and Scheicher (2010) identifies:

- Hedging against country risk as an insurance type offsetting instrument.
- Relative-value trading (i.e. having a short position in one country and long one in another).
- Arbitrage trading (i.e. buy/sell government bonds versus sell/buy sovereign CDS).

Liu and Morley (2012) explain that the importance of sovereign CDS markets increased during the financial crisis in 2008 and the Greek debt crisis that appeared afterwards. During these turbulent times, many countries have been under pressure to raise funds in order to finance fast growing fiscal deficits. As a result, investors started to attempt to insure against losses on holding sovereign debt thus increasing the significance of sovereign CDS markets.

The link between sovereign CDS market and the economy

Sovereign CDS are used to hedge sovereign credit risk, which can be defined as a risk of a government becoming unable or unwilling to honor its debt obligations. As CDS spread levels are an indication of the default risk zone and how much the investors are willing to pay to get insured against this risk (Atrissi and Mezher (2010)), an increase in sovereign CDS spreads indicates an increase in the perceived riskiness of the government of the country. As the government becomes riskier, borrowing costs increase, which in turn negatively affects the amount of money spent for investment and development of the country. This is a negative indicator for companies and for the future of the economy, which makes the sovereign CDS an important indicator of an economic health of a given country. The main fundamentals determining the credit quality of the sovereign issuer are:

- Government deficit, which occurs when the government's expenditures exceed the revenue it generates. It is relatively simple measure of credit quality and can be tracked on a regular basis thus market participants tend to follow this information very closely.
- Government debt is an indicator of the probability of default and is the relative size of the general government debt in relation to domestic economic output, that is, the debt-to-GDP

ratio. As higher ratio implies a higher probability of encountering difficulties with servicing the debt and also contributes to the so-called “snowball” effect[2], which signals about the risk of a country experiencing an ever-increasing debt burden due to high interest rate payment and/or low GDP growth rates.

- Current account deficit, which appears when country’s total imports of goods, services and transfers are greater than the country’s total export of goods, services and transfers. Countries having high current account deficits are considered to be particularly vulnerable to reversals in international funding. This results in the pressure of economic activities and also budgetary performance.

One of the attempt to find whether economy of the country determines the spreads of sovereign CDS or vice versa was performed by Liu and Morley (2012) who aim to find out whether the domestic economy as represented by the interest rate, the international economic status as represented by the exchange rate or both determine sovereign CDS spreads. The analysis reveals that international economic status has the most important effect on sovereign CDS spreads, while the domestic economy has only limited effect. Their findings suggest that for countries that are concerned with the cost of insuring their debt managing the exchange rate should be as much important as managing the domestic economy.

The link between stock market and the economy

In general, it might be expected that countries doing well in terms of GDP performance tend to experience gains in domestic stock exchange. Duca (2007) explains four theoretical arguments as to how stocks and economic output may be related.

First one is based on the standard discounted cash flows model, according to which the stock price is the discounted present value of the firm’s payout. Thus, if investors’ expectations about firm’s future payouts are correct on average, the stock prices are supposed to lead real economic activity.

The second argument is suggested by Tobin (1969) and the coefficient known as Tobin’s Q, which is the ratio of the market value of current capital to the cost of replacement capital. In times when share prices are high, Tobin’s Q coefficient is also high, that is, the value of the firm relative to the replacement cost of its stock of capital is also high. As a result, firms find it easier to finance investment expenditure and this in turn leads to increased investment expenditure and thus to higher

---

[2] Snowball effect $=\frac{D_{t-1}}{Y_{t-1}} \times \frac{i_t - y_t}{1+y_t}$, where D is the stock of government debt, Y is the level of GDP and i is the average interest payment on debt and y is the nominal GDP growth rate.

aggregate economic output. As Duca (2007) explains, this occurs because “investments would be easier as it would require a lower share offering in a situation of a high share price”.

The third argument as to how stock market performance is related with economy was suggested by Modigliani (1971). His proposition is based on the impact the wealth variable has on consumption. In more detailed, when the security prices exhibit permanent increase, it results in an increase in the individual’s wealth holding and in higher permanent income. Based on this permanent income hypothesis, Modigliani postulated “that intertemporally, consumers smoothen consumption in order to maximize their utility” (Duca (2007)). Thus, when income permanently increases, it enables consumers to re-adjust upwards their consumption levels in each period.

The last argument is referred to as the financial accelerator and it focuses on the impact that stock prices have on firm’s balance sheets. Because of asymmetric information in credit markets, the amount the company can borrow substantially depends on the collateral they can pledge. As the value of the collateral increases when the stock price value of the company increases this in turn leads to higher credit that can be raised. As credits can be used for investment purposes, this triggers an expansion in economic activity.

These arguments were confirmed as the unidirectional causality from the stock market to the economy was identified in the study performed by Duca (2007). Thus it implies that the level of economic activity in a country can potentially depend on the stock market amongst other variables. Andersson et al. (2011) also prove the predictive power of stock market, however not all sectors exhibit the same level of predictability. They found a strong predictive performance of financial sector and explain it by a pro-cyclical nature of financial system. Moreover, Henry et al. (2003) found evidence that stock returns are most useful in predicting growth when the economy is in the recession. However, despite some evidence of the predictive content of stock market data for country’s GDP, in general the mixed evidence are found in the literature for the information content of the total stock market.

To sum up, as explained in Forte and Pena (2009), “because credit risk affects all these assets – bonds, CDS and shares – information about this risk eventually shows in their prices. However, and due to structural differences between markets (organization, liquidity, participants), this information may be incorporated into the price of some of these assets more quickly than others”. The aim of this thesis is indeed to identify which market – sovereign CDS or stock market – tend to lead the other during different periods of time and across different countries.

The thesis is structured as follows. The next section reviews the current literature that analyzes the link between CDS, bond and stock markets, both at individual-firm and sovereign levels. It also includes the hypothesis I will aim to test. The fourth section provides an explanatory look at the data, including descriptive statistics. The fifth section presents empirical results, that is, correlations between different markets and countries, and the ones obtained from a Vector Autoregressive model and Granger causality test. The last section summarizes the main findings and presents conclusions.

III. LITERATURE REVIEW AND HYPOTHESIS

There is a wide variety of studies that aims to explain the link between stock, bond and CDS markets. Whereas the very early studies focused solely on the relationship between stock and bond markets, later ones incorporated the CDS market as an additional element at the individual firm level. However, in the light of European sovereign debt crisis, a number of studies were published that seeks to explain the link between CDS, bond and stock markets at the country-level.

At the individual-firm level the link between CDS spreads and bonds spreads was extensively analyzed by Norden and Weber (2004), Blanco et al. (2005), Zhu (2004), Forte and Pena (2009), among others. A number of researches conducted confirm the leading role of the CDS market with respect to the bond market.

In their analysis, Blanco et al. (2005) used a sample of 33 North American and European firms and applied a Vector Error Correction Model (VECM) to explain changes in bond and CDS spreads. They concluded that the CDS market leads the bond market. The results obtained are in line with Forte and Pena (2009) where the international sample of 17 non-financial firms was analyzed by implementing VECM. Blanco et al. (2005) state that reasons for this relationship to hold include (micro)structural factors that make the CDS market the most convenient location for the trading of credit risk and because there are different participants in the cash and derivative market who trade for different reasons. In a similar vein, Norden and Weber (2004) studied weekly and daily data from an international sample of 58 firms using a Vector Autoregressive model (VAR). Additionally, they performed a price discovery analysis using a VECM in line with Blanco et al. (2005) and Zhu (2004). Their findings support the leading role of the CDS market with respect to the bond market. As they explain, the CDS market is more flexible and less-capital intense because only premia but no bond prices have to be paid, CDS traders can easily go long and short in credit risk while shortening bonds is more difficult and that the CDS market is more standardized and less dependent on primary bond market issuances. In a research conducted by Zhu (2004) an international sample of 24 issuers was analyzed. By implementing Granger causality test, he concludes that the CDS market and the bond market appear to be equally important in the incorporation of new information about the credit risk of companies; however, the leading role of the CDS market is evidenced when VECM is used. Additionally, he identifies that one of the reasons that hold this relationship is liquidity, which means that higher liquidity in the CDS market is associated with a more active role of the derivatives market in price discovery. However, in contrast to arguments presented in Norden and Weber (2004), Zhu (2004) states that the short-sale restriction in the cash market only have a very small impact.

Conducting a research at an international level allows Norden and Weber (2004) to find that the contribution to price discovery of the CDS market relative to the bond market is substantially stronger for U.S. than for non-U.S. reference entities. This finding is also proved by Zhu (2004), where he finds that the derivatives market in the U.S. turns out to have been more active in reflecting changes in the credit market, whereas in Europe and Asia bond market seems to still lead the derivatives market in price discovery.

The link between CDS spreads and bond spread at the country-level was analyzed by Fontana and Scheicher (2010), Coudert and Gex (2010), Arce et al. (2011), among others.

Fontana and Scheicher (2010) performed an extensive analysis of euro area sovereign CDS and their relation with government bonds. The sample comprises weekly CDS and bond spreads of 10 euro area countries from January 2006 to June 2010. Firstly, they found that the recent repricing of the cost of sovereign debt is strongly linked to common factors some of which proxy for changes in investor risk appetite. Secondly, they applied Granger causality test and VECM on a daily data for two periods: "Before the crisis" and "Since September 2008". For the first period they found no lead-lag relationship between the markets and explain this that the parity between CDS and bond spreads approximately holds in the sense that the size of the basis (i.e. the CDS spread minus the credit spread on a fixed-rate bond of similar maturity) is similar. Also, before the crisis, limited trading activity in the sovereign CDS market affected price discovery and the linkages between the bond and the derivative market. However since September 2008, market integration for bonds and CDS varies across countries: in half of the sample countries (Italy, Ireland, Spain, Greece and Portugal), price discovery takes place in the CDS market and in the other half (Germany, France, the Netherlands, Austria and Belgium), price discovery is observed in the bond market. They conclude that the price discovery occurs in the market where informed investors trade the most.

Coudert and Gex (2010) in their research included CDS spreads and bond spreads of both corporate and sovereign entities. The sample includes 18 governments and 17 financials. For each entity they compared daily CDS spread on a generic 5-year bond spread (i.e. the difference between the bond yield and a risk-free rate). The results for corporates are in a line with findings of Blanco et al. (2005), Forte and Pena (2009), Zhu (2004) and Norden and Weber (2004) and are due to the greater liquidity of the CDS market: the CDS market has a lead over the bond market. Moreover, the CDS market's lead has been fuelled by the current crisis. Results for sovereigns are more challenging as the size of the CDS market is still relatively small compared with the debt market. Here the lead of the CDS market only holds for high-yield countries; however the government bond market still leads the CDS spreads in low-yield countries.

Arce et al. (2011) analyze the extent to which prices in the CDS and bond markets reflect the same information on credit risk in the context of the European Monetary Union. The data consists of daily 5-year sovereign bond yields and CDS spreads for 11 EMU countries for January 2004 to October 2011. Their evidence suggests that the price –discovery process is state dependent. That is, the levels of counterparty and global risk, funding cost, market liquidity, volume of debt purchased by the European Central Bank, and the bank's willingness to accept losses on their holdings of Greek bonds are found to be significant factors in determining which market leads price discovery. For example, the levels of counterparty and global risk and the successive agreements of private banks to accept losses on their holdings of Greek bonds impair the ability of the CDS market to lead the price-discovery process, while the level of funding costs and the volume of sovereign debt purchased by the ECB worsens the efficiency of the bond market in the price discovery process.

Studies that combine all three markets, namely CDS, bond and stock markets, indicate that stocks lead CDS and bonds more frequently than the other way around.

One of the first attempts to incorporate the stock market at the individual-firm level in the analysis was in Longstaff et al. (2003) who applied a VAR model to investigate the lead-lag relationship between changes in single-name CDS spreads, changes in bond spreads and stock returns. Their sample consists of 67 North American companies and it was concluded that information flows first into the CDS and the stock markets, and then into bond market. They also found that of these three variables, changes in the constant-coupon bond are by far the most forecastable, however in their sample there is no clear lead of the stock market with respect to the CDS market.

An important research was conducted in Bystrom (2005), which differs from others as it provides early evidence of a link between the iTraxx CDS index market and the stock market including volatilities in the iTraxx market. The sample includes 7 sectoral iTraxx CDS Europe indexes and corresponding sectoral stock indexes. As Bystrom (2005) explains, with private information informed traders could systematically prefer to trade in either the stock or the CDS market. Thus, a lead-lag relationship between the stock and CDS markets is observed if the private information is not simultaneously embedded into those two markets. Correlation analysis revealed that iTraxx CDS spreads narrow when stock prices rise and vice versa (in consistency with Merton (1974)). Furthermore, it was evidenced that firm-specific information is embedded into stock prices before it is embedded into CDS spreads. Moreover, this research revealed the significant positive autocorrelation in the iTraxx market, which is an interesting finding as it indicates an inefficient European CDS index market where predictable index changes could mean large profit possibilities for large investors. Results in this study partly confront the ones presented in Longstaff et al.

(2003), where no clear lead-lag relationship between the stock and the CDS market. Bystrom (2005) explains this difference as possible consequence of the U.S. CDS market being more efficient than the European and Asian CDS markets.

Another attempt to analyze the link between stock (S&P 500) and CDS markets by using CDS indexes was made by Fung et al. (2008). By using indexes instead of individual stock and CDS they are able to smooth the disturbances in information flow attributable to firm-specific risk. This is of particular importance since the evidence of the presence of insider trading in the CDS market is documented by Acharya and Johnson (2007). However, different from Bystrom (2005), the sample includes only U.S. data and analysis is performed on investment-grade and high-yields entities separately that leads to more specific conclusions. To avoid the mismatch of credit quality of the index components between the S&P 500 and CDX indexes, especially the high-yield CDX index, two sets of comparable stock index returns were created. Their initial hypothesis states that since the price of a CDS is solely determined by credit/default risk, and given that this market is comprised of a large number of sophisticated participants, information about the CDS should play a leading role in detecting default risk or changes in credit risk. Moreover, they expected changes in CDS spreads to occur before the stock market reacts. After implementing Granger causality test and VAR model, Fung et al. (2008) find that the lead-lag relationship between stock market and CDS market depends on the credit quality of the underlying reference entity. More specifically, significant mutual feedback of information between the stock market and the high-yield CDS market in terms of pricing and volatility was found, while the stock market leads the investment-grade CDS index in the pricing process. Results imply that the reference entities of the high-yield CDS index and their securities are subject to greater scrutiny and, as a result, the information flow between the CDS and stock markets should tend to be stronger for the high-risk groups. Moreover, the CDS market plays a more significant role in volatility spillover than the stock market. They conclude with the suggestion that market participants should seek information in both markets when they are about to engage in trading and/or hedging.

Forte and Pena (2009) contributes to the literature on market efficiency by analyzing, through a VECM, the relationship between changes in bond spreads, changes in CDS spreads and changes in stock market implied credit spreads. The last element makes the research distinct from the other studies analyzing the link between these three markets. Forte and Pena (2009) argues that using implied credit spreads may prove more appropriate results than using stock returns due to the fact that implied credit spreads incorporate information on other relevant variables simultaneously capturing the nonlinear relation between these variables and the credit risk premia as well allow consideration of the long run equilibrium relationships between bond, CDS and stock market spreads. The study concludes that stocks lead CDS and bonds more frequently than the other way round.

Whereas the link between CDS spreads and stock returns at the individual-firm level is vastly documented, the relationship between the markets of sovereign CDS, sovereign bonds and stocks had been overlooked until very recently, probably because of the limited liquidity of some markets for sovereign CDS, as claimed in Corzo et al. (2012). One of the first attempts to include entities into the analysis was triggered by European Sovereign Debt crisis and was performed by Coronado et al. (2011), which was extended by Corzo et al. (2012) recently. Coronado et al. (2011) examine the link between sovereign CDS and stock indexes during the period 2007-2010, for 8 European countries, which are divided into two groups: with worse and better CDS premiums. To examine the lead-lag relationship VAR model and a Panel data model for daily data were used. In line with the literature on corporate entities, they found that the stock market had a leading role over CDS market, however this relationship was reversed in year 2010 implying that the general market conditions underlying the credit information flow between the stock and CDS markets are important (in line with Fung et al. (2008)). Additionally, the increasing role of the sovereign CDS is found to be stronger for countries with high risk spread (as documented in Fontana and Scheicher (2010)). Corzo et al. (2012)[3] used a very similar pattern as taken by Coronado et al. (2011) however improved it by increased sample (13 countries), more recent data (2008-2011) and included bond spreads in the sample. Their main findings support the relationship presented in Coronado et al. (2011), additionally they found that the stock market regains its leading role in 2011. These relationships they tend to explain as private-to-to public (as identified in Ejsing and Lemke (2010) and Dieckmann and Plank (2010)) risk transfer during the Lehman period and a reversal to a public-to-private risk transfer during the sovereign debt crisis. The situation was not constant during the sample period: in 2008-2009 the bond market did not play an important role, however in 2011 the movement in three markets became more synchronized than in previous years and in many cases the information appears to be embedded into prices at the same time.

The summary of literature review is presented in the Table 1 below.

[3] The aim and methods applied in Corzo et al. (2012) closely correspond to this Master Thesis, however as it was published on March 2012, this Thesis is independent of Corzo et al. (2012) and their research will be used only as a point of reference.

Table 1: The summary of literature review

Paper	Aim of paper	Methodology	Data	Results
Norden and Weber (2004) "The comovement of credit default swap, bond and stock markets: an empirical analysis"	To examine weekly and daily lead-lag relationship	VAR	Weekly and daily data on CDS, stock and corporate bond markets from an international sample of 58 firms over the period 2000-2002.	Stock returns lead CDS and bond spread changes. CDS spread changes Granger cause bond spread changes for a higher number of firms than vice versa. CDS market plays a more important role for price discovery than the corporate bond market.
Blanco et al. (2005) "An Empirical Analysis of the Dynamic Relationship Between Investment Grade Bonds and Credit Default Swaps"	To explain changes in bond and CDS spreads.	VECM	Daily data on CDS, bond yields and risk-free rate markets from a sample of 33 North American and European firms over the period 2001-2002.	CDS lead the bond market.
Zhu (2004) "An empirical comparison of credit spreads between the bond market and the credit default swap market"	To compare the pricing of credit risk in the bond market and CDS market.	Granger causality test, VECM	Daily data on CDS and bond markets from a sample of 24 international issuers over the period 1999-2002.	Bond spreads and CDS spreads move together in the long run. In the short run this relationship does not always hold: the CDS market often moves ahead of the bond market in price adjustment, particularly for US entities, due to different responses to changes in credit conditions.
Pena and Forte (2009) "Credit spreads: An empirical analysis on the informational content of stocks, bonds and CDS"	To investigate the credit risk discovery process in bond, CDS and stock markets.	VECM	Daily data on stock market implied credit spreads, CDS spreads and bond spreads of international sample of 17 non-financial firms over the period 2001-2003.	Stocks lead CDS and bonds more frequently than the other way round. It confirms the leading role of CDS with respect to bonds.
Fontana and Scheicher (2010) "An analysis of Euro Area Sovereign CDS and their Relation with Government Bonds"	To study the relative pricing of euro area sovereign CDS and underlying government bonds.	Granger causality test, VECM	Weekly CDS and bond spreads of 10 euro area countries during the period of 2006-2010.	Before September 2008, no lead-lag relation is detected. Since September 2008 in half of the sample countries price discovery process takes place in the CDS market and in the other half price discovery is observed in the bond market.
Coudert and Gex (2010) "Credit Default Swaps and Bond Markets: which leads the other?"	To determine whether CDS or bond market is the leader in the price discovery process.	Regression analysis on lagged spreads and basis	Daily CDS and bond spreads of 18 governments and 17 financials over the period 2006-2010 (financials) and 2007-2010 (sovereigns)	The CDS market has a lead over the bond market for corporates. CDS market's lead has been fuelled by the current crisis. The same applies to sovereigns, although not for low-yield countries.
Arce et al. (2011) "Credit-Risk Valuation in the Sovereign CDS and Bond Markets: Evidence from the Euro Area Crisis"	To analyze the extent to which prices in the sovereign CDS and bond markets reflect the same information on credit risk in the context of the	Fixed-effects regression, VECM, Logit regression	Daily CDS and bond spreads of 11 EMU countries for the period 2004-2011.	Evidence in favour of a persistent positive basis for the crisis period in a number of countries after the subprime crisis. Price-discovery process is state dependent.

	EMU.			
Longstaff et al. (2003) "The Credit Default Swap Market: Is Credit Protection Priced Correctly?"	To examine whether credit protection is priced consistently in the corporate bond and credit-derivatives market.	VAR	Weekly CDS and bond spreads of 67 North American companies over the period 2001-2002.	Implied cost of credit protection is significantly higher in the corporate bond market. Credit derivatives and equity markets tend to lead the corporate bond market. However, there is no clear lead of the stock market with respect to the CDS market.
Bystrom (2005) "Credit Default Swaps and Equity Prices: the iTraxx CDS Index Market"	To analyze the link between the iTraxx CDS index market and the stock market.	Rank correlation s; OLS regressions	Daily data of 7 sectoral iTraxx CDS Europe indexes over the period 2004-2005.	iTraxx CDS indexes narrow when stock prices rise and vice versa. There is some evidence of firm-specific information being embedded into stock prices before it is embedded into CDS spreads.
Fung et al. (2008) „Are the U.S. Stock Market and Credit Default Swap Market Related? Evidence from the CDX Indexes"	To examine the market-wide relations between the U.S. stock market and the CDS market	VAR, Granger causality test	Daily stock (S&P500) and CDS index (The Investment Grade CDX index and the High Yield CDX index) over the period 2001-2007.	The lead-lag relationship between the U.S. stock market and the CDS market depends on the credit quality of the underlying reference entity. The high yield CDS market is more closely related to the stock market than the investment grade CDS market.
Coronado et al. (2011) "A case for Europe: the Relationship between sovereign CDS and Stock Indexes"	To study the lead-lag relationships of CDS and bond markets	VAR, Panel data model	Daily data of 8 European countries of sovereign CDS and stock indexes during the period from 2007 until 2010.	Stock market has a leading role during the sample period, but in 2010 CDS markets have the key role in incorporating new information. This relationship is stronger for countries with high-risk spread.
Corzo et al. (2012) "The Co-movement of Sovereign Credit Default Swaps, Sovereign Bonds and Stock Markets in Europe"	To investigate the relationship between sovereign CDSs, sovereign bonds and equity markets.	VAR	Daily data of sovereign CDS spreads, government bond spreads and stock indexes of 13 European countries during the period 2008-2011.	During 2008-2009 the equity market leads new information incorporation; however in 2010 sovereign CDS markets took over this role and led the process. Sovereign CDSs play a stronger role in economies with higher perceived risk.

To sum up, in order to analyze the link between CDS, stock and bond markets, majority of papers adopt either VAR model or VECM and Granger causality test. VAR models are used to describe the dynamic interrelationship among stationary variables and VECM is the restricted VAR model as it restricts the long run behavior of the endogenous variables to converge to their long run equilibrium relationships and allow the short run dynamics. Granger causality test helps to determine whether one time series is useful in forecasting another. Norden and Weber (2004) motivate their choice of using VAR model because "it has been developed to capture lead-lag relationships within and between stationary variables, moreover, it represents simultaneous equation estimation". On the other hand, Zhu (2004) in the analysis of CDS and bond markets chooses to use VECM to examine the relative importance of the two markets in price discovery "since the two credit spreads are cointegrated in the long term". Also, Zhu (2004) states that "to investigate the dynamic relationship between the two markets, the Granger causality test can be utilized as a starting point to provide insightful clues to the direction of the linkage."

Besides VAR model, VECM and Granger causality tests, some authors (Coudert and Gex (2010), Arce et al. (2011), Bystrom (2005)) choose to use other type of regressions (OLS, Logit) in their studies aiming to find the relationship between CDS, stock and bond markets. For example, Bystrom (2005) runs a regression of change in iTraxx CDS index spread not only on lagged values of CDS index spread and stock index return, but also on current stock index return in order to analyze the contemporaneous correlation between the variables. Arce et al. (2011) use Logit regression with an aim to analyze the determinants of market leadership in price discovery between CDS and bond markets.

The main findings are similar across the different studies, namely, stock returns lead the CDS and bond markets (Norden and Weber (2004), Pena and Forte (2009)), and additionally, CDS market has a lead over the bond market (Blanco et al. (2005), Zhu (2004), Coudert and Gex (2010)). Some more specific papers state that these relationships depend on several factors: the time period (Fontana and Scheicher (2010), Coronado et al. (2011), Corzo et al. (2012)), whether the credit risk of corporate or government is considered as high or low (Fung et al. (2008), Coudert and Gex (2010)), whether the issuer is located in Europe or North America (Zhu (2004) and other factors (Arce et al. (2011)).

Given this literature, I propose the following hypothesis concerning the link between sovereign CDS and stock indexes.

H1: Which markets leads the other one?

As March and Wagner (2012) explain markets are considered to have informational efficiency if new information is simultaneously priced into different markets. Thus the new information being priced faster in one market than in another suggests market inefficiencies.

As proved in Bystrom (2005), Forte and Pena (2009) and Coronado et al. (2011), among others, in general the stock market tends to lead the CDS market more often than the other way around. However, more specific papers identify that this relationship depends on credit quality of underlying reference entity (Fung et al. (2008), Fontana and Scheicher (2010), Coronado et al. (2012) whether the analyzed entities are located in U.S. or Europe and it is also different in different time periods (Corzo et al. (2011), Coronado et al. (2012)). These findings in general reveal the leading role of stock market over the CDS market and imply that new information in these markets is not incorporated at the same time.

