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Igor Esteban Zuccardi  
Banco de México y Banco Mundial

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# Sovereign Spreads in the Eurozone: Is Market Discipline Working?\*

Igor Esteban Zuccardi<sup>†</sup>  
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**Abstract:** This paper studies the behavior of sovereign spreads of countries in the European Monetary Union (EMU) and their apparent disconnection with country-specific fundamentals before the 2008-2013 debt crisis. We test three characteristics of spreads: i) a change in the level of spreads, ii) a weak link between spreads and macroeconomic fundamentals, and iii) a reduction in the cross-country variance of spreads. We find that, in comparison to economies from other regions, spreads from EMU members are lower, the relationship of spreads with variables like fiscal balance, public debt, and GDP growth rate is weaker, and their cross-country variance is statistically lower than the cross-country variance of spreads from non-EMU countries between 1999 and 2005. The results are consistent with the existence of creditor moral hazard in the EMU's sovereign bond market before the crisis.

**Keywords:** European Monetary Union, Sovereign Debt Risk, Investor (Creditor) Moral Hazard.

**JEL Classification:** F33, G12.

**Resumen:** Este artículo estudia el comportamiento de los diferenciales de tasa de la deuda soberana de países de la Unión Económica y Monetaria Europea (UEM) y su aparente desconexión con los fundamentales específicos de cada país antes de la crisis de deuda de 2008-2013. Evaluamos tres características: i) un cambio en el nivel de los diferenciales, ii) una relación débil entre diferenciales y fundamentales macroeconómicos, y iii) una reducción en la varianza de los diferenciales entre países. Encontramos que, comparado con economías de otras regiones, los diferenciales entre miembros de la UEM son más bajos, la relación entre diferenciales y variables como balance fiscal, deuda pública y tasa de crecimiento del PIB es más débil, y su varianza entre países es estadísticamente menor que la varianza de diferenciales entre países no miembros de la UEM entre 1999 y 2005. Los resultados son consistentes con la existencia de riesgo moral del acreedor en el mercado de bonos de deuda soberana de la UEM antes de la crisis.

**Palabras Clave:** Unión Económica y Monetaria de la Unión Europea, Riesgo soberano, Riesgo moral del inversionista (acreedor).

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## *I. Introduction*

The 2008-2013 debt crisis in the European Monetary Union (EMU) has given rise to two phenomena in the European sovereign bond market that had not been observed since the currency area's establishment. First, an unprecedented increase in the EMU member countries' sovereign bond spreads and, second, a widening of spreads among EMU members. In fact, while the pre-crisis spreads between 1999 and 2008 were on average 17.7 basis points (bps) with a cross-country standard deviation of 16.2 bps, the average spreads between September 2008 and October 2012 were 289 bps (191 bps if Greece is excluded) with a cross-country standard deviation of 327 bps for the same period (168 bps if Greece is excluded). Hence, the spreads during crisis are more than 15 times higher compared to pre-crisis conditions and have been most pronounced in countries like Greece, Ireland, Italy, Portugal, and Spain. As a consequence, these countries have been affected in their ability to borrow from international markets and have been forced to request loans from the European Union and the International Monetary Fund (IMF) (Figure 1).

In addition to the fact that the recent behavior of EMU's sovereign spreads sharply contrasts with their performance before the crisis in size and cross-country variability, there is evidence in the literature that pre-crisis spreads were not highly responsive to member countries' macroeconomic fundamentals. Sgherri and Zoli (2009), Attinasi et al. (2009), and Bernoth et al. (2012) documented that, before the crisis, global indicators of risk repricing and global liquidity (i.e., international interest rates) were the main drivers of EMU spreads, whereas fiscal and national macroeconomic indicators became important in explaining the increase and differentials in spreads only in recent years.

The latter result has been interpreted as "the return of market discipline" in the European bond market (Sgherri and Zoli, 2009), while the literature has proposed several hypotheses to explain why pre-crisis spreads were low and close together.



been able to explain why spreads did not seem to reflect macroeconomic weaknesses observed in several EMU countries before 2008.<sup>1</sup>

In this area, a growing literature has emerged which shows that investors' (creditors') bailout expectations have effects on the valuation of financial assets and of sovereign bonds, in particular. According to these studies - under creditors' expectations of bailout - spreads of sovereign (or sub-national) debt tend to have the following characteristics: i) lower levels (i.e., lower risk premia), ii) a weak relationship with national (or sub-national) macroeconomic fundamentals, and iii) a lower cross-sectional variance among bond spreads of national (or sub-national) economies. Empirical evidence supporting these features has been found in the case of the IMF's interventions in emerging economies during the financial crises in the 1990s as well as in partially segmented markets and in (national) currency areas (see below).

The purpose of this paper is to test whether pre-crisis sovereign bonds of EMU member countries exhibit the above characteristics. Specifically, we want to evaluate whether sovereign bond spreads of EMU countries tend to be lower, their relationship with macroeconomic fundamentals is weaker, and their cross-country variance tends to be lower in comparison to spreads' variance of countries that are not part of the EMU area. Economic theory suggests that, when creditors have the expectation that a country will receive a bailout package in the scenario of financial distress, they perceive that their losses in case of a country's default are reduced and, therefore, request a lower credit risk premium to invest in those bonds. Moreover, since country monitoring is a costly process, when creditors expect lower losses due to their perception of a future bailout, they are more likely to engage in reckless investment behaviors such as paying less attention to macroeconomic fundamentals when pricing bonds or investing in bonds from countries with weak economic positions. Consequently, we expect sovereign spreads to respond less to changes in macroeconomic indicators in comparison to the scenario when bailout expectations do not exist. Finally, under expectations of a future bailout, investors tend to invest in bonds with

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<sup>1</sup> For instance, the Stability and Growth Pact (SGP) established limits to the levels of public debt and fiscal deficits of 60% and 3% of GDP, respectively, in order ensure the macroeconomic stability of the EMU currency area. However, countries like Greece and Italy have shown historical levels of public debt above 100% of GDP, while countries like France, Germany, and Portugal exhibited debt levels above 60% of GDP since 2003-2005. In addition, the fiscal deficits of Greece, Portugal, and Italy were above 3% of GDP since 2000-2001, and Germany and France violated that limit between 2002 and 2004.

intrinsic higher risk (based on macroeconomic fundamentals). Under an arbitrage process, this behavior brings prices of risky bonds closer to prices of bonds with lower risk, which is reflected in a faster reduction of spreads of relatively more risky bonds vs. spreads of less risky bonds. Therefore, we anticipate that the cross-country variance of spreads will be lower under bailout expectations.

Using the methodologies of panel data with random effects, mixed models panel data, and the difference-in-difference approach, we analyze the relationship of pre-crisis spreads with countries' indicators of fiscal position (i.e., public debt and public balance), economic growth (i.e., GDP growth rate), external solvency (i.e., international reserves), and macroeconomic instability (i.e., inflation rate) , among others. Also, we include in our analysis global conditions such as investors' risk appetite (i.e., VIX index) and global liquidity (i.e., US FED policy rate).<sup>2</sup> Finally, we include variables that capture the aforementioned explanations suggested by the literature for the behavior of pre-crisis spreads in EMU countries, such as the *de facto* exchange rate regime (Reinhart and Rogoff, 2004), the outstanding amount of international debt securities issued by governments, the *de facto* financial integration indicator, and the growth rate of the stock market. We use monthly information between January 1996 and March 2008.

Our results show that, in comparison to economies from other regions, member countries of the EMU area have, on average, lower spreads. In addition, we find that the relationship of those spreads with macroeconomic fundamentals such as fiscal balance and the GDP growth rate is weaker, and that spreads are less sensitive to larger levels of public debt when the country is an EMU member. Finally, we find evidence that the cross-country variance of EMU spreads is statistically lower than the variance of non-EMU countries between 1999 and end-2005. Our results are valid when controlling for country fundamental indicators and global market conditions, and are robust even after controlling for other indicators that capture alternative explanations of the sovereign spreads' behavior, such as currency risk, liquidity (size) of the bond market, financial integration, and the general demand for financial assets from those countries (an "exuberance"

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<sup>2</sup> For discussion about the inclusion of macroeconomic fundamental variables, see Bernoth et al. (2012), Dell'Ariscia et al. (2006), McGuire and Schrijvers (2003), and Gonzalez-Rozada and Levy Yeyati (2005). For discussion about global condition variables, see McGuire and Schrijvers (2003) and Gonzalez-Rozada and Levy Yeyati (2005).

effect). Overall, our results suggest that institutional arrangements like the EMU area have effects on investors' valuation of sovereign risk, and are consistent with the existence of creditor moral hazard in the EMU's sovereign bond market.

This study has been influenced by two branches of literature: First, the literature on determinants of sovereign risk, which has mainly focused on distinguishing whether country-specific or international market-specific characteristics are the main determinants of the level and variability of debt spreads. On the one hand, papers like Akitoby and Stratmann (2006), Remolona, Scatigna and Wu (2007), and Baldacci, Gupta and Mati (2008) consider that the main drivers of sovereign debt spreads are country-specific characteristics such as debt indicators (i.e., government debt, external debt, currency composition of debt, etc.), macroeconomic indicators (i.e., inflation rate, current account balance, fiscal balance, output growth rate, etc.), and institutional indicators (i.e., rule of law, political risk, etc.). On the other hand, papers such as McGuire and Schrijvers (2003), Sgherri and Zoli (2009), and Gonzalez-Rozada and Levy Yeyati (2005) consider that international market-specific characteristics like market liquidity, investors' risk appetite, and global risk repricing are key determinants of movements of sovereign debt spreads. In the particular case of spreads for EMU member countries, papers such as Codogno et al. (2003), Bernoth et al. (2004), Manganelli and Wolswijk (2009) and Sgherri and Zoli (2009) have found that the behavior of spreads in this area before the onset of the crisis were mainly associated with global market liquidity factors and global risk repricing (i.e., common international risk).

Second, this study is also related to the literature on international moral hazard, which can be subdivided into two branches: the first branch comprises studies that focus on the effects of IMF interventions on spreads during the 1990s emerging economies' crises. This literature analyzes changes in the behavior of spreads and in their relationship with fundamentals before and after economic crises such as Mexico 1994, East Asia 1997, Russia 1998, or Argentina 2001, moments in which the lenders' expectation of bailout changed with the IMF interventions. For instance, Dell'Ariccia et al. (2002, 2006) and Evrensel and Kutan (2004, 2006) find strong evidence for the existence of the moral hazard effect on both bond and stock markets before the onset of the Russian crisis. Lee and Shin (2008) conclude that expectations of IMF lending weaken



the relationship between spreads and country fundamentals, with a higher incidence in countries with stronger connections to the IMF. Finally, Corsetti, Guimaraes and Roubini (2006) found that the moral hazard effect depends on the size of an IMF intervention and the quality of information that the IMF has.<sup>3</sup>

The second branch of studies evaluates the existence of creditor moral hazard in segmented markets or in (national) currency areas. For instance, Bernal et al. (2010) find that, in partially segmented markets, fundamentals play a residual role to explain bond pricing dynamics when creditors have expectations of bailout.<sup>4</sup> Consequently, they conclude that bailout expectations create creditors' moral hazard. Similarly, Heppke-Falk and Wolff (2008) and Schulz and Wolff (2008) provide evidence for the existence of creditor moral hazard in sub-national bond markets of German states. The first paper finds that, under expectations of bailout to Bremen and Saarland (materialized with the bailout's approval from the Federal Constitutional Court in 1992), lenders demand a lower rate of return to compensate for the default risk of these two regions. The second paper shows that, under expectations of bailout to Berlin, spreads of this sub-national government were less sensitive to changes in Berlin's fiscal fundamentals but, after the bailout's rejection in 2006, spreads partially increased and became more sensitive to debt indicators.<sup>5</sup>

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<sup>3</sup> Another paper with empirical results similar to these ones is Haldane and Scheibe (2004). For a detailed review of the literature of international moral hazard, see Roubini and Setser (2004), Chapter 3.

<sup>4</sup> Bernal et al. (2010) analyze the case of holders of (repudiated) Russian bonds in British and French markets during the World War I. Given the protection that the French government had offered to bondholders in previous cases (i.e., repudiated Mexican bonds during the Mexican Revolution), the authors claim that creditors in the French market had expectations of bailout from their own government. That situation explains the different price dynamics that the same Russian bond had in the French market vs. the British market.

<sup>5</sup> Henning and Kessler (2012) study the history of public debt of the US states and local governments. Although they do not analyze the spreads of US sub-national economies, they show that, between 1789 and 1840s, it was common for the states to carry out unsustainable debt levels under the expectation of a federal bailout. That expectation had its precedent on the Alexander Hamilton's plan to make the federal government responsible for the states' debt after the independence war, and crystallized during states' default events of 1812 and 1836. However, in the 1840s the US Congress rejected the bailout of eight states and Florida (a US territory at that moment). The elements that allowed the Congress to reject this bailout request were: 1) the accumulated debt of the sub-national governments was to finance local projects, 2) since 70 percent of the sub-national debt bonds were in hands of British and Dutch investors, domestically held sub-national bonds were not a large part of the US banking portfolio (reducing a national spillover effect of states' default), 3) the number of financially sound states was larger than the number of states in distress, and 4) the domestic US capital market was deep enough to make the federal government less dependent of foreign loans. According to Henning and Kessler (2012), Wyplosz (2012), and Dove (2012) this event changed the incentives of US states for fiscal discipline: almost all states adopted balanced budget amendments to their constitutions or passed laws establishing it. Consequently, the authors claim that the Congress rejection created an implicit and credible "non-bailout" clause in the USA that has been maintained ever since.

In a recent paper, Van Hecke (2013) examines the market of debt of sub-national governments for 13 EMU countries, between 1995 and 2009. This author finds evidence that there are spillover effects of sub-national debt accumulation on sovereign debt risk premiums. This spillover happens when sub-national governments have weak restrictions to borrow and when investors (creditors) believe that sub-national debts are backed by the sovereign (central) government. In particular, under investors' expectations, sub-national governments' bond yields tend to fall while the sovereign (central) government's bond yield rises.

Relative to the existing literature, this paper stresses two important points. First, it shows that, in addition to country- and market-specific characteristics, and without excluding other explanations (i.e., elimination of currency risk, larger financial liberalization, larger liquidity in the bond market, and the "exuberance" effect), institutional arrangements such as the EMU can have an important effect on the valuation of sovereign risk in international capital markets. Second, in contrast to most studies on the determinants of sovereign spreads that have been done for groups of countries or regions (i.e., developed economies, EMU countries or emerging economies), this paper undertakes a global analysis. This global perspective enables us to test for evidence of symptoms of moral hazard, using a natural experiment such as the EMU.

The results of this paper are quite relevant as they contribute to a better understanding of the dynamics of overborrowing, in particular how institutional arrangements affect borrowing costs in the international markets. In addition, our results add to the debate about which mechanisms should be created to deal with future sovereign debt distresses in EMU countries, with a particular focus on the means by which these mechanisms could generate international moral hazard and how to minimize it.

This paper is organized as follows: Section II explains why the EMU area could change investors' incentives to lend and to monitor EMU countries. Section III establishes the theoretical framework, the econometric strategy, and describes the data we used for the empirical analysis. Section IV presents the tests results and Section V concludes.

