

# **Risk premium in the Eurozone. Recent evolution and determining factors using panel data**

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## **ABSTRACT:**

This paper investigates the determining factors of the risk premium in the Eurozone during the period 1993-2012. The length of this period allows us to analyze the evolution of this important parameter and to study how its determining factors have changed over time.

In the years before the creation of the Economic and Monetary Union (EMU), we observe a generalized fall in risk premium in a market that mainly takes into account the recent history of this variable and international volatility. Contrary to later periods, the economic growth and the liquidity risk are not significant. During the EMU integration (1998-2007) these two factors appear in the models with important coefficients, while the proxy variables of the risk aversion disappear from them. During the debt crisis (2008-2012), the liquidity risk and the credit risk are the most relevant explanatory variables.

Our results demonstrate that the markets do not consistently consider the same criteria when determining the sovereign debt risk premium. We have observed that throughout this long period the relative importance assigned to the different explanatory factors has varied in a considerable manner.

JEL codes: G12, G32, C23

Keywords: risk premium, sovereign debt, risk assessment, Eurozone

# 1. INTRODUCTION

Risk premium has become a basic indicator of the solvency and financial stability of a country. Governments, analysts, investors and even ordinary people are aware of its value and evolution. However, is this indicator a new measure or has it existed for many years? If the latter is so, then what was its importance and its role in the past? Do we know the factors that determine its value? And lastly, how have these factors changed over time?

The present work attempts to answer these questions. We carry out a theoretical and empirical analysis of the factors that influence the yield of public debt in the Eurozone for the period 1993 - 2012. The length of this period allows us to bring in a different approach in the study of risk premium from two perspectives: first, we can analyze its evolution before these recent years of its growing role and, second, we can study how its determining factors have changed over time.

In the period considered, Europe has gone through different phases in its integration and through different economic cycles as well. In this work we distinguish three sub-periods:

- The first sub-stage is from 1993 to 1998 and corresponds to the years before the creation of the Economic and Monetary Union (EMU). It is a phase of transition in which countries needed to make great adjustments in their economies and policies. In terms of economic cycles it is a volatile period.
- From 1999 to 2007 the diverse economies achieved a greater level of integration; it was a phase of general economic growth that was interrupted at the end of the period.
- The final stage, from 2008 to 2012, is characterized by a major economic and financial crisis and in this work we will observe not only its outbreak, but also its further development.

Other works in this line have taken different periods of time. Some papers have focused on the pre-EMU period (Codogno et al., 2003; Bernoth, 2004; Gómez-Puig, 2006).

Others on the post-EMU period (Hernández, 2002; Manganelli et al., 2007), and lastly others have looked at the present crisis (Barrios, 2009; Arce, 2011). We have decided to include the whole period (1993-2012) but clearly differentiating the three sub-periods with the aim to better observe the evolution of risk premium itself as well as its determinants. This enables us to make comparisons and to draw more enlightening conclusions.

In this study we have selected eight economies of the EMU: Austria, Belgium, Finland, France, Ireland, Italy, Portugal and Spain. The first four countries can be classified as being more solvent and economically stable. Their risk-premia have remained in lower average values and with fewer oscillations. These countries are frequently called “core countries” in contrast with the last four countries mentioned, which are catalogued as “peripheral countries”. They are considered less developed economies and have registered a greater average risk premium over the period considered. In this group, all except Italy have required financial rescue from European Union (EU). Greece, the first country to have applied for assistance, has not been deliberately included in the study because its exceptional circumstances would have distorted the overall results.

Based on the previous literature, we propose that risk-premium variations in Eurozone depend on the alteration of the following elements: credit risk (e.g. Attinasi, 2009; Haugh et al., 2009; Manganelli, 2009, Arghyrou, 2010), liquidity risk (e.g. Gómez-Puig, 2005; Manganelli, 2009), risk-aversion (e.g. Remolona, 2007 et al.; Barrios, 2009; Sgherri et al., 2009; Arghyrou, 2010), economic growth (e.g. Arghyrou, 2010), other macroeconomic variables (e.g. Barrios et al., 2009; García-Vaquero et al., 2011) and contingent factors (e.g. Favero et al., 1996).