This lead-lag relationship between stock and CDS markets may appear because of the essential differences between these two markets. Firstly, while stocks are exchange-traded instruments (i.e. traded via specialized exchanges using standardized contracts), CDS are traded over the counter (i.e. traded and privately negotiated directly between two parties). However, market participants differ in the level of information they possess. Zhang (2009) investigates CDS and stock price reactions to a variety of credit events, such as news of economic distress, financial distress, M&A, SEC probes or accounting irregularities and leverage buyout (LBO). The stock market reveals information about negative credit events before the CDS market except for LBO news. However, the stock price over-reacts for SEC probe and under-reacts for financial distress news and Zhang (2009) explains that this may arise from trading behaviors of uninformed investors in the stock market. He also mentions that CDS market can be a preferred channel for informed trading due to its participants, embedded leverage and its market opacity.

Another important aspect that could determine the leading role of stock or CDS market is their liquidity because 'greater market liquidity also plays an important role in price discovery' (an AIMA research note (2011)). Tang and Yan (2006) defines liquidity as 'the degree to which an asset or security can be bought or sold in the market quickly without affecting the asset's price'. They explain that the market liquidity depends on 3 factors: tightness (i.e. if its bid-ask spread is small), depth (i.e. if more shares can be traded at current quote) and resiliency (i.e. if price recovers quickly after a demand or supply shocks). According to this, they summarize that CDS market exhibits characteristics that may suggest its illiquidity as CDS market is not continuous, there is virtually no depth in the market as each quote is for one contract only and the bid-ask spread is high (23% on average).

However, Zhu (2004) and Coudert and Gex (2012) explain that the CDS market tends to lead the bond market due to the higher liquidity of the former one. Coudert and Gex (2012) justify the higher liquidity of CDS because of several reasons. Firstly, the investor does not have to sell CDS contract back on the market if she wants to terminate it; instead she can write another contract in the opposite direction, the action which is not possible in the bond market. Secondly, CDS contracts, differently from bonds, are not limited in supply thus they can be sold in arbitrarily large amounts. Thirdly, opposite to the bond market, the CDS market on a given borrower is not fragmented, being made up of all its successive issuances. Fourthly, investors purchase bonds as part of a 'buy and hold' strategy whereas CDS sellers are more active in the market. Andersson (2010) adds that CDS contracts are more standardized than underlying bond contracts thus increasing the CDS market liquidity and facilitation in the price discovery process.

The same principle should apply to describe the relation between stock and CDS markets, that is, the more liquid the market is, the more it leads the other one. More specifically, Forte and Pena (2009) state that stock market is generally the most liquid, followed by the bond market and the CDS market.

H2: Does the relationship between sovereign CDS and stock indexes vary during different periods?

As stated in Corzo et al. (2011) and Coronado et al. (2012), the link between stock market and CDS market is not stable over different periods of time. For example, Coronado et al. (2012) find that during the Lehman period the risk transfer was private-to-public (evidenced by Dieckamann and Plank (2010)) whereas during the sovereign debt crisis a reverse public-to-private risk transfer was observed. Moreover, as explained by Coronado et al. (2012) in 2010 the stock market lost its leading role over the CDS market as during this year the sovereign debt attracted all the attention and relegated the stock market to a secondary role.

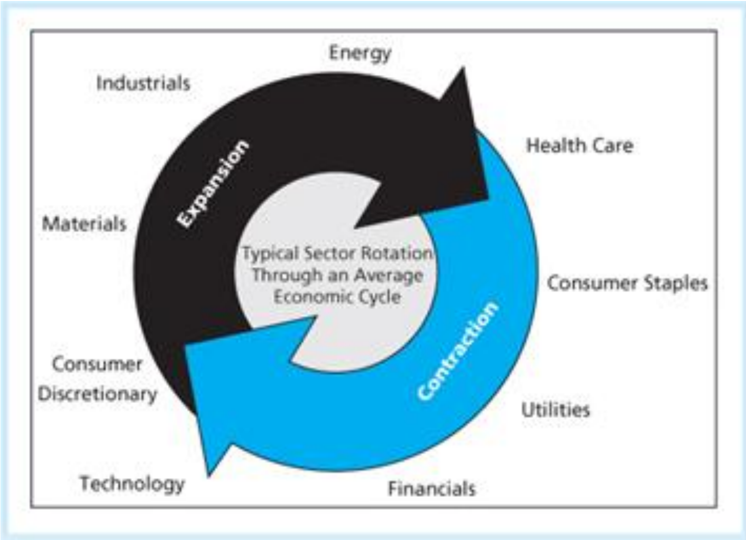
H3: Is the relationship between sovereign CDS and stock indexes different for PIIGS and for strong economy countries?

As found by Fung et al. (2008) at the individual-firm level, the lead-lag relationship between U.S. stock market and the CDS market depends on the credit quality of the underlying reference entity. More specifically, the high-yield CDS market is more closely related to the stock market than the investment-grade CDS market. Fung et al. (2008) explain that informed traders may prefer to trade CDS instead of equity shares for reference entities with higher risk aiming either "to bet on the likelihood of default on a company's bond or to insure against such default". As a result, the CDS spread changes should lead the stock prices for low credit quality companies. These findings should be also applicable to the relationship between sovereign CDS and stock markets: in countries with higher perceived credit risk CDS market should lead the stock market (in line Corzo et al. (2012)).

H4: Is the relationship between sovereign CDS and stock market different across different industries?

As explained in Bode, Kane and Marcus (2011), the economy recurrently experiences periods of expansion and contraction and this pattern is called the business cycle. The business cycle of the country is important as the sovereign CDS value, which depends on the probability of default of the given country and the loss suffered in such case, is related to macroeconomic conditions of the reference entity, as well as political factors (Kocsis and Nagy (2011)). Additionally, stock risk is comprised of three levels: stock-specific risk, market-risk and industry risk. As most stocks tend to move in any direction due to the underlying factors that drive the overall market, stocks in similar industry will tend to move because of the underlying factors that drive that industry. As a result, investors seek to shift the portfolio more heavily into industry or sector groups that are expected to outperform based on one's assessment of the state of the business cycle, the strategy which is called sector rotation (Bode, Kane and Marcus (2011)) (Figure 2).

Figure 2: Typical sector rotation through an average economic cycle



(Source: Bodie, Kane and Marcus (2011))

Not all industries are equally sensitive to the business cycle: some of them are cyclical (i.e. the industries that show above-average sensitivity to the state of economy) whereas the others are defensive (i.e. the industries that show little sensitivity to the business cycle). Thus different industries react differently to changes in the economy and as a result the link between the stock index of particular sector and sovereign CDS market should exhibit diversity, whereas using an aggregated stock market developments might and do mask striking differences across sectors (Andersson et al. (2011)). However, it is not vastly analyzed in research studies.

One of the attempt was perfomed by Bystrom (2005) in his research, in which he was using seven sectoral iTraxx indexes. He found that the correlation between 5-year iTraxx CDS index spreads and stock indexes is the strongest in sub-ordinated financials industry and the weakest in autos industry. Also, sub-ordinated financials industry CDS index express the highest autocorrelation whereas autos industry has insignificant autocorrelation due to the sudden and very significant spread widening in this sector towards the end of year 2005. The OLS-regression results indicate that the contemporaneous stock returns are significant for all the industries, industrials, autos and sub-ordinated financials having the highest coefficient levels. These results suggest that the link between CDS and stock markets among various industries should differ.

IV. EXPLANATORY LOOK AT THE DATA AND METHODOLOGY

I use the weekly data of the 5-year sovereign CDS mid – spreads, country stock indexes and sectoral stock indexes obtained from DataStream. Most of the studies (for example, Zhu (2004), Fung et al. (2008)), however, choose to analyze daily data as it could be more appropriate frequency to analyze the short-term dynamic interaction (Zhu (2004)). I use weekly data (in line with Norden and Weber (2004)) as daily CDS data from DataStream is too noisy and may provide biased results (for example, weekly data obtains constant value on average 3.07% of the time while data daily - 10.46% of the time). However, weekly data may also suffer from "day-of-the-week" effect (Ehlers et al. (2010)), according to which results obtained using different time series (Monday-to-Monday, Tuesday-to-Tuesday, etc.) provide different lead-lag relationships. Ehlers et al. (2011) suggest "to analyze the relationship between different time series for all possible return intervals and not only for one as this would have led for other conclusions". The time-series used in this study is Monday-to-Monday, chosen by the lowest number of constant values and also because no significant changes were observed across different weekdays. CDS of 5-year maturity denominated in USD are used as 5-year maturity is considered to be the most liquid and is often used as a reference in financial markets (for example, used by Fung et al. (2008), Coudert and Gex (2010), Arce et al. (2011)) and USD is the standard currency in the CDS market (Corzo et al. (2012)).

The sample contains data for ten European countries: Portugal, Italy, Ireland, Greece, Spain, Germany, France, Austria, Netherlands and Belgium. All selected countries are in euro zone which helps to avoid the mismatches due to different local currencies. The sample can also be divided into two groups (Table 2): higher risk countries (countries with CDS premiums above 100 bp for the whole period: Portugal, Italy, Ireland, Greece and Spain, or PIIGS) and lower risk countries (countries with CDS premiums below 100bp for the whole period: Germany, France, Austria, Netherlands and Belgium). This division of sample later in the research will be used to explore the relationship between the sovereign CDS and stock indexes during the sovereign debt crisis period.

Table 2: Average sovereign CDS spreads (bp)

This table provides average sovereign 5-years CDS spread levels in basis points on a weekly basis for the whole period (January 2007-June 2012), which is divided into three sub-periods: pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

Country	Whole period	Pre-crisis	Financial crisis	European debt crisis
Germany	30.31	5.20	35.14	41.20
France	63.25	6.02	39.92	114.91
Austria	75.03	5.62	99.21	108.98
Netherlands	44.38	6.37	52.92	65.54
Belgium	98.39	10.34	62.75	177.73
Portugal	332.60	17.88	78.61	685.41
Ireland	289.20	14.94	178.95	535.91
Italy	153.50	19.92	107.43	269.49
Greece	643.90	23.39	163.68	1,328.42
Spain	159.00	16.78	88.95	293.97

In Table 2 a significant difference, especially during turbulent times, between PIIGS and strong-economy countries can be observed. For the whole period average CDS spreads of strong-economy countries are below 100bp and above 100bp for PIIGS. Although in the pre-crisis period the difference between these two groups of countries was less significant, during financial crisis period the gap of average CDS spread increased and reached its peak in European debt crisis period. Through all the periods, Germany had the lowest average CDS spreads and during the debt crisis it increased 7 times as compared with the pre-crisis period (from 5.2bp to 41.20bp), while Greece had the highest average CDS spread, which increased more than 56 times during the last period as compared with pre-crisis period (from 23.39bp to 1,328.42bp). It is important to notice, however, that even in the tranquil pre-crisis period PIIGS demonstrated higher sovereign CDS spread levels than strong economy countries. This implies that PIIGS were perceived as countries with higher credit risk already before financial turmoil shook the markets.

The stock market in each country is represented by the main stock index: PSI-20 (Portugal), ISEQ-20 (Ireland), FTSEMIB (Italy), FTSE Athex-20 (Greece), IBEX 35 (Spain), DAX (Germany), CAC-40 (France), ATX (Austria), AEX (Netherlands) and BEL-20 (Belgium). The sample is similar to Coronado et al. (2010) and Corzo et al. (2012) however Coronado et al. (2010) use 8 European countries and, as Corzo et al. (2012), they also include non-euro zone countries.

To analyze the contemporaneous and lead-lag relationship between sovereign CDS and sectoral stock markets, I will use financial and non-financial sectors stock indexes as well as consumer staples and industrials stock indexes. Financial sector, being pro-cyclical and directly linked with the situation in the country's financial system , is useful to analyze in order to identify the changing patterns in the link between sovereign CDS market and financial sector. As a contrast to financial sector, non-financial sector stock index is included in the analysis. Industrials and consumer staples sectors both represent the non-financial sector and both of them are considered to be less cyclical, they were chosen because of their opposite positions in the sector rotation cycle.

The sample covers the period from January 2007 to June 2012. However, the CDS spread data for Germany in my analysis starts on 7th May 2007, since till this date DataStream provides a constant daily spread of 2.8bp. This constant spread might be due to the lack of data during this period and if it is not deleted, it might misrepresent the results of analysis. This leads to 285 total observations for all countries, except Germany, for which I have 267 observations.

In order to identify different patterns evolving during this period, I will break it into 3 sub-periods: pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009), European debt crisis (January 2010 – June 2012). As credit markets showed a different behavior during these sub-periods, the aim is to analyze the stability of relationship between sovereign CDS and stock markets in different periods. The division of period is similar as in Coronado et al. (2011) and Corzo et al. (2012) however it includes the most recent data.

To sum up, the main characteristics of my thesis that make it different from Coronado et al. (2011) and Corzo et al. (2012), are:

- Using weekly data instead of daily data.
- Using non-overlapping sub-periods instead of separate years.
- Including sectoral stock indexes data into the analysis.
- Different data source (DataStream instead of Bloomberg).

Descriptive statistics for sovereign CDS spreads and stock indexes returns

To understand the main characteristics of sovereign CDS and stock indexes, I calculated their mean, median, standard deviation and both minimum and maximum values. Descriptive statistics for CDS spreads and stock indexes for each country and during the different periods are presented in Tables A.1-A.6. Table 3 provides summary of average sovereign CDS spreads and stock indexes returns.

Table 3: Average weekly sovereign CDS spreads (bp) and stock indexes returns (%)

This table provides average sovereign 5-years CDS spreads (bp) and stock indexes returns for country's stock indexes, financials, non-financials, consumer staples and industrials in percentage on a weekly basis for strong economy countries (Germany, France, Austria, Netherlands, Belgium) and PIIGS (Portugal, Ireland, Italy, Greece, Spain) for the whole period (January 2007-June 2012), which is divided into three sub-periods: pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

	Strong economy countries				PIIGS			
	Whole	Pre-crisis	Financial crisis	European debt crisis	Whole	Pre-crisis	Financial crisis	European debt crisis
Sovereign CDS (bp)	62.27	6.71	57.99	101.67	315.65	18.58	123.52	446.20
Country's stock index	-0.13%	-0.21%	-0.11%	-0.08%	-0.36%	-0.40%	-0.10%	-0.48%
Financials	-0.38%	-0.48%	-0.25%	-0.19%	-0.67%	-0.63%	-0.06%	-1.02%
Non-financials	-0.03%	-0.10%	-0.04%	0.02%	-0.20%	-0.27%	-0.08%	-0.22%
Consumer staples	0.10%	-0.15%	0.31%	0.16%	0.03%	-0.18%	0.10%	0.14%
Industrials	-0.08%	-0.25%	-0.11%	0.01%	-0.21%	-0.42%	0.02%	-0.22%

Table A.1 shows a huge diversity of CDS spreads across the countries and during different time periods. Pre-crisis period may be characterized as low and stable, measured by standard deviation, CDS spreads period, during which the difference between PIIGS and strong economy country is not significant. For example, Germany had the lowest average CDS spread (5.2bp) whereas Greece had the highest (23.39bp). During financial crisis period average CDS spreads and their volatilities increased significantly: for example, average CDS spread of Germany reached 35.14bp, which is 6 times more than in pre-crisis period, whereas for Austria the spread increased more than 17 times and reached 99.21bp. Even though the spread levels for PIIGS during this period are higher than for considered strong-economy countries, the average CDS spread growth as compared with pre-crisis period was more significant for the latter countries. However, unprecedented growth of CDS spread is observed during European debt crisis period, being especially significant for PIIGS countries. During this period, the average price of credit risk for Greece reached 1,328.42bp, whereas for Germany it was only 41.20bp. Because of Belgium's inability to form a government and its high debt to GDP ratio, its average CDS spread increased dramatically during recent crisis period making it the riskiest country for a strong-economy countries subsample.

The evolution of CDS spreads for both subsamples are presented in Figure 3a and Figure 3b.

Figure 3a: The evolution of average 5-years weekly CDS spreads (bp) for strong-economy countries

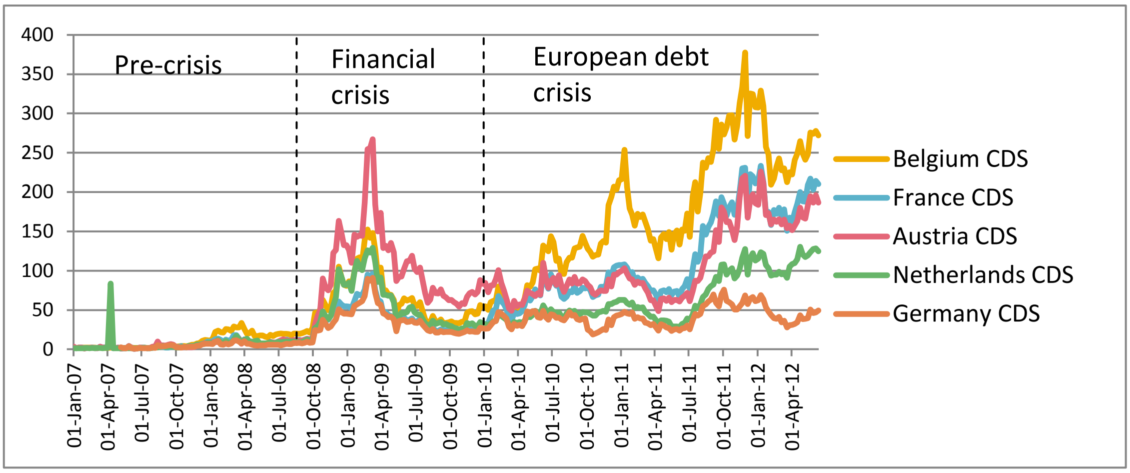
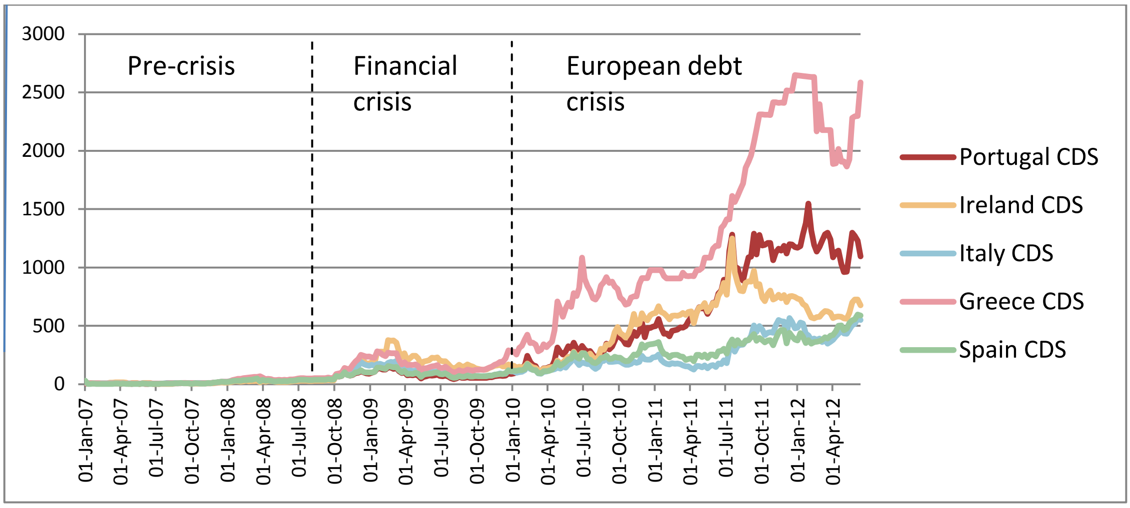


Figure 3b: The evolution of average 5-years weekly CDS spread (bp) for PIIGS



Figures 3a and 3b clearly indicate that during financial crisis period, strong-economy countries were more volatile whereas during the recent crisis period PIIGS countries reached unprecedented high of CDS spreads, the situation being especially dramatic for Greece.

The descriptive statistics for country's stock indexes are presented in Table A.2. It shows that for daily stock indexes returns there is no such clearly explicit pattern as for CDS spreads. However, some commonalities remain: throughout the whole period, DAX (Germany) had the positive weekly return of 0.04% while Athex-20 (Greece) stock index weekly return was negative by -0.74%. The volatility of stock indexes returns were the highest during financial crisis period while during recent crisis it is very similar to pre-crisis period. It is also observed that, even though country's stock indexes performed worse for PIIGS than strong economy countries, this was not the case during financial crisis period, during which both sub-samples had the same level of returns.

Descriptive statistics of financial, non-financial, consumer staples and industrials sectors' stocks returns for each of the country are presented in Table A.3, A.4, A.5 and A.6, respectively.

Financial sector stock index returns (Table A.3) are more volatile than returns of country's stock indexes and non-financial sector stock indexes (Table A.2). For example, in Ireland standard deviation for ISEQ-20 was 4.65% and 3.52% for non-financial sector stock index whereas it reached 12.62% for financial sector stock index during the whole sample period. Returns are also the lowest for financials: for example, in Germany weekly DAX return through the whole period was +0.04%, 0% for non-financial sector whereas for financial sector the return was -0.19%. The financial returns in strong economy countries were the lowest during pre-crisis period (except Netherlands); however in PIIGS the financial sector was performing the worst during European debt crisis. This negative result of financial sector stocks may appear due to the fact that financial sector is directly affected by the economic situation within the country as well as due to the lack of diversification in stock index as compared with country's stock index. The variability of non-financial sector returns throughout the periods is very wide: the lowest returns in France, Belgium, Ireland and Italy were observed during pre-crisis period, in Germany and Austria – during the financial crisis while in Netherlands, Portugal, Greece and Spain during the European debt crisis.

Throughout the whole period, consumer staples sector (Table A.3) stock market exhibited lower volatility than industrials stock market (Table A.4), except for Austria, Portugal and Greece. It also provided higher weekly stock return for most of the countries: the highest return was observed in Portugal (+0.27%) whereas the lowest was in Spain (-0.08%). Industrials, on the other hand, provided negative stock return during the whole sample period, ranging from -0.41% in Greece to 0% in Germany. It could be observed that industrials stock market's performance on average is significantly worse in PIIGS (-0.26%) than in strong economy countries (-0.08%). The same pattern is also observed in consumer staples stock market where average weekly return for PIIGS was +0.03% while for strong economy countries it was +0.1%.

In the pre-crisis period, consumer staples stock market provided the lowest return as compared with the other two periods (on average, -0.16%). However, the average returns for PIIGS and strong economy countries were similar, -0.18% and -0.15%, respectively. The lowest return was observed in Italy (-0.54%), whereas the highest one - in Greece (+0.1%). Industrials stock sector average return was also negative (-0.32%), however the difference between PIIGS and strong economy countries was more significant (-0.46% and -0.17%, respectively). During the financial crisis period the returns for both sectors increased: for strong economy countries the significant increase in returns was observed in consumer staples stock market (from -0.15% to +0.3%), whereas for PIIGS the returns in industrials stock market increased from -0.46% to 0.04%. During recent European debt crisis, consumer staples stock sector return increased for PIIGS and decreased for strong economy countries and opposite was observed in industrials stock market.

In general, during the whole sample period and non-overlapping sub-periods, financials performed much worse than non-financials for all the countries analyzed, the lowest returns were exhibited during pre-crisis period for strong economy countries and during recent European debt crisis for PIIGS. Consumer staples performed much better than industrials in both strong economy countries and PIIGS (Table 3).

V. EMPIRICAL RESULTS

To analyze the link between sovereign CDS and stock markets, I firstly analyze contemporaneous co-movement between these variables by calculating Spearman correlation coefficients and then I analyzed lead-lag relationship as captured by a Vector Autoregressive model and Granger causality test.

Contemporaneous co-movement between sovereign CDS and stock markets

To get the first impression of the contemporaneous co-movement of CDS and stock markets I use Spearman pairwise rank correlation, which estimates a linear association between the ranks of variables. While some correlation coefficients require variables to be normally distributed (for example, Pearson correlation coefficient), Spearman correlation coefficient can be used when the conditions of normality or sample size are not satisfied.

In order to test for the normality of variables, I performed a test for normality based on skewness (a normal standard has zero skewness), kurtosis (a normal standard has 3 for kurtosis) and a combination of both. I can reject the null hypothesis that both sovereign CDS levels and CDS spread changes are normally distributed, but I cannot reject the hypothesis of normality of sovereign CDS spread changes on the basis of skewness for more than half of the sample countries (Germany, Netherlands, Portugal, Ireland, Italy and Spain), whereas CDS levels exhibit a normality on the basis of kurtosis for all sample countries, except Netherlands and Ireland. In case of country's stock indexes, I can reject the hypothesis of normality for both levels and returns of the indexes, except for Greece stock index returns on the basis of skewness and for Germany and Portugal stock indexes level on the basis of kurtosis.

The contemporaneous co-movement between CDS changes and stock indexes returns is presented in Table 4, and the one for different sectors – in Table A.7.

Results presented in Table 4 clearly show the negative relationship between CDS spread changes and stock indexes returns, the strength of which differs over different periods and across different countries. The strength of this relationship increased significantly during financial crisis period as compared with pre-crisis period, suggesting that during turbulent times the CDS changes and stock indexes return tend to move together more closely than during tranquil periods.

However, in the light of European debt crisis, in Greece the contemporaneous co-movement between CDS changes and stock indexes return decreased as compared with financial crisis period: the CDS spreads were increasing in an ungovernable way which led to a decreased link of co-movement between CDS and stock markets. It shows that market started to perceive the credit risk of Greece government as being very high. Moreover, the debates arose in relation to the restructuring of the Greek debt obligation and whether this event should be considered as a credit event or not. At the start of the debt restructuring process, European policymakers aimed for a voluntary debt exchange which would not initiate the default swap in order to prevent the destabilizing chain reactions through Europe's financial system in case the payments of the CDS had been initiated.[4] As a result, "the whole nature of the CDS contract would be called into question" (Richard Portes, professor of economics at the London Business School). These debates might potentially also decreased the co-movement between Greece sovereign CDS and stock market index (FTSE Athex-20), because investors might valued the CDS contracts not only in the light of current negative situation in Greece economy, but also took into account the legal risk due to the "soft" restructuring.