## II. European Monetary Union and Investors' Incentives

Most of the studies on how institutional arrangements affect international investors' incentives to lend and/or to monitor borrower countries have focused on the effects of IMF interventions on the change of lenders' expectations about bailout. Specifically, they have focused on how spreads have changed after financial events such as the Mexican 1994, Asian 1997 or Russian 1998 crises.<sup>6</sup> This association seems natural given that, under its role of preserving the stability of the global financial system, the IMF might be perceived as a financial "safety net" for its member countries in case of economic distress. Therefore, an IMF intervention (or lack of intervention) and also the magnitude of the intervention should have effects on lenders' expectations regarding bailout.

In case of the EMU, this relationship is more subtle. When the EMU area was constituted, the Maastricht Treaty of 1992 established a "non-bailout" clause in which EU institutions, the European Central Bank, and members of the EMU area had the prohibition to assume liabilities of other EMU members. In addition, under concerns that a monetary union without a fiscal unification could generate incentives for EMU members to generate large fiscal imbalances that could jeopardize the stability of the area, the Stability and Growth Pact (SGP) stipulated some convergence criteria to limit the members' fiscal accounts: i) a maximum fiscal deficit of 3% of GDP (for the general government), and ii) a maximum public debt level of 60% of GDP, among others. Consequently, one can say that, in terms of its legal structure, the EMU area could not be considered a financial "safety net" for its member countries and, therefore, it should not affect lenders' incentives in the way that IMF interventions do.

Nevertheless, the process of financial liberalization, legal harmonization, the introduction of a single currency and a common central bank - implemented after the signing of the Maastricht Treaty and the establishment of the EMU area - has made the EMU members some of the most financially integrated countries in the world. Figure 2 shows a comparative evolution of the cross-country average financial integration from 1980 to 2008 for seven regions using two different

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<sup>6</sup> See Dell'Ariccia et al. (2006), Evrensel and Kutan (2004, 2006), Lee and Shin (2008), and Corsetti, Guimaraes and Roubini (2006).

measures: *de jure* and *de facto* indicators.<sup>7</sup> Figure 2A displays the *de jure* indicator - the Chinn and Ito (2006) index.<sup>8</sup> There, we see that countries in the EMU area significantly reduced their restrictions to cross-border transactions after the signing of the Maastricht Treaty and, along with other developed economies (some of them part of the European Union), they are among the countries with the largest financial liberalization. Figure 2B shows the evolution of the *de facto* financial integration- based on information from Lane and Milesi-Ferretti (2007).<sup>9</sup> The figure shows that the countries that later constituted the EMU area had, on average, a large level of financial integration during the 1980s in comparison to world's integration (where the world's integration is equal to 1). Moreover, after 1993 the EMU member countries showed a spectacular increase in integration and countries of that region became the most multilaterally integrated ones after 1999.

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<sup>7</sup> The indicators are calculated as a cross-country simple average per region. The EMU region covers Austria, Belgium, France, Italy, the Netherlands, Finland, Greece, Ireland, Portugal, and Spain. EU Developed covers the United Kingdom, Denmark, and Sweden. EU Developing covers Bulgaria, Czech Republic, Hungary, and Poland. Developed non-EU includes Canada and Norway. LAC includes: Argentina, Brazil, Chile, Colombia, Mexico, and Peru. Asia covers Malaysia, Philippines, and Thailand. Other Emerging includes Russia, Turkey, and South Africa.

<sup>8</sup> The Chinn and Ito (2006) index is a measure of financial liberalization since it captures the restrictions on cross-border financial transactions reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*.

This index is calculated using four categories of information: 1) the presence of multiple exchange rates, 2) restrictions imposed on the current account transactions, 3) restrictions imposed on capital account transactions, and 4) the requirement to surrender exports proceeds. A large number of the index means that the country imposes fewer restrictions on external accounts. See details in Chinn and Ito (2006).

<sup>9</sup> The *de facto* financial integration indicator captures the "intensity" of a country's financial integration with other countries (multilateral) because it computes the size of international assets and liabilities in proportion to its economy (GDP).

Since it has been observed that the world becomes more financially integrated over time, we normalized this indicator of financial integration per country with the ratio of the sum of financial assets and liabilities around the world over the world's GDP. In other words, the measure of financial integration for country  $i$  shown in Figure 2B is given by:

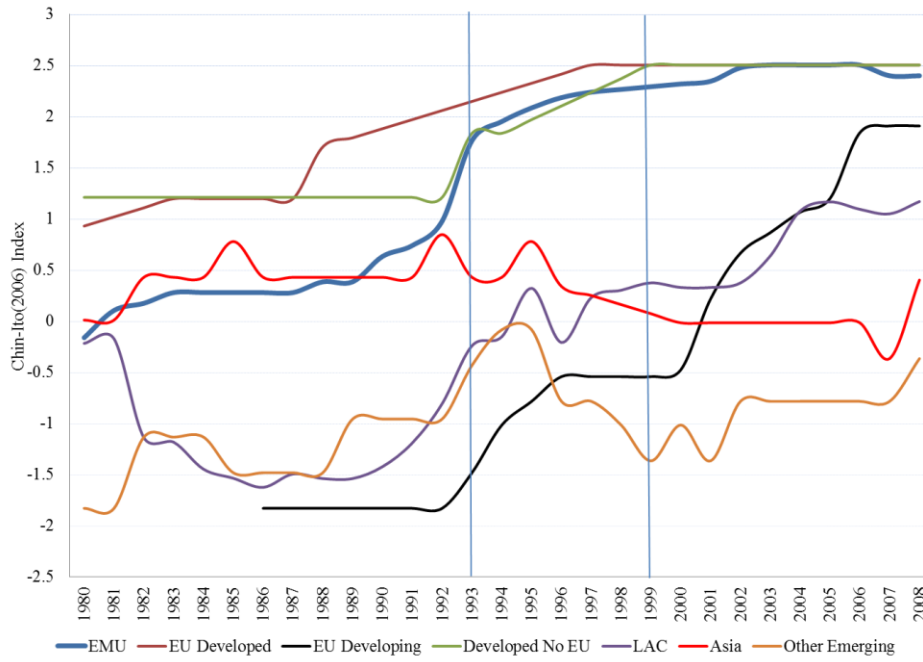
$$FI_{it} = \frac{\frac{A_{it} + L_{it}}{GDP_{it}}}{\frac{\sum_{j=1}^n A_{jt} + \sum_{j=1}^n L_{jt}}{\sum_{j=1}^n GDP_{jt}}}$$

where  $FI_{it}$  is the financial integration indicator for country  $i$  in period  $t$ ,  $A_{it}$  is the total international financial assets of country  $i$  in period  $t$ ,  $L_{it}$  is the total international financial liabilities of country  $i$  in period  $t$ ,  $GDP_{it}$  is the nominal GDP of country  $i$  in period  $t$ ,  $n$  is the total number of countries, and  $j$  is a counter for countries.

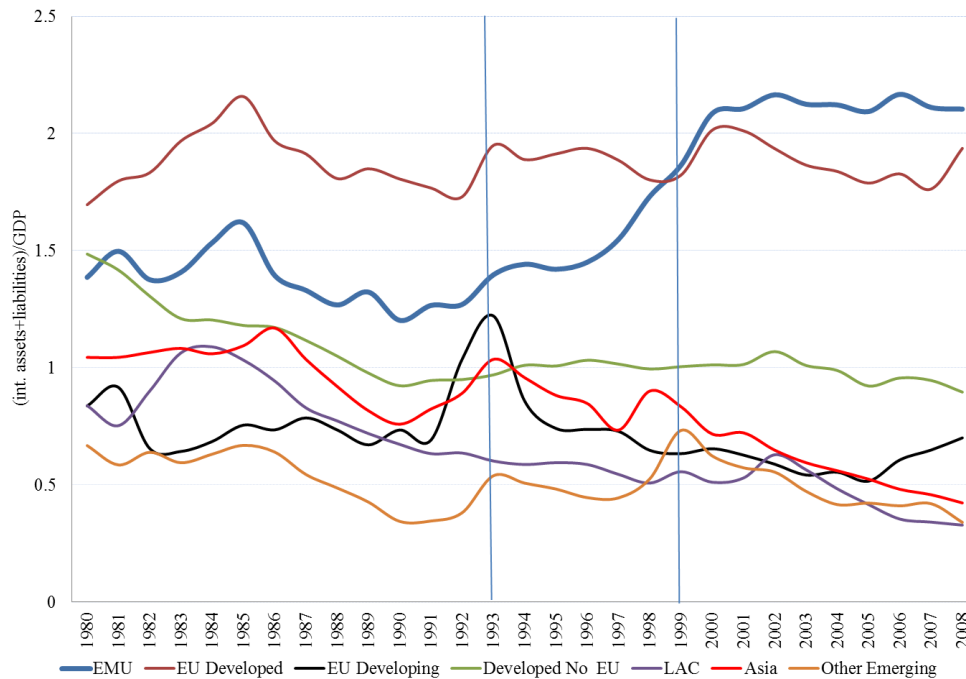
Information on international financial assets and liabilities were obtained from Lane and Milesi-Ferretti (2007) and updated for 2008 using data of the IMF-IFS. Data of nominal GDP are from the IMF-WEO.

## Figure 2: Financial Integration Indicators

### Figure 2A: *De Jure* Indicator



### Figure 2B: *De Facto* Indicator



Source: For *De Jure* indicator, Chinn and Ito (2006). For *De Facto* indicator, Lane and Milesi-Ferreti (2007). Annual information between 1980 and 2008. Author's calculations.

This process of financial integration has been particularly concentrated in the EMU area since the introduction of the Euro. Figure 3 displays the *de facto* financial integration indicators of several countries with member countries of the EMU area, North America (USA and Canada), and the European Union outside the EMU area, in 1997 and 2008.<sup>10</sup> It is clear that, in 1997, countries that later constituted the EMU zone did not have particularly strong financial links with other members of the EMU: on average, future EMU countries showed a financial integration indicator with the EMU area, USA and Canada, and the EU but non-EMU area of 22.2%, 23.3%, and 17% of GDP, respectively. However, by 2008, there was a clear increase in financial links among EMU members in comparison to the other zones: for countries inside the EMU area, their financial integration indicator with countries of the same region rose to 119.5% of GDP on average, whereas integration with the USA and Canada, and with the EU non-EMU area were, on average, 33.2% and 41.8% of GDP, respectively.

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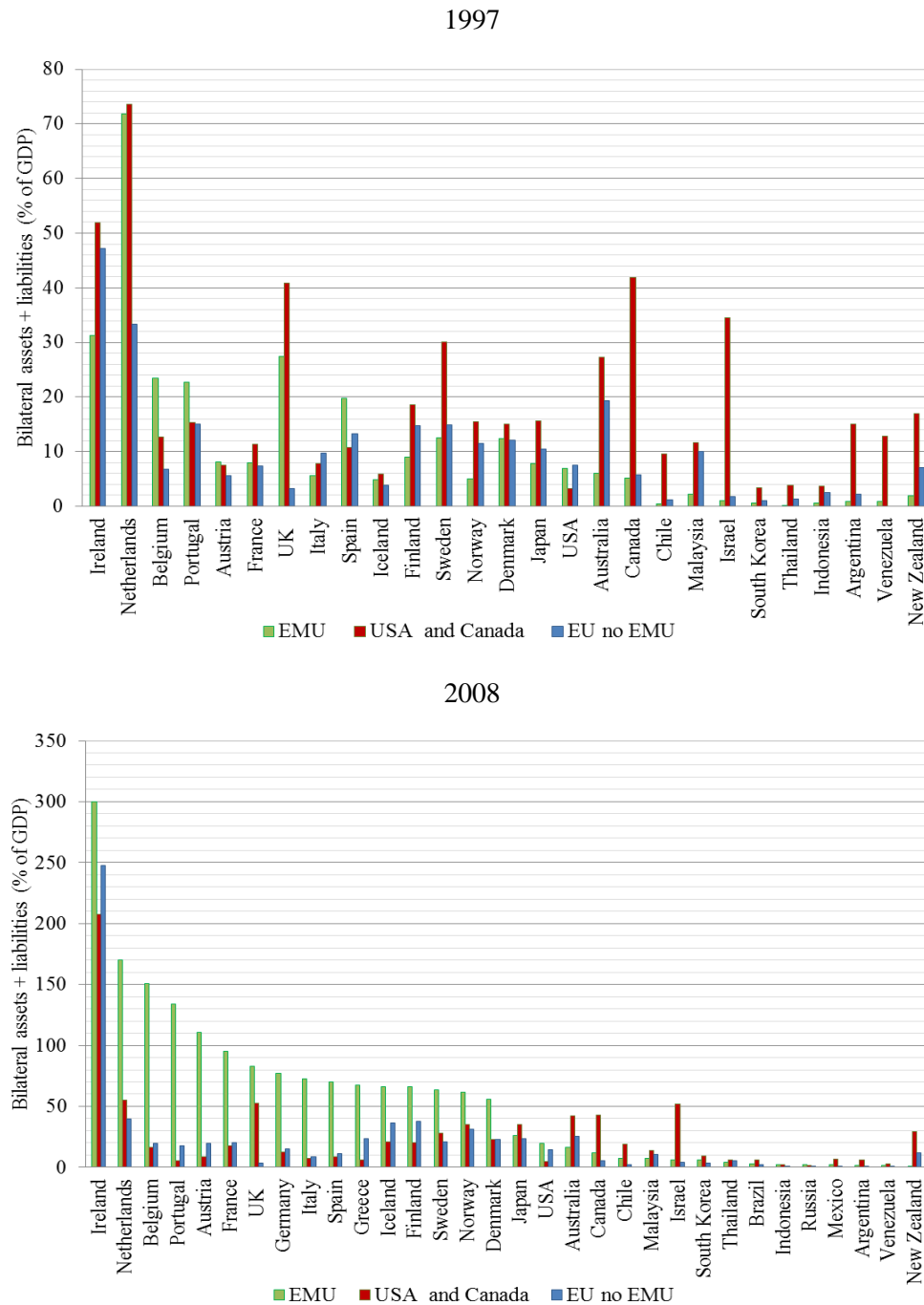
<sup>10</sup> For country  $i$ , the *de facto* financial integration indicator of country  $i$  with region  $K$  is calculated as:

$$FI_{iK,t} = \frac{\sum_{j \in K} (A_{ij,t} + L_{ij,t})}{GDP_{i,t}}$$

where  $i$  represents country  $i$ ,  $j$  represents a country  $j$  that is member of region  $K$ ,  $A_{ij,t}$  is the total value of international assets of country  $i$  in country  $j$  for period  $t$ ,  $L_{ij,t}$  is the total value of international liabilities of country  $i$  with country  $j$  for period  $t$ , and  $GDP_{i,t}$  is country  $i$ 's GDP in period  $t$ .

This indicator is calculated using information from the IMF's Coordinated Portfolio Investment Survey (CPIS), which has annual data of bilateral assets and liabilities for years 1997, and between 2001 and 2010.