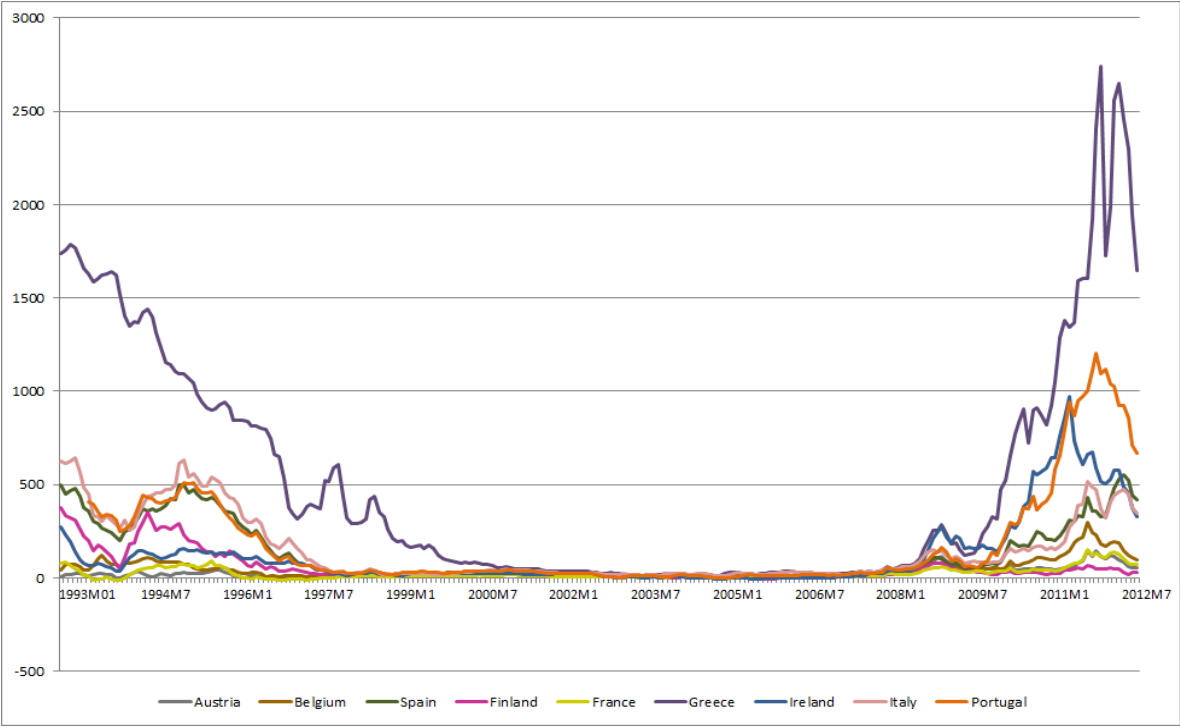
This work is organized in four sections: section 2 describes the economic and financial situation of the three sub-periods considered in order to achieve a better interpretation of risk-premium evolution in the Eurozone. In section 3 we describe the theoretical factors that

influence risk premium and we propose different measurement variables for each one. Section 4 presents the empirical study and the results, and the final conclusions are stated in section 5.

## 2. RISK-PREMIUM EVOLUTION

The Maastricht convergence criteria (1992) imposed quantitative limits on some macroeconomic variables which were considered crucial for a real and sustainable convergence: inflation stability, exchange rate stability, convergence of interest rates, budgetary deficit and public debt. These criteria have determined risk-premium evolution, especially during the first period. Figure 1 depicts the behaviour of this variable along the sample.

**FIGURE 1: RISK PREMIUM EVOLUTION (1993-2012)**



Source: own elaboration from the European Central Bank database

Between 1993 and 1998, countries carried out structural reforms in order to observe these rules. Initially, capital requirements notably increased and countries achieved important

deficits. This caused a decrease in sovereign-debt price of the European countries and the subsequent increase in their risk premium. This process of adjustment lasted until the beginning of 1995. In particular, in September of 1994, the long term rate for German public bonds was 7.52%, for Italian public bonds 11.94% and 11.22% for the Spanish ones.

As the decade progressed, the different countries improved their parameters and their sovereign bonds spread over Germany began to decrease. This was primarily due to the opening of trade barriers in the second half of the decade, which allowed an improvement of the current-account balance in most European countries. Another causal factor was the utilization of the monetary and exchange policies which were still decided nationally. This freedom of decision permitted a monetary devaluation and a subsequent decrease in interest rate with the objective of improving competitiveness. Nonetheless, these policies increased the external debt service which resulted in a country-risk growth. It should be stressed the high yield required from Germany in this period, due to the important deficit induced by its reunification process.

In conclusion, during this first sub-period, risk premium was determined by the expectations concerning the possibility for each country of reaching the initial objectives in function of its domestic characteristics. Since investors assumed an effective future homogenization of economies and the arrival of a period of growth and stability in the entire region, a generalized risk premium decrease was granted during the second half of the nineties (see figure 1).

The second phase (1999-2007) constitutes a period of integration of the different countries in the EMU. It started with the irrevocable fixing of the conversion rates of the currencies of the 11 Member States initially participating, and with the introduction of the euro as the single currency. It is also since this date that the Governing Council of the

European Central Bank (ECB) has been responsible for conducting the single monetary policy for the Euro area.

During this second period the perception of homogenization continued. The risk perceived for all countries was the same since they will finally become similar in most of its parameters. Restrictions in monetary policies contributed to increasing the confidence of achieving this integration. The public bonds of different countries were considered as almost interchangeables and risk premium took null values, and even negative values in some years and for some countries (for example in Ireland and in Finland at the end of 2005).