Table 4: Spearman correlation coefficients between weekly CDS changes and stock indexes returns

This table provides Spearman correlation coefficients between sovereign 5-years CDS spread changes and country's stock indexes returns in percentage on a weekly basis during pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

(* indicates 5% significance level)

	Sovereign CDS and country's stock markets		
	Pre-crisis	Financial crisis	European debt crisis
Germany	-0.21	-0.40*	-0.49*
France	-0.17	-0.49*	-0.63*
Austria	-0.29*	-0.66*	-0.62*
Netherlands	-0.16	-0.48*	-0.52*
Belgium	-0.15*	-0.46*	-0.62*
Portugal	-0.42*	-0.56*	-0.54*
Ireland	-0.25*	-0.29*	-0.31*
Italy	-0.39*	-0.56*	-0.69*
Greece	-0.54*	-0.61*	-0.35*
Spain	-0.31*	-0.48*	-0.72*

Table A.8 reveals that the co-movement between sovereign CDS and different sectors stock markets was low or was not significant during pre-crisis period, especially in strong economy countries. The

4 http://economictimes.indiatimes.com/news/international-business/greeces-debt-restructuring-brings-credit-default-swaps-into-spotlight/articleshow/11990317.cms

strength of co-movement increased during financial crisis period, but slightly decreased during recent European debt crisis for most of the countries and sectors as well.

The evolution of CDS spreads and country's stock indexes for Germany and Greece are presented in Figure 4a and Figure 4b:

Figure 4a: The evolution of Germany 5-years CDS weekly spreads and DAX index:

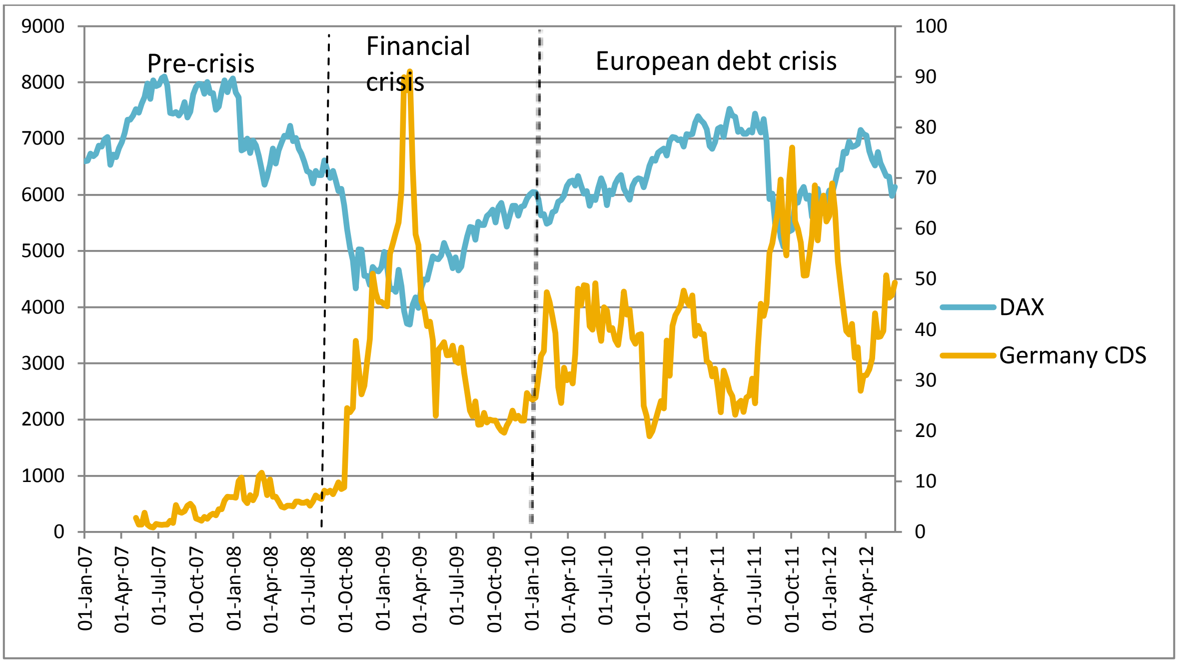
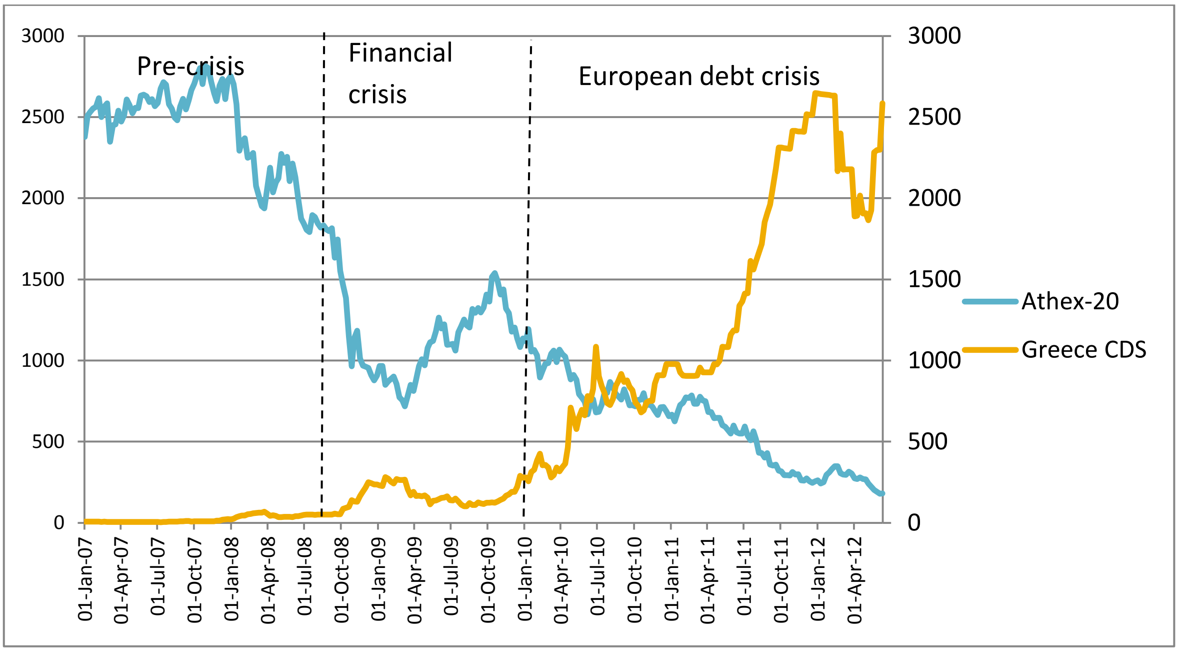


Figure 4b: The evolution of Greece 5-years CDS weekly spreads and FTSE Athex-20 index:



Figures 4a and 4b clearly indicates that CDS changes and stock indexes returns move in the opposite directions: increasing CDS spread result in decreasing stock index returns and vice versa.

The average correlation coefficients are presented in Table 5.

Table 5: Average Spearman correlation coefficients between strong economy countries and PIIGS across different sectors stock indexes returns

This table provides average Spearman correlation coefficients between sovereign CDS, country's stock indexes, financials, non-financials, consumer staples and industrials stock indexes returns in percentage on a weekly basis between strong economy countries (Germany, France, Austria, Netherlands, Belgium) and PIIGS (Portugal, Ireland, Italy, Greece, Spain) during pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012). In the European debt crisis values in brackets represent the average Spearman correlation coefficients excluding Greece.

	CDS	Stock index	Financials	Non-financials	Consumer staples	Industrials
				Pre-crisis		
Strong economy countries	0.436	0.883	0.874	0.819	0.366	0.795
Strong economy countries and PIIGS	0.323	0.793	0.745	0.745	0.350	0.684
PIIGS	0.536	0.706	0.625	0.672	0.286	0.613
				Financial crisis		
Strong economy countries	0.837	0.869	0.827	0.783	0.391	0.874
Strong economy countries and PIIGS	0.785	0.801	0.727	0.749	0.412	0.718
PIIGS	0.845	0.746	0.653	0.713	0.373	0.619
				European debt crisis		
Strong economy countries	0.791	0.890	0.862	0.789	0.447	0.786
Strong economy countries and PIIGS	0.569 (0.634)	0.765 (0.816)	0.703 (0.742)	0.707 (0.770)	0.384 (0.435)	0.618 (0.695)
PIIGS	0.548 (0.641)	0.671 (0.737)	0.598 (0.657)	0.659 (0.740)	0.312 (0.379)	0.551 (0.608)

As Gunduz and Kaya (2012) explains, "a higher correlation among sovereign CDS markets of the Euro-zone economies would imply a more integrated structure. The evolution of the co-movement of sovereign CDS markets as well as the magnitude of the correlations shed light on the spillover effects, which are especially important during crisis periods."

During pre-crisis period, CDS changes across different countries were relatively low correlated and highly diverse, ranging from 27.2% between Greece and Germany to 78.2% between Italy and Portugal. The correlation coefficients between PIIGS countries are higher as compared with strong-economy countries, meaning that CDS changes during pre-crisis period were relatively low linked between strong-economy countries or between strong economy countries and PIIGS. However, the opposite results are obtained from analyzing correlation coefficients between stock indexes returns. Here the correlation is higher between strong-economy countries as compared with PIIGS countries.

During financial crisis period important changes were observed. Correlation coefficients between CDS changes increased significantly, ranging from 60.0% between Ireland and Germany and 94.6%

between Portugal and Spain. This finding suggests the idea that during turbulent times, the contemporaneous movements between CDS changes are more strongly related than during tranquil periods. However, the same conclusion cannot be applied to stock indexes return, as no significant changes in correlation coefficients were observed during this period.

In the presence of European debt crisis, the contemporaneous co-movement of CDS changes between strong economy countries remained at the same level as compared with financial crisis period, however the strength of the link between PIIGS countries decreased, and the most significant decrease is observed for Greece between both PIIGS and strong-economy countries. The same pattern is observed also for correlation coefficients of stock indexes returns.

The Spearman correlation coefficients between financial and non-financial sectors stock indexes, as presented in Tables A.10 and A.11, reveal that the co-movement between financial and non-financial sector stock markets varies country by country. For example, stock indexes move more closely together for financial sector between Netherlands and Belgium through different periods whereas in case of Germany and Portugal the co-movement of non-financial sectors is stronger than for financial sectors.

In terms of contemporaneous co-movement between consumer staples and industrials across the sample countries (Tables A.12 and A.13), it is observed that industrials stock markets are more strongly correlated than consumer staples during all the periods analyzed.

During pre-crisis period, industrials stock markets tend to co-move more closer between strong economy countries than between PIIGS. The same pattern applies also for consumer staples stock market, however returns of consumer staples stock market in Austria exhibit no co-movement with other countries, except Spain. During financial crisis period the co-movement across the countries increased for both sectors, however Austria still remained uncorrelated with other countries. In the light of European debt crisis, the correlation between industrials stock markets decreased, especially for Greece. For consumer staples sector the results are mixed: for co-movement for some countries increased (for example, Ireland), while for others decreased (for example, Germany).

To summarize, correlation coefficients between strong economy countries across different sub-periods and industries are much stronger as compared with other pairs. During pre-crisis period the financial sector exhibited the highest level of co-movement, which decreased during financial crisis, however it still remained the highest across different sectors, except for industrials between strong economy countries, which increased significantly. During European debt crisis, the correlation coefficients increased for all sectors as compared with financial crisis period, except for industrials that demonstrated a decrease in the level of contemporaneous co-movement. Consumer staples remained the least correlated sector throughout all the sub-periods, very often the relationship being even insignificant (Table 5).

Lead-lag relationship between sovereign CDS and stock markets

To analyze the lead-lag relationship between sovereign CDS and stock markets, I will apply Vector Autoregressive model (VAR). This model will be applied to test the relationship between sovereign CDS spread changes and country's stock index returns as well as sovereign CDS financial sector index and non-financial sector returns. VAR model is appropriate to analyze the co-movement of both markets as it captures the lead-lag relationships within and between stationary variables in a simultaneous multivariate framework. The model used is in line with Norden and Weber (2004) and Coronado et al. (2010):

$$R_t = \alpha_1 + \sum_{p=1}^{p} \beta_{1p} R_{t-p} + \sum_{p=1}^{p} \gamma_{1p} \Delta CDS_{t-p} + \varepsilon_{1t}$$

$$\Delta CDS_t = \alpha_2 + \sum_{p=1}^{p} \beta_{2p} R_{t-p} + \sum_{p=1}^{p} \gamma_{2p} \Delta CDS_{t-p} + \varepsilon_{2t},$$

where

R_t: stock index return in t, ΔCDS_t - sovereign CDS spread change in t, p – lag order index, ε_t - disturbance term in t.

After implementing VAR model, I will test for Granger causality, which is a technique used to determine whether one time series is useful in forecasting another. In this case, the Granger causality test will identify if sovereign CDS market is predictive for country's stock market and vice versa.

As explained in Granger (1969):

"If some other series Y_t contains information in past terms that helps in the prediction of X_t, and if this information is contained in no other series used in the predictor, then Y_t is said to cause X_t."

The two-variable simple causal model, where X_t and Y_t are two stationary time series, is defined in Granger (1969) as:

$$X_t = \sum_{j=1}^{m} a_j X_{t-j} + \sum_{j=1}^{m} b_j Y_{t-j} + \varepsilon_t$$

$$Y_t = \sum_{j=1}^{m} c_j X_{t-j} + \sum_{j=1}^{m} d_j Y_{t-j} + \vartheta_t$$

The model given above implies that Y_t is causing X_t provided some b_j is not zero, and in an opposite direction, X_t is causing Y_t if some c_j is not zero. However, if both b_j and c_j are not zero, there is said to be a feedback relationship between X_t and Y_t. Thus time series X is said to Granger-cause Y if it can be shown through lagged values of X (and with lagged values of Y also included) that those X values provide statistically significant information about the future values of Y.

Data preparation for VAR model

Before applying VAR model, it is necessary to test whether variables are stationary and to determine the number of lags to be used. After applying VAR, in line with Corzo et al. (2012), I will implement a Langrange-Multiplier to test whether residuals are not autocorrelated at the lag order selected. Autocorrelated residuals would suggest that the model used may provide improper results.

Testing for stationarity is an important step in implementing the VAR model because only stationary variables are appropriate for this type of model. The variable Y_t is said to be stationary if its mean and variance are both finite and independent of time and the auto-covariance does not grow over time for all t and t-j, that is:

1. $E(Y_t)=E(Y_{t-j})=\mu$;

2. $Var(Y_t)=E[(Y_t- \mu)^2(Y_{t-j}- \mu)^2]$;

3. $Cov(Y_t,Y_{t-j})=E[(Y_t- \mu)(Y_{t-j}- \mu)]=\gamma_j$.

In an opposite way, time series is said to be non-stationary if the variance is time dependent and goes to infinity as time approaches to infinity.

As non-stationary data is unpredictable and cannot be modeled or forecasted, the results obtained by using non-stationary time-series may be spurious because they may indicate a relationship between two variables where one does not exist. If a variable is stationary, it has a tendency to return to a constant mean. Because of this feature, the level of the variable can be used as a significant predictor of next period’s change as in this case, large values are followed by smaller values and vice versa. To test for non-stationarity I will use augmented Dickey-Fuller test, which tests whether a unit root is present in autoregressive model (in line with Coronado et al. (2011). The results I obtained by applying the augmented Dickey-Fuller test are in line with Coronado et al. (2011): all series in levels are non-stationary whereas the first difference series are stationary. This result allows applying VAR model for the first-difference series.

A critical point in the specification of VAR model is to determine the lag length of the VAR. To achieve this, the maximum number of lags proposed by five different tests is chosen: likelihood ratio (LR), final prediction error (FPE), Akaike's information criteria (AIC), Hannan-Quinn information criteria (HQIC) and Schwarz's Bayesian information criteria (SBIC). In majority cases, I use the number of lags determined by likelihood ratio, although Corzo et al. (2012) use AIC and SIC criteria while Coronado et al. (2011) found the optimal lag computing all four information criteria (FPE, AIC, HQIC, SBIC). However, Hatemi and Hacker (2011) performed an simulation study where they investigated whether the LR test can pick the optimal lag order in the VAR model when the most applied information criteria suggest two different lag orders. After running Monte Carlo simulation, they found that combining the LR test with SBIC and HQIC substantially increase the success rate of choosing the optimal lag order compared to cases when only SBIC or HQIC are used.

A VAR model and Granger causality test results: country by country analysis

Using the number of lags found in the previous step, I implemented VAR model and Granger causality test for sample countries and during different non-overlapping periods. The lead-lag relationship between sovereign CDS spread changes and stock index returns for strong economy countries and PIIGS is presented in Table A.14. Table 6 below provides a summary of the lead-lag relationship as found by VAR model.

Table 6: The summary of the VAR model results

This table shows the leading variable, either sovereign CDS or stock market (indicated by x), across different stock indexes (country's stock index, financials, non-financials, consumer staples and industrials) and countries, during the whole period (January 2007-June 2012), which is divided into three sub-periods: pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

	German.		France		Austria		Netherl.		Belgium		Portugal		Ireland		Italy		Greece		Spain	
	CDS	Stock	CDS	Stock	CDS	Stock	CDS	Stock	CDS	Stock	CDS	Stock	CDS	Stock	CDS	Stock	CDS	Stock	CDS	Stock
Whole period																				
Stock index	x	x	x	x				x					x			x		x		
Financials			x	x	x			x	x	x			x			x	x		x	
Non-financials	x	x	x					x					x			x		x		
Consumer staples	x				x	x						x	x		x	x				x
Industrials						x		x		x						x				
Pre-crisis																				
Stock index	x		x		x				x			x	x		x		x		x	
Financials	x		x												x		x		x	
Non-financials			x		x				x				x		x				x	
Consumer staples					x				x	x					x			x		
Industrials											x				x		x			x
Financial crisis																				
Stock index		x			x			x	x						x		x		x	
Financials	x	x	x		x				x		x		x		x		x		x	
Non-financials	x	x	x					x							x			x	x	x
Consumer staples					x	x				x		x	x	x		x				x
Industrials										x		x				x			x	x
European debt crisis																				
Stock index	x		x	x						x		x	x			x		x		
Financials			x	x			x		x				x	x	x	x				x
Non-financials	x		x									x	x			x		x		
Consumer staples												x	x	x	x	x				
Industrials								x						x		x		x		

In response to Hypothesis 1, which asks about the leading market, it is observed that in general during the whole period analyzed (January 2007-June 2012) stock market tends to lead CDS market (Germany, France, Netherlands, Italy, Greece). These findings are in line with Corzo et al. (2012) However, in Germany and France this relationship is less straightforward as CDS market also shows a leading role over stock market. In Ireland, CDS market tends to lead stock market. Additionally, stock market tends to Granger cause the sovereign CDS market more often (France, Netherlands, Italy, Greece) than the other way around (Germany).

In line with Hypothesis 2 and Hypothesis 3, I analyzed the lead-lag relationship country by country through different periods. In the pre-crisis period the CDS market showed a leading role over stock market for all strong economy countries and PIIGS, except Netherlands, where no significant lead-lag relationship was found and Portugal, where this relationship is opposite. Also, no predictive power of stock markets over sovereign CDS markets was observed, however the sovereign CDS spread changes could have been used to predict stock indexes returns in France, Ireland, Italy and Spain. During financial crisis period the lead-lag relationship is mixed: stock market took a lead over CDS market in Germany and Netherlands, whereas the relationship was opposite in Austria, Belgium, Italy, Greece and Spain. Results are also mixed in terms of Granger causality, where CDS markets were observed to Granger cause the stock markets in Italy, Greece and Spain, but opposite relationship was identified in Germany Netherlands. However, during recent European debt crisis, stock market took a leading role over CDS market for most of the countries in the sample (France, Belgium, Portugal, Italy, and Greece). In Germany and Ireland this relationship was opposite and CDS market led the stock market during the last period analyzed. During this period, the stock market also regained its predictive power over CDs market during European debt crisis where stock market Granger causes CDs market in Portugal, Italy and Greece, whereas opposite relationship is observed only in Ireland and bi-directional relationship was found in France.

Overall, during the whole period analyzed, the stock market showed a leading role over CDS market. In the pre-crisis period, CDS market was the leading market, the relationship became mixed during financial crisis period, however in the recent European debt crisis the stock market took a leading role.

Part of the results contradict to the ones found in Corzo et al. (2012). They found, that during 2008 and 2009 the stock market took a lead over sovereign CDS market for most of the countries, while in 2010 the leading role of the stock market disappeared and it started to perform a secondary role. In 2011, they found that the lead-lag relationship lowered in intensity and the movement in the markets became more synchronized than in previous year, however the stock market regained its leading role. The differences between results obtained by Corzo et al. (2012) and my study may appear due to some essential characteristics:

- Weekly data instead of daily helps to avoid noise in the relationship, however it also looses the possibility to track short-term movements.
- Different source of data (DataStream instead of Bloomberg) also gives a potential difference in the results, especially in case of CDS that are traded over-the-counter.
- Periods instead of separate years provide a relationship which is observed during the longer period of time.
- As results of VAR model is very sensitive to the number of lags chosen, different number of lags also cause a potential mismatch in the results.

The lead-lag relationship between sovereign CDS and country's financial sector stock index (Table A.15) differs from the one between sovereign CDS and country's stock index. During the whole period, the CDS market took a lead over financial sector stock market for most of the countries (France, Austria, Belgium, Ireland, Greece and Spain), whereas financial sector stock market led sovereign CDS market only in Italy and Netherlands with some leading evidence also observed in France and Belgium. In terms of forecasting powers identified by Granger causality test, financial sector stock markets Granger causes the sovereign CDS markets in France, Netherlands, Italy and Greece, whereas the opposite relationship is observed in Ireland and Spain.

During pre-crisis for countries with significant lead-lag relationship the CDS market took a leading role as well as during financial crisis period, except Germany, where evidence of stock leading over the CDS market was observed. Moreover, sovereign CDS market was found to Granger cause financial sector stock markets during both pre-crisis period (Germany, Italy, Spain) and financial crisis period (France, Austria, Belgium, Ireland, Italy, Greece, Spain). Even though in the lead-lag relationship between sovereign CDS and country's stock index the stock market during European debt crisis stock market gained a leading role, the CDS market kept playing its role in the relationship analyzed between sovereign CDS and financial sector stock index return for most of the countries in the sample (France, Netherlands, Belgium, Ireland, Italy). During the recent European debt crisis the sovereign CDS market Granger caused financials stock market in Netherland and Ireland whereas in France and Italy the Granger causality was found to be bi-directional between these two markets, that is, there was a mutual feedback between them.

In general, financials stock sector more often than opposite was led by the sovereign CDS market through all the periods except recent European debt crisis, during which the relationship became mixed.

In case of the relationship between sovereign CDS and non-financial sector stock indexes (Table A.16) fewer significant relationships are observed, which suggests that sovereign CDS and non-financial sector exhibit lead-lag relationship less often than financial sector or country's stock indexes in general.

During the whole period for countries with significant lead-lag relationship non-financial stock market tend to lead CDS market, the result which is observed for Germany, Netherlands, Italy and Greece. In terms of predictability, in Netherlands and Greece non-financial sector stock markets Granger caused sovereign CDS markets while the opposite relationship was found in Ireland. In the period of pre-crisis, as was already observed, CDS market took a lead over non-financial sector stock market for most of the countries (France, Belgium, Ireland, Italy and Spain) and also tend to Granger cause the non-financial sector stock market (France, Austria, Belgium, Ireland, Italy, Spain). During financial crisis the relationship is mixed: CDS market took a lead in Italy, stock market took a lead in Netherlands whereas in Germany and Spain both markets show signs of leading each other at different level of lags. In the recent European debt crisis period, stock market started to lead in Portugal, Italy and Greece, whereas the opposite relationship was observed for Germany and Ireland. During the recent European debt crisis, the non-financial sector stock market could have been used to forecast sovereign CDS market in Portugal, Italy and Greece, while in France and Ireland – in the opposite way.

To sum up, the relationship between non-financials and sovereign CDS exhibited the same pattern as in case for sovereign CDS and country's stock market, that is, in general non-financials stock market tend to lead the CDS market. During pre-crisis period, sovereign CDS market took a leading role, the relationship became mixed during financial crisis period and in during the recent crisis period non-financials stock market regained its leading role.

The lead-lag relationship between sovereign CDS market and either consumer staples (Table A.17) or industrials (Table A.18) varies across the countries. In France there is no relationship between these markets during any period and in Germany only during the whole sample period it is observed that sovereign CDS market leads consumer staples stock market. In Austria, the lead-lag relationship between sovereign CDS and industrials stock markets is observed only during the whole period, whereas between sovereign CDS and consumer staples stock market more links are found: during the whole period both markets shows some evidences of leading each other and Granger causality is bi-directional, during the pre-crisis period CDS market tend to lead consumer staples market whereas two-way relationship is again observed during the financial crisis period, which disappears during the recent debt crisis. In case of Belgium, industrials stock market took a leading role during the whole period, whereas in financial crisis period both consumer staples and industrials stock markets led the sovereign CDS and consumer staples stock market also Granger caused the sovereign CDS market. Overall, for strong economy countries, sovereign CDS market tends to take a lead over consumer staples stock market, whereas industrials stock market showed some evidence of leading role over the sovereign CDS market.

In PIIGS more significant relationships were found. In Portugal, consumer staples stock market showed a leading role for all periods except pre-crisis and also Granger caused sovereign CDS market. However, sovereign CDS market led and Granger caused industrials stock market during pre-crisis period but the opposite relationships were observed during financial crisis period. In

Ireland, industrials stock market took a lead over sovereign CDS market only during recent European debt crisis but sovereign CDS market Granger caused consumer staples stock market for all the periods. Also, sovereign CDS market led consumer staples stock market during the whole period whereas two-way relationships were observed in both of crisis periods. Industrials stock market took a lead over and Granger caused sovereign CDS market except pre-crisis period where opposite relationship was observed. In consumer staples market, during the whole and European debt crisis periods evidence of both markets leading each other is observed, however sovereign CDS market led consumer staples stock market during pre-crisis period while opposite relationship was found in financial crisis period. In Greece, during pre-crisis period consumer staples stock market led sovereign CDS market but the opposite relationship was identified between sovereign CDS market and industrials stock market. However, in the recent European dent crisis, industrials stock market showed a leading role over sovereign CDS market. In case of Spain, leading role of consumer staples stock market was observed during the whole and financial crisis periods. However, in the pre-crisis period industrials stock market led sovereign CDS market whereas two-way relationship appeared during financial crisis both in terms of intertemporal relationship and Granger causality. Overall in PIIGS, industrials stock market tends to lead sovereign CDS market, except in pre-crisis period, where the opposite relationship is identified, and consumer staples stock market took the leading role more often than opposite during all periods.