**Figure 3: *De facto* Financial Integration with the EMU area, USA and Canada, and EU countries outside the EMU area**

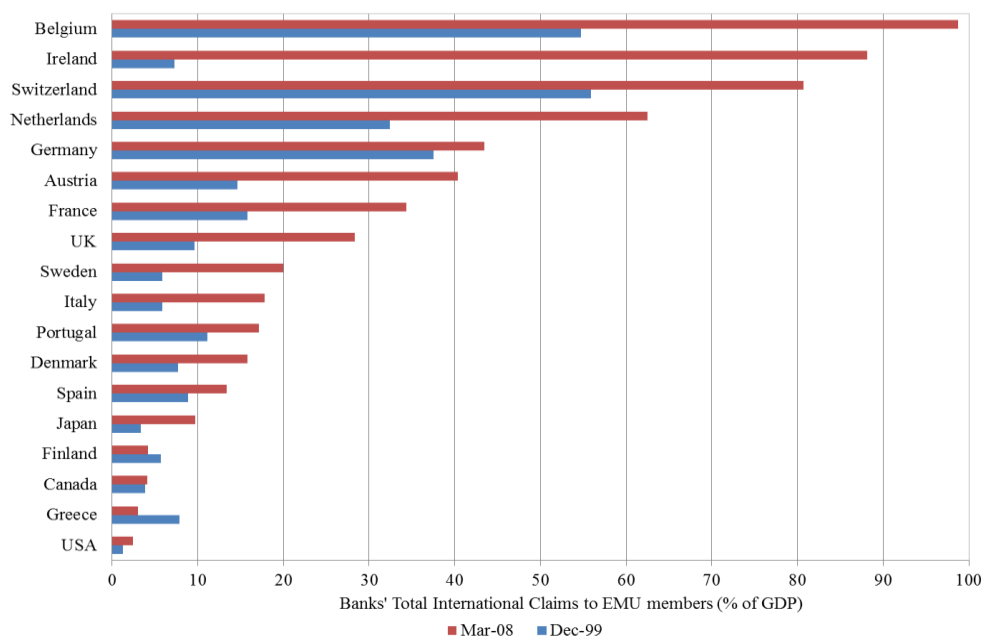


Note: *De facto* financial integration indicator calculated as the ratio of the sum of bilateral financial assets and liabilities over GDP. Years 1997 and 2008. No available information for Germany, Greece, Russia, Brazil, and Mexico in 1997.

Source: IMF-CPIS. Author's calculations.

As part of this process, financial linkages among EMU members have strengthened over time: the EMU members' financial systems have increased their EMU cross-border investments and, therefore, have raised their exposure to idiosyncratic shocks from other EMU countries. Figure 4A displays the total of banks' international claims (as percent of GDP) to EMU member countries in December 1999 and in March 2008.<sup>11</sup> We see a dramatic increment of the banking sector's exposure to other EMU members: while the average level of EMU banks' international claims to EMU countries was 19.6% of GDP in December 1999, this value more than doubled to 41.8% of GDP in March 2008. Countries such as Belgium, Ireland, and Netherlands even exhibited levels of bank exposure of over 60% of GDP.

**Figure 4A: Bank Exposure to the EMU Area**



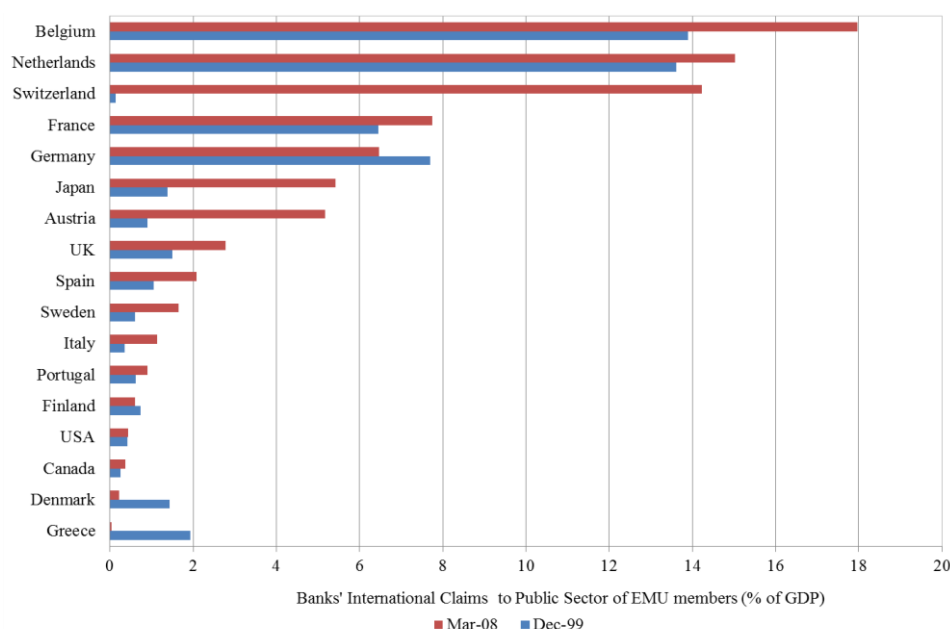
Note: Bank exposure to EMU area calculated as ratio of Bank's Total International Claims to EMU member countries over GDP. Information for December 1999 and March 2008. Data for Germany is Foreign Claims (available data since March 2005). For France, data since June 2003. For Greece, data since December 2003. Source: BIS and IMF-WEO. Author's calculations.

<sup>11</sup> Banks' international claims are defined as bank's cross-border claims plus local claims of foreign affiliates in foreign currencies. We use information of immediate borrower basis due to data availability for bilateral transactions in 1999. Data comes from BIS-Consolidated Banking Statistics.



This rise in financial linkages is particularly relevant when analyzing the vulnerability of the EMU's financial system to the public sector. Figure 4B shows banks' exposure to the public sector from other EMU member countries: on average, the level of EMU banks' international claims to EMU's public sector went up from 4.7% of GDP in 1999 to 5.7% of GDP in 2008. However the pattern of this exposure is not homogeneous across EMU countries: while countries such as Belgium, the Netherlands, France, Germany, and Austria (countries composing what is usually called "core" EMU countries in financial press) exhibited levels of banks' exposure above 5% of GDP in 2008, countries like Spain, Italy, Portugal, and Greece (part of the "peripheral" EMU area) had an exposure of 2% of GDP or lower in the same period. This pattern suggests that banks' resources to the public sector went from "core" EMU countries to "peripheral" EMU countries.<sup>12</sup>

**Figure 4B: Bank Exposure to the EMU's Public Sector**



Note: Bank exposure to EMU's Public Sector calculated as ratio of Bank's International Claims to Public Sector of EMU member countries over GDP. Information for December 1999 and March 2008. Data for Germany is Foreign Claims to the Public sector (available data since March 2005). For France, data since June 2003. For Greece, data since December 2003.

Source: BIS and IMF-WEO. Author's calculations.

<sup>12</sup> Additional calculations show that banks' exposure to the public sector of Peripheral Euro Countries (PEC) - Greece, Ireland, Italy, Portugal, and Spain - in March 2008 were (as a percent of GDP): 9.8% for Belgium, 6.4% for the Netherlands, 5% for France, 4.3% for Germany, 2.4% for Austria, 0.8% for Spain, 0.5% for Italy, 0.43% for Portugal, 0.1% for Finland, and 0.001% for Greece.

As a consequence of this regional integration process, EMU countries have become more interconnected and at the same time more vulnerable to each other's idiosyncratic shocks: a (sovereign, financial, or sectorial) crisis in one country could spread to other EMU (creditor) countries through their financial sector. Given the magnitude of their banks' exposures, this could generate large disruptions in their domestic credit supply and in turn affect the real sector of their domestic economies. Since monetary policy is no longer in the hands of national governments and they face legal restrictions to implement regulations to capital movements, under this scenario, it is expected that EMU governments execute plans to mitigate the spillover effects of a crisis: extending support to their own financial system (e.g., Diamond and Dybvig, 1983) and/or giving support to countries in financial distress (and thereby indirectly support their own financial sector).<sup>13</sup> In other words, EMU countries in strong economic position might be extending "implicit guarantees" to weak EMU countries in case of a financial distress.<sup>14</sup>

Under these circumstances, it can be expected that investors internalize these "implicit guarantees" in their valuations of sovereign bonds, stimulating investors' imprudent behavior regarding the monitoring macroeconomic fundamentals of weak economies. In this way, it is possible that investors consider the "non-bailout" clause and the SGP as non-credible fiscal rules, an idea that could be reinforced by the fact that the largest EMU economies (i.e., Germany and France) violated the SGP fiscal limits since 2003-2004 with no consequences.<sup>15</sup>

Papers like Breton et al. (2012), Acharya and Steffen (2013), and Mengus (2013) discuss this mechanism. In particular, Breton et al. (2012) state that, in financially integrated economies like the EMU, cross-border financial linkages become a source of contagion across countries'

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<sup>13</sup> Claessens, Tong, and Zuccardi (2013) give evidence for the role of the financial channel in the spillover of the EMU crisis in 2010 and 2011. They show that policy announcements to mitigate the crisis impacted financially-constrained firms more, particularly in creditor countries with greater bank exposure to peripheral EMU countries.

In addition, Horvath and Huizinga (2011) show that the creation of the European Financial Stability Facility (EFSF) represented a direct bailout of heavily indebted EMU governments and an indirect bailout of holders of their bonds (EU banks with large exposures to countries in crisis, private investors, etc.). They conclude that the establishment of the EFSF represented a risk transfer from the financial sector to the government in creditor countries.

<sup>14</sup> Henning and Kessler (2012) and Ang and Longstaff (2011) discuss this financial channel for the case of US states. They say that differences between the USA and the EMU in terms of bond ownership and regulatory frameworks make US banks unable to transmit shocks to US states as European banks do to European sovereign countries. This is one of the factors why systemic risk is lower among the US states than among the EMU member countries.

<sup>15</sup> For a detailed review of the weaknesses of the SGP, see Larch, van den Noord, and Jonung (2010). Also, a discussion about the problems of centralized fiscal rules (like the SGP) can be found in Wyplosz (2012).

banking systems. They also state that this situation creates incentives for national authorities to bail out any other foreign country in trouble, especially if that foreign country's debt is held by financial institutions considered to be systemic in the national authorities' home country. Those expectations of bailout may lead financial institutions (creditors) in integrated economies to higher exposure to common risk factors as banks choose more correlated portfolios to benefit from public bailout in case of distress at many banks. Acharya and Steffen (2013) find evidence of this mechanism: they show that large European banks, those that have high short-term debt (large short-term leverage), are undercapitalized, and/or have high risk-weighted assets are significantly more exposed to sovereign debt of Greece, Ireland, Italy, Portugal, and Spain. This result is in line with the general perception of large (and too-systemic-to-fail) banks exploiting an implicit bailout guarantee from their sovereign. Furthermore, Mengus (2013) establishes a two-country theoretical model in which expectations of a foreign country's debt bailout by the home country's authorities generate incentives for private agents (of both countries) to engage *ex ante* in a collective bet on the foreign country's debt. The model has three equilibria, of which one is characterized by high financial exposure of the home country to the foreign country's debt, and the fact that the foreign country's debt becomes a substitute for the home country's debt (in other words, their yields are similar). Mengus (2013) associates this equilibrium with the situation in the EMU area before 2008.

### *III. Framework and Data*

#### III.1. Specification

##### *III.1.1. Basic Structure*<sup>16</sup>

Let us assume an international capital market composed by debtor countries and multiple risk-neutral lenders. Each debtor country  $i$  borrows from international lenders and faces two possible states: one in which the country is in crisis, and the other one in which there is no crisis. The probability of crisis is given by  $\theta_i$ .

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<sup>16</sup> This section strongly follows Dell'Ariccia et al. (2002). The following model is a one-period model and all parameters are related to that periodicity.

Once country  $i$  is in crisis, it has the possibility to default on its debt with the international lenders. The probability of default *conditional* on the occurrence of a crisis is given by  $(1-\lambda)$ , where  $\lambda$  is the “recovery rate” or the probability that country  $i$  repays lenders during crisis. Consequently, country  $i$ 's probability of default is given by  $\theta_i(1-\lambda)$ .

Let us assume that the probability of crisis  $\theta_i$  is a function of observable country-specific fundamentals  $x_i$  (i.e.,  $\theta_i=\theta(x_i)$ ). Also, for simplification, let us assume that the recovery rate  $\lambda$  is identical across countries.

In this way, the expected benefit of a risk-neutral lender buying country  $i$ 's sovereign bond (i.e., expected benefit of lending to country  $i$ ) is given by:

$$\Phi = (1 - \theta_i)R_i + \theta_i(\lambda R_i + (1 - \lambda)0)$$

$$\Phi = R_i(1 - (1 - \lambda)\theta_i) \tag{1}$$

where  $R_i$  is the gross interest rate that country  $i$  promises to pay the lender in case of no default.<sup>17</sup> If country  $i$  is in crisis and decides to default on its debt, then lenders would not receive any payment (i.e., payment is zero).

Assuming that each lender has the possibility to invest in a risk-free bond (available in international capital markets) that pays an exogenous gross interest rate  $R^*$ , lenders will buy country  $i$ 's bond if the expected benefit of doing so is larger or equal to the benefit of the risk-free bond. Given the competition among lenders, each lender will face the following no-arbitrage condition:

$$R_i(1 - (1 - \lambda)\theta_i) = R^*$$

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<sup>17</sup> We assume that country  $i$  does not make a strategic default. In other words, if the country is not in crisis, it will always honor its debts. Consequently, lenders will receive payment  $R_i$  in either non-crisis state (with probability  $(1-\theta_i)$ ), or in crisis state when the country does not default (with probability  $\lambda\theta_i$ ).

Consequently,  $R_i$  is given by:

$$R_i = \frac{R^*}{(1-(1-\lambda)\theta_i)} \quad (2)$$

and the spread of country  $i$  over a risk-free interest rate (in the remainder, referred as "spreads") is given by:

$$\begin{aligned} s_i &= R_i - R^* \\ s_i &= R^* \frac{(1-\lambda)\theta_i}{1-(1-\lambda)\theta_i} \end{aligned} \quad (3)$$

Let us call  $b$  the perceived probability that a country will receive an international rescue package in the event of a crisis. According to Dell'Ariccia et al. (2002), there are three channels by which the expectation of an international rescue package could affect spreads:

1. "Country moral hazard":  $b$  could affect observable fundamentals through government policies (i.e.,  $x_i = x_i(b)$ ). The expectation of a rescue package could affect the incentives of country  $i$ 's authorities to carry out prudent macroeconomic policies and, in this way, it could indirectly affect the crisis probability. This means that  $\theta_i$  could be a function of  $b$  (i.e.,  $\theta_i = \theta[x_i(b)]$ ).
2. "Direct effect":  $b$  could directly affect the probability of crisis, conditioning on fundamentals (i.e.,  $\theta_i = \theta[x_i(b), b]$ ). For instance, the presence of an international "safety net" might reduce the probability of economic crises such as runs on a country  $i$ 's debt or currency.
3. "Investor's (creditor's) moral hazard":  $b$  could affect the recovery rate in event of a crisis (i.e.,  $\lambda = \lambda(b)$ ). The expectation of a rescue package could increase the expected amount of resources that a lender would receive as a repayment from country  $i$  in time of crisis (i.e.,  $(\partial\lambda(b)/\partial b) > 0$ ). Since the lender's loss rate in crisis is lower, lenders could involve in reckless behaviors such as an increment of risky lending and/or a reduction in monitoring of country  $i$ 's macroeconomic performance.