Therefore, throughout this period, international factors were the relevant ones, relegating to a second place the economic fundamentals of each country. Indeed, the data of each country relative to current-account balance, deficit and debt level showed that convergence was not that strong, but this was justified as a logical consequence of the adaptation process. Contributing to this situation was the fact that Germany was one of the countries that in some cases exceeded the limits of the Stability and Growth Pact, while others, like Spain, maintained a moderate level of debt. The market did not pay attention to the productivity of each country, its growth model, its taxation and other important variables that determine its subsequent development.

During this period of growth, the same monetary policy was implemented for the Euro area, with divergent consequences depending on the country. In most of them this policy allowed an expansion of public expenditure, a high private consumption and fed the development of speculative processes. The financial deregulation process that was taking place at international level allowed a blurring of severe financial imbalance between countries and contributed to sustaining the perception of continuity of good economic times. The market did not make the pertinent and gradual risk correction for each country. In September 2008 the bankruptcy of Lehman Brothers raised the alarm. A cross-border contagion occurred

and sovereign spreads in Europe began to increase, as it is well appreciated in figure 1. A period of volatility and risk premium began, caused not only by the economic and financial situation of each country, but by other aspects like speculative movements, the rating agencies decisions, the depreciation of the euro, the consideration of German bonds as safe assets or the necessity of some important countries to request a financial rescue from the EU.

This severe crisis was initially identified as a debt crisis but later was classified as an economic and financial crisis and even a crisis of values, a crisis of the capitalism model, which will involve a change of paradigm.

### **3. RISK-PREMIUM DETERMINANTS: THEORETICAL FACTORS AND MEASUREMENT VARIABLES**

As noted in the introduction, changes in Eurozone risk premium may be mainly caused by changes in the following factors: credit risk, liquidity, risk aversion, economic growth, other macroeconomic variables and contingent factors. In this section we justify the choice of these factors based on sovereign-risk literature and on the historical context of risk-premium evolution (briefly described in the preceding section). In addition, we will explain how these factors are incorporated in this research, that is, the definition and the database source of each proxy variable.

Risk premium is the endogenous variable of the model. This variable is defined as the difference between ten-year bond yield of each country and ten-year German bond yield. Data are available for quarterly periods.

The first theoretical factor considered is credit risk, since it reflects the domestic variables affecting an economy's capacity to meet its debt obligations. Foremost among these variables are: public deficit, sovereign debt and current account balance (all of them in ratio to

GDP). The first two variables show the fiscal situation of a country and its vulnerability to the financial turbulences; the latter one approximates the competitiveness of each economy.

Data for these variables were obtained from Eurostat. This database provides both historical and estimated data. For the three mentioned variables, we have chosen estimated data. With this choice, we are assuming that investors take into account expectations in their investment decisions (e. g. Aßmann, 2009; Attinasi, 2009; Barrios et al., 2009; Haugh et al., 2009 and Sgherri and Zoli, 2009). Reports for these variables are issued twice a year, in Spring and in Autumn. Since data from this study are quarterly, Spring values have been used in first and second quarters and Autumn values have been used in third and fourth quarters. The estimates for year  $t$  and  $t+1$  have been considered, although forecasts for year  $t$  were proved to be more appropriate.

Following the reasoning of Barrios et al. (2009) and Arghyrou (2010), estimated data of debt, public deficit and current account deficit are expressed as divergences from German values. For this reason, the higher the spreads of these variables vis-à-vis Germany are, the higher the bond yield spread will be. Another possible measurement option of credit risk is the Credit Default Swap (CDS) (e.g. Remolona, 2007, Manganelli, 2007 and Attinasi, 2009). Nevertheless we preferred to use the three variables explained above in order to show a more comprehensive picture of credit risk.

The second theoretical factor included is liquidity risk. Following Gómez-Puig (2005), this factor is directly related to the degree of liquidity of each country's debt, understood as its greater ease of opting out of a debt position in the different markets. A valid measurement for liquidity risk is the relative size of a country's debt. In this research this variable is presented as the ratio between the outstanding market domestic debt securities and the total outstanding debt securities in the EMU (e.g. Bernoth, 2004; Gómez-Puig, 2006; Manganelli, 2007 and Attinasi et al. 2009). More specifically, this variable is calculated as a difference from



German values. Therefore, an increase in liquidity-premium spread implies a reduction in risk-premium spread. The outstanding sovereign bonds of a country and of the entire EMU are available in the ECB database on a quarterly basis.

The argument for liquidity as a key determinant of risk is discordant among authors. Whereas Gómez-Puig (2006), and Manganelli and Wolswijk (2009) underline the important effect of this variable, other researchers like Codogno et al. (2003), Bernoth et al. (2004) and Arghyrou (2010) question its influence and even warn of a high degree of co-linearity between liquidity measures and global risk factor.