After implementing VAR model, I use Lagrange-Multiplier test to check for the autocorrelation in the residuals of the model. The test is performed at the same number of lags as used for performing VAR model specification and for each number of lags, the null hypothesis of the test that there is no autocorrelation at a specified level of lags. For all the models calculated, I could not reject the null hypothesis, thus the result provides no hint of model misspecification.

VI. CONCLUSION

Recent turmoil, both financial crisis that appeared after Lehman Brother collapse and European debt crisis that originated in Greece, revealed new patterns in the financial linkages and changed the perception of credit riskiness of the sovereigns dramatically. During these turbulent times, unprecedented high spread levels of sovereign CDS were observed and complicated situation in one of the European Monetary Union member, Greece, which later spread to other European countries, gave rise to a suspicion about the sovereign "bankruptcy", which earlier was considered to be highly unlikely.

In the light of these dramatic changes, it is interesting to analyze the relationship between sovereign CDS spreads, which represents the riskiness of the default of the government, and stock indexes, which is a litmus paper of the economic health of the country. By analyzing the sovereign CDS spreads and stock indexes of 10 European Union countries (Germany, France, Austria, Netherlands, Belgium, Portugal, Ireland, Italy, Greece, Spain) since January 2007 to June 2012 and applying Vector Autoregressive model and Granger causality test, four hypothesis were risen.

Firstly, which market leads the other one? Findings, which are also in line with previous findings in other studies, reveal that in general stock market tends to lead sovereign CDS market more often than the other way around.

Secondly, how does the relationship between sovereign CDS and stock market change over time? To answer this, the whole period was divided into three non-overlapping sub-periods: pre-crisis (January 2007 – August 2008), financial crisis (September 2008 – December 2009) and European debt crisis (January 2010 – June 2012) periods. The findings reveal the changing patterns: during tranquil pre-crisis period sovereign CDS market tend to lead the stock market, the relationship became mixed during financial crisis period and stock market took a leading role during recent European debt crisis period.

Thirdly, is the relationship between sovereign CDS and stock indexes different for PIIGS (abbreviation used to describe less stable and more vulnerable countries to unusual circumstances, i.e. Portugal, Ireland, Italy, Greece and Spain) and for strong economy countries (Germany, France, Austria, Netherlands, Belgium)? The results reveal that in general the stock market tend to lead CDS market to both types of countries. However, during financial crisis in strong economy countries the relationships were mixed, while in PIIGS sovereign CDS market led the stock market. In the light of recent European debt crisis, in strong economy countries the relationships remained mixed, but in PIIGS stock market took a lead over CDS market for most of the countries.

Lastly, is the relationship between sovereign CDS and stock market different across different industries (financials, non-financials, consumer staples, industrials)? In general, the relationship between sovereign CDS and financials and consumer staples was mixed, whereas for non-financials and industrials stock market took a clear lead. In the pre-crisis period, CDS market led all four sectors' stock markets, whereas during financial crisis this relationship remained only for financials. For non-financials this relationship was mixed, however for consumer staples and industrials stock market took a lead over sovereign CDS market. In the light of European debt crisis, the relationships were mixed for all sectors, where the leading market varied over the countries, except for industrials, where stock market clearly led sovereign CDS market.

To sum up, the analysis reveal that the relationship between sovereign CDS and stock indexes is not straightforward and varies across different countries and industries and during different periods of time.

These results imply that in general policymakers should react to changes in country's stock market in order to control the spreads of sovereign CDS. During tranquil periods, the governments should focus on proper government debt management in order to ensure the financial stability within the country, however during crisis periods they should try to ensure the business' stability in order to govern the price of country credit risk. Moreover, special attention should be paid not only to financial sector, but to non-financials and industrials as well, as their impact on sovereign CDS spreads was observed. Additionally, speculators, hedgers and arbitrageurs should also exhibit an interest to the situation within non-financials and industrials in order to anticipate changes within credit riskiness of the country and thus change their strategies accordingly.

However, as this topic is not finite, and new patterns may evolve during time, further research analyzing this relationship should be performed. It would be useful to analyze the relationship between sovereign CDS and stock market on a daily basis and compare it with the analysis using weekly data and more thoroughly test for the effect of "day-of-the-week" on results. Moreover, analyzing pooled VAR instead of country-by-country would provide more insights about the way relationship between sovereign CDS and stock market evolves across strong economy countries and PIIGS.

VII. REFFERENCES

Acharya, Viral V. and Johnson, Timothy C., Insider Trading in Credit Derivatives (July 2005). Available at SSRN: http://ssrn.com/abstract=767864 or http://dx.doi.org/10.2139/ssrn.767864

Alter, Adrian and Schüler, Yves Stephan, Credit Spread Interdependencies of European States and Banks During the Financial Crisis (December 10, 2011). Available at SSRN: http://ssrn.com/abstract=1843282 or http://dx.doi.org/10.2139/ssrn.1843282

An AIMA Research Note, "The European Sovereign CDS Market", April 2011. Available at: http://www.aima.org/filemanager/root/site_assets/regulatory_and_tax/2011-04 08_research_sovereign_cds_paper.pdf

Andersson, Magnus, D'Agostino, Antonello, De Bondt, Gabe and Roma, Moreno, The Predictive Content of Sectoral Stock Prices: A US-Euro Area Comparison (May 13, 2011). ECB Working Paper No. 1343. Available at SSRN: http://ssrn.cm/abstract=1840568

Apergis, Nicholas, Mamatzakis, Emmanuel C. and Staikouras, Christos, Testing for Regime Changes in Greek Sovereign Debt Crisis (November 2010). Available at SSRN: http://ssrn.com/abstract=1752834 or http://dx.doi.org/10.2139/ssrn.1752834

Arce, Oscar, Mayordomo, Sergio and Peña, Juan Ignacio, Credit-Risk Valuation in the Sovereign CDS and Bonds Markets: Evidence from the Euro Area Crisis (February 7, 2012). Available at SSRN: http://ssrn.com/abstract=1896297 or http://dx.doi.org/10.2139/ssrn.1896297

Avino, Davide, Lazar, Emese and Varotto, Simone., Which Market Drives Credit Spreads in Tranquil and Crisis Periods? An Analysis to the Contribution to Price Discovery of Bonds, CDS, Stocks and Options (July 2011). ICMA Centre Discussion Papers in Finance DP2011-17.

Blanco, Roberto, Brennan, Simon and Marsh, Ian W., An Empirical Analysis of the Dynamic Relationship between Investment Grade Bonds and Credit Default Swaps (February 2004). Bank of England Working Paper No. 211; Cass Business School Research Paper. Available at SSRN: http://ssrn.com/abstract=478825

Bystrom, Hans, Credit Grades and the iTraxx CDS Index Market. Financial Analysts Journal, Vol. 62, No. 6, pp. 65-76, November/December 2006. Available at SSRN: http://ssrn.com/abstract=953065

Coronado, Maria, Corzo, M. Teresa and Lazcano, Laura, A Case for Europe: The Relationship between Sovereign CDS and Stock Indexes (July 1, 2011). Available at SSRN: http://ssrn.com/abstract=1889121 or http://dx.doi.org/10.2139/ssrn.1889121

Corzo, M. Teresa, Gomez-Biscarri, Javier and Lazcano, Laura , The Co-Movement of Sovereign Credit Default Swaps and Bonds, and Stock Markets in Europe (February 3, 2012). Available at SSRN: http://ssrn.com/abstract=2000057 or http://dx.doi.org/10.2139/ssrn.2000057

Coudert, V. & Gex, M., 2010. "Credit default swap and bond markets: which leads the other?," Financial Stability Review, Banque de France, issue 14, pages 161-167, July.

Duca, Gevit, The Relationship between the Stock Market and the Economy: Experience from International Financial Markets. Bank of Valletta Review, No. 36, Autumn 2007

Ehlers, Stefan, Gürtler, Marc and Olboeter, Sven, Financial Crises and Information Transfer - An Empirical Analysis of the Lead –Lag Relationship between Equity and CDS iTraxx Indices (April 6, 2010). Available at SSRN: http://ssrn.com/abstract=1585132 or http://dx.doi.org/10.2139/ssrn.1585132

Fontana, Alessandro and Scheicher, Martin, An Analysis of Euro Area Sovereign CDS and Their Relation with Government Bonds (November 4, 2010). ECB Working Paper No. 1271. Available at SSRN: http://ssrn.com/abstract=1715483

Forte, Santiago and Peña, Juan Ignacio, Credit Spreads: An Empirical Analysis on the Informational Content of Stocks, Bonds, and CDS (November 2009). Journal of Banking and Finance, Vol. 33, pp. 2013-2025, November 2009. Available at SSRN: http://ssrn.com/abstract=722981

Fung, Hung-Gay Gay, Sierra, Gregory E., Yau, Jot and Zhang, Gaiyan, Are the U.S. Stock Market and Credit Default Swap Market Related? Evidence from the CDX Indices (July 7, 2008). Journal of Alternative Investments, Summer 2008. Available at SSRN: http://ssrn.com/abstract=1156600

Granger, C. W. J. (1969). Investigating Causal Relationship by Econometric Model and Cross-spectral Methods. *Econometrica*, vol. 37, pages 424-438

Gunduz, Yalin and Kaya, Orcun, Sovereign Default Swap Market Efficiency and Country Risk in the Eurozone (July 13, 2012). Available at SSRN: http://ssrn.com/abstract=1969131

A. Hatemi-J & R. S. Hacker (2009): Can the LR test be helpful in choosing the optimal lag order in the VAR model when information criteria suggest different lag orders?, Applied Economics, 41:9, 1121-1125

Longstaff, F.A., S. Mithal and E. Neis (2003) “The Credit Default Swap Market: Is Credit Protection Priced Correctly?” Working paper, Anderson School, UCLA, August

Longstaff, F.A. (2010) “The Subprime Credit Crisis and Contagion in Financial Markets” Journal of Financial Economics 97 (2010) 436-450

Longstaff, F.A., J. Pan, L.H. Pedersen and K.J. Singleton (2011) “How Sovereign is Sovereign Credit Risk?” American Economic Journal: Macroeconomics, 3, 75-103

Michael G. Arghyrou & Alexandros Kontonikas, 2010. "The EMU sovereign-debt crisis: Fundamentals, expectations and contagion," Working Papers 2010_25, Business School - Economics, University of Glasgow.

Oldani, Chiara, The Management of Greek Sovereign Risk (May 26, 2011). The IUP Journal of Financial Risk Management, Forthcoming. Available at SSRN: http://ssrn.com/abstract=1992228

Stulz, Rene M., Credit Default Swaps and the Credit Crisis (September 18, 2009). Charles A. Dice Center Working Paper No. 2009-16 ; Fisher College of Business Working Paper No. 2009-03-16; ECGI - Finance Working Paper No. 264/2009. Available at SSRN: http://ssrn.com/abstract=1475323 or http://dx.doi.org/10.2139/ssrn.1475323

Tang, Dragon Yongjun and Yan, Hong, Liquidity and Credit Default Swap Spreads (August 20, 2007). Available at SSRN: http://ssrn.com/abstract=1008325 or http://dx.doi.org/10.2139/ssrn.1008325

Weber, Martin and Norden, Lars, The Comovement of Credit Default Swap, Bond and Stock Markets: An Empirical Analysis (October 2004). CEPR Discussion Paper No. 4674. Available at SSRN: http://ssrn.com/abstract=635981

Yang Liu & Bruce Morley (2012): Sovereign credit default swaps and the macroeconomy, Applied Economics Letters, 19:2, 129-132

Zhang, Gaiyan, Informational Efficiency of Credit Default Swap and Stock Markets: The Impact of Adverse Credit Events (November 1, 2008). International Review of Accounting, Banking and Finance, Vol. 1, 2009 . Available at SSRN: http://ssrn.com/abstract=1497537

Zhu, Haibin, An Empirical Comparison of Credit Spreads Between the Bond Market and the Credit Default Swap Market (August 2004). EFMA 2004 Basel Meetings Paper; BIS Working Paper No. 160. Available at SSRN: http://ssrn.com/abstract=477501 or http://dx.doi.org/10.2139/ssrn.477501

VIII. APPENDIX

Table A.1: Descriptive statistics for sovereign CDS spreads (bp)

This table provides mean, median, standard deviation, minimum and maximum values for sovereign 5-years CDS spread levels in basis points on a weekly basis for the whole period (January 2007-June 2012), which is divided into three sub-periods: pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

	Germany	France	Austria	Netherlands	Belgium	Portugal	Ireland	Italy	Greece	Spain
Whole period N=285, except Germany (N=267)										
Mean	30.31	63.25	75.03	44.38	98.39	332.60	289.20	153.50	643.96	159.00
Median	30.88	45.90	71.68	37.46	63.20	99.10	178.00	117.78	229.70	102.80
St Dev	19.78	62.50	62.10	36.96	93.01	422.67	285.46	147.38	800.52	147.45
Min	0.90	0.50	0.50	1.20	1.60	3.60	1.80	5.30	4.40	2.50
Max	91.03	233.43	267.18	130.31	377.59	1,548.30	1,249.30	566.47	2,647.66	595.95
Pre-crisis N=87, except Germany (N=69)										
Mean	5.20	6.02	5.62	6.37	10.34	17.88	14.94	19.92	23.39	16.78
Median	5.20	4.30	5.00	4.10	4.20	9.10	12.95	10.80	10.20	9.10
St Dev	2.65	4.39	3.67	9.25	9.27	14.50	9.16	14.52	20.21	13.90
Min	0.90	0.50	0.50	1.20	1.60	3.60	1.80	5.30	4.40	2.50
Max	11.70	18.20	13.50	83.46	33.60	49.70	30.00	50.10	68.70	48.20
Financial crisis (N=70)										
Mean	35.14	39.92	99.21	52.92	62.75	78.61	178.95	107.43	163.68	88.95
Median	31.99	35.98	87.91	41.41	55.31	73.37	170.53	96.45	151.39	86.91
St Dev	18.36	19.72	53.50	31.35	32.26	27.25	76.90	43.03	62.80	27.85
Min	7.50	11.10	11.30	9.20	20.50	37.70	29.80	40.10	50.70	37.50
Max	91.03	96.08	267.18	129.35	152.20	144.00	378.40	199.07	289.28	156.80
European debt crisis (N=128)										
Mean	41.20	114.91	108.98	65.54	177.73	685.41	535.91	269.49	1,328.42	293.97
Median	39.86	89.00	88.11	50.56	159.85	539.17	590.27	194.73	977.49	263.18
St Dev	12.54	57.25	47.71	31.34	79.78	412.42	243.68	143.07	753.32	114.66
Min	18.95	31.98	48.71	28.32	46.80	91.65	114.66	90.31	255.46	93.63
Max	76.02	233.43	226.12	130.31	377.59	1,548.30	1,249.30	566.47	2,647.66	595.95

Table A.2: Descriptive statistics for country stock indexes returns (%)

This table provides mean, median, standard deviation, minimum and maximum values for country's stock indexes returns in percentage on a weekly basis for the whole period (January 2007-June 2012), which is divided into three sub-periods: pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

	Germany	France	Austria	Netherlands	Belgium	Portugal	Ireland	Italy	Greece	Spain
Whole period (N=284)										
Mean	0.04%	-0.15%	-0.20%	-0.12%	-0.20%	-0.27%	-0.28%	-0.33%	-0.74%	-0.20%
Median	0.24%	-0.01%	0.09%	-0.01%	-0.31%	-0.11%	-0.07%	-0.32%	-0.56%	-0.13%
St Dev	3.61%	3.61%	4.50%	3.55%	3.56%	3.23%	4.65%	4.00%	5.72%	3.88%
Min	-14.82%	-12.90%	-18.94%	-13.76%	-12.98%	-14.99%	-18.15%	-13.93%	-16.96%	-19.45%
Max	15.97%	15.02%	22.05%	15.15%	17.20%	13.31%	19.14%	13.26%	17.87%	15.25%
Pre-crisis (N=86)										
Mean	-0.01%	-0.23%	-0.21%	-0.20%	-0.39%	-0.28%	-0.84%	-0.42%	-0.25%	-0.21%
Median	0.38%	0.37%	-0.04%	0.15%	-0.07%	0.20%	-0.72%	-0.29%	0.18%	0.17%
St Dev	2.86%	2.98%	3.36%	2.98%	3.02%	2.85%	4.90%	2.61%	3.59%	2.94%
Min	-12.18%	-12.20%	-10.39%	-12.85%	-12.98%	-10.77%	-12.22%	-9.71%	-11.09%	-12.51%
Max	4.38%	6.02%	6.35%	5.19%	5.33%	5.89%	15.79%	6.33%	7.10%	5.82%
Financial crisis (N=70)										
Mean	0.05%	-0.04%	-0.29%	-0.13%	-0.13%	0.07%	-0.24%	-0.11%	-0.42%	0.21%
Median	-0.04%	-0.27%	0.48%	0.12%	-0.24%	0.47%	0.53%	0.08%	-0.27%	0.37%
St Dev	4.92%	4.64%	6.50%	5.01%	5.07%	3.92%	6.52%	5.43%	6.87%	4.95%
Min	-10.35%	-11.05%	-18.94%	-13.76%	-12.74%	-14.99%	-18.15%	-13.93%	-16.96%	-19.45%
Max	15.97%	15.02%	22.05%	15.15%	17.20%	13.31%	19.14%	13.26%	17.87%	15.25%
European debt crisis (N=128)										
Mean	0.07%	-0.15%	-0.13%	-0.07%	-0.10%	-0.44%	0.08%	-0.38%	-1.23%	-0.41%
Median	0.24%	0.05%	0.09%	-0.25%	-0.34%	-0.37%	0.11%	-0.73%	-1.09%	-0.45%
St Dev	3.23%	3.37%	3.83%	2.91%	2.86%	3.06%	2.94%	3.88%	6.18%	3.78%
Min	-14.82%	-12.90%	-17.33%	-12.70%	-11.80%	-9.96%	-12.70%	-11.74%	-16.68%	-10.30%
Max	8.75%	8.02%	8.64%	7.03%	8.61%	7.08%	6.87%	9.94%	17.62%	8.97%

Table A.3: Descriptive statistics for financial sector stock indexes weekly returns (%)

This table provides mean, median, standard deviation, minimum and maximum values for country's financial sector stock indexes returns in percentage on a weekly basis for the whole period (January 2007-June 2012), which is divided into three sub-periods: pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

	Germany	France	Austria	Netherlands	Belgium	Portugal	Ireland	Italy	Greece	Spain
Whole period (N=284)										
Mean	-0.19%	-0.27%	-0.28%	-0.29%	-0.44%	-0.83%	-0.79%	-0.49%	-0.92%	-0.32%
Median	-0.12%	-0.15%	0.07%	0.15%	-0.17%	-0.36%	-1.57%	-0.38%	-0.74%	-0.26%
St Dev	3.97%	5.29%	4.79%	5.04%	5.10%	5.33%	12.62%	5.10%	7.44%	4.89%
Min	-16.58%	-15.38%	-20.53%	-22.35%	-21.21%	-18.43%	-59.21%	-16.56%	-22.98%	-20.98%
Max	15.88%	24.50%	15.69%	15.72%	18.50%	18.27%	79.87%	18.24%	26.70%	21.05%
Pre-crisis (N=86)										
Mean	-0.35%	-0.51%	-0.49%	-0.43%	-0.64%	-0.71%	-1.09%	-0.56%	-0.32%	-0.49%
Median	0.08%	-0.19%	-0.28%	0.00%	-0.37%	-0.22%	-0.94%	-0.25%	-0.43%	-0.26%
St Dev	3.04%	4.08%	3.39%	3.56%	3.81%	4.21%	6.36%	2.96%	3.75%	3.27%
Min	-14.21%	-15.02%	-9.59%	-14.54%	-16.62%	-18.43%	-14.80%	-10.92%	-9.66%	-12.67%
Max	5.79%	11.81%	6.33%	6.77%	6.74%	13.66%	22.17%	6.97%	7.61%	6.45%
Financial crisis (N=70)										
Mean	-0.12%	0.05%	-0.23%	-0.52%	-0.45%	-0.21%	0.16%	-0.09%	-0.44%	0.26%
Median	-0.04%	0.71%	0.46%	0.64%	0.62%	0.41%	-2.59%	0.26%	-0.96%	0.87%
St Dev	5.36%	6.94%	6.80%	7.85%	7.84%	5.02%	21.28%	6.47%	8.34%	6.44%
Min	-16.58%	-15.38%	-20.53%	-22.35%	-21.21%	-12.84%	-59.21%	-16.22%	-19.84%	-20.98%
Max	15.88%	24.50%	15.69%	15.72%	18.50%	13.00%	79.87%	18.24%	20.22%	21.05%
European debt crisis (N=128)										
Mean	-0.13%	-0.30%	-0.17%	-0.06%	-0.30%	-1.24%	-1.10%	-0.67%	-1.58%	-0.52%
Median	-0.22%	-0.13%	-0.04%	-0.13%	-0.51%	-1.22%	-2.34%	-1.02%	-1.78%	-0.67%
St Dev	3.64%	5.00%	4.27%	3.83%	3.86%	6.10%	9.02%	5.40%	8.68%	4.84%
Min	-12.87%	-14.66%	-15.73%	-14.94%	-12.61%	-16.52%	-21.75%	-16.56%	-22.98%	-11.56%
Max	9.33%	12.75%	12.79%	10.57%	9.53%	18.27%	26.93%	12.27%	26.70%	13.99%

Table A.4: Descriptive statistics for non-financial sector stock indexes weekly returns (%)

This table provides mean, median, standard deviation, minimum and maximum values for country's non-financial sector stock indexes returns in percentage on a weekly basis for the whole period (January 2007-June 2012), which is divided into three sub-periods: pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

	Germany	France	Austria	Netherlands	Belgium	Portugal	Ireland	Italy	Greece	Spain
					Whole period (N=284)					
Mean	0.00%	-0.08%	-0.12%	-0.04%	0.10%	-0.13%	-0.07%	-0.18%	-0.46%	-0.18%
Median	0.24%	0.20%	0.13%	-0.01%	0.22%	0.02%	-0.06%	-0.01%	-0.34%	-0.05%
St Dev	3.21%	3.15%	3.61%	3.33%	3.04%	3.11%	3.52%	3.26%	3.70%	3.08%
Min	-16.03%	-12.66%	-16.53%	-12.14%	-13.85%	-14.47%	-16.50%	-12.17%	-15.48%	-14.10%
Max	12.05%	16.08%	18.36%	15.84%	16.17%	15.49%	12.37%	13.46%	14.40%	12.92%
					Pre-crisis (N=86)					
Mean	-0.02%	-0.17%	-0.09%	0.00%	-0.21%	-0.13%	-0.53%	-0.32%	-0.22%	-0.17%
Median	0.31%	0.33%	0.30%	0.47%	0.11%	0.07%	-0.29%	-0.11%	-0.01%	0.22%
St Dev	2.57%	2.67%	2.94%	2.87%	2.63%	2.76%	3.91%	2.52%	2.64%	2.66%
Min	-10.61%	-10.44%	-9.34%	-10.93%	-9.42%	-8.82%	-16.50%	-7.87%	-9.42%	-10.71%
Max	3.94%	4.89%	6.42%	5.75%	7.64%	6.38%	10.59%	5.53%	4.99%	5.01%
					Financial crisis (N=70)					
Mean	-0.14%	-0.04%	-0.32%	-0.01%	0.33%	0.12%	-0.01%	-0.11%	-0.34%	-0.05%
Median	0.03%	-0.08%	-0.13%	-0.02%	0.41%	0.27%	0.02%	0.18%	0.31%	0.19%
St Dev	4.01%	4.16%	5.13%	4.62%	4.41%	3.99%	4.21%	4.41%	4.32%	3.76%
Min	-9.22%	-11.26%	-16.53%	-11.34%	-13.85%	-14.47%	-10.78%	-10.76%	-11.78%	-14.10%
Max	12.05%	16.08%	18.36%	15.84%	16.17%	15.49%	12.37%	13.46%	14.40%	12.92%
					European debt crisis (N=128)					
Mean	0.08%	-0.03%	-0.03%	-0.09%	0.19%	-0.26%	0.20%	-0.12%	-0.68%	-0.26%
Median	0.33%	0.20%	0.05%	-0.26%	0.30%	-0.12%	0.06%	-0.01%	-0.85%	-0.23%
St Dev	3.11%	2.82%	2.98%	2.75%	2.31%	2.79%	2.73%	2.98%	3.96%	2.95%
Min	-16.03%	-12.66%	-15.45%	-12.14%	-10.59%	-10.86%	-13.56%	-12.17%	-15.48%	-8.93%
Max	8.45%	6.41%	5.67%	6.23%	6.71%	6.40%	6.83%	8.11%	11.30%	5.98%

Table A.5: Descriptive statistics for consumer staples stock indexes weekly returns (%)

This table provides mean, median, standard deviation, minimum and maximum values for country's consumer staples sector stock indexes returns in percentage on a weekly basis for the whole period (January 2007-June 2012), which is divided into three sub-periods: pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