The current analysis is focused on investor's moral hazard.<sup>18</sup> Similar to Dell'Ariccia et al. (2002), we control for country  $i$ 's specific fundamentals in estimations shown in section *Empirical Results* (i.e., we assume fundamentals as predetermined<sup>19</sup>). In addition, we assume that  $\theta_i$  does not directly depend on  $b$ , ruling out the second channel in which the expectation of rescue package has a direct effect on the probability of crisis.<sup>20</sup> Consequently, equation (3) becomes:

$$s_i = R^* \frac{[1-\lambda(b)]\theta_i(x_i)}{1-[1-\lambda(b)]\theta_i(x_i)} \quad (4)$$

where spread  $s_i$  is a function of the risk-free interest rate  $R^*$ , fundamental variables  $x_i$ , and the perceived probability of rescue package  $b$ .

Based on equation (4), Dell'Ariccia et al. (2002) state three testable implications of investor's moral hazard:<sup>21</sup>

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<sup>18</sup> Even though the first and the second channels are out of the scope of this research, we recognize their importance to explain the behavior of spreads. For instance, country moral hazard is an important channel as discussed by Breton et al. (2012). For a theoretical analysis of this channel see Corsetti, Guimaraes and Roubini (2006). For an empirical analysis for the case of EMU area, see Baskaran and Hessami (2012). For the second channel, we consider it less relevant for the case of EMU area (as discussed in section *European Monetary Union and Investor's Incentives* and footnote 21). There is not any empirical analysis on that channel for the EMU area so far in our knowledge.

<sup>19</sup> In an analysis where both spreads and macroeconomic variables are endogenously determined, we cannot completely rule out the influence of spreads on country's fundamentals. In other words, in that case, we are aware of the possibility that low levels of spreads could affect country authorities' incentives to pursue prudent macroeconomic policies. Without excluding the existence of that channel, our empirical results are consistent with the hypothesis of creditor moral hazard, as can be seen in section *Empirical Results*.

<sup>20</sup> Dell'Ariccia et al. (2002) has an interesting discussion of the implications of this assumption. According to them, if we allow the probability of crisis  $\theta_i$  to depend on  $b$ , such as  $\partial\theta(x_i, b)/\partial b < 0$ , then we will have an identification problem since we would be unable to distinguish the effects on spreads attributable from moral hazard or those from "true risk reduction" generated by international crisis lending.

This "true risk reduction" generated by international crisis lending arises when international lending is part of a financial safety net that eliminates self-fulfilling debt runs (Sachs, 1984) or help to prevent bank runs triggered by shifts in exchange rate expectations.

This problem is relevant when analyzing the effect of IMF's lending on international risk pricing since one of the main mandates of the IMF is to help in the preservation of the stability of the global financial system. That implies that one of the purposes of the IMF lending is to reduce the incidence of crisis.

We assume that this problem is less relevant when analyzing the effect of the European Monetary Union (EMU) on risk pricing because the SGP established a non-bailout rule among EMU member countries and the European Union had not created any institution to help countries in distress until the current financial crisis. Consequently, the existence of EMU does not imply the existence of a safety net *per se* among EMU members. However, the existence of one common currency, one Central Bank, and the strong financial ties produced in the intra-regional financial integration process could imply the existence of some implicit guarantees among EMU members in times of crises. We believe that this perception is captured by  $\lambda(b)$  instead of  $\theta(x_i, b)$  because the existence of those institutions does not necessarily change the incidence of crisis, but the implicit guarantee associated with those institutions could change lenders' perception of the losses they could face in crisis.

<sup>21</sup> See details in Dell'Ariccia et al. (2002), Appendix II.

- 1. Implication 1 (Level Test):** Holding constant the set of fundamentals  $X=(x_1', x_2', \dots, x_k')$ , equation (4) implies that if  $\partial\lambda/\partial b > 0$  then  $\partial s_i/\partial b < 0$  for any country  $i$ .

The intuition behind this implication is that, under investor's moral hazard, if the perceived probability of bailout rises, then lenders could expect that the recovery rate also increases, which should be reflected in lower spreads. For instance, if country  $i$  is part of the EMU, lenders would expect a higher recovery rate for country  $i$ 's bonds than for bonds of any other country outside of the EMU area due to the implicit guarantees among EMU members. Consequently, we should expect lower spreads for EMU countries.

- 2. Implication 2 (Slope Test):** Equation (4) implies that if  $\partial\lambda/\partial b > 0$  then  $\partial^2 s_i/\partial x_{ij}\partial b < 0$  for any country  $i$  and any country-specific fundamental  $x_{ij}$  (assuming that  $\partial\theta_i/\partial x_{ij} > 0$ ), holding constant the set of other fundamentals  $X=(x_1', x_2', \dots, x_k')$  different to  $x_{ij}$ .

As explained by Dell'Ariccia et al. (2002), under the lender's standpoint, a higher recovery rate represents a higher probability that lenders get off "scot-free" in times of crisis. Consequently, lenders have fewer incentives to carry out prudent lending policies such as avoiding lending to countries with high probability of crisis and/or monitoring debtor country's fundamentals. In the extreme case that  $\lambda(b)=1$ , all countries would pay the same risk-free interest rate, regardless of their fundamentals. In our case, if country  $i$  is part of the EMU, a higher lenders' perception of bailout generates that they reduce monitoring on country  $i$ 's fundamentals.

Finally, let  $\Delta s = s_m - s_n$ ,  $m \neq n$  where  $s_m$  and  $s_n$  are spreads of two countries  $m$  and  $n$ .

- 3. Implication 3 (Variance Test):** Holding constant the set of fundamentals  $X=(x_1', x_2', \dots, x_k')$ , equation (4) implies that if  $\partial\lambda/\partial b > 0$  then  $\partial \Delta s/\partial b < 0$  for any two countries  $m$  and  $n$ ,  $m \neq n$  for which we can approximate  $\Delta s = s_m - s_n$  by a first-order Taylor expansion.

Implication 3 states that a higher probability of being bailed out reduces the spread difference between any pair of countries, with a decrease more pronounced for countries with higher spreads. As lenders pay less attention to differences in fundamentals across countries, the differences between spreads should narrow. In the case of EMU countries, if countries  $m$  and

$n$  are part of the EMU zone, the higher perception of bailout not only reduces the level of the spread for both countries  $m$  and  $n$ , but also the fall in spreads should be more pronounced for the country with higher initial spreads. Consequently, we should expect a decline in the cross-country variance of spreads among EMU countries in comparison to a similar variance for a set of countries outside the EMU zone.

### III.1.2. Econometric Setup

In order to test the implications stated in subsection *Basic Structure* (level test, slope test, and variance test), we use different econometric methods: a. Panel-Data with random effects, b. Mixed model Panel-Data, and c. Difference-in-Difference approach.

#### A. Panel data with random effects

Let us assume the following econometric model:

$$y_{it} = \alpha + x_{it}\beta + \vartheta_i + \varepsilon_{it} \quad (5)$$

for  $i=1, \dots, N$  and  $t=1, \dots, T_i$ , where  $N$  is the number of countries, and  $T_i$  is the number of periods the country  $i$  is observed in the sample.

In this model  $y_{it}$  is the dependent variable (i.e.,  $\log(\text{Spread}_{it})$ )<sup>22</sup>,  $x_{it}$  is a set of independent variables that includes both country-specific macroeconomic fundamentals and global market indicators,  $\alpha$  and  $\beta$  are parameters,  $\vartheta_i$  is an unobserved country specific effect, and  $\varepsilon_{it}$  is an error term. Let us assume that the country-specific effect  $\vartheta_i$  is independent and identically distributed with mean zero and variance  $\sigma_\vartheta^2$  (i.e.,  $\vartheta_i \sim iid(0, \sigma_\vartheta^2)$ ) and independent of  $x_{it}$ . In addition, let us assume that the error term  $\varepsilon_{it}$  has an autoregressive structure AR(1) given by:

$$\varepsilon_{it} = \rho\varepsilon_{it-1} + \eta_{it} \quad (6)$$

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<sup>22</sup> We use a logarithmic transformation for *Spread* in order to “stabilize” its distribution. In other words, a logarithmic transformation is a monotonic transformation that selectively spreads out low values in a distribution and compresses high values. Given that in a few cases *Spread* can be very large for some countries in some periods (particularly periods in which markets behave highly speculative), this transformation allows us to better estimate the empirical relationship between *Spread* and the independent variables, reducing the “noise” of those periods. This transformation does not affect the sign and significance of the estimated coefficients.



where  $\rho < 1$  and  $\eta_{it}$  is an error term that is independent and identically distributed with mean zero and variance  $\sigma_\eta^2$  (i.e.,  $\eta_{it} \sim iid(0, \sigma_\eta^2)$ ).<sup>23</sup>

- 1. Level Test:** In order to test whether there is a fall in the spread level when country  $i$  is member of the EMU, we modify equation (5) as follows:

$$y_{it} = \alpha + \beta_1 d_{it} + x_{it}\beta + \vartheta_i + \varepsilon_{it} \quad (7)$$

where  $d_{it}$  is a dummy variable with the following values:

$$d_{it} = \begin{cases} 1, & \text{if country } i \in \text{EMU in time } t \\ 0, & \text{otherwise} \end{cases} \quad (8)$$

Consequently, we test whether  $\beta_1$  has a negative value. In terms of hypothesis testing, we have:

$$\begin{aligned} H_0: \beta_1 &= 0 \\ H_a: \beta_1 &< 0 \end{aligned}$$

If our model is correct, we expect the null hypothesis to be rejected, showing that country members of the EMU face, in general, lower spreads than countries outside the EMU.

- 2. Slope Test:** In this case, we modify equation (7) as follows:

$$y_{it} = \alpha + \beta_1 d_{it} + x_{it}\beta + x_{it}^f d_{it} \gamma + \vartheta_i + \varepsilon_{it} \quad (9)$$

where  $x_{it}^f$  is the subset of independent variables  $x_{it}$  that represents country  $i$ 's macroeconomic fundamentals, and  $\gamma$  captures the interaction effects between  $x_{it}^f$  and  $d_{it}$ . This term  $\gamma$  represents the average change in the slope coefficient of  $x_{it}^f$  due to the fact that country  $i$  is a member of the EMU. In other words, the slope coefficient of a macroeconomic fundamental variable  $x_{kit}^f$  is given by:

$$slope_k = \begin{cases} \beta_k + \gamma_k, & \text{if country } i \in \text{EMU area} \\ \beta_k, & \text{otherwise} \end{cases}$$

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<sup>23</sup> We included an autoregressive error term in order to capture a possible persistence effect on spreads given that this characteristic is usual in financial time series.

If international lenders reduce monitoring on fundamental  $x_{kit}^f$ , then we expect that parameter  $\gamma_k$  has a contrary sign to the the sign of parameter  $\beta_k$ . This result represents that the relationship between  $x_{kit}^f$  and spreads is weaker by the fact that country  $i$  is part of the EMU area.

**3. Variance Test:** In this case, let us assume that spreads of EMU countries are given by:

$$y_{it} = \alpha + \beta_1 d_{it} + x_{it} \beta^0 + \vartheta_i + \varepsilon_{it} \quad (10)$$

for country  $i$  that is part of the EMU area. In this case, the parameter  $\beta^0$  captures both the parameters associated with independent variables  $x_{it}$  and the slope change parameter  $\gamma$  shown in equation (9).

Similarly, spreads for countries that are not part of the EMU zone are given by:

$$y_{jt} = \alpha + x_{jt} \beta^1 + \vartheta_j + \varepsilon_{jt} \quad (11)$$

for country  $j$  which is not part of the EMU area.

Based on equations (10) and (11), the cross-country variance of each group of countries is given by:

$$VAR_i(y_t) = \beta^0' VAR_i(X_t) \beta^0 + \sigma_{\vartheta}^2 + \sigma_{\eta}^2 / (1 - \rho^2) \quad (12)$$

and

$$VAR_j(y_t) = \beta^1' VAR_j(X_t) \beta^1 + \sigma_{\vartheta}^2 + \sigma_{\eta}^2 / (1 - \rho^2) \quad (13)$$

where  $X_t$  is the set of independent variables at period  $t$ .

Therefore, if we take the difference between equations (12) and (13), we have:

$$VAR_i(y_t) - VAR_j(y_t) = \beta^0' VAR_i(X_t) \beta^0 - \beta^1' VAR_j(X_t) \beta^1 \quad (14)$$

Under investor's moral hazard we expect the cross-country variance of spreads of EMU countries to be lower than the variance for countries outside of EMU area. In terms of hypothesis testing, we have that:

$$\begin{aligned}
H_0: \beta^0' VAR_i(X_t)\beta^0 &= \beta^1' VAR_j(X_t)\beta^1 \\
H_a: \beta^0' VAR_i(X_t)\beta^0 &< \beta^1' VAR_j(X_t)\beta^1
\end{aligned} \tag{15}$$

Consequently, if the null hypothesis is rejected, then the cross-country variance of EMU members is lower than that of non-EMU countries.

### B. Mixed models panel data

In order to check the robustness of our results, we use a panel data mixed model which allows us to evaluate whether the results of the level and slope tests still hold or are driven by some random effect on the parameters. For that, spreads have the following structure:

$$y_{it} = \alpha + x_{it}\beta + z_{it}u_i + \varepsilon_{it} \tag{16}$$

where  $z_{it}$  are observable variables,  $u_i$  is a random variable with mean zero and covariance matrix  $\Sigma_u$  (i.e.,  $u_i \sim iid(0, \Sigma_u)$ ), and  $\varepsilon_{it}$  is a random term with the following autoregressive structure:

$$\varepsilon_{it} = \rho\varepsilon_{it-1} + \eta_{it}$$

where  $|\rho| < 1$  and  $\eta_{it} \sim iid(0, \sigma_\eta^2)$ . The conditional mean of  $y_{it}$  is given by  $\alpha + x_{it}\beta$  whereas the error term is given by  $z_{it}u_i + \varepsilon_{it}$ .

In this estimation, we included in  $z_{it}$  some of the country  $i$ 's macroeconomic fundamentals also included in  $x_{it}$ .<sup>24</sup> Therefore, the slope parameters for those fundamentals will have both a fixed and a random element. In order to conduct the level, slope and variance test, we modify equation (16) similar to what was done in equations (7), (9), and (14).

### C. Difference-in-difference approach

As an additional exercise, we use the difference-in-difference approach to evaluate our results. Under this approach, we are interested in capturing the effects of a policy change (or "treatment") on our dependent variable. In this case, the "treatment" is the fact that country  $i$  becomes a member of the EMU area from period  $t$  onward. Therefore, our country sample is

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<sup>24</sup> The term  $z_{it}$  also includes a vector of ones in order to capture the country specific random effect  $\vartheta_i$  specified in equation (5).

divided in two groups: 1) the set of countries that are members of the EMU area (the "treatment" group), and 2) the set of countries that are not members of the EMU area (the "control" group).