Risk-aversion indicates the greater or lesser predisposition of an investor to take on risk. Investors can change their expectations depending on the volatility of the global market portfolio and the risk-tolerance of marginal investors (e.g. Favero and Pagan, 2005). Preference for risk is higher when stability floods the markets, whereas at times of uncertainty portfolios are restructured towards low-risk assets. Under normal circumstances this would be the case of sovereign debt, that is, German securities bring more security and stability to stockholders.

The most commonly used indicator in literature to measure risk-aversion is the Chicago Board Options Exchange Market Volatility Index or VIX index. This index is a measure of the implied volatility of S&P 500 index options, over the next 30 day period. For this reason VIX index is an approximation of global financial instability and international risk-aversion (e.g. Remolona, 2007). The Chicago Board Options Exchange (CBOE) provides monthly information of this index. In order to incorporate this information in the research, we have converted data into quarterly terms.

Other risk aversion measurements have been proposed in the literature. One of them is the difference between the yield of ten-year corporate US bonds with high rating (AAA) and the yield of US government bonds for the same maturity; an increase in this difference

involves a perception of the corporate bonds as more risky and the government ones as more secure, indicating a greater risk-aversion of investors. These data were obtained from the Federal Reserve.

Another indicator of risk-aversion is the short-term interest rate level; a low value of this rate increases incentive to take on risk with the objective of obtaining a higher profitability. This indicator is measured as the interest rate on the Main Refinancing Operations (MRO) of the ECB.

A last indicator is the volatility of the euro/yen exchange rate; an appreciation of yen, and the subsequent weakness of euro, is interpreted as a greater risk aversion in market. These values have been obtained from the Bank of Spain.

The size and growth of an economy show its capacity to adapt internal factors, like technological innovation and human resources, to achieve higher productivity which might diminish the debt ratio. The traditional indicator for economic growth is the rate of GDP growth. Data were obtained from the Organization for Economic Cooperation and Development (OECD) and they have quarterly frequency.

Another interesting and illustrative measurement is the Industrial Production Index (IPI), which measures the monthly evolution of the production activities: extractive industries, manufacturing industries, production and distribution of electrical energy and water and gas industries. The IPI can be used as a measure of the production cycle and in this paper we follow authors like Arghyrou (2010), who uses the IPI to know the influence of industrial production growth over risk-premium variability. Data were obtained from Eurostat database.

We expect a negative relationship between all these variables and the risk premium.

As macroeconomic factors we include the domestic factors that might affect the capacity of a country to meet its financial obligations due to its economic internal situation, such as an increase in inflation or unemployment. An economy not providing employment,

having an inflation rate that increases over time and not offering signs of prosperity will be unsustainable and will contribute to a rising risk-premium.

Domestic factors are more important in periods of financial stress because in those moments investors increase discrimination between economies (Barrios et al., 2009). For this reason, during the recent debt crisis, the deterioration of the macroeconomic framework was accompanied by a risk-premium increase, especially in those economies with worse macroeconomic outlook, as peripheral countries (e. g. García-Vaquero et al., 2011).

Unemployment and inflation data are taken from Eurostat database. Once data are available, the difference from German values is calculated. Unemployment was available on a quarterly basis but inflation data had monthly frequency, so we converted it to a quarterly frequency.

Finally, we have included the contingent factors of the analysed period. We refer to those particular circumstances or contingencies that only have sense at a given time and in specific economic conditions. In our case we have considered the national currency exchange rates and the difficulties of Greece's economy.

Prior to the establishment of the euro as the European single currency, monetary parity had a high value as an indicator of the economic situation of a country, so this determinant is only valid in the first sub-period of the study (1993-1998). Data have been obtained from Eurostat database [national currency versus ECU (European Currency Unit)] at a quarterly frequency.

The inadequacy of Greece to contain the risk-premium rising exposes the Eurozone to a crisis of confidence and to greater turbulences. This fact had a negative effect on the sovereign spreads of the entire EMU. To quantify the impact of this contagion effect we have included Greek risk-premium (the yield of ten-year Greek bond in relation to German bond).

Data were obtained from ECB. They were on monthly basis, so we transformed it into quarterly basis.

#### **4. THE ECONOMETRIC MODEL**

In order to ascertain risk-premium determinants, analysis has been carried out on the basis of panel data methodology, for a better group result. Panel data techniques are used with “N” cross-sectional data (in our case, the eight countries) along a “T” time period (the quarters ranging from 1993 to 2012). The resulting model has following expression:

$$y_{it} = \alpha_i + \beta X_{it} + u_{it}, \quad i=1,\dots,N, \quad t=1,\dots,T \quad (1)$$

where subscript i denotes the country and t denotes the quarter.

The dependent variable is a measure of risk premium and the explanatory variables are the measures of the different theoretical determinants of the risk premium explained and defined in section 3. These variables are summarized in table 1, which provides information on how variables are constructed, their notation, and the database where data come from.