	Germany	France	Austria	Netherlands	Belgium	Portugal	Ireland	Italy	Greece	Spain
Whole period (N=284)										
Mean	0.00%	0.03%	0.11%	0.08%	0.27%	0.28%	-0.01%	-0.06%	0.03%	-0.08%
Median	0.09%	0.26%	0.00%	0.16%	0.45%	0.34%	0.24%	0.12%	0.09%	0.00%
St Dev	2.75%	2.87%	3.84%	2.72%	3.65%	4.37%	3.05%	3.35%	4.97%	2.29%
Min	-13.44%	-17.72%	-25.00%	-18.01%	-18.46%	-26.41%	-18.43%	-17.39%	-18.94%	-11.84%
Max	9.20%	7.64%	17.10%	9.70%	10.77%	15.18%	10.90%	15.72%	24.83%	8.32%
Pre-crisis (N=86)										
Mean	-0.30%	-0.15%	-0.28%	-0.04%	0.03%	-0.04%	-0.41%	-0.54%	0.10%	0.00%
Median	0.08%	0.03%	0.00%	0.21%	0.48%	0.20%	-0.20%	-0.46%	0.29%	-0.09%
St Dev	2.23%	2.55%	2.73%	2.56%	3.67%	3.90%	3.01%	2.80%	4.39%	1.61%
Min	-6.85%	-7.58%	-10.74%	-6.96%	-10.85%	-17.12%	-7.44%	-7.25%	-18.94%	-3.89%
Max	3.12%	7.64%	8.92%	9.70%	10.49%	9.22%	5.81%	10.32%	13.57%	8.32%
Financial crisis (N=70)										
Mean	0.25%	0.11%	0.44%	0.22%	0.51%	0.46%	-0.10%	0.28%	0.24%	-0.39%
Median	-0.03%	0.38%	-1.31%	0.16%	1.00%	0.43%	0.45%	0.32%	-0.61%	-0.38%
St Dev	3.78%	4.03%	6.23%	3.77%	5.14%	6.06%	4.37%	4.70%	6.15%	2.86%
Min	-1.34%	-17.72%	-25.00%	-18.01%	-18.46%	-26.41%	-18.43%	-17.39%	-15.30%	-11.84%
Max	9.20%	7.10%	17.10%	9.31%	10.77%	15.18%	10.90%	15.72%	24.83%	6.51%
European debt crisis (N=128)										
Mean	0.07%	0.11%	0.20%	0.09%	0.31%	0.41%	0.32%	0.07%	-0.14%	0.02%
Median	0.16%	0.37%	0.25%	0.00%	0.16%	0.46%	0.40%	0.15%	0.07%	0.15%
St Dev	2.40%	2.29%	2.62%	2.10%	2.54%	3.54%	2.04%	2.77%	4.66%	2.34%
Min	-9.90%	-8.71%	-12.32%	-5.89%	-6.45%	-12.75%	-9.38%	-10.10%	-11.75%	-7.77%
Max	7.53%	6.04%	5.95%	4.78%	7.51%	10.52%	4.52%	6.63%	17.99%	6.84%

Table A.6: Descriptive statistics for industrials sector stock indexes weekly returns (%)

This table provides mean, median, standard deviation, minimum and maximum values for country's industrials sector stock indexes returns in percentage on a weekly basis for the whole period (January 2007-June 2012), which is divided into three sub-periods: pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

	Germany	France	Austria	Netherlands	Belgium	Portugal	Ireland	Italy	Greece	Spain
Whole period (N=284)										
Mean	0.00%	-0.04%	-0.11%	-0.04%	-0.19%	-0.24%	-0.16%	-0.26%	-0.41%	0.00%
Median	0.21%	0.10%	0.24%	0.10%	0.08%	-0.02%	-0.23%	-0.09%	-0.49%	0.21%
St Dev	4.10%	3.76%	3.59%	4.27%	4.38%	3.38%	5.06%	3.52%	4.32%	4.10%
Min	-20.01%	-17.18%	-20.37%	-18.66%	-22.88%	-13.58%	-17.23%	-14.93%	-22.26%	-20.01%
Max	16.55%	14.54%	7.82%	11.96%	12.61%	10.37%	18.02%	11.36%	15.86%	16.55%
Pre-crisis (N=86)										
Mean	-0.20%	-0.33%	-0.18%	-0.10%	-0.42%	-0.74%	-0.29%	-0.42%	-0.44%	-0.20%
Median	-0.05%	-0.31%	0.03%	0.13%	0.01%	-0.77%	-0.04%	-0.51%	0.15%	-0.05%
St Dev	3.08%	3.29%	3.44%	2.70%	2.95%	4.93%	2.70%	2.84%	3.36%	3.08%
Min	-5.85%	-7.68%	-9.06%	-6.87%	-9.82%	-11.23%	-6.67%	-7.89%	-8.85%	-5.85%
Max	8.57%	6.89%	10.25%	6.35%	7.24%	18.02%	5.78%	5.28%	5.54%	8.57%
Financial crisis (N=70)										
Mean	-0.08%	0.04%	-0.31%	0.10%	-0.32%	0.35%	0.35%	-0.21%	-0.32%	-0.08%
Median	-0.30%	-0.11%	0.29%	1.12%	0.46%	0.45%	-0.16%	0.71%	0.70%	-0.30%
St Dev	6.14%	5.28%	5.07%	6.07%	6.28%	4.43%	6.35%	4.33%	5.81%	6.14%
Min	-20.01%	-17.18%	-20.37%	-18.66%	-22.88%	-13.58%	-17.23%	-14.93%	-22.26%	-20.01%
Max	16.55%	14.54%	7.82%	11.96%	12.61%	10.37%	15.34%	8.99%	10.59%	16.55%
European debt crisis (N=128)										
Mean	0.07%	0.03%	0.15%	-0.03%	-0.18%	-0.44%	-0.04%	-0.27%	-0.44%	0.07%
Median	0.21%	0.31%	0.36%	0.04%	0.05%	-0.30%	0.21%	-0.30%	-0.76%	0.21%
St Dev	3.17%	3.17%	2.74%	3.58%	4.07%	2.96%	4.31%	3.54%	4.24%	3.17%
Min	-12.13%	-10.84%	-10.49%	-12.66%	-15.69%	-10.51%	-15.31%	-12.69%	-14.56%	-12.13%
Max	9.21%	9.30%	6.09%	11.33%	11.43%	8.31%	13.38%	11.36%	15.86%	9.21%

Table A.7:

This table provides Spearman correlation coefficients between sovereign 5-years CDS spread changes and country's stock sectoral (financials, non-financials, consumer staples and industrials) indexes returns in percentage on a weekly basis during pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

(* indicates 5% significance level)

	Sovereign CDS and financial sector stock markets			Sovereign CDS and non-financial sector stock markets			Sovereign CDS and consumer staples sector stock markets			Sovereign CDS and industrials sector stock markets		
	Pre-crisis	Financial crisis	European debt crisis	Pre-crisis	Financial crisis	European debt crisis	Pre-crisis	Financial crisis	European debt crisis	Pre-crisis	Financial crisis	European debt crisis
Germany	-0.23	-0.42*	-0.49*	-0.24*	-0.44*	-0.45*	-0.24*	-0.58*	-0.25*	-0.23	-0.53*	-0.31*
France	-018	-0.52*	-0.68*	-0.16	-0.46*	-0.61*	-0.22*	-0.61*	-0.43*	-0.27*	-0.64*	-0.55*
Austria	-0.21	-0.64*	-0.59*	-0.25*	-0.60*	-0.59*	-0.17	0.10	-0.09	-0.26*	-0.61*	-0.42*
Netherlands	-0.17	-0.49*	-0.59*	-0.16	-0.45*	-0.49*	-0.11	-0.40*	-0.30*	-0.23*	-0.58*	-0.47*
Belgium	-0.14	-0.46*	-0.68*	-0.18	-0.42*	-0.43*	-0.19	-0.49*	-0.31*	-0.29*	-0.66*	-0.40*
Portugal	-0.36*	-0.40*	-0.56*	-0.37*	-0.47*	-0.48*	-0.19	-0.56*	-0.25*	-0.21	-0.52*	-0.53*
Ireland	-0.30*	-0.37*	-0.38*	-0.21	-0.29*	-0.27*	-0.24*	-0.09	-0.15	-0.30*	-0.30*	-0.34*
Italy	-0.38*	-0.60*	-0.70*	-0.38*	-0.49*	-0.64*	-0.20	-0.57*	-0.34*	-0.39*	-0.57*	-0.58*
Greece	-0.57*	-0.61*	-0.31*	-0.35*	-0.57*	-0.34*	-0.22*	-0.47*	-0.16	-0.42*	-0.50*	-0.39*
Spain	-0.31*	-0.48*	-0.72*	-0.27*	-0.46*	-0.71*	-0.26*	-0.47*	-0.43*	-0.19	-0.58*	-0.64*

Table A.8: Spearman correlation coefficients between CDS weekly changes (5% significance level)

This table provides Spearman correlation coefficients between sovereign 5-years CDS spread changes in percentage on a weekly basis between sample countries during pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

(* indicates 5% significance level)

	Germany	France	Austria	Netherlands	Belgium	Portugal	Ireland	Italy	Greece	Spain
Pre-crisis										
Germany	1	0.715*	0.648*	0.426*	0.318*	0.318*	0.318*	0.293*	0.272*	0.411*
France	0.715*	1	0.731*	0.406*	0.361*	0.381*	0.312*	0.382*	0.308*	0.369*
Austria	0.648*	0.731*	1	0.303*	0.332*	0.487*	0.319*	0.464*	0.423*	0.479*
Netherlands	0.426*	0.406*	0.303*	1	0.120	0.137	0.135	0.047	-0.026	0.111
Belgium	0.318*	0.361*	0.332*	0.120	1	0.484*	0.427*	0.410*	0.423*	0.384*
Portugal	0.318*	0.381*	0.487*	0.137	0.484*	1	0.408*	0.782*	0.666*	0.629*
Ireland	0.318*	0.312*	0.319*	0.135	0.427*	0.408*	1	0.323*	0.276*	0.556*
Italy	0.293*	0.382*	0.464*	0.047	0.410*	0.782*	0.323*	1	0.710*	0.536*
Greece	0.272*	0.308*	0.423*	-0.026	0.423*	0.666*	0.276*	0.710*	1	0.477*
Spain	0.411*	0.369*	0.479*	0.111	0.384*	0.629*	0.556*	0.536*	0.477*	1
Financial crisis										
Germany	1	0.910*	0.768*	0.774*	0.862*	0.791*	0.600*	0.811*	0.686*	0.761*
France	0.910*	1	0.775*	0.836*	0.902*	0.821*	0.658*	0.861*	0.739*	0.783*
Austria	0.768*	0.775*	1	0.830*	0.834*	0.753*	0.764*	0.877*	0.819*	0.792*
Netherlands	0.774*	0.836*	0.830*	1	0.877*	0.815*	0.783*	0.890*	0.747*	0.797*
Belgium	0.862*	0.902*	0.834*	0.877*	1	0.865*	0.738*	0.897*	0.752*	0.822*
Portugal	0.791*	0.821*	0.753*	0.815*	0.865*	1	0.779*	0.886*	0.820*	0.946*
Ireland	0.600*	0.658*	0.764*	0.783*	0.738*	0.779*	1	0.802*	0.822*	0.792*
Italy	0.811*	0.861*	0.877*	0.890*	0.897*	0.886*	0.802*	1	0.844*	0.872*
Greece	0.686*	0.739*	0.819*	0.747*	0.752*	0.820*	0.822*	0.844*	1	0.887*
Spain	0.761*	0.783*	0.792*	0.797*	0.822*	0.946*	0.792*	0.872*	0.887*	1
European debt crisis										
Germany	1	0.763*	0.756*	0.803*	0.700*	0.429*	0.462*	0.647*	0.310*	0.628*
France	0.763*	1	0.833*	0.838*	0.834*	0.545*	0.565*	0.804*	0.347*	0.816*
Austria	0.756*	0.833*	1	0.808*	0.769*	0.550*	0.562*	0.783*	0.317*	0.771*
Netherlands	0.803*	0.838*	0.808*	1	0.806*	0.459*	0.540*	0.759*	0.290*	0.697*
Belgium	0.700*	0.834*	0.769*	0.806*	1	0.517*	0.613*	0.770*	0.275*	0.767*
Portugal	0.429*	0.545*	0.550*	0.459*	0.517*	1	0.744*	0.564*	0.329*	0.666*
Ireland	0.462*	0.565*	0.562*	0.540*	0.613*	0.744*	1	0.647*	0.329*	0.675*
Italy	0.647*	0.804*	0.783*	0.759*	0.770*	0.564*	0.647*	1	0.336*	0.850*
Greece	0.310*	0.347*	0.317*	0.290*	0.275*	0.329*	0.329*	0.336*	1	0.342*
Spain	0.628*	0.816*	0.771*	0.697*	0.767*	0.666*	0.675*	0.850*	0.342*	1

Table A.9: Spearman correlation coefficients between stock indexes weekly returns

This table provides Spearman correlation coefficients between country's stock indexes returns in percentage on a weekly basis between sample countries during pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

(* indicates 5% significance level)

	Germany	France	Austria	Netherlands	Belgium	Portugal	Ireland	Italy	Greece	Spain
					Pre-crisis					
Germany	1	0.931*	0.869*	0.872*	0.849*	0.746*	0.807*	0.879*	0.749*	0.818*
France	0.931*	1	0.884*	0.927*	0.903*	0.728*	0.825*	0.932*	0.766*	0.826*
Austria	0.869*	0.884*	1	0.883*	0.824*	0.720*	0.805*	0.808*	0.789*	0.776*
Netherlands	0.872*	0.927*	0.883*	1	0.892*	0.685*	0.770*	0.846*	0.786*	0.788*
Belgium	0.849*	0.903*	0.824*	0.892*	1	0.742*	0.807*	0.855*	0.762*	0.802*
Portugal	0.746*	0.728*	0.720*	0.685*	0.742*	1	0.736*	0.659*	0.577*	0.743*
Ireland	0.807*	0.825*	0.805*	0.770*	0.807*	0.736*	1	0.765*	0.664*	0.761*
Italy	0.879*	0.932*	0.808*	0.846*	0.855*	0.659*	0.765*	1	0.751*	0.758*
Greece	0.749*	0.766*	0.789*	0.786*	0.762*	0.577*	0.664*	0.751*	1	0.647*
Spain	0.818*	0.826*	0.776*	0.788*	0.802*	0.743*	0.761*	0.758*	0.647*	1
					Financial crisis					
Germany	1	0.961*	0.793*	0.932*	0.862*	0.742*	0.671*	0.907*	0.711*	0.895*
France	0.961*	1	0.803*	0.951*	0.884*	0.786*	0.715*	0.948*	0.736*	0.924*
Austria	0.793*	0.803*	1	0.796*	0.809*	0.835*	0.672*	0.798*	0.813*	0.796*
Netherlands	0.932*	0.951*	0.796*	1	0.896*	0.759*	0.788*	0.915*	0.719*	0.880*
Belgium	0.862*	0.884*	0.809*	0.896*	1	0.805*	0.756*	0.879*	0.742*	0.828*
Portugal	0.742*	0.786*	0.835*	0.759*	0.805*	1	0.602*	0.809*	0.845*	0.795*
Ireland	0.671*	0.715*	0.672*	0.788*	0.756*	0.602*	1	0.676*	0.639*	0.667*
Italy	0.907*	0.948*	0.798*	0.915*	0.879*	0.809*	0.676*	1	0.757*	0.910*
Greece	0.711*	0.736*	0.813*	0.719*	0.742*	0.845*	0.639*	0.757*	1	0.755*
Spain	0.895*	0.924*	0.796*	0.880*	0.828*	0.795*	0.667*	0.910*	0.755*	1
					European debt crisis					
Germany	1	0.920*	0.819*	0.908*	0.885*	0.673*	0.791*	0.873*	0.542*	0.803*
France	0.920*	1	0.872*	0.939*	0.928*	0.759*	0.814*	0.928*	0.569*	0.893*
Austria	0.819*	0.872*	1	0.863*	0.859*	0.735*	0.779*	0.853*	0.585*	0.815*
Netherlands	0.908*	0.939*	0.863*	1	0.902*	0.717*	0.849*	0.889*	0.508*	0.834*
Belgium	0.885*	0.928*	0.859*	0.902*	1	0.785*	0.782*	0.895*	0.607*	0.854*
Portugal	0.673*	0.759*	0.735*	0.717*	0.785*	1	0.620*	0.770*	0.548*	0.787*
Ireland	0.791*	0.814*	0.779*	0.849*	0.782*	0.620*	1	0.776*	0.398*	0.692*
Italy	0.873*	0.928*	0.853*	0.889*	0.895*	0.770*	0.776*	1	0.601*	0.906*
Greece	0.542*	0.569*	0.585*	0.508*	0.607*	0.548*	0.398*	0.601*	1	0.608*
Spain	0.803*	0.893*	0.815*	0.834*	0.854*	0.787*	0.692*	0.906*	0.608*	1

Table A.10: Spearman correlation coefficients between financial sector stock indexes weekly returns

This table provides Spearman correlation coefficients between country's financial stock indexes returns in percentage on a weekly basis between sample countries during pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).
(* indicates 5% significance level)

	Germany	France	Austria	Netherlands	Belgium	Portugal	Ireland	Italy	Greece	Spain
					Pre-crisis					
Germany	1	0.922*	0.813*	0.880*	0.882*	0.574*	0.785*	0.839*	0.706*	0.824*
France	0.922*	1	0.845*	0.904*	0.898*	0.594*	0.803*	0.918*	0.691*	0.827*
Austria	0.813*	0.845*	1	0.856*	0.835*	0.555*	0.731*	0.779*	0.759*	0.804*
Netherlands	0.880*	0.904*	0.856*	1	0.903*	0.525*	0.778*	0.818*	0.738*	0.788*
Belgium	0.882*	0.898*	0.835*	0.903*	1	0.643*	0.780*	0.825*	0.731*	0.819*
Portugal	0.574*	0.594*	0.555*	0.525*	0.643*	1	0.551*	0.535*	0.388*	0.609*
Ireland	0.785*	0.803*	0.731*	0.778*	0.780*	0.551*	1	0.715*	0.610*	0.744*
Italy	0.839*	0.918*	0.779*	0.818*	0.825*	0.535*	0.715*	1	0.695*	0.737*
Greece	0.706*	0.691*	0.759*	0.738*	0.731*	0.388*	0.610*	0.695*	1	0.670*
Spain	0.824*	0.827*	0.804*	0.788*	0.819*	0.609*	0.744*	0.737*	0.670*	1
					Financial crisis					
Germany	1	0.862*	0.797*	0.776*	0.842*	0.554*	0.539*	0.856*	0.716*	0.812*
France	0.862*	1	0.773*	0.862*	0.915*	0.651*	0.639*	0.877*	0.813*	0.886*
Austria	0.797*	0.773*	1	0.754*	0.816*	0.621*	0.611*	0.804*	0.742*	0.728*
Netherlands	0.776*	0.862*	0.754*	1	0.877*	0.576*	0.687*	0.832*	0.718*	0.781*
Belgium	0.842*	0.915*	0.816*	0.877*	1	0.634*	0.659*	0.849*	0.756*	0.831*
Portugal	0.554*	0.651*	0.621*	0.576*	0.634*	1	0.377*	0.648*	0.702*	0.600*
Ireland	0.539*	0.639*	0.611*	0.687*	0.659*	0.377*	1	0.555*	0.669*	0.580*
Italy	0.856*	0.877*	0.804*	0.832*	0.849*	0.648*	0.555*	1	0.767*	0.864*
Greece	0.716*	0.813*	0.742*	0.718*	0.756*	0.702*	0.669*	0.767*	1	0.767*
Spain	0.812*	0.886*	0.728*	0.781*	0.831*	0.600*	0.580*	0.864*	0.767*	1
					European debt crisis					
Germany	1	0.901*	0.783*	0.891*	0.850*	0.656*	0.585*	0.848*	0.544*	0.793*
France	0.901*	1	0.820*	0.917*	0.912*	0.747*	0.602*	0.906*	0.566*	0.862*
Austria	0.783*	0.820*	1	0.831*	0.832*	0.651*	0.562*	0.809*	0.542*	0.765*
Netherlands	0.891*	0.917*	0.831*	1	0.885*	0.672*	0.620*	0.875*	0.506*	0.812*
Belgium	0.850*	0.912*	0.832*	0.885*	1	0.737*	0.621*	0.884*	0.589*	0.828*
Portugal	0.656*	0.747*	0.651*	0.672*	0.737*	1	0.472*	0.747*	0.502*	0.740*
Ireland	0.585*	0.602*	0.562*	0.620*	0.621*	0.472*	1	0.590*	0.336*	0.603*
Italy	0.848*	0.906*	0.809*	0.875*	0.884*	0.747*	0.590*	1	0.540*	0.884*
Greece	0.544*	0.566*	0.542*	0.506*	0.589*	0.502*	0.336*	0.540*	1	0.564*
Spain	0.793*	0.862*	0.765*	0.812*	0.828*	0.740*	0.603*	0.884*	0.564*	1

Table A.11: Spearman correlation coefficients between non-financial sector stock indexes weekly returns

This table provides Spearman correlation coefficients between country's non-financial stock indexes returns in percentage on a weekly basis between sample countries during pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).
(* indicates 5% significance level)

	Germany	France	Austria	Netherlands	Belgium	Portugal	Ireland	Italy	Greece	Spain
					Pre-crisis					
Germany	1	0.938*	0.830*	0.893*	0.779*	0.734*	0.820*	0.876*	0.716*	0.830*
France	0.938*	1	0.803*	0.892*	0.766*	0.710*	0.796*	0.913*	0.697*	0.844*
Austria	0.830*	0.803*	1	0.819*	0.680*	0.634*	0.747*	0.795*	0.686*	0.704*
Netherlands	0.893*	0.892*	0.819*	1	0.793*	0.677*	0.730*	0.867*	0.751*	0.776*
Belgium	0.779*	0.766*	0.680*	0.793*	1	0.600*	0.664*	0.763*	0.605*	0.681*
Portugal	0.734*	0.710*	0.634*	0.677*	0.600*	1	0.671*	0.649*	0.570*	0.708*
Ireland	0.820*	0.796*	0.747*	0.730*	0.664*	0.671*	1	0.739*	0.600*	0.732*
Italy	0.876*	0.913*	0.795*	0.867*	0.763*	0.649*	0.739*	1	0.704*	0.779*
Greece	0.716*	0.697*	0.686*	0.751*	0.605*	0.570*	0.600*	0.704*	1	0.565*
Spain	0.830*	0.844*	0.704*	0.776*	0.681*	0.708*	0.732*	0.779*	0.565*	1
					Financial crisis					
Germany	1	0.909*	0.770*	0.899*	0.709*	0.795*	0.765*	0.858*	0.670*	0.819*
France	0.909*	1	0.719*	0.919*	0.693*	0.783*	0.746*	0.937*	0.655*	0.886*
Austria	0.770*	0.719*	1	0.773*	0.667*	0.767*	0.677*	0.765*	0.691*	0.708*
Netherlands	0.899*	0.919*	0.773*	1	0.767*	0.762*	0.802*	0.892*	0.621*	0.836*
Belgium	0.709*	0.693*	0.667*	0.767*	1	0.670*	0.705*	0.666*	0.608*	0.644*
Portugal	0.795*	0.783*	0.767*	0.762*	0.670*	1	0.642*	0.775*	0.697*	0.749*
Ireland	0.765*	0.746*	0.677*	0.802*	0.705*	0.642*	1	0.725*	0.665*	0.656*
Italy	0.858*	0.937*	0.765*	0.892*	0.666*	0.775*	0.725*	1	0.650*	0.893*
Greece	0.670*	0.655*	0.691*	0.621*	0.608*	0.697*	0.665*	0.650*	1	0.682*
Spain	0.819*	0.886*	0.708*	0.836*	0.644*	0.749*	0.656*	0.893*	0.682*	1
					European debt crisis					
Germany	1	0.916*	0.818*	0.867*	0.661*	0.696*	0.774*	0.871*	0.480*	0.789*
France	0.916*	1	0.851*	0.916*	0.728*	0.756*	0.821*	0.935*	0.493*	0.892*
Austria	0.818*	0.851*	1	0.822*	0.583*	0.708*	0.747*	0.845*	0.503*	0.782*
Netherlands	0.867*	0.916*	0.822*	1	0.729*	0.692*	0.841*	0.881*	0.487*	0.823*
Belgium	0.661*	0.728*	0.583*	0.729*	1	0.557*	0.648*	0.682*	0.318*	0.659*
Portugal	0.696*	0.756*	0.708*	0.692*	0.557*	1	0.619*	0.801*	0.496*	0.796*
Ireland	0.774*	0.821*	0.747*	0.841*	0.648*	0.619*	1	0.805*	0.367*	0.713*
Italy	0.871*	0.935*	0.845*	0.881*	0.682*	0.801*	0.805*	1	0.553*	0.905*
Greece	0.480*	0.493*	0.503*	0.487*	0.318*	0.496*	0.367*	0.553*	1	0.538*
Spain	0.789*	0.892*	0.782*	0.823*	0.659*	0.796*	0.713*	0.905*	0.538*	1

Table A.12:Spearman correlation coefficients between consumer staples stock indexes weekly returns

This table provides Spearman correlation coefficients between consumer staples stock indexes returns in percentage on a weekly basis between sample countries during pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).