In general, the difference-in-difference approach estimates the average change in the output variable for the "treatment" group generated by the fact that this group was exposed to the "treatment". In order to do that, this methodology considers two steps: first, for each group, it calculates the difference between the average value of the output variable before and after the "treatment" in order to control for biases caused by permanent time trends or unobserved time phenomena affecting both groups; and second, it calculates the difference between the "treatment" and the "control" groups in order to remove biases caused by permanent differences between the groups or unobserved individual phenomena not related with the "treatment".<sup>25</sup>

Under this approach, equation (7) becomes:

$$y_{it} = \alpha + \beta_1 d_{it} + x_{it}\beta + \vartheta_i + \varphi_t + \varepsilon_{it} \quad (17)$$

for  $i=1, \dots, N$  and  $t=1, \dots, T_i$ , where  $N$  is the number of countries, and  $T_i$  is the number of periods the country  $i$  is observed in the sample.

We assume that the unobserved country-specific effect  $\vartheta_i$  is a fixed effect. In addition, we include a parameter  $\varphi_t$  to capture unobserved time-specific effects (also fixed). These two parameters allow us to control for individual and time differences between the "treatment" and the "control" groups that are not related to the "treatment" (i.e., for individual and time biases, respectively). The variable  $d_{it}$  is still defined as in equation (8), allowing us to capture the effect of the "treatment". Finally, we assume the error term  $\varepsilon_{it}$  to be independent and identically distributed with mean zero and variance  $\sigma_\varepsilon^2$ .

In order to conduct the slope and variance tests, we modify equation (17) similarly to what was done in equations (9) and (14), respectively.

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<sup>25</sup> For more details on this methodology see Wooldridge (2002), chapters 10 and 11, and Laporte and Windmeijer (2005).

### III.2. Key Data

In the following, we describe the dependent variable and independent variables (country fundamental indicators, global market conditions, and additional indicators) used in the empirical analyses of section *Empirical Results*. Table 1 displays descriptive statistics of both the dependent and the independent variables.

**Dependent Variable:** For the estimation of the models proposed in the previous subsection, we use sovereign bond spreads from January 1996 to March 2008 as dependent variable.<sup>26</sup> For developed economies, the sovereign spread is computed as the difference between country *i*'s 10-year government bond yield and the US 10-year government bond yield. In case of EMU countries, we do the same calculation but with respect to the German 10-year government bond yield, as commonly used in the literature of sovereign risk. For emerging markets, we use EMBI global spreads, which are calculated using US government bonds with comparable maturity features.<sup>27</sup>

As independent variables, we include the following information:

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<sup>26</sup> In this document we are analyzing sovereign spreads before the 2008-2010 financial crisis. There is not a clear date of the start of this crisis: some authors consider that the crisis started with Lehman Brothers' bankruptcy in September 2008. Others consider that the crisis started with the takeover of Bears Stearns by JPMorgan in March 2008. Consequently, we use March 2008 as a closing date for our analysis in order to avoid potential effects of the start of the crisis in our results.

<sup>27</sup> Unfortunately, there is not a homogeneous measure of sovereign bond spreads between developed and developing economies that covers a period before and after the establishment of the EMU area. On the one hand, most of the emerging economies do not issue 10-year bonds in foreign currency (i.e., US dollars or Euros) and their issuances in domestic currency have strong effects of currency volatility and/or low demand. On the other hand, JP Morgan, who is the company that calculates the EMBI global index (and spreads) for emerging economies, does not calculate an equivalent index for developed ones. Consequently, we work with the most common definitions of bond spreads used in the literature of sovereign risk.

Regarding to the difference in currencies (US dollars and Euros), as Fratzscher (2002) states, the underlying assumption of using yields in different currencies is that investors are able to hedge at least some of their foreign exchange exposure between these two currencies. This is a plausible assumption in today's growing world of financial derivatives. However, we also did estimations using EMU countries' sovereign bond spreads calculated from the US 10-year government bond yield and we found similar results to those shown in section *Empirical Results*.

Finally, we estimated a poolability test in order to establish whether we can do a pool of these series. We found that we have no statistical evidence to reject the hypothesis that these series can be in pool sample ( $f$ -statistic 0.91061, with  $\text{Pr.}(F \leq 0.91061) = 0.08$ ).

1. **Country fundamentals:** we control for the commonly used indicators in the empirical literature on sovereign risk, such as: a) the government debt-to-GDP ratio, b) the government balance-to-GDP ratio (these last two variables as indicators of country  $i$ 's financial solvency), c) the GDP annual growth rate, d) the international reserves-to-GDP ratio (as indicator of country  $i$ 's international solvency), and e) the annual inflation rate (as indicator of macroeconomic instability).<sup>28</sup>
  
2. **Global market conditions:** we also control for commonly used indicators of global investors' risk aversion and global liquidity conditions, such as: a) the VIX index (capturing the market's expectation of stock market volatility, a measure of changes in investors' risk appetite), b) the US FED policy rate (as standard measure of global liquidity conditions), and c) TED spreads (as indicator of perceived credit risk in the interbank lending market).<sup>29</sup>
  
3. **Further indicators:** we include further covariates in order to control for other relevant country characteristics, such as: a) the *de facto* Exchange Rate Regime based on Reinhart and Rogoff (2004) (to capture possible effects of currency regime - and currency risk- on sovereign default risk), b) sovereign credit rating from International Investors Magazine (to reflect the effect of credit qualification on the borrowing cost that countries face<sup>30</sup>), c) outstanding amount of international debt securities issued by country  $i$ 's government (to capture the effect of international bonds' liquidity on spreads), d) the annual growth rate of the stock market (reflecting possible changes in demand for country  $i$ 's assets, the

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<sup>28</sup> For public debt and fiscal balance we use information of the general government when available. Otherwise, we use central government information.

In earlier versions of this document, we also included other variables commonly mentioned in the literature, such as: a) the current account balance-to-GDP ratio, b) the trade balance-to-GDP ratio, and c) the annual growth rate of industrial production. However, we found that their estimated coefficients were not statistically significant in any specification.

<sup>29</sup> TED spreads are calculated as the difference between the interest rate paid by interbank loans and the interest rate paid by a short-term US government bond (T-bills). An increment of TED spreads represents a higher perceived risk of default on interbank loans, a measure of the conditions of the credit market.

<sup>30</sup> The sovereign credit rating from International Investors Magazine is an annual index that measures the default risk based on a local survey of leading economists in each country. This index goes from 0 to 100, where 0 is default and 100 is no default risk.

Given that sovereign credit ratings are based on information of country-specific fundamentals, we have a collinearity problem if we directly include this variable as independent variable for spreads. Consequently, we previously estimated a regression with ratings as dependent variable and all country-specific fundamentals as independent ones. Later, we included the orthogonal part of this estimation as one explanatory variable of spreads.

"exuberance" effect<sup>31</sup>), e) the ratio of the sum of international assets and liabilities to GDP (capturing the effect of the *de facto* financial integration on spreads).

We use monthly series of spreads and market variables, and other variables at their shortest frequency (quarterly, or annually). Information for spreads is collected from Bloomberg and Thompson-Reuters Datastream. Information of country fundamentals are mainly collected from national sources (Central Banks, Ministry of Finance, etc.), IMF-IFS and the Inter-American Development Bank. Data of global market conditions stem from Bloomberg and Thompson-Reuters Datastream. Finally, data to calculate further indicators come from International Investors Magazine, BIS, Bloomberg, and Lane and Milesi-Ferretti (2007).

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<sup>31</sup> In the same way as sovereign credit ratings, the behavior of the stock market index could depend on country-specific macroeconomic fundamentals. Consequently, as we did with sovereign credit ratings, we previously estimated a regression which uses the annual growth rate of the stock market index as dependent variable and macroeconomic fundamentals as independent ones. Later, we used the orthogonal part of this estimation as explanatory variable of spreads.

**Table 1: Descriptive Statistics**

Variable	Obs.	Mean	St. Deviation	Min	p25	p50	p
<u>Dependent Variable</u>							
Sovereign Bond Spreads	2321	281.7	745.9	0.02	21.4	76.5	23
<u>Macroeconomic Fundamentals</u>							
Public Debt (1)	2321	53.0	26.6	5.9	36.7	45.9	6
Fiscal Balance (1)	2321	-1.2	3.0	-9.0	-3.0	-1.4	0
GDP (2)	2321	3.4	2.8	-15.2	2.0	3.4	5
Reserves (1)	2321	10.4	10.3	0.1	2.9	7.1	1
Inflation	2321	3.6	3.6	-2.2	1.7	2.6	4
<u>Global market Indicators</u>							
VIX	2321	20.1	6.7	10.8	14.4	19.6	2
US FED Interest Rate (%)	2321	3.6	1.8	1.0	1.8	3.9	5
TED Spreads	2321	0.4	0.3	0.1	0.2	0.3	0
<u>Further indicators</u>							
Credit Rating (IIR) (1-100)	2321	69.9	20.3	14.5	51.3	75.3	8
Outstanding Government's Debt Securities (US\$ millions)	2321	35891	40377	411	6104	22569	53
National Stock Market Index (2005=100)	2321	96.2	49.8	14.7	64.9	87.6	11
Financial Integration Indicator (Lane-Milesi)	2321	1.10	0.86	0.23	0.49	0.80	1

Note: Monthly data from January 1996 to March 2008 for 31 countries: Argentina, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, C  
Denmark, Finland, France, Greece, Hungary, Ireland, Italy, Malaysia, Mexico, the Netherlands, Norway, Peru, Philippines, Poland, Port  
Spain, Sweden, Thailand, Turkey, and United Kingdom.

(1) As % of GDP.

(2) Annual growth rate.



#### IV. *Empirical Results*

##### IV.1. Level Test

Table 2 shows the estimated results for equation (7) using panel data with random effects. Macroeconomic fundamentals such as public debt, international reserves, inflation, fiscal balance, and the growth rate of GDP are lagged in order to avoid any endogeneity problem in our estimations. As can be seen, most of the independent variables have the expected sign and, in most cases, they are statistically significant. For instance, regarding to macroeconomic fundamentals, we find that public debt has a positive and significant sign (i.e., higher public debt levels are associated with higher spreads). This result represents that lenders might perceive that a country with a high level of public debt is more likely to default in the event of a crisis.<sup>32</sup>

With regard to fiscal balance, we find that the sign is negative and significant: large fiscal deficits might imply large financing needs by the government (i.e., public debt accumulation) and/or future inability to honor government's debts. Consequently, lenders might request a higher yield to be compensated for the higher default risk. The GDP growth rate is negatively associated with spreads (although not significant): if a country is facing an economic boom, then its government might be able to collect larger current revenues (i.e., tax revenues, profits from public companies, etc.) than in times of an economic bust and, therefore, the perceived default risk on government debt is lower. In addition, international reserves have a negative sign (although not significant): lenders might consider that a country with a high reserves level has resources in foreign currency to be able to honor its international payments in all states, even during crisis. Finally, the sign of inflation is positive (and significant) because high inflation represents macroeconomic instability and, therefore, a higher probability of default.

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<sup>32</sup> We included the square of public debt in order to capture a nonlinear relationship between this variable and spreads. We found that the square of public debt is not significant. Its sign is negative, a result that we are going to discuss later in this document.

With respect to global market indicators, bond spreads are positively correlated with the VIX index. For instance, if the VIX index increases (i.e., there is a fall in investors' risk appetite), then lenders are less willing to buy government bonds and, therefore, they have to be compensated with an increase in the return of these bonds, raising spreads. Finally, the correlation between spreads and the US policy interest rate is negative in this estimation. Even though this result is counter-intuitive, it is not uncommon in the literature on the determinants of sovereign spreads. Studies such as Eichengreen and Mody (1998), Kamin and von Kleist (1999), McGuire and Schrijvers (2003), Baldacci et al. (2008), and Noy (2008) have found similar results.<sup>33</sup>

With respect to further indicators, the measure of debt-securities liquidity is negative (although not significant): more liquid sovereign bonds tend to have lower spreads (i.e., liquidity premium). In addition, the annual growth rate of the stock market index is negative and significant. It seems that periods of high demand for country *i*'s financial assets are associated with high demand for government bonds and, therefore, the bond price rises and the yield falls, reflected in a reduction of spreads.

It must be taken into account that our measure of stock market index is previously controlled by country *i*'s macroeconomic fundamentals, which means that this correlation is not attributed to the general macroeconomic conditions of that country, but a general interest for its assets (i.e., an "exuberance" effect).

Finally, we include an indicator of multilateral financial integration. As explained above, this variable calculates the amount of international assets and liabilities that the country *i* has with other countries with respect to the size of its economy.

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<sup>33</sup> McGuire and Schrijvers (2003) state that there is an open discussion on the relationship between US interest rates and bond spreads. The results depend on the type of market spreads used (primary or secondary markets), the inclusion/exclusion of certain emerging market issuers, the time period under consideration, and the regression technique applied to the data. See McGuire and Schrijvers (2003) for more details of this discussion.

Column 8 shows that financial integration is negatively correlated with spreads, which means that countries having larger financial linkages with other countries tend to have lower spreads. This result might reflect that, in general, a reduction of transaction costs, harmonization of financial regulations, an increase in access to international capital flows (portfolio and/or foreign direct investment), etc., produce a fall in country  $i$ 's financing costs.<sup>34</sup>

The main result of Table 2 is that - after controlling for country fundamental indicators, global market conditions and other indicators - member countries of the EMU area have, on average, lower spreads than countries outside of this area. As shown in the first row of this Table, the "Eurozone" dummy is negative and significant, and this result holds for different arrangements of the independent variables.

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<sup>34</sup> One way to understand this result is that the financial liberalization could generate a price convergence process, in which asset prices from different countries tend to satisfy the one-price law. In other words, prices of financial assets with the same quality (i.e., same payoff structure, same risk level, etc.) but from different countries will tend to be equal when transaction barriers and costs are eliminated, and only reflect the risk associated with that asset.

Similar results can be found using *de jure* financial integration indicator (Chinn and Ito, 2006).