TABLE 1: DEFINITIONS OF THE VARIABLES

<i>Endogenous variable</i>	<i>Risk premium</i>	<b>IRP</b>	<i>Logarithm of the difference between the yield of the ten-year sovereign bonds of a country and the German value</i>	<i>European Central Bank database</i>
<b>F1</b> <i>Credit Risk</i>	<i>Sovereign debt</i>	<b>difdebt</b>	<i>Difference between the estimated public debt (in proportion to GDP) of a country and the German value</i>	<i>Eurostat database</i> <i>Estimated data</i>
	<i>Current account balance</i>	<b>difCA</b>	<i>Difference between the estimated current account balance (in proportion to GDP) of each country and the German value</i>	
	<i>Public deficit</i>	<b>difPD</b>	<i>Difference between the estimated public deficit (in proportion to GDP) of each country and the German value</i>	
<b>F2</b> <i>Liquidity Risk</i>	<i>Liquidity premium</i>	<b>LiqP</b>	<i>Difference between the domestic debt securities outstanding (in relation to the total outstanding debt securities in the EMU) and the German value</i>	<i>European Central Bank database</i>
<b>F3</b> <i>Risk aversion</i>	<i>VIX index (Risk aversion)</i>	<b>IVIX</b>	<i>Logarithm of the VIX index</i>	<i>Chicago Board Options Exchange database</i>
	<i>Difference between the yield of the private and public bonds</i>	<b>IUSbond</b>	<i>Logarithm of the difference between the yield of the 10 year corporate US bonds with high rating (AAA) and the US government bonds for the same maturity</i>	<i>Federal Reserve</i>
	<i>Short-term Interest rate</i>	<b>IMRO</b>	<i>Logarithm of the interest rate on the Main Refinancing Operations of the ECB</i>	<i>European Central Bank database</i>
	<i>Euro-Yen exchange rate</i>	<b>EY exch</b>	<i>Euro-Yen exchange rate</i>	<i>Bank of Spain Quarterly basis</i>
<b>F4</b> <i>Economic growth</i>	<i>GDP</i>	<b>GDPgr</b>	<i>GPD growth of each country</i>	<i>OECD database</i>
	<i>Industrial Production Index</i>	<b>difIPI</b>	<i>Difference between the Industrial Production Index of a country and the German value</i>	<i>Eurostat database</i>
<b>F5</b> <i>Macroeconomic factors</i>	<i>Unemployment</i>	<b>Unem</b>	<i>Differential of the unemployment rate in relation to Germany</i>	<i>Eurostat database</i>
	<i>Inflation</i>	<b>difHIPC</b>	<i>Difference between the Harmonised Index of Consumer Prices (HIPC) of a country and the German value.</i>	<i>Eurostat database</i>
<b>F6</b> <i>Contingent factors</i>	<i>Greek risk premium</i>	<b>IGre</b>	<i>Logarithm of the risk premium for Greece</i>	<i>European Central Bank database</i>
	<i>Exchange rate</i>	<b>ER</b>	<i>The exchange rate (national currency vs ECU)</i>	<i>Eurostat database</i>

Regression model (1) has been estimated by means of the Estimated Generalized Least Squares (EGLS) method and the Panel Corrected Standard Errors (PCSE) method, in order to correct serial correlation, and accepting that disturbances are related to the countries. In addition, Fixed Effects are taken into account (e.g. Barrios, 2009; Remolona, 2007).

The period considered (1993-2012) is wide and one of the main objectives of the empirical study is to know whether risk-premium determinants remained stable throughout this period or, on the contrary, the relative importance of each determinant has changed over

time. To this end we have divided the entire period into three sub-periods: EMU antecedents (1993-1998), EMU integration (1999-2007) and debt crisis (2008-2012). As we argued in previous sections, these three phases were clearly different in their institutional and economic characteristics.

We carry out the same modelling procedure for the whole sample and for each of the three mentioned sub-periods and it would take the following form:

$$\begin{aligned} \text{IRP}_t = & \alpha + \beta_1 \cdot \text{IRP}_{t-1} + \beta_2 \cdot F1 (\textit{credit risk}) + \beta_3 \cdot F2 (\textit{liquidity risk}) + \\ & + \beta_4 \cdot F3 (\textit{risk aversion}) + \beta_5 \cdot F4 (\textit{economic growth}) + \\ & + \beta_6 \cdot F5 (\textit{macroeconomic factors}) + \beta_7 \cdot F6 (\textit{contingent factors}) \end{aligned} \quad (2)$$

In equation (2), notations F1, F2, ..., F6, refer to the different theoretical determining factors of the risk premium. As it has been described in section 3, for almost all the theoretical determinants of the risk premium, we can find more than one suitable measurement variable. Model has been tested with all the considered variables, although we have not presented all this evidence due to limited space. Nevertheless, in the economic interpretation of the results, we will also justify the irrelevance of certain variables.