(* indicates 5% significance level)

	Germany	France	Austria	Netherlands	Belgium	Portugal	Ireland	Italy	Greece	Spain
					Pre-crisis					
Germany	1	0.668*	0.131	0.683*	0.509*	0.422*	0.485*	0.417*	0.290*	0.581*
France	0.668*	1	0.136	0.578*	0.377*	0.296*	0.456*	0.365*	0.192	0.460*
Austria	0.131	0.136	1	0.072	0.050	0.123	0.116	0.076	0.129	0.273*
Netherlands	0.683*	0.578*	0.072	1	0.460*	0.445*	0.380*	0.445*	0.319*	0.630*
Belgium	0.509*	0.377*	0.050	0.460*	1	0.329*	0.364*	0.372*	0.324*	0.453*
Portugal	0.422*	0.296*	0.123	0.445*	0.329*	1	0.184	0.326*	0.173	0.500*
Ireland	0.485*	0.456*	0.116	0.380*	0.364*	0.184	1	0.199	0.224*	0.401*
Italy	0.417*	0.365*	0.076	0.445*	0.372*	0.326*	0.199	1	0.119	0.423*
Greece	0.290*	0.192	0.129	0.319*	0.324*	0.173	0.224*	0.119	1	0.306*
Spain	0.581*	0.460*	0.273*	0.630*	0.453*	0.500*	0.401*	0.423*	0.306*	1
					Financial crisis					
Germany	1	0.807*	0.022	0.657*	0.520*	0.537*	0.297*	0.577*	0.585*	0.589*
France	0.807*	1	-0.062	0.732*	0.596*	0.523*	0.306*	0.612*	0.505*	0.667*
Austria	0.022	-0.062	1	0.073	0.048	0.035	0.130	0.115	0.018	0.106
Netherlands	0.657*	0.732*	0.073	1	0.519*	0.559*	0.411*	0.595*	0.387*	0.559*
Belgium	0.520*	0.596*	0.048	0.519*	1	0.410*	0.342*	0.540*	0.475*	0.419*
Portugal	0.537*	0.523*	0.035	0.559*	0.410*	1	0.169	0.556*	0.298*	0.474*
Ireland	0.297*	0.306*	0.130	0.411*	0.342*	0.169	1	0.320*	0.277*	0.230
Italy	0.577*	0.612*	0.115	0.595*	0.540*	0.556*	0.320*	1	0.396*	0.587*
Greece	0.585*	0.505*	0.018	0.387*	0.475*	0.298*	0.277*	0.396*	1	0.424*
Spain	0.589*	0.667*	0.106	0.559*	0.419*	0.474*	0.230	0.587*	0.424*	1
					European debt crisis					
Germany	1	0.728*	0.160	0.662*	0.504*	0.460*	0.489*	0.466*	0.179*	0.540*
France	0.728*	1	0.177*	0.768*	0.630*	0.491*	0.593*	0.501*	0.229*	0.614*
Austria	0.160	0.177*	1	0.197*	0.019	0.244*	0.289*	0.086	0.053	0.191*
Netherlands	0.662*	0.768*	0.197*	1	0.622*	0.450*	0.632*	0.409*	0.271*	0.492*
Belgium	0.504*	0.630*	0.019	0.622*	1	0.480*	0.432*	0.423*	0.155	0.427*
Portugal	0.460*	0.491*	0.244*	0.450*	0.480*	1	0.401*	0.351*	0.117	0.454*
Ireland	0.489*	0.593*	0.289*	0.632*	0.432*	0.401*	1	0.446*	0.256*	0.467*
Italy	0.466*	0.501*	0.086	0.409*	0.423*	0.351*	0.446*	1	0.088	0.542*
Greece	0.179*	0.229*	0.053	0.271*	0.155	0.117	0.256*	0.088	1	-0.006
Spain	0.540*	0.614*	0.191*	0.492*	0.427*	0.454*	0.467*	0.542*	-0.006	1

Table A.13: Spearman correlation coefficients between industrials stock indexes weekly returns

This table provides Spearman correlation coefficients between country's industrials stock indexes returns in percentage on a weekly basis between sample countries during pre-crisis (January 2007-August 2008), financial crisis (September 2008-December 2009) and European debt crisis (January 2010-June 2012).
(* indicates 5% significance level)

	Germany	France	Austria	Netherlands	Belgium	Portugal	Ireland	Italy	Greece	Spain
					Pre-crisis					
Germany	1	0.813*	0.768*	0.767*	0.707*	0.600*	0.610*	0.780*	0.654*	0.784*
France	0.813*	1	0.845*	0.852*	0.768*	0.635*	0.703*	0.876*	0.553*	0.817*
Austria	0.768*	0.845*	1	0.858*	0.764*	0.621*	0.702*	0.793*	0.548*	0.720*
Netherlands	0.767*	0.852*	0.858*	1	0.810*	0.659*	0.679*	0.844*	0.554*	0.767*
Belgium	0.707*	0.768*	0.764*	0.810*	1	0.581*	0.588*	0.770*	0.623*	0.648*
Portugal	0.600*	0.635*	0.621*	0.659*	0.581*	1	0.590*	0.637*	0.426*	0.609*
Ireland	0.610*	0.703*	0.702*	0.679*	0.588*	0.590*	1	0.680*	0.477*	0.692*
Italy	0.780*	0.876*	0.793*	0.844*	0.770*	0.637*	0.680*	1	0.648*	0.779*
Greece	0.654*	0.553*	0.548*	0.554*	0.623*	0.426*	0.477*	0.648*	1	0.591*
Spain	0.784*	0.817*	0.720*	0.767*	0.648*	0.609*	0.692*	0.779*	0.591*	1
					Financial crisis					
Germany	1	0.911*	0.804*	0.865*	0.849*	0.643*	0.592*	0.755*	0.572*	0.829*
France	0.911*	1	0.833*	0.915*	0.878*	0.714*	0.686*	0.831*	0.660*	0.900*
Austria	0.804*	0.833*	1	0.869*	0.898*	0.751*	0.594*	0.785*	0.655*	0.772*
Netherlands	0.865*	0.915*	0.869*	1	0.914*	0.703*	0.637*	0.802*	0.617*	0.868*
Belgium	0.849*	0.878*	0.898*	0.914*	1	0.716*	0.589*	0.792*	0.666*	0.821*
Portugal	0.643*	0.714*	0.751*	0.703*	0.716*	1	0.448*	0.671*	0.536*	0.770*
Ireland	0.592*	0.686*	0.594*	0.637*	0.589*	0.448*	1	0.506*	0.567*	0.595*
Italy	0.755*	0.831*	0.785*	0.802*	0.792*	0.671*	0.506*	1	0.643*	0.813*
Greece	0.572*	0.660*	0.655*	0.617*	0.666*	0.536*	0.567*	0.643*	1	0.643*
Spain	0.829*	0.900*	0.772*	0.868*	0.821*	0.770*	0.595*	0.813*	0.643*	1
					European debt crisis					
Germany	1	0.890*	0.760*	0.819*	0.717*	0.529*	0.690*	0.824*	0.391*	0.758*
France	0.890*	1	0.780*	0.860*	0.757*	0.561*	0.737*	0.878*	0.377*	0.818*
Austria	0.760*	0.780*	1	0.815*	0.751*	0.484*	0.637*	0.754*	0.336*	0.673*
Netherlands	0.819*	0.860*	0.815*	1	0.710*	0.503*	0.724*	0.815*	0.391*	0.742*
Belgium	0.717*	0.757*	0.751*	0.710*	1	0.477*	0.568*	0.717*	0.380*	0.686*
Portugal	0.529*	0.561*	0.484*	0.503*	0.477*	1	0.423*	0.574*	0.429*	0.627*
Ireland	0.690*	0.737*	0.637*	0.724*	0.568*	0.423*	1	0.660*	0.403*	0.661*
Italy	0.824*	0.878*	0.754*	0.815*	0.717*	0.574*	0.660*	1	0.417*	0.824*
Greece	0.391*	0.377*	0.336*	0.391*	0.380*	0.429*	0.403*	0.417*	1	0.489*
Spain	0.758*	0.818*	0.673*	0.742*	0.686*	0.627*	0.661*	0.824*	0.489*	1

Table A.14: Country specific lead-lag analysis with two-dimensional VAR model between sovereign CDS and country's stock index

This table reports the coefficients and p-values of VAR model that consist of two equations with the country's stock index returns (R_t) and the sovereign 5-years CDS spread change (ΔCDS) as dependent variables. Bold p-values of VAR model and Granger causality test mark the coefficients at 5% significance level.

	Whole period				Pre-crisis				Financial crisis				European debt crisis			
	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.
Germany																
R_{t-1}	-0.05	0.42	-0.20	**0.03**	-0.15	0.24	0.05	0.40	-0.02	0.89	-0.44	**0.01**	-0.09	0.33	0.03	0.86
R_{t-2}	-0.10	0.15	0.03	0.76	0.02	0.85	-0.02	0.76	-0.28	0.05	0.26	0.12	0.05	0.63	-0.12	0.47
ΔCDS_{t-1}	-0.01	0.78	-0.08	0.23	-0.44	0.10	-0.15	0.23	-0.05	0.65	-0.04	0.76	0.00	0.98	-0.10	0.32
ΔCDS_{t-2}	-0.08	0.12	-0.02	0.81	-0.58	**0.04**	-0.21	0.11	-0.15	0.16	0.19	0.13	-0.03	0.54	-0.11	0.26
ΔCDS_{t-3}	-0.13	**0.01**	0.09	0.18	0.09	0.75	-0.01	0.96	-	-	-	-	-0.07	0.19	0.10	0.32
ΔCDS_{t-4}	-	-	-	-	-	-	-	-	-	-	-	-	-0.14	**0.01**	0.09	0.36
R^2	0.04		0.03		0.11		0.08		0.06		0.15		0.08		0.06	
GC: R_t				0.17				0.79				**0.00**				0.81
GC: ΔCDS_t		**0.04**				0.06				0.36				0.11		
France																
R_{t-1}	-0.07	0.28	-0.29	0.09	-0.16	0.15	-0.02	0.74	-0.13	0.38	-0.30	0.13	-0.09	0.42	-0.13	0.75
R_{t-2}	-0.13	0.07	0.12	0.48	-0.11	0.28	0.07	0.25	-0.28	0.07	0.30	0.14	0.01	0.90	0.12	0.76
R_{t-3}	0.00	0.99	-0.26	0.14	-	-	-	-	-	-	-	-	-0.06	0.57	-0.92	**0.02**
R_{t-4}	-0.14	0.05	0.40	**0.02**	-	-	-	-	-	-	-	-	-0.35	0.00	0.87	**0.04**
ΔCDS_{t-1}	0.00	0.99	-0.25	0.00	-0.30	0.11	-0.25	0.02	-0.08	0.46	-0.03	0.86	0.00	0.99	-0.24	0.03
ΔCDS_{t-2}	-0.01	0.81	-0.09	0.22	-0.46	**0.02**	-0.18	0.10	-0.08	0.46	0.21	0.15	0.03	0.40	-0.12	0.27
ΔCDS_{t-3}	-0.07	**0.02**	0.09	0.20	-	-	-	-	-	-	-	-	-0.06	**0.05**	-0.03	0.80
ΔCDS_{t-4}	-0.07	**0.01**	0.20	0.00	-	-	-	-	-	-	-	-	-0.11	**0.00**	0.28	0.01
R^2	0.06		0.12		0.09		0.10		0.05		0.08		0.14		0.18	
GC: R_t				**0.02**				0.46				0.06				**0.03**
GC: ΔCDS_t		0.05				**0.03**				0.61				**0.00**		
Austria																
R_{t-1}	-0.02	0.79	-0.41	0.06	-0.12	0.29	-0.03	0.58	0.08	0.60	-0.80	0.08	-0.11	0.35	-0.13	0.72
R_{t-2}	0.00	0.97	0.08	0.71	-0.01	0.90	-0.03	0.58	-0.03	0.86	0.10	0.82	0.05	0.65	0.12	0.76
ΔCDS_{t-1}	0.01	0.68	-0.08	0.28	-0.48	**0.04**	-0.40	0.00	0.02	0.67	-0.06	0.69	0.01	0.72	-0.17	0.13
ΔCDS_{t-2}	0.00	0.88	-0.03	0.73	-0.48	**0.04**	-0.01	0.91	-0.02	0.62	0.09	0.55	0.04	0.20	-0.15	0.18
ΔCDS_{t-3}	-0.02	0.33	-0.07	0.35	-	-	-	-	-0.03	0.58	-0.05	0.71	-0.02	0.63	-0.15	0.16
ΔCDS_{t-4}	0.02	0.49	-0.17	0.02	-	-	-	-	0.10	**0.04**	-0.40	0.01	-	-	-	-
R^2	0.02		0.03		0.07		0.16		0.11		0.14		0.04		0.06	
GC: R_t				0.16				0.44				0.09				0.43
GC: ΔCDS_t		0.80				0.12				0.33				0.54		
Netherlands																
R_{t-1}	0.01	0.87	-0.53	**0.00**	0.02	0.83	-0.17	0.66	0.05	0.70	-0.53	**0.02**	-0.03	0.80	-0.25	0.26
R_{t-2}	0.00	0.99	0.03	0.87	0.00	0.99	0.25	0.52	-0.06	0.65	0.24	0.32	0.09	0.41	-0.08	0.72
ΔCDS_{t-1}	0.02	0.48	-0.37	0.00	0.01	0.65	-0.66	0.00	0.01	0.89	0.03	0.81	0.06	0.23	-0.23	0.02
R^2	0.00		0.13		0.00		0.33		0.02		0.10		0.05		0.11	
GC: R_t				**0.00**				0.74				**0.04**				0.42
GC: ΔCDS_t		0.77				0.83				0.53				0.12		
Belgium																
R_{t-1}	-0.04	0.59	-0.48	0.07	-0.10	0.37	-0.11	0.15	0.02	0.90	-0.48	0.08	-0.20	0.07	-0.33	0.67
R_{t-2}	-0.08	0.25	0.11	0.69	-0.11	0.33	0.06	0.45	-0.15	0.23	0.07	0.81	0.00	0.98	0.26	0.75
R_{t-3}	-	-	-	-	0.17	0.13	-0.07	0.37	-0.17	0.17	0.27	0.32	0.01	0.95	-1.74	**0.03**
ΔCDS_{t-1}	0.02	0.34	-0.28	0.00	-0.43	**0.01**	0.02	0.84	-0.03	0.65	-0.08	0.51	0.01	0.46	-0.28	0.01
ΔCDS_{t-2}	-0.01	0.68	-0.04	0.54	0.06	0.72	-0.35	0.00	-0.14	**0.02**	0.10	0.45	0.01	0.53	-0.05	0.66
R^2	0.01		0.06		0.12		0.21		0.17		0.11		0.10		0.12	
GC: R_t				0.17				0.28				0.21				0.11
GC: ΔCDS_t		0.51				0.05				**0.04**				0.34		

	Whole period				Pre-crisis				Financial crisis				European debt crisis			
	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.
Portugal																
R_{t-1}	0.00	1.00	1.71	0.11	0.02	0.89	-0.18	0.11	-0.12	0.45	0.29	0.52	-0.01	0.96	5.99	**0.03**
R_{t-2}	-0.05	0.43	1.21	0.25	-0.03	0.82	0.02	0.86	-0.12	0.45	0.27	0.55	-0.11	0.29	3.63	0.18
R_{t-3}	0.18	0.01	-1.82	0.08	0.18	0.17	0.02	0.87	0.07	0.66	-0.04	0.93	0.15	0.14	-4.86	0.06
R_{t-4}	-0.09	0.16	1.14	0.28	-0.09	0.49	0.23	**0.04**	-	-	-	-	-0.30	0.00	4.81	0.07
ΔCDS_{t-1}	0.00	0.93	-0.09	0.15	-0.17	0.22	0.04	0.72	-0.01	0.82	0.01	0.94	0.00	0.99	-0.01	0.89
ΔCDS_{t-2}	0.01	0.10	-0.09	0.17	-0.13	0.35	-0.01	0.93	-0.02	0.72	-0.05	0.77	0.01	0.13	-0.03	0.75
ΔCDS_{t-3}	0.00	0.55	-0.21	0.00	0.15	0.29	-0.03	0.84	-0.10	0.08	0.16	0.33	0.00	0.86	-0.34	0.00
ΔCDS_{t-4}	0.00	0.71	-0.19	0.01	0.05	0.74	0.40	0.00	-	-	-	-	0.00	0.24	-0.11	0.29
R^2	0.07		0.11		0.08		0.14		0.12		0.06		0.16		0.18	
GC: R_t				0.06				0.20				0.85				**0.01**
GC: ΔCDS_t		0.51				0.41				0.36				0.45		
Ireland																
R_{t-1}	-0.13	0.03	0.04	0.94	-0.29	0.01	0.01	0.95	-0.09	0.45	-0.11	0.84	-0.05	0.57	1.84	0.31
R_{t-2}	-0.06	0.31	0.17	0.75	-0.37	0.00	0.00	1.00	-0.07	0.58	0.45	0.41	0.12	0.17	0.87	0.63
R_{t-3}	-0.01	0.83	0.07	0.89	-	-	-	-	-0.13	0.24	0.32	0.55	-0.08	0.35	-1.60	0.37
ΔCDS_{t-1}	0.00	0.88	-0.06	0.33	-0.01	0.96	-0.37	0.00	-0.02	0.57	0.02	0.88	0.00	0.45	-0.05	0.55
ΔCDS_{t-2}	0.00	0.84	-0.22	0.00	-0.36	**0.01**	-0.04	0.75	-0.03	0.29	0.09	0.49	0.01	**0.04**	-0.23	0.01
ΔCDS_{t-3}	-0.02	**0.01**	0.00	0.98	-	-	-	-	-0.05	0.08	0.01	0.93	-0.02	**0.00**	-0.03	0.74
R^2	0.09		0.06		0.21		0.13		0.19		0.05		0.18		0.07	
GC: R_t				0.98				1.00				0.46				0.59
GC: ΔCDS_t		0.07				**0.03**				0.30				**0.00**		
Italy																
R_{t-1}	0.01	0.86	-0.47	0.25	-0.13	0.24	-0.01	0.95	0.06	0.67	-0.32	0.41	-0.09	0.48	-0.41	0.69
R_{t-2}	-0.01	0.90	0.10	0.80	-0.20	0.07	0.19	0.09	-0.09	0.53	0.14	0.72	0.10	0.41	-0.22	0.83
R_{t-3}	0.12	0.08	-1.17	**0.00**	0.16	0.17	0.01	0.93	-0.12	0.40	-0.11	0.79	0.24	0.05	-3.28	**0.00**
R_{t-4}	-	-	-	-	-0.31	0.01	0.09	0.44	-	-	-	-	-	-	-	-
ΔCDS_{t-1}	0.00	0.79	-0.22	0.00	-0.40	**0.00**	0.13	0.25	0.00	0.95	-0.10	0.52	0.00	0.90	-0.23	0.06
ΔCDS_{t-2}	0.01	0.35	-0.06	0.40	-0.26	**0.03**	0.23	0.05	-0.03	0.59	-0.02	0.91	0.03	0.09	-0.11	0.39
ΔCDS_{t-3}	-0.01	0.68	-0.05	0.49	0.29	**0.02**	-0.03	0.80	-0.17	**0.00**	0.21	0.18	0.02	0.24	-0.24	0.05
ΔCDS_{t-4}	-	-	-	-	-0.26	**0.04**	0.36	0.01	-	-	-	-	-	-	-	-
R^2	0.03		0.07		0.30		0.19		0.14		0.07		0.06		0.12	
GC: R_t				**0.02**				0.48				0.84				**0.01**
GC: ΔCDS_t		0.73				**0.00**				**0.03**				0.30		
Greece																
R_{t-1}	-0.01	0.85	-1.43	**0.03**	-0.22	0.08	-0.03	0.77	0.01	0.97	-0.24	0.54	-0.04	0.68	-2.30	0.07
R_{t-2}	-0.07	0.24	-0.83	0.21	-0.10	0.40	0.03	0.81	-0.15	0.29	0.61	0.13	-0.07	0.47	-2.07	0.11
R_{t-3}	0.07	0.24	-1.26	0.06	-	-	-	-	-0.05	0.70	0.03	0.94	0.06	0.52	-2.55	**0.05**
ΔCDS_{t-1}	0.00	0.96	-0.16	0.01	-0.34	**0.02**	0.25	0.05	0.00	0.93	0.11	0.44	0.00	0.90	-0.21	0.02
ΔCDS_{t-1}	-0.01	0.12	0.06	0.34	0.00	0.98	0.03	0.82	-0.04	0.44	0.02	0.91	-0.01	0.25	0.02	0.83
ΔCDS_{t-2}	-0.01	0.16	0.22	0.00	-	-	-	-	-0.12	**0.02**	0.29	0.06	-0.01	0.37	0.18	0.04
R^2	0.03		0.10		0.07		0.08		0.11		0.12		0.03		0.13	
GC: R_t				**0.03**				0.91				0.44				**0.04**
GC: ΔCDS_t		0.27				0.06				0.10				0.58		
Spain																
R_{t-1}	-0.17	0.02	-0.03	0.94	-0.18	0.09	-0.18	0.18	-0.26	0.07	-0.12	0.75	-0.09	0.48	0.39	0.71
R_{t-2}	-0.02	0.76	0.25	0.54	-0.11	0.30	-0.10	0.46	-0.11	0.46	0.61	0.14	0.05	0.68	0.27	0.78
R_{t-3}	-	-	-	-	-	-	-	-	-0.17	0.24	0.31	0.44	-	-	-	-
ΔCDS_{t-1}	-0.01	0.36	-0.23	0.00	-0.12	0.17	-0.54	0.00	-0.05	0.37	-0.14	0.35	0.00	0.81	-0.21	0.10
ΔCDS_{t-2}	0.01	0.27	-0.12	0.09	-0.22	**0.00**	-0.07	0.43	-0.01	0.89	0.02	0.92	0.02	0.12	-0.13	0.30
ΔCDS_{t-3}	-	-	-	-	-	-	-	-	-0.19	**0.00**	0.24	0.13	-	-	-	-
R^2	0.03		0.06		0.12		0.25		0.21		0.09		0.04		0.07	
GC: R_t				0.81				0.36				0.43				0.90
GC: ΔCDS_t		0.26				**0.01**				**0.00**				0.24		

Table A.15: Country specific lead-lag analysis with two-dimensional VAR model between sovereign CDS and country's financial sector stock index

This table reports the coefficients and p-values of VAR model that consist of two equations with the country's financial stock index returns (R_t) and the sovereign 5-years CDS spread change (ΔCDS) as dependent variables. Bold p-values of VAR model and Granger causality test mark the coefficients at 5% significance level.

	Whole period				Pre-crisis				Financial crisis				European debt crisis			
	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.
Germany																
R_{t-1}	-0.02	0.74	-0.13	0.13	-0.17	0.17	0.04	0.42	0.09	0.54	-0.38	**0.02**	-0.04	0.69	-0.01	0.95
R_{t-2}	-0.09	0.21	-0.05	0.59	-0.04	0.74	-0.01	0.85	-0.13	0.36	0.05	0.74	-0.03	0.80	-0.15	0.31
R_{t-3}	0.06	0.42	-0.12	0.18	-	-	-	-	-0.07	0.62	-0.07	0.66	0.21	0.03	-0.22	0.15
R_{t-4}	-	-	-	-	-	-	-	-	0.19	0.17	-0.13	0.41	-	-	-	-
ΔCDS_{t-1}	-0.01	0.91	-0.08	0.27	-0.65	0.**02**	-0.16	0.20	0.05	0.69	-0.09	0.50	0.01	0.83	-0.10	0.33
ΔCDS_{t-2}	-0.06	0.31	-0.05	0.50	-0.37	0.21	-0.21	0.10	-0.16	0.18	0.13	0.37	-0.01	0.94	-0.13	0.18
ΔCDS_{t-3}	-0.11	0.06	0.07	0.34	-	-	-	-	-0.16	0.18	0.00	0.99	-0.05	0.46	0.06	0.54
ΔCDS_{t-4}	-	-	-	-	-	-	-	-	0.25	**0.04**	-0.26	0.06	-	-	-	-
R^2	0.04		0.03		0.09		0.09		0.12		0.12		0.07		0.06	
GC: R_t				0.28				0.69				0.17				0.39
GC: ΔCDS_t		0.22				0.05				0.10				0.89		
France																
R_{t-1}	-0.06	0.42	-0.27	**0.03**	-0.19	0.08	-0.01	0.88	-0.14	0.35	-0.24	0.10	-0.09	0.45	-0.37	0.24
R_{t-2}	-0.18	0.02	0.02	0.89	-0.12	0.26	0.02	0.62	-0.48	0.00	0.08	0.58	-0.02	0.86	-0.14	0.67
R_{t-3}	0.01	0.88	-0.19	0.13	-	-	-	-	-0.24	0.11	-0.09	0.55	-0.03	0.80	-0.50	0.11
R_{t-4}	-0.09	0.23	0.35	**0.00**	-	-	-	-	-	-	-	-	-0.39	0.00	0.75	**0.02**
ΔCDS_{t-1}	-0.01	0.76	-0.29	0.00	-0.41	0.12	-0.25	0.02	-0.16	0.32	-0.09	0.57	-0.01	0.82	-0.34	0.01
ΔCDS_{t-2}	-0.05	0.28	-0.11	0.15	-0.55	**0.04**	-0.19	0.09	-0.44	**0.01**	0.10	0.52	0.02	0.63	-0.19	0.14
ΔCDS_{t-3}	-0.10	**0.03**	0.08	0.30	-	-	-	-	-0.41	**0.01**	0.04	0.79	-0.09	0.09	-0.01	0.92
ΔCDS_{t-4}	-0.10	**0.02**	0.23	0.00	-	-	-	-	-	-	-	-	-0.18	**0.00**	0.34	0.01
R^2	0.06		0.13		0.08		0.08		0.19		0.07		0.14		0.19	
GC: R_t				**0.00**				0.86				0.31				**0.02**
GC: ΔCDS_t		0.09				0.06				**0.01**				**0.01**		
Austria																
R_{t-1}	0.04	0.60	-0.25	0.22	-0.10	0.36	-0.02	0.66	0.18	0.22	-0.58	0.20	-0.09	0.42	-0.13	0.71
R_{t-2}	0.18	0.01	-0.29	0.16	-0.10	0.34	-0.05	0.32	0.28	0.04	-0.50	0.25	0.09	0.45	0.07	0.84
R_{t-3}	0.09	0.22	-0.38	0.06	-	-	-	-	0.05	0.71	-0.09	0.84	0.05	0.69	-0.69	0.05
R_{t-4}	-	-	-	-	-	-	-	-	0.34	0.02	-0.78	0.08	-	-	-	-
ΔCDS_{t-1}	0.02	0.44	-0.07	0.36	-0.35	0.13	-0.40	0.00	0.06	0.25	-0.07	0.63	0.01	0.76	-0.17	0.14
ΔCDS_{t-2}	0.06	**0.03**	-0.11	0.13	-0.38	0.11	-0.01	0.92	0.08	0.10	-0.11	0.45	0.07	0.09	-0.16	0.17
ΔCDS_{t-3}	-0.03	0.33	-0.12	0.11	-	-	-	-	-0.05	0.33	-0.07	0.62	-0.01	0.81	-0.20	0.08
ΔCDS_{t-4}	-	-	-	-	-	-	-	-	0.12	**0.02**	-0.37	0.01	-	-	-	-
R^2	0.04		0.03		0.05		0.16		0.21		0.14		0.04		0.08	
GC: R_t				0.06				0.58				0.09				0.19
GC: ΔCDS_t		0.10				0.17				**0.04**				0.37		
Netherlands																
R_{t-1}	0.08	0.21	-0.41	**0.00**	-0.05	0.64	-0.16	0.61	0.19	0.15	-0.27	0.09	-0.05	0.62	-0.29	0.12
R_{t-2}	-0.04	0.50	-0.08	0.49	0.02	0.83	0.23	0.47	-0.15	0.26	0.04	0.79	0.12	0.29	-0.30	0.10
ΔCDS_{t-1}	0.02	0.54	-0.41	0.00	0.02	0.58	-0.66	0.00	0.02	0.84	0.02	0.86	0.10	0.11	-0.33	0.00
ΔCDS_{t-2}	-0.01	0.79	-0.19	0.01	0.03	0.43	-0.33	0.00	-0.13	0.22	-0.07	0.62	0.14	**0.04**	-0.29	0.01
R^2	0.03		0.15		0.01		0.34		0.10		0.08		0.06		0.09	
GC: R_t				**0.00**				0.66				0.47				0.10
GC: ΔCDS_t		0.47				0.72				0.68				0.05		