**Table 2: Sovereign Debt Risk and Determinants**

Panel Data with Random Effects. Sample: Monthly information Jan 1996 to Mar 2008

Dependent Variable: Log (Sovereign Bond Spreads)								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Eurozone	-0.9053*** [0.2178]	-0.9136*** [0.2183]	-0.8971*** [0.2170]	-0.8973*** [0.2170]	-0.9073*** [0.1948]	-0.9168*** [0.1933]	-0.9228*** [0.1919]	-0.8226*** [0.1933]
Public Debt (1)	0.8150*** [0.2900]	1.8701** [0.8462]	1.2607 [0.8593]	1.2634 [0.8597]	1.7733** [0.7840]	1.7476** [0.7900]	2.3043*** [0.7946]	2.1208*** [0.7921]
Square Public Debt (1)		-0.7322 [0.5498]	-0.4704 [0.5527]	-0.4727 [0.5531]	-0.4291 [0.5157]	-0.4053 [0.5149]	-0.7208 [0.5151]	-0.653 [0.5125]
Fiscal Balance (1)			-6.0288*** [1.8044]	-5.9957*** [1.8228]	-5.6018*** [1.6710]	-5.5324*** [1.6621]	-5.4659*** [1.6571]	-5.3235*** [1.6451]
GDP (2)				-0.1727 [1.3028]	-0.5446 [1.2847]	-0.6107 [1.2799]	-0.8618 [1.2720]	-0.8584 [1.2690]
Credit Rating (IIR)					-0.0408*** [0.0041]	-0.0411*** [0.0041]	-0.0420*** [0.0041]	-0.0396*** [0.0041]
Liquidity						0.0089 [0.0521]	0.0051 [0.0518]	-0.0287 [0.0524]
Nat Stock Market Index							-0.4373*** [0.1031]	-0.4227*** [0.1030]
Financial Int. (Lane-Milesi)								-0.0748*** [0.0240]
Reserves (1)	1.0096 [0.9990]	1.0531 [1.0009]	1.17 [0.9877]	1.1809 [0.9903]	-0.4706 [0.8271]	-0.4544 [0.8516]	-0.4724 [0.8513]	-0.9085 [0.8501]
Inflation	1.4476 [1.1561]	1.7444 [1.1802]	2.0582* [1.1803]	2.0494* [1.1829]	2.1341* [1.1510]	2.1496* [1.1438]	1.8557 [1.1375]	2.0581* [1.1356]
VIX	0.0273*** [0.0028]	0.0273*** [0.0028]	0.0270*** [0.0028]	0.0270*** [0.0028]	0.0307*** [0.0028]	0.0310*** [0.0028]	0.0307*** [0.0028]	0.0298*** [0.0028]
US FED Interest Rate	-0.0547** [0.0248]	-0.0543** [0.0249]	-0.0510** [0.0249]	-0.0506** [0.0251]	-0.0508** [0.0247]	-0.0499** [0.0243]	-0.0478** [0.0239]	-0.0456* [0.0239]
Dummy Exchange Rate Regime	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dummy Asian, Russian, Argentine Crises	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.0228*** [0.3202]	2.7157*** [0.3954]	2.7969*** [0.3921]	2.7995*** [0.3926]	2.7046*** [0.3491]	2.6221*** [0.5847]	2.5085*** [0.5804]	3.1979*** [0.6177]
No. Obs	2317	2317	2317	2317	2317	2317	2317	2317
No. Countries	31	31	31	31	31	31	31	31
R2 overall	0.5602	0.5561	0.5751	0.575	0.7868	0.788	0.7926	0.7924
Rho AR(1) error	0.861	0.862	0.8621	0.862	0.8594	0.8543	0.8516	0.8515

Robust standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

(1) As % of GDP. (2) Annual growth rate.

Source: Author's calculations.

## IV.2. Slope Test

Table 3 shows the results of the slope test for the case of the random effects method. Here, we include an interaction variable between the dummy variable "Eurozone" and each country-specific fundamental variable (i.e., public debt, fiscal balance, GDP annual growth rate, international reserves, and inflation) in order to capture any change in the estimated coefficients due to the fact that the country is part of the EMU area. As explained above, this test could help us discover whether or not the relationship between country-specific fundamentals and spreads is weaker by the fact that country  $i$  is part of the EMU area.

As seen in Table 3, the estimated coefficient of the "Eurozone" dummy is still negative and significant. In addition, we observe that the estimated coefficients of the country-specific fundamental variables still have the expected signs and, in most cases, they are significant. Also, we see a significant change in slope for public debt, fiscal balance, and GDP growth rate for EMU country members.

For instance, the fiscal balance is negative and significant. However, the interaction effect between fiscal balance and Eurozone dummy is positive (although not significant). For the model in column 8 (which has the best parameterization and a larger overall  $R^2$ ), we tested the hypothesis whether the sum of the estimated coefficients for fiscal balance and the interaction effect is equal zero, and found that this hypothesis cannot be rejected.<sup>35</sup> Consequently, this result suggests that the correlation between spreads and fiscal balance is lower for EMU area member countries.

Regarding the GDP growth rate, its coefficient is negative (although not significant), but its interaction effect with the Eurozone dummy is positive and significant. Consequently, the coefficient of GDP growth rate is smaller if the country is part of the EMU area.

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<sup>35</sup> Value of Wald test: 2.54. P-value: 11.13%

**Table 3: Inclusion of EMU effects**

Panel Data with Random Effects. Sample: Monthly information Jan 1996 to Mar 2008

Dependent Variable: Log (Sovereign Bond Spreads)								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Eurozone	-2.5389***	-3.3213***	-3.3721***	-4.1790***	-4.0114***	-4.0349***	-3.7994***	-3.4823***
	[0.4862]	[0.7668]	[0.7647]	[0.7866]	[0.7094]	[0.7078]	[0.7064]	[0.7305]
Public Debt (1)	0.3508	0.9172	0.2109	0.1839	0.5449	0.529	1.2188	1.2376
	[0.3252]	[0.9655]	[0.9796]	[0.9701]	[0.8750]	[0.8808]	[0.8872]	[0.8869]
Pub. Debt*Eurozone	1.2827**	3.6990*	3.9866**	4.6544**	5.4136***	5.4526***	4.9283***	4.4429**
	[0.5055]	[1.9529]	[1.9701]	[1.9629]	[1.8005]	[1.8007]	[1.7940]	[1.8157]
Square Public Debt (1)		-0.3917	-0.0779	-0.0875	0.0525	0.0662	-0.3164	-0.3327
		[0.6490]	[0.6529]	[0.6469]	[0.6011]	[0.6016]	[0.6014]	[0.6012]
Sq. Pub. Debt*Eurozone		-1.5302	-1.6658	-1.8952	-2.5048**	-2.5271**	-2.2699**	-2.0314*
		[1.2359]	[1.2421]	[1.2365]	[1.1588]	[1.1581]	[1.1530]	[1.1610]
Fiscal Balance (1)			-7.0128***	-6.6382***	-5.8859***	-5.8675***	-5.5380***	-5.5641***
			[2.1460]	[2.1605]	[1.9091]	[1.9112]	[1.9080]	[1.9070]
Fiscal Bal.*Eurozone			3.5275	3.3038	1.1451	1.1652	0.3531	0.819
			[3.7609]	[3.7559]	[3.5284]	[3.5324]	[3.5224]	[3.5319]
GDP (2)				-1.0202	-1.1404	-1.1645	-1.3682	-1.4309
				[1.3184]	[1.3006]	[1.3020]	[1.2947]	[1.2949]
GDP*Eurozone				17.3117***	12.6534***	12.7599***	12.4600**	13.3038***
				[5.1402]	[4.8881]	[4.8781]	[4.8506]	[4.8757]
Credit Rating (IIR)					-0.0396***	-0.0396***	-0.0405***	-0.0390***
					[0.0040]	[0.0040]	[0.0040]	[0.0040]
Liquidity						0.0007	-0.0005	-0.0204
						[0.0498]	[0.0497]	[0.0511]
Nat Stock Market Index							-0.4282***	-0.4217***
							[0.1026]	[0.1026]
Financial Int. (Lane-Milesi)								-0.0419*
								[0.0249]
Constant	3.7020***	3.5315***	3.6379***	3.7794***	3.6135***	3.6116***	3.4213***	3.7313***
	[0.3447]	[0.4312]	[0.4275]	[0.4239]	[0.3764]	[0.5894]	[0.5863]	[0.6143]
No. Obs	2317	2317	2317	2317	2317	2317	2317	2317
No. Countries	31	31	31	31	31	31	31	31
R2 overall	0.5887	0.5803	0.6084	0.6177	0.807	0.8073	0.8108	0.8105
Rho AR(1) error	0.8525	0.8529	0.853	0.845	0.8431	0.8413	0.8392	0.8393

Controlled by international reserves, inflation rate, VIX index, US FED interest Rate, Exchange Rate Regime, Asian, Russian and Argentine Crises Dummies.

Robust standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

(1) As % of GDP. (2) Annual growth rate.

Source: Author's calculations.

Table 3 also shows a particular phenomenon related to the estimated coefficient of public debt: in the panel estimations we included public debt and squared public debt in order to capture a non-linear relationship between spreads and public debt. In the estimations of Table 2 we see that the coefficient of squared public debt is negative (albeit not significant), which suggests a slightly concave relationship between public debt and spreads.

However, in Table 3 we see that the interaction effect between squared public debt and the "Eurozone" dummy is negative and significant suggesting that the results of Table 3 were mainly driven by EMU countries.<sup>36</sup> In particular, countries like Greece, Italy, and Belgium have historically exhibited public debt levels above 85% of GDP and enjoyed low interest rates borrowing from international capital markets.<sup>37</sup> This result suggests that spreads of EMU countries are less sensitive to a high level of public debt than spreads of an "average" non-EMU country. This could be interpreted that lenders perceive a lower default risk at high debt levels if the country is part of the EMU zone in comparison with a country outside the EMU zone.<sup>38</sup>

Overall, our results seem to confirm that lenders pay less attention to fundamentals related to fiscal position (public debt and fiscal balance) and GDP growth when they trade with bonds from EMU zone countries. In particular, they are less sensitive to larger levels of public debt when the country is an EMU member.

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<sup>36</sup> The coefficient of squared public debt is still negative (not significant) but its value fell 49% in comparison with the results from Table 2.

<sup>37</sup> A similar result is found by Bernoth et al. (2012) in a study of primary market's sovereign spreads for European countries.

<sup>38</sup> We also find similar behaviors for international reserves and inflation. First, we find a negative and significant coefficient for international reserves. However, the interaction effect between international reserves and the Eurozone dummy is positive and significant, suggesting that spreads have weaker relationship with international reserves if the country is part of the EMU area. Second, our results show a positive and significant coefficient for the inflation rate. But the interaction effect of this variable with the Eurozone dummy is negative and significant. Therefore, there is a weaker relationship between spreads and the inflation rate if the country is a member of the Eurozone. Although these results are interesting, they are not robust to other econometric specifications used below.

#### *IV.2.1. Results with Mixed Models*

Table 4 displays estimations of equation (9) using mixed models.<sup>39</sup> As shown in this table, all variables maintain their expected sign.

Table 4 also shows that the "Eurozone" dummy is negative and significant, which means that EMU countries have, on average, lower spreads than countries not part of that area.

Regarding the fiscal balance, its coefficient is negative and significant but its interaction effect with the "Eurozone" dummy is positive. We performed a Wald test under the null hypothesis that the sum of these two coefficients is equal zero and we could not reject the null hypothesis at 5% significance.<sup>40</sup> Therefore, similar to the case with random effects, sovereign bond spreads are negatively associated with the level of fiscal balance but this correlation is lower (and statistically equal zero) when a country is part of the EMU area.

The GDP growth rate shows a negative relationship with spreads, but its interaction effect is positive and significant, confirming our previous results with random effects. With respect to public debt, Table 4 shows that the relationship with spreads is positive and significant. However, squared public debt is negative, similar to the results found with random effects. Yet, in this case, the main coefficient is significant, which is contradictory to the results shown in Table 3. This result is discussed in the next subsection.

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<sup>39</sup> Since equation (9) includes the "Eurozone" coefficient as one of the regressors, we are not only testing change in the slopes for macroeconomic fundamentals, but also a change in the level of spreads. In these estimations we included country-specific fundamentals such as fiscal balance, GDP growth rate, and public debt in the term  $z_{it}$  of equation (16). The reason is that those fundamentals are consistently significant in Tables 2 and 3. Also, because they exhibit large changes in slopes when a country is an EMU member. Consequently, we want to test whether those changes in slope are not caused by a random effect.

<sup>40</sup> Value of Wald test: 3.61. P-value: 5.7%



**Table 4: Level and Slope Tests I**

Mixed Models Panel Data. Sample: Monthly information Jan 1996 to Mar 2008

Dependent Variable: Log (Sovereign Bond Spreads)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Eurozone	-1.7570***	-2.2779***	-2.3673***	-2.9535***	-3.0869***	-3.0736***	-2.8562***	-2.5568***
	[0.5804]	[0.8804]	[0.8808]	[0.9080]	[0.8233]	[0.8259]	[0.8280]	[0.8525]
Public Debt (1)	0.261	1.6134	1.275	1.3164	1.4463	1.4201	1.6697	1.7957*
	[0.3766]	[1.1100]	[1.1407]	[1.1426]	[1.0453]	[1.0575]	[1.0592]	[1.0562]
Pub. Debt*Eurozone	0.8673	2.0264	1.9668	2.367	3.4768*	3.4475*	2.9971	2.5394
	[0.5553]	[2.1481]	[2.1900]	[2.1992]	[2.0236]	[2.0295]	[2.0285]	[2.0466]
Square Public Debt (1)		-1.0363	-1.0646	-1.1682	-1.1124	-1.0906	-1.1826	-1.3063*
		[0.7600]	[0.7970]	[0.8050]	[0.7488]	[0.7538]	[0.7490]	[0.7505]
Sq. Pub. Debt*Eurozone		-0.5296	-0.3448	-0.4072	-1.1574	-1.1483	-0.933	-0.6508
		[1.3503]	[1.3897]	[1.3975]	[1.3094]	[1.3117]	[1.3068]	[1.3175]
Fiscal Balance (1)			-6.0277**	-6.0762**	-6.5451***	-6.5299***	-6.4711***	-6.4113***
			[2.6865]	[2.6554]	[2.2243]	[2.2371]	[2.2378]	[2.2214]
Fiscal Bal.*Eurozone			-0.0772	0.1048	0.8632	0.86	0.3656	0.4206
			[4.5099]	[4.4463]	[3.8519]	[3.8635]	[3.8554]	[3.8459]
GDP (2)				-0.2493	-0.255	-0.2583	-0.637	-0.7485
				[1.4082]	[1.3936]	[1.3964]	[1.3916]	[1.3916]
GDP*Eurozone				12.6719**	10.1564*	10.1971*	9.9439*	10.5465*
				[5.6701]	[5.5465]	[5.5553]	[5.5268]	[5.5338]
Credit Rating (IIR)					-0.0295***	-0.0293***	-0.0294***	-0.0287***
					[0.0049]	[0.0049]	[0.0050]	[0.0050]
Liquidity						0.0058	0.0058	-0.0135
						[0.0632]	[0.0634]	[0.0640]
Nat Stock Market Index							-0.3981***	-0.3906***
							[0.1050]	[0.1050]
Financial Int.(Lane-Milesi)								-0.0479
								[0.0324]
Constant	3.6782***	3.3530***	3.4397***	3.5241***	3.4255***	3.3730***	3.2744***	3.5788***
	[0.4168]	[0.5029]	[0.4992]	[0.4982]	[0.4482]	[0.7336]	[0.7334]	[0.7553]
No. Obs	2317	2317	2317	2317	2317	2317	2317	2317
chi2	140.3547	144.3325	157.0984	164.3796	298.0251	293.3329	301.1912	315.281
p	0	0	0	0	0	0	0	0

Controlled by international reserves, inflation rate, VIX index, US FED interest Rate, Exchange Rate Regime, Asian, Russian and Argentine Crises Dummies.

Robust standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

(1) As % of GDP. (2) Annual growth rate.

Source: Author's calculations.

In conclusion, using this methodology, we find that EMU zone members have a lower level of spreads and that these spreads are less correlated with fiscal balance and the GDP growth rate than spreads for an "average" non-EMU country. These results suggest that lenders have lower incentives to monitor those country-specific fundamentals than they do with an "average" country.

#### *IV.2.2. Results with the Difference-in-Difference Approach*

In addition to the random and mixed effects panel data methods, we applied the difference-in-difference approach to conduct the slope test.<sup>41</sup> Table 5 shows the results using this methodology. First, we find that the "Eurozone" dummy is negative and significant, confirming our previous results that, on average, EMU countries have a lower spreads level. Consequently, countries that joined the EMU enjoyed lower borrowing costs than non-EMU countries.