## 5. RESULTS

The resulting models are displayed in table 2; the corresponding adjusted determination coefficient is also shown. Table 3 shows the results for the Augmented Dickey-Fuller test and the Fixed Effects test for the estimated models.

**TABLE 2. ESTIMATED REGRESSIONS**

	1993-2012	1993-1998	1999-2007	2008-2012
Constant	1.09***	0.46	-1.64***	-5.46***
VIX	0.52***	0.35*		0.39***
Sovereign Debt	0.015***		0.032***	1.09***
Current account balance		0.01**		
Liquidity premium			-0.10***	-14.56***
Unemployment	0.04**			
GDP growth or IPI			-0.14***(GDP)	-0.009*(IPI)
Greece risk premium	0.60**		1.23***	0.32***
Exchange rate		0.002**		
AR (1)	0.62***	0.94***	0.58***	0.83***
$\bar{R}^2$	0.93	0.92	0.80	0.95

Note: "\*", "\*\*" and "\*\*\*" denote a significance level of 10%, 5% and 1%, respectively.

**TABLE 3. AUGMENTED DICKEY-FULLER TEST AND FIXED EFFECTS TEST**

	Augmented Dickey-Fuller Test		Fixed Effects Test	
	Z Statistic	p-value	Statistic	p-value
1993-2012	-12.65	0.00	5.81	0.00
1993-1998	-4.34	0.00	0.55	0.79
1999-2007	-8.93	0.00	3.05	0.00
2008-2012	-2.99	0.00	1.85	0.08

We will follow a chronological order with the objective of affording an understanding of the risk premium evolution throughout the whole period considered.

After testing the model with all the variables defined in table 1, the significant variables in the period before the creation of the EMU (1993-98) are the following (see table 2): the recent history of the Risk Premium ( $IRP_{t-1}$ ), the VIX index ( $IVIX_t$ ), the difference between the current account balance of each country and the German value ( $difCA_t$ ) and the exchange rate ( $ER_t$ ). These variables jointly explain 92% of the variability of the sovereign debt spreads. Relationships between the explicative variables and the dependent one present the expected sign. Estimated residuals are stationary, in accordance with the results of the ADF test (see table 3).

In this first period, we find a certain influence of the credit risk (measured by the proxy variable ‘current account balance’). It is significant and presents the expected sign, but its coefficient is low. This indicates that the investors take into consideration the competitiveness of each economy in their demand for sovereign bonds, but without it being the prevailing aspect in this decision. On the contrary, the risk aversion appears to be a more important factor. The VIX index is significant and it has the highest coefficient, which indicates that the uncertainty in the markets affects to the spreads of the sovereign debt during these first years. After carrying out an additional analysis with the remaining proxy variables of this factor, we check that no other is relevant in this period (and not in the subsequent periods either).

This period is the only one in which the market doesn’t assess the economic growth and the liquidity risk indicators, explanatory variables that we will find in the subsequent phases. This is also the only temporal phase of the study in which we can include the exchange rate of each currency and we find this variable as significant with the expected sign. However, its influence is weak, as it is shown by its coefficient value. As it was expected, the Greek risk premium has no significance in this period. Lastly, we highlight that the absence of significance of the macroeconomic variables remains throughout all the phases.

The particular circumstances of the period previous to the EMU integration are reflected in the determining factors of the risk premium, which are different from the other two periods under study. The Greek risk premium, the liquidity risk or the economic growth don’t have influence in this period. The different countries had to make important adjustments to achieve the objectives of the Maastricht Treaty and the market valuation has been conditioned by a favorable expectation about this convergence process. Although the current account balance and the exchange rate are taken into consideration, for the moment their influence is slight. The markets do not impose severe penalties on those countries with worse



values in their domestic parameters. We observe a generalized fall in the risk premium in a market that mainly takes into account the recent history of this variable and the international volatility (as the factor that could hinder this union process).

By means of panel regression, we determine that the key elements for understanding the risk premium in the second period (1999-2007) are: the past history of the risk premium ( $IPR_{t-1}$ ), the difference of the estimated public debt in proportion to GDP, related to the German value ( $difdebt_t$ ), the liquidity premium related to the German value ( $LiqP_t$ ), the GDP growth of each country ( $GDPgr_t$ ) and the Greek risk premium ( $IGre_t$ ). The independent variables jointly explain 80% of risk premium variability, according to table 2; moreover, the regression coefficients show the expected sign. We have also applied the ADF test for the estimated residuals and the null hypothesis is rejected, so that we have stationary residuals (see table 3).

In this second phase, the credit risk is revealed by the ratio of public debt to GDP but it has a low coefficient, while the public deficit or the current account balance are not taken into consideration by the market. The risk premium hardly underwent alterations and this occurred despite the failure of some countries to comply with the parameters prescribed for important indicators.