	Whole period				Pre-crisis				Financial crisis				European debt crisis			
	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.
Belgium																
R_{t-1}	0.02	0.77	-0.43	**0.02**	-0.11	0.33	-0.11	0.06	0.10	0.41	-0.30	0.12	-0.16	0.19	-0.76	0.24
R_{t-2}	-0.09	0.19	0.04	0.83	-0.01	0.92	0.02	0.73	-0.14	0.25	-0.07	0.73	0.08	0.52	0.11	0.87
ΔCDS_{t-1}	0.02	0.30	-0.28	0.00	-0.42	0.05	0.02	0.86	0.03	0.72	-0.09	0.52	0.00	0.97	-0.33	0.01
ΔCDS_{t-2}	-0.03	0.24	-0.04	0.55	0.14	0.48	-0.38	0.00	-0.20	**0.02**	0.05	0.70	0.02	0.42	-0.08	0.53
ΔCDS_{t-3}	-0.05	**0.03**	0.04	0.55	-0.01	0.97	0.24	0.03	-0.17	0.07	0.15	0.28	-0.04	0.12	-0.08	0.51
ΔCDS_{t-4}	0.01	0.69	0.02	0.82	-	-	-	-	0.15	0.10	-0.11	0.45	-0.06	**0.02**	0.06	0.64
R^2	0.05		0.09		0.08		0.24		0.24		0.08		0.10		0.14	
GC: R_t				0.08				0.08				0.55				0.06
GC: ΔCDS_t		0.10				0.15				**0.01**				0.10		
Portugal																
R_{t-1}	0.06	0.41	0.94	0.15	0.00	0.99	-0.10	0.16	-0.07	0.63	0.26	0.41	0.07	0.51	1.95	0.14
R_{t-2}	-0.06	0.41	1.06	0.11	0.00	1.00	-0.02	0.75	-0.19	0.17	0.02	0.95	-0.09	0.39	2.27	0.09
R_{t-3}	0.17	0.01	-0.71	0.28	0.20	0.09	-0.10	0.17	0.03	0.85	-0.19	0.55	0.17	0.10	-1.06	0.42
ΔCDS_{t-1}	0.00	0.68	-0.10	0.14	-0.27	0.18	0.08	0.48	-0.05	0.44	0.01	0.92	0.00	0.56	-0.08	0.43
ΔCDS_{t-2}	0.01	0.07	-0.08	0.24	-0.25	0.20	-0.05	0.68	-0.06	0.36	-0.09	0.54	0.01	0.10	-0.05	0.64
ΔCDS_{t-3}	0.01	0.18	-0.20	0.00	0.32	0.11	-0.12	0.30	-0.14	**0.02**	0.13	0.37	0.01	0.13	-0.25	0.02
R^2	0.05		0.10		0.11		0.14		0.12		0.06		0.09		0.14	
GC: R_t				0.12				0.24				0.74				0.10
GC: ΔCDS_t		0.30				0.13				0.11				0.26		
Ireland																
R_{t-1}	-0.16	0.01	-0.23	0.26	-0.22	0.05	0.02	0.73	-0.19	0.17	0.15	0.41	-0.03	0.75	-1.29	**0.04**
R_{t-2}	-0.01	0.92	-0.08	0.70	-0.23	0.04	0.02	0.76	-0.07	0.60	0.29	0.12	0.01	0.91	-0.26	0.65
ΔCDS_{t-1}	-0.02	0.26	-0.08	0.20	-0.07	0.73	-0.37	0.00	0.03	0.78	0.04	0.80	-0.01	0.33	-0.14	0.13
ΔCDS_{t-2}	0.00	0.89	-0.24	0.00	-0.37	0.06	-0.03	0.81	-0.12	0.25	0.12	0.39	0.02	0.24	-0.31	0.00
ΔCDS_{t-3}	-0.07	**0.00**	0.01	0.92	-	-	-	-	-0.31	**0.00**	0.13	0.34	-0.05	**0.00**	-0.02	0.82
R^2	0.08		0.07		0.10		0.13		0.16		0.09		0.13		0.13	
GC: R_t				0.77				0.91				0.09				0.21
GC: ΔCDS_t		**0.01**				0.16				**0.01**				**0.00**		
Italy																
R_{t-1}	0.00	0.98	-0.51	0.12	-0.12	0.30	-0.04	0.67	0.10	0.49	-0.25	0.46	-0.15	0.25	-0.86	0.26
R_{t-2}	0.03	0.65	-0.17	0.61	-0.15	0.18	0.13	0.17	-0.12	0.42	0.06	0.86	0.21	0.13	-1.02	0.20
R_{t-3}	0.15	0.05	-0.97	**0.00**	0.22	0.07	-0.11	0.28	-0.10	0.48	-0.23	0.49	0.33	0.01	-2.24	**0.00**
ΔCDS_{t-1}	0.01	0.66	-0.25	0.00	-0.42	**0.00**	0.14	0.22	0.00	0.97	-0.09	0.53	0.00	0.92	-0.32	0.01
ΔCDS_{t-2}	0.03	0.14	-0.10	0.18	-0.25	0.08	0.21	0.07	-0.04	0.53	-0.04	0.79	0.06	**0.02**	-0.24	0.09
ΔCDS_{t-3}	0.01	0.71	-0.07	0.35	0.47	**0.00**	-0.12	0.32	-0.19	**0.01**	0.17	0.29	0.05	**0.04**	-0.25	0.07
R^2	0.03		0.07		0.27		0.20		0.14		0.07		0.09		0.11	
GC: R_t				**0.01**				0.34				0.82				**0.02**
GC: ΔCDS_t		0.54				**0.00**				0.05				**0.04**		
Greece																
R_{t-1}	0.04	0.47	-0.90	0.07	-0.28	0.02	-0.03	0.76	0.00	0.98	-0.16	0.64	0.05	0.56	-1.14	0.21
R_{t-2}	-0.06	0.32	-0.58	0.24	-0.12	0.32	-0.01	0.96	-0.18	0.20	0.51	0.13	-0.05	0.55	-1.12	0.22
ΔCDS_{t-1}	0.01	0.38	-0.16	0.01	-0.32	**0.03**	0.25	0.05	0.00	0.94	0.10	0.46	0.01	0.38	-0.18	0.04
ΔCDS_{t-2}	-0.02	**0.04**	0.07	0.26	0.02	0.89	0.01	0.92	-0.08	0.19	0.03	0.84	-0.01	0.13	0.05	0.59
ΔCDS_{t-3}	-0.01	0.14	0.22	0	-	-	-	-	-0.18	**0.01**	0.33	0.03	-0.01	0.40	0.20	0.03
R^2	0.03		0.10		0.08		0.07		0.14		0.12		0.04		0.12	
GC: R_t				**0.03**				0.95				0.41				0.08
GC: ΔCDS_t		0.07				0.10				**0.02**				0.27		
Spain																
R_{t-1}	-0.05	0.47	-0.21	0.50	-0.15	0.16	-0.14	0.24	-0.04	0.76	-0.29	0.31	-0.08	0.56	-0.02	0.98
R_{t-2}	-0.07	0.36	0.22	0.49	-0.16	0.15	0.00	0.99	-0.13	0.33	0.41	0.16	-0.02	0.91	0.09	0.91
R_{t-3}	0.02	0.76	-0.51	0.10	-	-	-	-	-0.25	0.07	0.15	0.61	0.05	0.68	-1.73	**0.03**
ΔCDS_{t-1}	0.00	0.86	-0.24	0.00	-0.16	0.11	-0.54	0.00	-0.02	0.79	-0.19	0.21	0.00	0.94	-0.23	0.07
ΔCDS_{t-2}	0.00	0.79	-0.10	0.18	-0.24	**0.00**	-0.06	0.51	-0.04	0.58	-0.01	0.96	0.02	0.44	-0.12	0.35
ΔCDS_{t-3}	-0.03	**0.04**	0.05	0.51	-	-	-	-	-0.29	**0.00**	0.21	0.16	-0.02	0.46	-0.10	0.44
R^2	0.04		0.09		0.10		0.25		0.20		0.10		0.05		0.11	
GC: R_t				0.27				0.50				0.33				0.16
GC: ΔCDS_t		0.19				**0.01**				**0.00**				0.65		

Table A.16: Country specific lead-lag analysis with two-dimensional VAR model between sovereign CDS and country's non-financial sector stock index

This table reports the coefficients and p-values of VAR model that consist of two equations with the country's non-financials stock index returns (R_t) and the sovereign 5-years CDS spread change (ΔCDS) as dependent variables. Bold p-values of VAR model and Granger causality test mark the coefficients at 5% significance level.

	Whole period				Pre-crisis				Financial crisis				European debt crisis			
	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.
Germany																
R_{t-1}	-0.07	0.28	-0.24	**0.02**	-0.16	0.21	0.05	0.47	0.07	0.58	-0.64	**0.00**	-0.19	0.05	0.01	0.95
R_{t-2}	-0.10	0.16	0.07	0.49	-0.04	0.72	0.00	0.96	-0.36	0.01	0.44	0.03	0.07	0.48	-0.07	0.68
R_{t-3}	-0.06	0.41	0.00	0.97	-	-	-	-	-	-	-	-	0.01	0.92	-0.09	0.61
R_{t-4}	-	-	-	-	-	-	-	-	-	-	-	-	-0.13	0.18	-0.09	0.61
ΔCDS_{t-1}	-0.02	0.73	-0.08	0.24	-0.42	0.08	-0.16	0.18	-0.03	0.71	-0.04	0.77	-0.02	0.70	-0.10	0.31
ΔCDS_{t-2}	-0.08	0.06	0.00	1.00	-0.43	0.07	-0.21	0.09	-0.18	**0.04**	0.23	0.06	-0.03	0.52	-0.10	0.33
ΔCDS_{t-3}	-0.09	**0.04**	0.10	0.12	-	-	-	-	-	-	-	-	-0.09	0.11	0.12	0.22
ΔCDS_{t-4}	-	-	-	-	-	-	-	-	-	-	-	-	-0.14	**0.01**	0.08	0.40
R^2	0.03		0.04		0.08		0.08		0.10		0.22		0.10		0.05	
GC: R_t				0.11				0.77				**0.00**				0.96
GC: ΔCDS_t		0.07				0.06				0.11				0.09		
France																
R_{t-1}	-0.08	0.20	-0.24	0.22	-0.09	0.43	-0.06	0.37	-0.12	0.39	-0.29	0.19	-0.14	0.20	0.06	0.91
R_{t-2}	-0.08	0.25	0.18	0.35	-0.09	0.42	0.09	0.19	-0.13	0.40	0.32	0.17	-0.03	0.79	0.34	0.48
R_{t-3}	0.03	0.66	-0.20	0.30	-	-	-	-	-0.04	0.77	0.13	0.54	-0.11	0.30	-0.94	0.05
R_{t-4}	-0.14	0.03	0.39	0.05	-	-	-	-	-	-	-	-	-0.30	0.01	0.85	0.08
ΔCDS_{t-1}	0.00	0.95	-0.24	0.00	-0.20	0.23	-0.25	0.02	-0.04	0.67	-0.03	0.83	0.00	0.99	-0.22	0.04
ΔCDS_{t-2}	0.00	0.91	-0.08	0.26	-0.42	**0.01**	-0.18	0.09	0.01	0.94	0.20	0.19	0.01	0.58	-0.09	0.39
ΔCDS_{t-3}	-0.05	**0.04**	0.11	0.12	-	-	-	-	-0.19	**0.04**	0.17	0.22	-0.05	**0.04**	0.00	0.97
ΔCDS_{t-4}	-0.06	**0.01**	0.18	0.01	-	-	-	-	-	-	-	-	-0.09	**0.00**	0.25	0.02
R^2	0.06		0.11		0.08		0.11		0.10		0.09		0.14		0.17	
GC: R_t				0.08				0.26				0.17				0.09
GC: ΔCDS_t		0.07				0.04				0.18				**0.00**		
Austria																
R_{t-1}	0.01	0.88	-0.35	0.16	-0.05	0.66	-0.07	0.23	0.08	0.56	-0.77	0.15	-0.08	0.43	-0.01	0.99
R_{t-2}	-0.06	0.37	0.19	0.44	-0.01	0.93	-0.06	0.36	-0.13	0.34	0.43	0.42	0.02	0.84	-0.03	0.95
ΔCDS_{t-1}	0.01	0.51	-0.04	0.53	-0.42	**0.04**	-0.41	0.00	0.02	0.62	0.00	0.99	0.01	0.69	-0.15	0.15
ΔCDS_{t-2}	-0.02	0.28	-0.01	0.85	-0.42	0.06	-0.11	0.37	-0.06	0.11	0.14	0.30	0.02	0.53	-0.17	0.10
R^2	0.01		0.01		0.09		0.21		0.11		0.13		0.05		0.05	
GC: R_t				0.37				0.36				0.12				0.80
GC: ΔCDS_t		0.73				0.05				0.34				0.35		
Netherlands																
R_{t-1}	-0.01	0.91	-0.51	**0.00**	0.05	0.62	-0.08	0.85	0.00	0.99	-0.50	**0.04**	-0.02	0.81	-0.26	0.26
R_{t-2}	0.02	0.77	-0.02	0.91	-0.09	0.42	0.15	0.71	0.01	0.96	0.17	0.52	0.12	0.22	-0.01	0.95
ΔCDS_{t-1}	0.01	0.77	-0.37	0.00	0.00	0.95	-0.66	0.00	0.00	0.95	0.03	0.80	0.05	0.25	-0.26	0.01
ΔCDS_{t-2}	0.00	0.96	-0.15	0.02	0.01	0.84	-0.33	0.00	-0.06	0.30	-0.02	0.88	0.07	0.09	-0.19	0.06
R^2	0.00		0.13		0.01		0.33		0.02		0.08		0.03		0.07	
GC: R_t				**0.01**				0.92				0.09				0.53
GC: ΔCDS_t		0.95				0.98				0.59				0.16		
Belgium																
R_{t-1}	-0.09	0.13	-0.25	0.40	-0.14	0.20	-0.05	0.61	0.00	0.97	-0.28	0.37	-0.29	0.00	0.17	0.85
R_{t-2}	-0.08	0.19	0.17	0.58	-0.19	0.08	0.04	0.65	-0.09	0.49	0.09	0.77	-0.01	0.88	0.56	0.53
ΔCDS_{t-1}	0.02	0.23	-0.24	0.00	-0.35	**0.01**	-0.06	0.57	0.02	0.68	-0.03	0.79	0.01	0.27	-0.26	0.01
ΔCDS_{t-2}	-0.01	0.50	-0.02	0.74	-0.01	0.96	-0.34	0.00	-0.08	0.09	0.08	0.50	0.01	0.55	-0.04	0.71
R^2	0.03		0.06		0.12		0.12		0.12		0.07		0.14		0.10	
GC: R_t				0.62				0.77				0.62				0.52
GC: ΔCDS_t		0.21				**0.03**				0.33				0.16		

	Whole period				Pre-crisis				Financial crisis				European debt crisis			
	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.
Portugal																
R_{t-1}	-0.04	0.55	1.63	0.13	0.06	0.65	-0.16	0.15	-0.13	0.36	0.14	0.73	-0.07	0.49	6.29	**0.03**
R_{t-2}	-0.02	0.74	0.78	0.46	-0.09	0.49	0.04	0.71	0.02	0.87	0.27	0.54	-0.07	0.46	2.41	0.39
R_{t-3}	0.14	0.02	-1.62	0.12	0.10	0.45	0.07	0.56	0.08	0.60	0.02	0.97	0.09	0.37	-4.38	0.11
R_{t-4}	-0.09	0.17	0.98	0.36	-0.10	0.43	0.20	0.07	-	-	-	-	-0.21	0.03	4.55	0.10
ΔCDS_{t-1}	0.00	0.92	-0.10	0.11	-0.12	0.40	0.05	0.66	0.00	0.95	-0.02	0.88	0.00	0.79	-0.03	0.76
ΔCDS_{t-2}	0.01	0.08	-0.10	0.09	-0.14	0.32	0.01	0.92	0.01	0.78	-0.05	0.73	0.01	0.08	-0.07	0.47
ΔCDS_{t-3}	0.00	0.33	-0.20	0.00	0.05	0.70	0.01	0.95	-0.09	0.08	0.17	0.28	0.00	0.44	-0.31	0.00
ΔCDS_{t-4}	0.00	0.56	-0.19	0.00	0.04	0.77	0.37	0.00	-	-	-	-	0.00	0.28	-0.13	0.21
R^2	0.06		0.10		0.06		0.14		0.11		0.05		0.13		0.17	
GC: R_t				0.15				0.25				0.93				**0.02**
GC: ΔCDS_t		0.34				0.72				0.37				0.31		
Ireland																
R_{t-1}	-0.08	0.16	0.18	0.80	-0.27	0.01	-0.03	0.74	0.08	0.54	-0.24	0.78	-0.06	0.49	2.51	0.20
R_{t-2}	-0.07	0.21	0.36	0.62	-0.28	0.01	-0.04	0.72	-0.19	0.13	0.77	0.36	0.10	0.23	0.86	0.66
R_{t-3}	0.02	0.80	-0.17	0.81	-	-	-	-	-	-	-	-	-0.04	0.62	-2.04	0.28
ΔCDS_{t-1}	0.00	0.44	-0.06	0.34	0.00	0.99	-0.38	0.00	-0.01	0.77	0.01	0.95	0.00	0.22	-0.05	0.54
ΔCDS_{t-2}	0.00	0.57	-0.22	0.00	-0.27	**0.02**	-0.04	0.72	-0.02	0.35	0.07	0.58	0.01	**0.04**	-0.24	0.01
ΔCDS_{t-3}	-0.01	**0.00**	0.00	0.94	-	-	-	-	-	-	-	-	-0.02	**0.00**	-0.04	0.69
R^2	0.06		0.06		0.17		0.13		0.04		0.01		0.18		0.08	
GC: R_t				0.98				0.90				0.64				0.41
GC: ΔCDS_t		**0.03**				**0.04**				0.62				**0.00**		
Italy																
R_{t-1}	0.01	0.90	-0.30	0.52	-0.03	0.76	0.00	0.99	0.02	0.90	-0.39	0.39	-0.03	0.76	0.04	0.97
R_{t-2}	-0.04	0.51	0.34	0.46	-0.21	0.06	0.20	0.07	-0.04	0.78	0.18	0.69	-0.04	0.71	0.69	0.55
R_{t-3}	0.08	0.26	-1.15	**0.01**	0.11	0.33	0.09	0.42	-0.08	0.55	0.05	0.91	0.06	0.59	-3.62	**0.00**
R_{t-4}	-	-	-	-	-0.36	0.00	0.04	0.71	-	-	-	-	-	-	-	-
ΔCDS_{t-1}	0.00	0.95	-0.19	0.01	-0.34	**0.00**	0.12	0.29	0.01	0.74	-0.09	0.53	0.00	0.88	-0.18	0.10
ΔCDS_{t-2}	0.00	0.64	-0.04	0.57	-0.18	0.12	0.24	0.04	-0.01	0.79	-0.01	0.96	0.01	0.47	-0.03	0.81
ΔCDS_{t-3}	-0.01	0.23	-0.01	0.89	0.13	0.28	0.02	0.90	-0.12	**0.01**	0.24	0.10	0.00	0.67	-0.16	0.15
ΔCDS_{t-4}	-	-	-	-	-0.31	**0.01**	0.35	0.00	-	-	-	-	-	-	-	-
R^2	0.02		0.06		0.28		0.19		0.11		0.07		0.03		0.12	
GC: R_t				0.07				0.46				0.81				**0.02**
GC: ΔCDS_t		0.58				**0.00**				0.07				0.81		
Greece																
R_{t-1}	0.03	0.66	-2.44	**0.02**	0.01	0.91	-0.18	0.17	0.12	0.38	-0.07	0.91	-0.03	0.70	-4.46	**0.03**
R_{t-2}	-0.07	0.22	-0.98	0.33	-0.06	0.61	0.11	0.41	-0.14	0.32	1.16	**0.05**	-0.06	0.49	-3.22	0.11
R_{t-3}	0.10	0.10	-1.24	0.22	0.04	0.72	0.00	0.98	0.15	0.30	-0.81	0.19	0.06	0.52	-2.53	0.22
R_{t-4}	-	-	-	-	-0.04	0.76	0.22	0.08	-	-	-	-	-	-	-	-
ΔCDS_{t-1}	0.00	0.84	-0.16	0.01	-0.19	0.07	0.18	0.11	0.01	0.71	0.17	0.21	0.00	0.77	-0.21	0.02
ΔCDS_{t-2}	0.00	0.67	0.07	0.29	0.00	0.98	-0.05	0.69	0.00	0.95	0.02	0.91	0.00	0.69	0.02	0.85
ΔCDS_{t-3}	-0.01	0.10	0.23	0.00	-0.02	0.87	0.24	0.04	-0.02	0.54	0.18	0.22	-0.01	0.16	0.21	0.02
ΔCDS_{t-4}	-	-	-	-	-0.03	0.78	0.26	0.02	-	-	-	-	-	-	-	-
R^2	0.03		0.10		0.06		0.22		0.06		0.15		0.03		0.12	
GC: R_t				0.05				0.23				0.17				0.05
GC: ΔCDS_t		0.43				0.42				0.92				0.55		
Spain																
R_{t-1}	-0.15	0.03	0.21	0.67	-0.17	0.11	-0.19	0.19	-0.19	0.16	0.04	0.93	-0.04	0.77	0.91	0.46
R_{t-2}	0.00	0.98	0.37	0.45	-0.09	0.37	-0.16	0.26	0.07	0.63	0.99	**0.04**	0.01	0.97	0.32	0.79
R_{t-3}	0.10	0.13	-0.47	0.32	-	-	-	-	-0.02	0.92	0.51	0.30	0.01	0.94	-2.12	0.08
ΔCDS_{t-1}	-0.01	0.27	-0.20	0.01	-0.11	0.14	-0.53	0.00	-0.01	0.72	-0.13	0.36	0.00	0.81	-0.17	0.17
ΔCDS_{t-2}	0.01	0.55	-0.09	0.20	-0.19	**0.00**	-0.07	0.43	0.03	0.47	0.02	0.87	0.01	0.37	-0.09	0.48
ΔCDS_{t-3}	-0.02	0.13	0.08	0.25	-	-	-	-	-0.10	**0.01**	0.23	0.11	-0.02	0.16	-0.04	0.75
R^2	0.06		0.08		0.12		0.26		0.16		0.12		0.05		0.10	
GC: R_t				0.60				0.27				0.21				0.31
GC: ΔCDS_t		0.19				**0.01**				0.05				0.32		

Table A.17: Country specific lead-lag analysis with two-dimensional VAR model between sovereign CDS and country's consumer staples sector stock index

This table reports the coefficients and p-values of VAR model that consist of two equations with the country's consumer staples stock index returns (R_t) and the sovereign 5-years CDS spread change (ΔCDS) as dependent variables. Bold p-values of VAR model and Granger causality test mark the coefficients at 5% significance level.