Regarding public debt, we find that spreads and public debt have a convex relationship for the average country, as expected from theory. In other words, there is a non-linear positive relationship between these two variables: as public debt grows, spreads increase more than proportional in order to compensate international creditors for the rise of the default risk. However, as we found in previous estimations, if the country is part of the EMU area, this relationship becomes concave, suggesting that spreads are less sensitive to larger debt levels when the country is part of the EMU.

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<sup>41</sup> Similar to the results of mixed models, in this regression we are including the dummy "Eurozone" as one of the regressors. That helps us to also evaluate a change in the level of spreads for countries of the EMU.

**Table 5: Level and Slope Tests II**

Difference-in-Difference Approach. Sample: Monthly information Jan 1996 to Mar 2008

Dependent Variable: Log (Sovereign Bond Spreads)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Eurozone	-1.9068*** [0.6328]	-3.6258*** [0.8064]	-4.5721*** [0.7889]	-5.4979*** [0.8668]	-5.6248*** [0.8684]	-5.5267*** [0.8671]	-5.6910*** [0.8735]	-5.7318*** [0.8696]
Public Debt (1)	1.3525 [0.9930]	-1.85 [1.2968]	-2.6488* [1.3651]	-2.7121** [1.3020]	-3.3848*** [1.0738]	-3.1018** [1.1310]	-1.9047 [1.1813]	-1.8121 [1.1886]
Pub. Debt*Eurozone	2.0725*** [0.7428]	7.6087*** [1.7929]	9.4396*** [1.8711]	9.8289*** [1.6598]	10.4708*** [1.7142]	10.4194*** [1.6910]	10.4817*** [1.5995]	10.6779*** [1.5340]
Square Public Debt (1)		2.1420*** [0.6700]	2.5397*** [0.6412]	2.5064*** [0.5858]	3.0849*** [0.5078]	3.0000*** [0.5297]	2.3533*** [0.5444]	2.3214*** [0.5684]
Sq. Pub. Debt*Eurozone		-3.7951*** [1.0634]	-4.6163*** [1.1693]	-4.5477*** [1.0244]	-5.0373*** [1.1036]	-5.0148*** [1.0731]	-5.0656*** [0.9826]	-5.2004*** [0.9177]
Fiscal Balance (1)			-5.4895* [2.8535]	-4.5967 [2.8608]	-6.2315** [2.5444]	-5.9825** [2.6074]	-5.2751* [2.6511]	-5.7166* [2.9246]
Fiscal Bal.*Eurozone			12.8285** [4.9864]	10.5218** [4.6465]	10.0031** [4.6760]	9.2474** [4.3650]	9.9728** [4.1461]	10.3627** [4.0465]
GDP (2)				-1.4714 [1.1326]	-1.2906 [1.1348]	-1.6004 [1.1653]	-1.4655 [1.2897]	-1.7245 [1.2350]
GDP*Eurozone				20.8389*** [5.6999]	17.9288*** [5.9312]	17.8654*** [5.8179]	18.3347*** [5.8725]	18.4198*** [5.7935]
Credit Rating (IIR)					-0.0363*** [0.0125]	-0.0410*** [0.0129]	-0.0446*** [0.0128]	-0.0471*** [0.0137]
Liquidity						-0.098 [0.1159]	-0.0953 [0.1152]	-0.0953 [0.1137]
Nat Stock Market Index							-0.4852*** [0.1640]	-0.4987*** [0.1642]
Financial Int. (Lane-Milesi)								-0.0412 [0.0590]
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.5353*** [0.6968]	4.4737*** [0.6714]	4.7882*** [0.6676]	4.8231*** [0.6555]	4.8869*** [0.6680]	5.6917*** [1.2357]	5.3276*** [1.2482]	5.3911*** [1.2240]
No. Obs	2414	2414	2414	2414	2414	2414	2414	2414
No. Countries	30	30	30	30	30	30	30	30
R2 overall	0.1776	0.2108	0.3083	0.3083	0.7045	0.726	0.7395	0.7584

Controlled by international reserves, inflation rate, VIX index, US FED interest Rate, Exchange Rate Regime, Asian, Russian and Argentine Crises Dummies.

Robust standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

(1) As % of GDP. (2) Annual growth rate.

Source: Author's calculations.

Similar to our previous results, for the average country, the fiscal balance has a negative and significant relationship with spreads. But, if the country is part of the EMU area, there is an additional positive effect that makes this relationship weaker.<sup>42</sup> Finally, we find that the GDP growth rate shows a negative relationship with spreads, but its interaction effect is positive and significant. Consequently, the coefficient of GDP growth rate is smaller if the country is part of the EMU area.

In conclusion, we find that the relationships of sovereign spreads with public debt, fiscal balance, and economic growth are weaker for EMU countries, which suggests that creditors pay less attention to indicators of fiscal position and future debt dynamics when pricing sovereign bonds if the country is part of the EMU area.

Our findings are in line with the results of Sgherri and Zoli (2009) and Manganelli and Wolswijk (2009), who conclude that Euro area sovereign spreads were driven by global risk repricing and global liquidity conditions (i.e., low global interest rates) until October 2008. After that date, spreads tended to reflect more country-specific fundamentals, in particular, those related to fiscal accounts and future debt dynamics.

#### IV.3. Variance Test

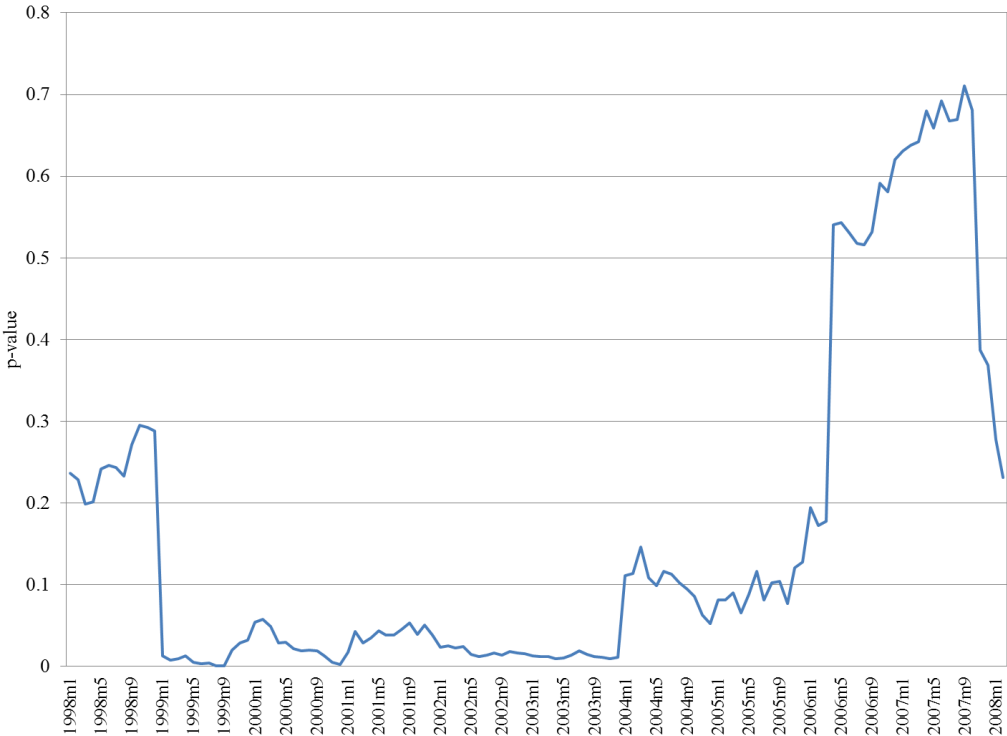
In order to test whether there is a difference between cross-country variances of spreads for EMU member countries and for non-EMU countries, we first calculated the fitted values of spreads for the parameterization of column 8 in Tables 3, 4, and 5. In a second step, we computed the cross-country variance of fitted spreads for each group per period. Finally, we computed a test of difference in variances.

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<sup>42</sup> Similar to the exercises with random effects and mixed model, we tested the null hypothesis that the sum of the coefficient for fiscal balance and the coefficient for the interaction of fiscal balance and "Eurozone" dummy is equal zero. We find that the null hypothesis cannot be rejected at 10% significance.

Figure 5 shows the p-value of the hypothesis test in equation (15) using random effects. We can reject the null hypothesis of equal variances at 10% significance for the period between January 1999 and October 2005. In other words, the cross-country variance of spreads for EMU country members is statistically lower than the variance of spreads for countries outside the EMU area in the above mentioned period. However, we do not have evidence to reject the null hypothesis after 2006.

**Figure 5: Variance Test with Random Effects**

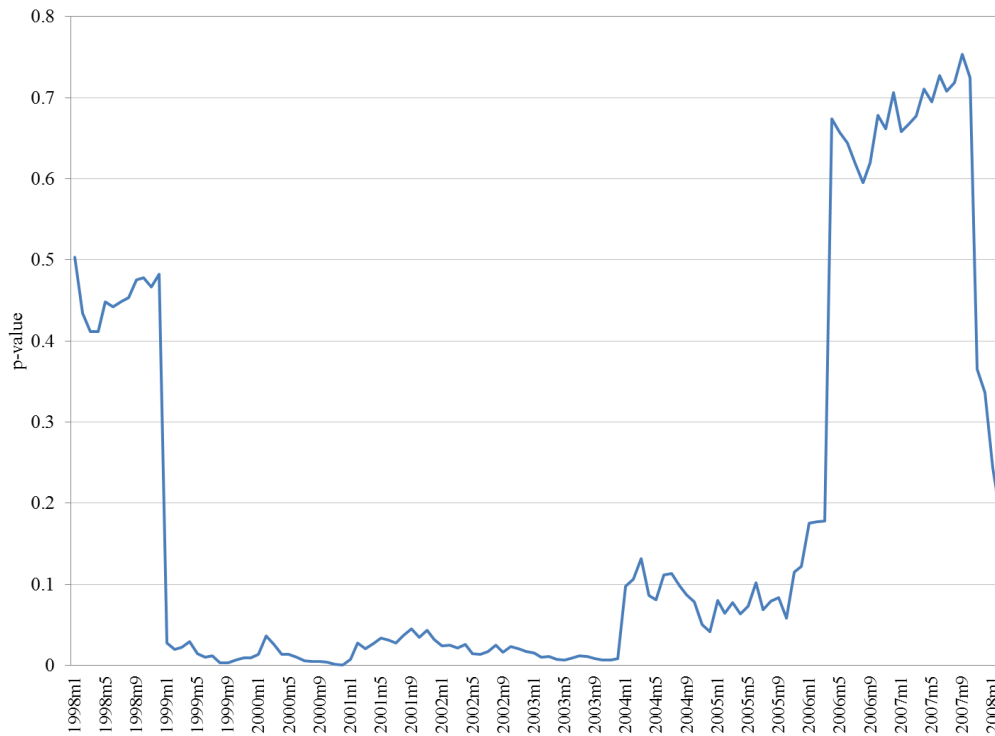


Note: p-value from test of difference in variances, comparing the cross-country variance of fitted values of spreads for EMU countries vs. fitted values of spreads for non-EMU countries, per period. January 1998 to March 2008.

Source: Author’s calculations.

Figure 6 shows the p-value of the hypothesis test in equation (15) using mixed model method. The result supports our previous result of Figure 5. Again, we can reject the null hypothesis of equal variances at 10% significance for the period January 1999 and October 2005 but not for the period after 2006.

**Figure 6: Variance Test with Mixed Model**



Note: p-value from test of difference in variances, comparing the cross-country variance of fitted values of spreads for EMU countries vs. fitted values of spreads for non-EMU countries, per period. January 1998 to March 2008.

Source: Author's calculations.

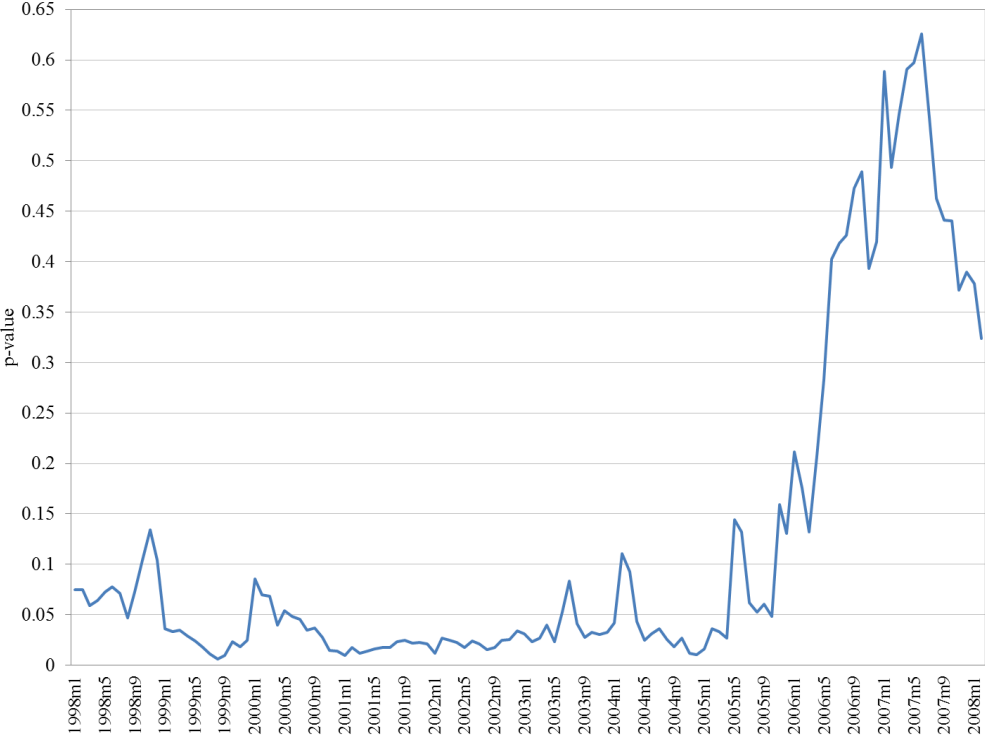
Finally, Figure 7 shows the p-value of the variance test with the difference-in-difference approach. At 10% significance, we see that spreads of EMU member countries were close together even before the start of the EMU area, probably reflecting some anticipated convergence of spreads in expectation of the start of this currency area. At 5% significance, we find that cross-country variance of spreads for EMU country members is statistically lower than the variance of spreads for countries outside the EMU area between 1999 and 2005.

After 2005, this test is not able to reject the null hypothesis that the cross-country variance of spreads for EMU countries is equal to the cross-country variance of spreads for non-EMU countries. This result is caused by the fact that spreads of Latin American countries and Russia started to fall and move closer to spreads of Asian and other European countries

since 2006, reducing the cross-country variance of non-EMU countries (the variance of EMU countries has not significantly changed in that period). Even though this is out of the scope of this study, one explanation for this phenomenon might be that Latin America and Russia are net exporters of commodities and, therefore, it seems that this behavior is associated to the boom of commodity prices observed between 2006 and 2008. In other words, the rise of commodity prices during that period could increase the income of commodities export countries, which is, therefore, reflected in lower default risks and lower sovereign spreads.