The impact of the liquidity risk is important in this period and it has the expected sign. A fall in this variable implies a deterioration of the liquidity conditions of a country, which increases its risk premium. With respect to risk aversion, it is interesting that this is the only period in which no proxy-variable of this factor appears in the model. The international uncertainty does not seem to modify the secondary market of the sovereign debt during these years.

In relation to the economic growth, we observe that in this period the market favours the sovereign debt of those countries with higher GDP growth rates. This result can be

conditioned by the economic growth of the Eurozone, especially in the peripheral countries like Spain and Ireland, which enabled them to keep their risk premium at low levels.

In this period, the Greek risk premium appears as a significant variable. The high coefficient of this variable can be explained due to the fact that the behavior of the yield differential of the Greek debt was very similar to those of the countries included in our study.

The results of this phase, taken as a whole, confirm that the market sees the different countries as belonging to a homogeneous group. It attributes a similar low default risk to the different economies. Despite the credit risk appearing, the coefficient is low and does not alter the spread of the sovereign debt in a major way. We also observe that the liquidity premium allows reducing the differential yield of a country and that the Greek risk premium has a similar evolution to that of the other countries included. Finally, the expansive cycle which characterized these years would explain the negative influence of the GDP growth on the risk premium. Indeed, throughout this second phase, the peripheral countries achieved in most cases greater values in their GDP growth than the core countries. This helps financial markets to perceive all countries as the same, without knowing their respective core industries and their future prospects, nor the nature of their debt growth, nor the productivity or stability indicators of each economy.

It seems that the risk perception was disturbed during all these years and for all the countries. Our findings confirm that the market's support for future expectation is strengthened during this second period of the study. These are years of macroeconomic stability and growth, and the market considers that this situation is going to continue. In Cecchetti et al (2011) words, "it was set up the sensation that the world was a safe place and it will continue to be safe in the future", as it would be reflected in the lack of significance of the international volatility.

In the last stage of our study, the period of the debt crisis (2008-2012), the significant variables are the following (see table 2): the recent history of the risk premium ( $IRP_{t-1}$ ), the VIX index ( $IVIX_t$ ), the difference between the estimated public debt of a country (in proportion to GDP) and the German value ( $difdebt_t$ ), the liquidity premium ( $LiqP_t$ ), the industrial production index ( $difIPI_t$ ) and the Greek risk premium ( $IGre_t$ ). These variables jointly explain 95% of the variability of the sovereign debt spreads and, as we can see in table 3, in accordance with the results of the ADF test, the estimated residuals are stationary.

Like in previous periods, the former risk premium values have a remarkable influence in their current values. But unlike previous years, the credit risk has now a leading role as we note from the increase of the regression coefficient related to the difference of each country's public debt with respect to Germany.

Liquidity risk is also very important in this period of crisis, as we observe in the high related coefficient of its proxy variable. Preferences to take risks are greater when stability floods into the markets, whereas in periods of uncertainty portfolios are restructured to less risky assets (known as safe-haven assets), which are more liquid. During this phase, the liquidity conditions of the government bonds deteriorated for some countries, having major implications for their respective risk premiums. According to Barrios (2009), liquidity risk and credit risk are interconnected; an increase in sovereign-bond purchases, diminishes pressure on liquidity problems.

It should be noted that risk aversion re-appears again in the model; in this phase, market volatility and uncertainty influence the risk premium. In addition, the influence of the economic growth is represented by the industrial production index in this period, even though its coefficient is low. Once again, none of the macroeconomic variables (inflation or unemployment) is significant. Greek risk premium continues to have a significant influence in

this period, although with a smaller coefficient than in previous period. Changes in the Greek risk premium affect the return spread of debt issued by the countries under study.

In this period there is a change in the risk assessment and the investor perception also changes because some doubts about the Union feasibility arise again. Therefore, the presence of credit risk and liquidity risk is remarkable. These variables can discriminate the situation of each country and we observe that aversion to risk becomes again an important international factor for the risk premium evolution. The contagious effect of the Greek risk premium is noticeable, especially on peripheral countries, and the time series persistence increases.

Our results support the idea, set out in many previous works: the market does not act rationally, as the risk is undervalued in periods of growth, whereas the market overreacts in periods of uncertainty. Markets do not correct the risk assessment in a gradual and timely way through an ongoing, rigorous and systematic study of each country's situation. This market performance is not neutral, but has future consequences. In particular, this behavior had important implications in euro-area economies, particularly in the peripheral ones. As a consequence of the ease of access to funding, peripheral economies over-borrowed and postponed some necessary economic reforms.

If we consider the whole period (1993-2012), the risk premium determinants are: the VIX index ( $IVIX_t$ ), the gap between the estimated debt-to-GDP ratio for each country and Germany ( $difdebt_t$ ), the Greek risk premium ( $IGre_t$ ) and the differential of the unemployment rate in relation to Germany for each country ( $Unem_t$ ). The independent variables jointly explain 93.6% of risk premium variability, according to table 2. We have applied the ADF test for the estimated residuals and the null hypothesis is rejected (see table 3).