	Whole period				Pre-crisis				Financial crisis				European debt crisis			
	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.
Germany																
R_{t-1}	-0.10	0.15	-0.05	0.68	0.09	0.47	-0.04	0.59	-0.18	0.18	0.27	0.23	-0.15	0.12	-0.37	0.09
R_{t-2}	0.03	0.61	-0.09	0.47	0.04	0.75	0.05	0.50	-0.06	0.64	-0.03	0.88	0.10	0.27	-0.29	0.19
R_{t-3}	-0.12	0.07	0.17	0.15	0.00	1.00	0.04	0.59	-0.31	0.02	0.18	0.42	-	-	-	-
ΔCDS_{t-1}	-0.03	0.44	-0.01	0.85	0.04	0.85	-0.32	0.01	-0.07	0.41	0.21	0.13	-0.02	0.60	-0.14	0.12
ΔCDS_{t-2}	-0.03	0.34	0.00	1.00	-0.11	0.64	0.17	0.18	-0.03	0.76	0.07	0.64	-0.03	0.44	-0.10	0.29
ΔCDS_{t-3}	-0.07	**0.05**	0.07	0.28	-0.27	0.24	0.06	0.66	-0.12	0.18	0.02	0.88	-	-	-	-
R^2	0.03		0.01		0.05		0.18		0.09		0.05		0.04		0.04	
GC: R_t				0.40				0.79				0.56				0.15
GC: ΔCDS_t		0.16				0.76				0.40				0.68		
France																
R_{t-1}	-0.16	0.01	0.07	0.73	0.00	0.98	-0.11	0.12	-0.31	0.03	-0.02	0.94	-0.16	0.11	0.49	0.35
R_{t-2}	0.09	0.16	-0.22	0.27	0.16	0.15	-0.01	0.84	0.00	0.98	-0.35	0.14	0.04	0.66	-0.17	0.75
ΔCDS_{t-1}	-0.02	0.42	-0.12	0.07	0.16	0.38	-0.33	0.00	-0.09	0.26	0.05	0.72	-0.01	0.53	-0.12	0.24
ΔCDS_{t-2}	0.01	0.68	-0.08	0.21	-0.02	0.90	0.03	0.75	-0.05	0.55	-0.04	0.76	0.01	0.57	-0.10	0.32
R^2	0.03		0.02		0.04		0.12		0.08		0.04		0.03		0.04	
GC: R_t				0.47				0.30				0.32				0.59
GC: ΔCDS_t		0.63				0.62				0.45				0.66		
Austria																
R_{t-1}	0.07	0.25	0.36	0.08	0.11	0.31	-0.04	0.48	0.05	0.66	0.74	**0.05**	0.02	0.80	-0.48	0.27
R_{t-2}	-0.08	0.20	-0.46	**0.02**	-0.08	0.47	0.05	0.34	-0.10	0.40	-0.94	**0.01**	-0.04	0.68	0.11	0.80
R_{t-3}	-0.12	0.05	0.54	**0.01**	-	-	-	-	-0.20	0.09	0.83	**0.03**	-	-	-	-
ΔCDS_{t-1}	-0.03	0.09	0.01	0.80	-0.43	**0.05**	-0.30	0.01	-0.04	0.27	0.14	0.23	-0.01	0.42	-0.11	0.21
ΔCDS_{t-2}	-0.02	0.21	-0.02	0.76	-0.16	0.43	0.03	0.76	-0.01	0.82	0.02	0.84	-0.02	0.21	-0.10	0.25
ΔCDS_{t-3}	-0.05	**0.01**	-0.03	0.56	-	-	-	-	-0.08	**0.02**	-0.04	0.74	-	-	-	-
R^2	0.07		0.04		0.07		0.11		0.15		0.15		0.02		0.03	
GC: R_t				**0.01**				0.52				**0.01**				0.52
GC: ΔCDS_t		**0.01**				0.14				**0.05**				0.37		
Netherlands																
R_{t-1}	-0.14	0.02	-0.29	0.15	-0.03	0.75	-0.14	0.75	-0.26	0.04	-0.01	0.97	-0.16	0.09	0.09	0.75
R_{t-2}	0.07	0.24	-0.22	0.26	0.10	0.35	0.22	0.60	0.04	0.76	-0.27	0.40	-0.01	0.95	-0.33	0.24
ΔCDS_{t-1}	-0.01	0.54	-0.33	0.00	0.00	1.00	-0.67	0.00	-0.06	0.26	0.20	0.11	-0.01	0.76	-0.15	0.11
ΔCDS_{t-2}	0.00	0.92	-0.13	0.03	0.01	0.74	-0.32	0.00	-0.01	0.87	-0.23	0.06	0.00	0.91	-0.06	0.50
R^2	0.03		0.10		0.01		0.34		0.10		0.13		0.02		0.04	
GC: R_t				0.24				0.82				0.29				0.45
GC: ΔCDS_t		0.83				0.93				0.34				0.95		
Belgium																
R_{t-1}	-0.11	0.07	0.13	0.60	-0.26	0.02	0.07	0.19	0.08	0.52	-0.09	0.74	-0.32	0.00	1.46	0.06
R_{t-2}	0.02	0.72	-0.03	0.92	0.03	0.81	0.04	0.46	0.13	0.32	-0.44	0.09	-0.20	0.03	0.98	0.21
R_{t-3}	-	-	-	-	0.02	0.89	0.05	0.37	-0.13	0.31	0.65	**0.01**	-	-	-	-
R_{t-4}	-	-	-	-	0.15	0.22	-0.11	**0.05**	-	-	-	-	-	-	-	-
ΔCDS_{t-1}	0.02	0.21	-0.18	0.00	-0.61	**0.01**	0.25	0.02	0.11	0.08	0.13	0.31	0.01	0.37	-0.20	0.03
ΔCDS_{t-2}	0.00	0.96	-0.06	0.31	0.08	0.74	-0.25	0.03	-0.02	0.74	-0.11	0.38	0.00	0.76	-0.06	0.48
ΔCDS_{t-3}	-	-	-	-	0.12	0.63	0.24	0.03	-0.05	0.39	0.33	0.01	-	-	-	-
ΔCDS_{t-4}	-	-	-	-	0.56	**0.02**	0.05	0.68	-	-	-	-	-	-	-	-
R^2	0.02		0.03		0.17		0.20		0.08		0.15		0.12		0.08	
GC: R_t				0.86				0.10				**0.02**				0.12
GC: ΔCDS_t		0.45				**0.02**				0.24				0.60		

	Whole period				Pre-crisis				Financial crisis				European debt crisis			
	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.
Portugal																
R_{t-1}	-0.17	0.00	1.42	**0.04**	0.05	0.64	-0.09	0.20	-0.37	0.02	0.40	0.17	-0.26	0.00	4.40	**0.02**
R_{t-2}	0.05	0.45	-1.03	0.14	-0.04	0.71	-0.02	0.77	0.16	0.30	-0.68	**0.02**	-0.05	0.57	-2.75	0.15
ΔCDS_{t-1}	0.00	0.91	-0.13	0.04	-0.29	0.13	0.24	0.03	-0.10	0.17	0.11	0.46	0.00	0.98	-0.09	0.30
ΔCDS_{t-2}	0.01	0.23	-0.16	0.01	0.12	0.54	-0.26	0.02	0.06	0.47	-0.30	0.05	0.00	0.24	-0.18	0.04
R^2	0.04		0.06		0.04		0.15		0.12		0.13		0.07		0.11	
GC: R_t				**0.02**				0.59				**0.01**				**0.01**
GC: ΔCDS_t		0.47				0.47				0.30				0.49		
Ireland																
R_{t-1}	-0.06	0.33	0.99	0.17	0.01	0.93	-0.15	0.16	-0.13	0.28	0.02	0.98	-0.02	0.86	4.67	**0.04**
R_{t-2}	0.14	0.01	-0.57	0.43	0.13	0.23	-0.07	0.50	0.07	0.53	-1.11	0.11	0.17	0.04	-0.34	0.88
R_{t-3}	0.01	0.81	-0.12	0.87	-	-	-	-	-0.07	0.55	0.33	0.64	-0.09	0.31	-0.94	0.67
R_{t-4}	-0.01	0.86	-0.96	0.18	-	-	-	-	0.09	0.42	-1.36	**0.05**	-0.11	0.18	-1.58	0.46
ΔCDS_{t-1}	0.00	0.86	-0.06	0.34	0.11	0.31	-0.35	0.00	-0.04	**0.03**	0.26	0.03	0.00	0.31	-0.09	0.29
ΔCDS_{t-2}	0.00	0.98	-0.22	0.00	-0.21	0.07	0.18	0.10	0.01	0.50	-0.25	0.04	0.00	0.71	-0.25	0.01
ΔCDS_{t-3}	-0.01	**0.04**	0.02	0.69	-	-	-	-	-0.04	0.07	0.15	0.20	-0.01	**0.02**	-0.01	0.89
ΔCDS_{t-4}	-0.02	**0.00**	0.00	0.98	-	-	-	-	-0.03	0.20	-0.12	0.31	-0.01	**0.00**	0.02	0.86
R^2	0.07		0.06		0.11		0.20		0.15		0.16		0.17		0.10	
GC: R_t				0.32				0.31				0.12				0.23
GC: ΔCDS_t		**0.01**				**0.03**				**0.04**				**0.00**		
Italy																
R_{t-1}	-0.22	0.00	0.57	0.19	-0.05	0.58	0.05	0.57	-0.44	0.00	0.51	0.29	-0.13	0.17	1.14	0.29
R_{t-2}	0.15	0.02	-0.65	0.13	-0.02	0.88	0.00	0.96	0.27	0.05	-1.06	**0.03**	0.13	0.17	-0.70	0.51
R_{t-3}	-0.01	0.89	-0.86	**0.04**	0.04	0.65	-0.12	0.13	-	-	-	-	0.00	0.99	-2.16	**0.04**
ΔCDS_{t-1}	-0.02	0.08	-0.14	0.03	-0.27	**0.04**	0.21	0.05	-0.07	0.06	0.11	0.41	-0.01	0.18	-0.15	0.11
ΔCDS_{t-2}	-0.01	0.58	-0.12	0.06	-0.27	**0.04**	0.18	0.11	0.05	0.18	-0.25	0.07	-0.01	0.28	-0.12	0.21
ΔCDS_{t-3}	-0.02	**0.05**	0.03	0.59	0.66	**0.00**	0.05	0.66	-	-	-	-	-0.02	**0.04**	-0.01	0.92
R^2	0.09		0.07		0.26		0.14		0.25		0.12		0.07		0.09	
GC: R_t				0.06				0.42				**0.01**				0.16
GC: ΔCDS_t		0.10				**0.00**				0.06				0.14		
Greece																
R_{t-1}	-0.15	0.01	-0.52	0.49	-0.10	0.38	-0.02	0.76	0.09	0.50	0.27	0.54	-0.30	0.00	-1.81	0.31
R_{t-2}	0.05	0.45	-0.59	0.43	0.07	0.54	-0.07	0.32	-0.17	0.21	0.75	0.09	0.10	0.26	-2.76	0.13
R_{t-3}	-	-	-	-	0.07	0.53	-0.02	0.71	-	-	-	-	-	-	-	-
R_{t-4}	-	-	-	-	-0.06	0.57	0.14	**0.03**	-	-	-	-	-	-	-	-
ΔCDS_{t-1}	0.00	0.68	-0.06	0.35	-0.22	0.22	0.22	0.04	0.07	0.09	0.14	0.30	0.00	0.47	-0.09	0.32
ΔCDS_{t-1}	0.00	0.77	0.10	0.10	-0.07	0.70	0.24	0.03	-0.08	0.08	-0.05	0.74	0.00	0.57	0.07	0.41
ΔCDS_{t-2}	-	-	-	-	0.19	0.29	-0.13	0.23	-	-	-	-	-	-	-	-
ΔCDS_{t-4}	-	-	-	-	0.11	0.53	0.28	0.01	-	-	-	-	-	-	-	-
R^2	0.03		0.02		0.05		0.26		0.07		0.07		0.12		0.03	
GC: R_t				0.62				0.23				0.19				0.27
GC: ΔCDS_t		0.87				0.60				0.09				0.63		
Spain																
R_{t-1}	-0.01	0.84	1.21	**0.04**	0.35	0.00	-0.08	0.59	-0.06	0.60	0.52	0.34	-0.08	0.43	2.14	0.09
R_{t-2}	0.18	0.01	-0.39	0.51	-0.09	0.42	-0.17	0.27	0.36	0.00	-0.82	0.13	0.14	0.17	-0.45	0.72
R_{t-3}	-	-	-	-	-	-	-	-	-0.11	0.39	1.35	**0.01**	-	-	-	-
R_{t-4}	-	-	-	-	-	-	-	-	-0.29	0.03	1.33	**0.02**	-	-	-	-
ΔCDS_{t-1}	0.00	0.76	-0.24	0.00	0.01	0.87	0.10	0.34	-0.01	0.71	-0.08	0.52	0.00	0.63	-0.24	0.01
ΔCDS_{t-2}	0.01	0.44	-0.12	0.05	-0.12	0.12	0.07	0.55	0.04	0.14	-0.20	0.10	0.00	0.91	-0.13	0.19
ΔCDS_{t-3}	-	-	-	-	-	-	-	-	-0.03	0.29	0.21	0.09	-	-	-	-
ΔCDS_{t-4}	-	-	-	-	-	-	-	-	-0.04	0.11	0.26	0.04	-	-	-	-
R^2	0.03		0.10		0.14		0.05		0.19		0.24		0.02		0.12	
GC: R_t				0.10				0.35				**0.00**				0.22
GC: ΔCDS_t		0.66				0.30				0.12				0.87		

Table A.18: Country specific lead-lag analysis with two-dimensional VAR model between sovereign CDS and country's industrials sector stock index

This table reports the coefficients and p-values of VAR model that consist of two equations with the country's industrials stock index returns (R_t) and the sovereign 5-years CDS spread change (ΔCDS) as dependent variables. Bold p-values of VAR model and Granger causality test mark the coefficients at 5% significance level.

	Whole period				Pre-crisis				Financial crisis				European debt crisis			
	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.
Germany																
R_{t-1}	-0.07	0.33	-0.05	0.54	-0.02	0.86	0.00	0.97	-0.03	0.83	0.03	0.83	-0.15	0.13	-0.22	0.20
R_{t-2}	0.11	0.10	-0.07	0.42	-0.02	0.85	0.05	0.33	0.07	0.61	0.04	0.78	0.20	0.04	-0.29	0.09
ΔCDS_{t-1}	-0.03	0.60	-0.03	0.71	0.02	0.95	-0.31	0.02	-0.03	0.84	0.13	0.36	-0.03	0.62	-0.14	0.14
ΔCDS_{t-2}	-0.03	0.63	-0.01	0.91	-0.50	0.11	0.16	0.21	-0.06	0.70	0.12	0.41	0.02	0.71	-0.13	0.19
R^2	0.02		0.00		0.05		0.15		0.04		0.03		0.06		0.04	
GC: R_t				0.62				0.62				0.96				0.15
GC: ΔCDS_t		0.78				0.24				0.66				0.80		
France																
R_{t-1}	-0.11	0.11	-0.05	0.78	-0.10	0.39	-0.08	0.18	-0.07	0.60	-0.03	0.88	-0.20	0.08	0.04	0.93
R_{t-2}	0.09	0.18	-0.25	0.12	-0.01	0.93	0.02	0.72	0.04	0.80	-0.12	0.51	0.14	0.20	-0.60	0.16
R_{t-3}	-	-	-	-	-	-	-	-	-0.34	0.02	0.27	0.14	-	-	-	-
ΔCDS_{t-1}	-0.01	0.68	-0.14	0.04	-0.10	0.66	-0.32	0.01	0.00	0.98	0.05	0.75	-0.03	0.35	-0.15	0.16
ΔCDS_{t-2}	0.02	0.60	-0.11	0.12	-0.34	0.11	0.04	0.72	-0.05	0.67	0.01	0.95	0.03	0.30	-0.18	0.10
ΔCDS_{t-3}	-	-	-	-	-	-	-	-	-0.24	0.03	0.17	0.24	-	-	-	-
R^2	0.02		0.03		0.04		0.11		0.10		0.05		0.05		0.05	
GC: R_t				0.30				0.35				0.43				0.34
GC: ΔCDS_t		0.77				0.28				0.17				0.30		
Austria																
R_{t-1}	0.05	0.50	0.25	0.31	0.00	0.97	-0.05	0.28	0.16	0.26	0.32	0.58	-0.16	0.10	0.56	0.22
R_{t-2}	0.09	0.19	-0.47	**0.05**	0.00	0.98	-0.02	0.74	-0.01	0.94	-0.78	0.19	0.18	0.06	-0.42	0.36
R_{t-3}	-	-	-	-	-	-	-	-	0.02	0.90	0.08	0.89	-	-	-	-
ΔCDS_{t-1}	0.00	0.81	0.02	0.75	-0.33	0.24	-0.34	0.00	0.01	0.72	0.10	0.51	-0.02	0.29	-0.04	0.70
ΔCDS_{t-2}	-0.01	0.60	-0.07	0.31	-0.48	0.06	0.00	0.99	-0.02	0.49	-0.07	0.65	0.01	0.80	-0.13	0.18
ΔCDS_{t-3}	-	-	-	-	-	-	-	-	-0.04	0.27	0.00	0.99	-	-	-	-
R^2	0.01		0.02		0.05		0.11		0.06		0.03		0.06		0.04	
GC: R_t				0.11				0.53				0.61				0.27
GC: ΔCDS_t		0.85				0.15				0.56				0.54		
Netherlands																
R_{t-1}	-0.01	0.93	-0.34	**0.01**	0.00	0.98	-0.13	0.68	0.02	0.92	0.01	0.98	-0.09	0.40	-0.07	0.69
R_{t-2}	0.07	0.26	-0.13	0.30	0.01	0.91	0.30	0.35	0.01	0.94	-0.20	0.35	0.21	0.04	-0.35	**0.05**
R_{t-3}	-	-	-	-	-	-	-	-	-0.10	0.47	0.30	0.15	0.05	0.64	-0.09	0.62
R_{t-4}	-	-	-	-	-	-	-	-	-	-	-	-	-0.21	0.05	0.38	**0.04**
ΔCDS_{t-1}	0.00	0.96	-0.37	0.00	0.00	0.98	-0.67	0.00	-0.05	0.61	0.19	0.18	0.03	0.58	-0.19	0.07
ΔCDS_{t-2}	0.01	0.76	-0.15	0.02	0.01	0.77	-0.32	0.00	-0.02	0.86	-0.25	0.07	0.07	0.24	-0.11	0.28
ΔCDS_{t-3}	-	-	-	-	-	-	-	-	-0.13	0.20	0.34	0.02	0.02	0.76	-0.02	0.88
ΔCDS_{t-4}	-	-	-	-	-	-	-	-	-	-	-	-	-0.08	0.20	0.17	0.11
R^2	0.00		0.11		0.00		0.34		0.03		0.12		0.07		0.08	
GC: R_t				**0.02**				0.60				0.41				0.10
GC: ΔCDS_t		0.95				0.94				0.62				0.49		
Belgium																
R_{t-1}	0.01	0.88	0.09	0.70	0.12	0.31	-0.03	0.73	0.09	0.58	0.25	0.33	-0.15	0.10	0.33	0.50
R_{t-2}	0.12	0.07	-0.52	**0.02**	-0.08	0.52	-0.09	0.24	0.04	0.79	-0.56	**0.03**	0.16	0.09	-0.77	0.12
ΔCDS_{t-1}	0.02	0.39	-0.17	0.01	-0.15	0.41	0.16	0.16	0.00	1.00	0.22	0.14	0.01	0.53	-0.20	0.04
ΔCDS_{t-2}	0.01	0.78	-0.12	0.07	0.03	0.88	-0.32	0.01	-0.06	0.48	-0.23	0.12	0.02	0.33	-0.14	0.13
R^2	0.02		0.05		0.04		0.10		0.03		0.08		0.07		0.08	
GC: R_t				0.06				0.45				0.07				0.20
GC: ΔCDS_t		0.69				0.71				0.78				0.56		

	Whole period				Pre-crisis				Financial crisis				European debt crisis			
	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.	R_t	p-val.	ΔCDS_t	p-val.
Portugal																
R_{t-1}	0.02	0.81	1.31	0.15	0.13	0.22	-0.15	0.09	-0.16	0.24	0.61	0.08	-0.06	0.53	3.56	0.14
R_{t-2}	0.06	0.34	-1.20	0.19	-0.08	0.45	-0.11	0.20	0.09	0.55	-1.08	**0.00**	0.09	0.34	-2.38	0.29
R_{t-3}	-	-	-	-	-	-	-	-	-	-	-	-	0.04	0.63	-1.37	0.54
R_{t-4}	-	-	-	-	-	-	-	-	-	-	-	-	-0.14	0.14	1.97	0.38
ΔCDS_{t-1}	0.00	1.00	-0.13	0.04	-0.30	**0.03**	0.18	0.09	-0.09	0.09	0.11	0.40	0.00	0.82	-0.12	0.22
ΔCDS_{t-2}	0.00	0.40	-0.16	0.01	-0.18	0.20	-0.25	0.02	0.00	0.93	-0.23	0.08	0.00	0.50	-0.21	0.03
ΔCDS_{t-3}	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.70	-0.14	0.15
ΔCDS_{t-4}	-	-	-	-	-	-	-	-	-	-	-	-	-0.01	0.12	-0.09	0.37
R^2	0.00		0.05		0.13		0.13		0.04		0.16		0.04		0.10	
GC: R_t				0.17				0.08				**0.00**				0.37
GC: ΔCDS_t		0.70				**0.03**				0.24				0.49		
Ireland																
R_{t-1}	-0.15	0.01	0.60	0.18	-0.23	0.03	-0.03	0.64	-0.24	0.06	-0.05	0.92	-0.09	0.36	2.28	**0.04**
R_{t-2}	0.00	0.98	0.01	0.99	-0.15	0.16	-0.06	0.38	-0.10	0.41	0.07	0.90	0.07	0.43	0.23	0.84
R_{t-3}	-	-	-	-	-	-	-	-	-0.27	0.03	0.75	0.15	-	-	-	-
ΔCDS_{t-1}	0.00	0.76	-0.05	0.39	0.01	0.96	-0.33	0.00	-0.05	0.11	0.21	0.10	0.01	0.28	-0.05	0.57
ΔCDS_{t-2}	0.00	0.79	-0.21	0.00	-0.33	0.07	0.16	0.14	0.00	1.00	-0.15	0.25	0.00	0.54	-0.25	0.01
ΔCDS_{t-3}	-	-	-	-	-	-	-	-	-0.03	0.40	0.19	0.14	-	-	-	-
R^2	0.03		0.05		0.10		0.19		0.11		0.09		0.03		0.09	
GC: R_t				0.40				0.66				0.54				0.11
GC: ΔCDS_t		0.92				0.14				0.39				0.46		
Italy																
R_{t-1}	-0.01	0.92	0.54	0.22	0.07	0.54	-0.09	0.33	0.16	0.23	0.12	0.79	-0.25	0.03	2.01	**0.04**
R_{t-2}	0.19	0.01	-1.11	**0.01**	-0.09	0.41	0.02	0.80	0.23	0.09	-1.53	**0.00**	0.20	0.09	-1.26	0.20
R_{t-3}	-	-	-	-	-0.04	0.73	0.05	0.58	-	-	-	-	0.03	0.78	-2.62	**0.01**
R_{t-4}	-	-	-	-	-0.24	0.03	-0.07	0.44	-	-	-	-	-	-	-	-
ΔCDS_{t-1}	0.00	0.84	-0.12	0.09	-0.12	0.36	0.16	0.17	0.00	0.95	-0.03	0.82	-0.02	0.17	-0.05	0.68
ΔCDS_{t-2}	0.01	0.25	-0.20	0.00	-0.36	**0.01**	0.14	0.22	0.06	0.11	-0.29	0.03	0.01	0.68	-0.16	0.16
ΔCDS_{t-3}	-	-	-	-	0.31	**0.03**	0.03	0.83	-	-	-	-	-0.01	0.52	-0.12	0.30
ΔCDS_{t-4}	-	-	-	-	-0.44	**0.00**	0.16	0.19	-	-	-	-	-	-	-	-
R^2	0.03		0.06		0.24		0.15		0.08		0.14		0.07		0.13	
GC: R_t				**0.02**				0.74				**0.00**				**0.01**
GC: ΔCDS_t		0.49				**0.00**				0.28				0.46		
Greece																
R_{t-1}	0.15	0.02	-0.83	0.36	-0.05	0.65	0.01	0.91	0.20	0.14	-0.34	0.47	0.18	0.07	-1.39	0.51
R_{t-2}	0.01	0.92	-0.41	0.65	0.13	0.25	-0.07	0.52	0.01	0.95	0.34	0.50	-0.05	0.63	-1.75	0.42
R_{t-3}	-	-	-	-	-	-	-	-	0.04	0.80	0.05	0.92	-0.04	0.65	-1.05	0.63
R_{t-4}	-	-	-	-	-	-	-	-	-	-	-	-	-0.25	0.02	-4.63	**0.04**
ΔCDS_{t-1}	-0.01	0.24	-0.07	0.28	-0.27	**0.02**	0.18	0.11	0.03	0.44	0.11	0.42	-0.01	0.11	-0.11	0.22
ΔCDS_{t-1}	0.00	0.81	0.09	0.15	0.05	0.66	0.28	0.01	-0.01	0.76	-0.11	0.45	0.00	0.58	0.04	0.68
ΔCDS_{t-2}	-	-	-	-	-	-	-	-	-0.04	0.39	0.29	0.06	0.00	0.58	0.00	1.00
ΔCDS_{t-4}	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.76	-0.07	0.43
R^2	0.03		0.02		0.09		0.16		0.06		0.11		0.11		0.06	
GC: R_t				0.57				0.80				0.83				0.20
GC: ΔCDS_t		0.50				0.05				0.67				0.52		
Spain																
R_{t-1}	-0.06	0.40	0.43	0.29	0.00	0.98	-0.16	**0.02**	-0.03	0.81	0.28	0.51	-0.19	0.12	1.51	0.15
R_{t-2}	0.13	0.06	-0.40	0.33	0.08	0.47	-0.10	0.15	0.14	0.27	-0.70	0.10	0.15	0.21	-0.56	0.59
R_{t-3}	-	-	-	-	-	-	-	-	-0.46	0.00	0.92	**0.03**	-	-	-	-
ΔCDS_{t-1}	0.00	1.00	-0.25	0.00	-0.03	0.88	0.02	0.84	-0.03	0.45	0.02	0.86	-0.01	0.46	-0.20	0.09
ΔCDS_{t-2}	0.01	0.36	-0.14	0.04	-0.27	0.11	0.04	0.72	0.04	0.35	-0.27	0.04	0.01	0.55	-0.15	0.20
ΔCDS_{t-3}	-	-	-	-	-	-	-	-	-0.15	**0.00**	0.31	0.02	-	-	-	-
R^2	0.02		0.09		0.05		0.10		0.20		0.15		0.03		0.12	
GC: R_t				0.35				**0.03**				**0.05**				0.29
GC: ΔCDS_t		0.65				0.27				**0.00**				0.56		