Looking at the nineteen years jointly, there is evidence of former risk premium influence on current risk premium. In fact, the past evolution of this variable is the only factor

that appears in all sub-periods. The second most important factor is aversion to international risk, measured through the VIX index.

Credit risk, like Greek risk premium, are present in phases 2 and 3, and maintain their influence on the total sample. On the contrary, liquidity premium, a factor that is outstanding during two phases, does not appear in the total sample; the same happens with the other variables only present in one period. However, unemployment is present in the total sample, even though it was not relevant in any of the sub-periods models.

## **6. CONCLUSIONS**

The risk premium of the sovereign debt is a “living”, constantly moving variable, whose changes have important repercussions for the countries. Diverse studies have undertaken to determine which factors are driving these movements. Nevertheless, for the moment they have not obtained any conclusive results. This paper presents a new approach in the study of these factors, focusing on how they have evolved over time. For doing this, we have taken a wide period of time (1993-2012), in which the Eurozone has passed through phases in its integration and through different economic cycles as well. In concrete, we consider three phases: 1) The pre-EMU period (1993-1998), 2) EMU integration (1999-2007) and 3) debt crisis (2008-2012).

The study starts with a description of the institutional, social and economic background of each sub-period. Then, we propose the diverse theoretical determinants of the risk premium, on the basis of the historical context of each moment and the previous studies on this subject. Finally, we unveil the factors for each one of these phases and for the whole sample, which allows us to know to what degree the market has changed these relevant factors in its valuation of the countries' sovereign risk and their relative importance. The countries included in the study are: Austria, Belgium, Finland, France, Ireland, Italy, Portugal and Spain.

Our empirical results indicate that the formation of the EMU supposed a great institutional and economic transformation, which causes that the determinants of the risk spreads in this first phase are different from the two following ones. The major influence is exercised by the previous trajectory of this variable. As domestic factors, the market considers the current account balance and the exchange rate, but for the moment their influence is slight. However, the importance conceded to international factors which might make the integration process difficult is greater, as displayed by the VIX index, the observable indicator of the international risk.

As a whole, the results of this first phase of the study demonstrate that the market valuation is based on the favorable expectations of the total region as a single group. It considers that in a (near) future the economies will converge and, if in fact it takes into account internal factors, those do not presuppose harsh penalties for those countries with worse values. In this way, it is interesting to notice that the two principal factors of domestic risk (credit risk and liquidity risk), as well as the economic growth of each country, are aspects that do not yet appear as significant in the models of the first period.

Our findings confirm that the future expectation as an element of market decision, increases notably during the integration phase (1999-2007), the second period of the study. These are years of macroeconomic stability and growth, and the market considers that this situation will continue, which is demonstrated by the disappearance of the VIX index in this sample partition. Likewise to the previous phase, in the current one the market does not discriminate among countries either: all of them are considered as belonging to the same homogeneous group, and the market attributes a low risk of default to all of them. In effect, even if the credit risk and the liquidity risk, just as the GDP growth appear as significant variables (with the expected sign), their coefficients are low and, consequently, they do not importantly alter the sovereign debt spread of a country.

The results of this second phase show that the market had an altered perception of the risk. Investors do not concern themselves with valuing each country's growth, its competitiveness, stability and sustainability for the future. This fact is known as "the shortsightedness of the market". The important thing is not the indicators, but rather the expectations.

In 2008, risk evaluation underwent an abrupt change: the investors' perception of the risk was modified, showing again doubts about the viability of the European Union. Credit and liquidity risk had a notably intensified presence and their proxy variables come to discriminate among the situation of each country. Risk aversion appears as an international factor (after its disappearance in the previous phase) and we also observe an increase in the persistence of the series.

In this period we notice how the irregularities of the Greek risk premium affect the peripheral countries. The Hellenic spread could be considered a proxy variable of the systemic risk. The increasing weakness of the Greek economy magnifies the differences between the sovereign debt yield of the countries in Europe, raises finance costs and puts into question the viability of the European system.

This paper demonstrates that the market does not take the same risk factors as determinants in its valuation of the sovereign debt risk premium and that the relative importance assigned to the different factors changes over time. This reinforces the fact, highlighted by previous studies, that the market does not behave in a rational way: in periods of growth it undervalues risk, while in periods of uncertainty it overreacts. This way of acting is not neutral, but rather has negative consequences for the countries (for example, it permitted deepening debt and delayed the necessary reforms in different European countries, like Spain or Ireland).

Finally, we highlight that the market behaviour makes it difficult to predict the future evolution of the sovereign bond spreads of the countries, seeing that the investor process of decision is changeable. Cross-sectional analysis apprehends elements of a specific period of time, but does not manage to afford an adequate understanding of the risk premium performance in the future.

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