In conclusion, we find evidence that cross-country variance of spreads for EMU members is lower than that of non-EMU members between 1999 and end-2005. This result suggests that there was a convergence of spreads of EMU countries, with a faster fall in spreads from countries with larger perceived default risk. This finding could be interpreted as one of the symptoms of investor’s moral hazard explained in subsection *Basic Structure*.

**Figure 7: Variance Test with Difference in Difference**



Note: p-value from test of difference in variances, comparing the cross-country variance of fitted values of spreads for EMU countries vs. fitted values of spreads for non-EMU countries, per period. January 1998 to March 2008. Source: Author’s calculations.

#### IV.4. Robustness Test

Catao and Kapur (2006) have pointed out that macroeconomic volatility plays a role in explaining why several countries face high levels of sovereign spreads under moderate levels of public debt-to-GDP ratio. In particular, they state that the historical volatility of GDP can affect the ability of countries to borrow in international markets. Their main result is that a larger volatility is associated with a higher default risk and, therefore, reflected in a higher risk premium at any given level of debt.

In order to evaluate the robustness of our results in consideration of the findings by Catao and Kapur (2006), we included the GDP volatility as one of the independent variables. The GDP volatility is calculated in the following steps: i) we took the logarithm of real quarterly GDP in US dollars; ii) we estimated the potential real GDP applying a Hodrick-Prescott filter (with smoothing parameter 1600 as usual with quarterly information) to the log of real GDP; iii) we calculated the cyclical part of GDP as the difference of the log of actual GDP minus the potential GDP; and iv) we calculated the GDP volatility as the standard deviation of the cyclical part of GDP with a rollover window of 8 quarters (2 years).<sup>43</sup> This variable is included with a lag in our regressions, in order to avoid endogeneity problems.

Table 6 displays the results of the slope test using random effects model which includes GDP volatility. Column 1 shows our previous results of Table 3, column 8. Column 2 includes the GDP volatility for a 2-year rollover window.<sup>44</sup> We observe that GDP volatility is positive and significant, which means that higher historical volatility is associated with higher spreads. Also, we see that our main results do not change with the inclusion of GDP volatility: i) spreads of the EMU members tend to be lower on average, ii) there is a negative correlation of fiscal balance and spreads, but this correlation is lower if the country is part of the EMU area,<sup>45</sup> and iii) there is a negative correlation between GDP and spreads, but if the country is part of the EMU area, this correlation is lower. Regarding public debt, the level is

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<sup>43</sup> We also calculated and estimated the models using a 3-year, 4-year, and 5-year rollover window. As explained below, we found similar results.

<sup>44</sup> Similar results can be found using a 3-year, 4-year, or 5-year windows.

<sup>45</sup> In column 2, the Wald test for fiscal balance is equal to 2.78, with p-value of 9.52%.



positive and significant for both the general sample and EMU members, and the square of public debt is negative (although not significant).

**Table 6: With GDP Volatility I**  
Panel Data with Random Effect

Dependent Variable: Log (Sovereign Bond Spreads)		
VARIABLES	(1)	(2)
Eurozone	-3.4823***	-3.3686***
	[0.7305]	[0.7309]
Public Debt (1)	1.2376	1.5031*
	[0.8869]	[0.8979]
Pub. Debt*Eurozone	4.4429**	3.9621**
	[1.8157]	[1.8191]
Square Public Debt (1)	-0.3327	-0.5535
	[0.6012]	[0.6190]
Sq. Pub. Debt*Eurozone	-2.0314*	-1.7488
	[1.1610]	[1.1670]
Fiscal Balance (1)	-5.5641***	-5.3151***
	[1.9070]	[1.9100]
Fiscal Bal.*Eurozone	0.819	0.4414
	[3.5319]	[3.5308]
GDP (2)	-1.4309	-0.5194
	[1.2949]	[1.3771]
GDP*Eurozone	13.3038***	13.5976***
	[4.8757]	[4.8470]
Credit Rating (IIR)	-0.0390***	-0.0376***
	[0.0040]	[0.0042]
Liquidity	-0.0204	-0.0225
	[0.0511]	[0.0506]
Nat Stock Market Index	-0.4217***	-0.4503***
	[0.1026]	[0.1028]
Financial Int. (Lane-Milesi)	-0.0419*	-0.0479*
	[0.0249]	[0.0247]
<u>GDP Volatility</u>		
<i>Difference Actual GDP-Potential GDP</i>		
2-year window		13.9111***
		[5.3163]
Constant	3.7313***	3.5924***
	[0.6143]	[0.6163]
No. Obs	2317	2296
No. Countries	31	31
R2 overall	0.8105	0.8155
Rho AR(1) error	0.8393	0.8322

Controlled by international reserves, inflation rate, VIX index, US FED interest Rate, Exchange Rate Regime, Asian, Russian and Argentine Crises Dummies.

(1) As % of GDP. (2) Annual growth rate. Source: Author's calculations.

Table 7 shows the results of the same exercise using the difference-in-difference approach. Again, column 1 shows our previous results of Table 5, column 8. Column 2 includes the GDP volatility for a 2-year rollover window. In this case, we find that the GDP volatility is positive but not significant.

Again, our previous results stay robust with the inclusion of GDP volatility: i) spreads of the EMU countries tend to be lower; ii) there is a negative relationship between spreads and fiscal balance, which is weaker if the country is part of the EMU area; and iii) there is a negative relationship between GDP and spreads, which weakens if the country is part of the EMU area.

Finally, there is a positive and increasing relationship between spreads and public debt but, if the country is a member of the EMU area, spreads tend to be less sensitive to large levels of debt.

Figures 8 and 9 show the result of the variance test with the inclusion of GDP volatility, using random effects and difference-in-difference methods, respectively. As before, we find that the variance of spreads for EMU countries is significantly lower in comparison to the variance of non-EMU countries between 1999 and 2005.

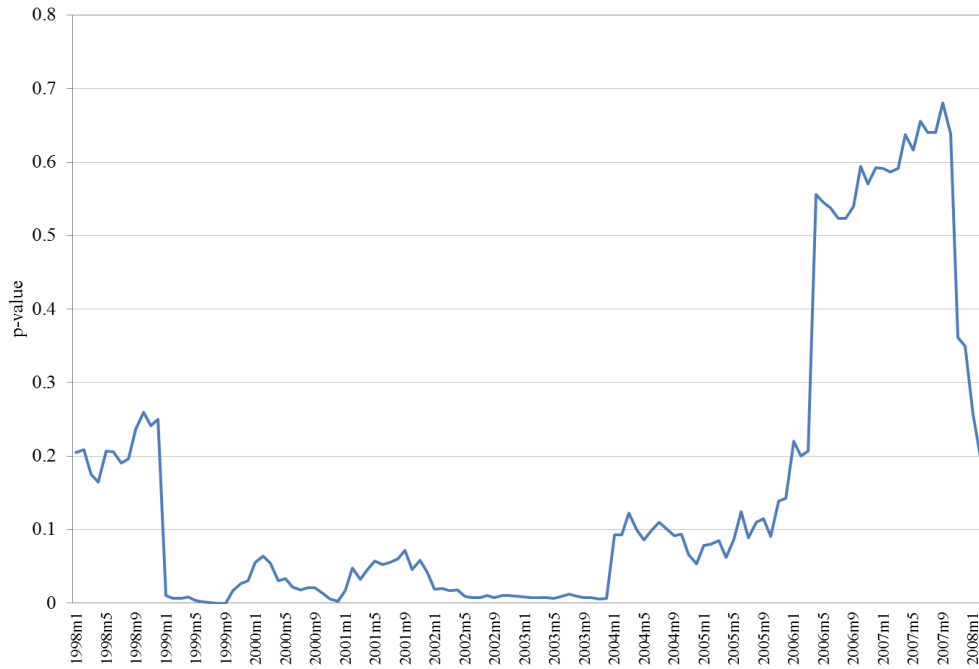
**Table 7: With GDP Volatility II**  
Difference in Difference Approach

Dependent Variable: Log (Sovereign Bond Spreads)		
VARIABLES	(1)	(2)
Eurozone	-5.7318***	-5.3476***
	[0.8696]	[0.7635]
Public Debt (1)	-1.8121	-1.7288
	[1.1886]	[1.2686]
Pub. Debt*Eurozone	10.6779***	10.2591***
	[1.5340]	[1.3397]
Square Public Debt (1)	2.3214***	2.3484***
	[0.5684]	[0.5408]
Sq. Pub. Debt*Eurozone	-5.2004***	-5.4868***
	[0.9177]	[0.8329]
Fiscal Balance (1)	-5.7166*	-5.2740*
	[2.9246]	[2.9427]
Fiscal Bal.*Eurozone	10.3627**	8.6257*
	[4.0465]	[4.3183]
GDP (2)	-1.7245	-1.6715
	[1.2350]	[1.2345]
GDP*Eurozone	18.4198***	18.9266***
	[5.7935]	[6.1081]
Credit Rating (IIR)	-0.0471***	-0.0446***
	[0.0137]	[0.0142]
Liquidity	-0.0953	-0.0863
	[0.1137]	[0.1127]
Nat Stock Market Index	-0.4987***	-0.5366***
	[0.1642]	[0.1620]
Financial Int. (Lane-Milesi)	-0.0412	-0.0552
	[0.0590]	[0.0610]
<u>GDP Volatility</u>		
<i>Difference Actual GDP-Potential GDP</i>		
2-year window		0.9239
		[3.2026]
Constant	5.3911***	5.3757***
	[1.2240]	[1.2699]
Country Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
No. Obs	2414	2387
No. Countries	30	30
R2 overall	0.7584	0.7637

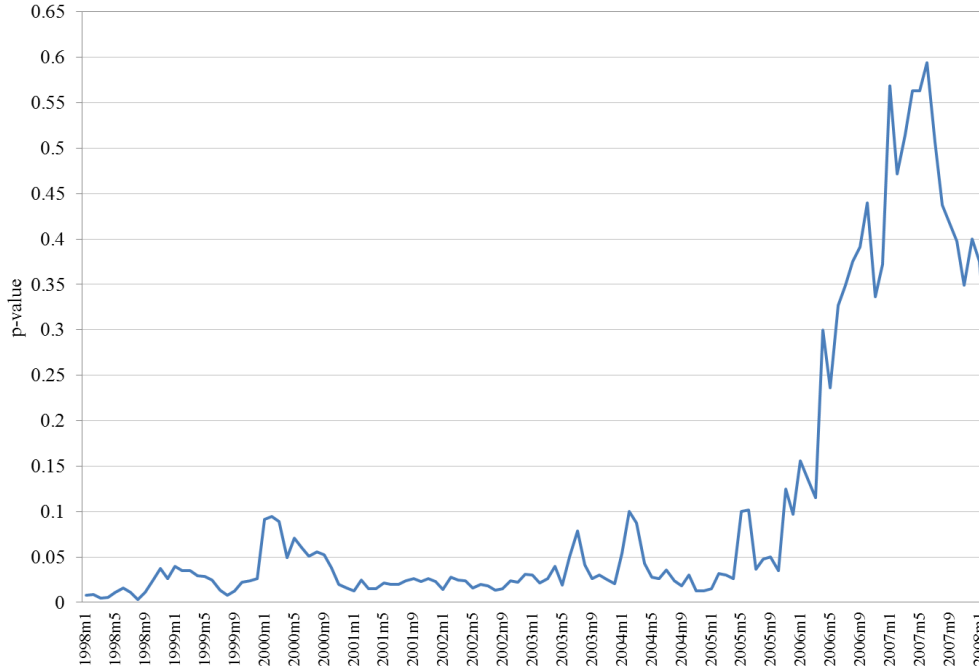
Controlled by international reserves, inflation rate, VIX index, US FED interest Rate, Exchange Rate Regime, Asian, Russian and Argentine Crises Dummies.

(1) As % of GDP. (2) Annual growth rate. Source: Author's calculations.

**Figure 8: Variance Test Random Effects, with GDP Volatility**



**Figure 9: Variance Test Difference-in-Difference, with GDP Volatility**



Note:  $p$ -value from test of difference in variances, comparing the cross-country variance of fitted values of spreads for EMU countries vs. fitted values of spreads for non-EMU countries, per period. January 1998 to March 2008. Source: Author's calculations

## V. Conclusions

The 2008-2013 debt crisis in the EMU zone has been characterized by an unprecedented increase and differentiation of sovereign bond spreads of EMU countries. Market analysts associate this behavior with the financial markets' concerns about the fiscal positions (i.e., large public debts and fiscal deficits) of several EMU members, in particular Greece, Ireland, Italy, Portugal, and Spain.

This behavior contrasts with the EMU spreads' performance before the crisis, when they were low and close together. Even though several EMU countries had exhibited weak fiscal positions years before the onset of the crisis, it is puzzling why pre-crisis spreads do not seem to reflect those deteriorating positions before 2008.

In this paper, we study the behavior of sovereign bond spreads of EMU countries before the 2008-2013 debt crisis. In particular, we test whether pre-crisis spreads exhibit three features that the literature has related to the existence of creditors' expectations of bailouts in case of an economic crisis: i) a lower spread level, ii) a weak relationship with macroeconomic fundamentals, and iii) a lower cross-sectional variance among bond spreads from different economies.

Using econometric methods such as panel data with random effects, mixed effects models, and the difference-in-difference approach, we find that: first, EMU member countries have, on average, lower spreads than countries outside this area; second, spreads of EMU countries are less correlated with country-specific fundamentals such as fiscal balance and the GDP growth rate, and spreads are less sensitive to larger levels of public debt when the country is a EMU member; and third, the cross-country variance of EMU spreads is statistically lower than the variance of non-EMU spreads between 1999 and end-2005. Our results are valid after controlling for country fundamental indicators (including GDP volatility) and global market conditions, and remain robust when we additionally control for indicators that capture alternative explanations of the sovereign spreads' behavior such as

currency risk, liquidity (size) of the bond market, financial integration, and the general demand for financial assets from those countries (an "exuberance" effect).

Overall, our results suggest that institutional arrangements like the EMU area have effects on investors' valuation of sovereign risk. Without excluding alternative explanations for the behavior of pre-crisis sovereign spreads that the literature has suggested (i.e., elimination of currency risk, larger financial liberalization and integration, larger liquidity on the EMU's sovereign bond market, and the "exuberance" effect), these findings are consistent with the existence of creditor moral hazard in the EMU's sovereign bond market. In other words, our results suggest that holders of sovereign bonds of EMU countries behaved imprudently before the 2008-2013 crisis in the sense that they had less incentives to rigorously monitor country-specific fundamentals of EMU countries when pricing their bonds. Consequently, they did not discriminate among EMU countries with respect to credit risk associated with their fundamentals, indicating lack of "market discipline".

In terms of future research, we think it would be helpful to create a theoretical model that explains how the economic integration and the institutional structure of the EMU area generate implicit guarantees among EMU countries, in order to better understand how creditors' expectations of bailout are created. For this, it is important to analyze the role of the financial sector in the allocation of resources among EMU countries and the determinants of the subsequent banks' exposure to those countries.

## Glossary

BIS	Bank of International Settlements
CIPS	Coordinated Portfolio Investment Survey (IMF's database)
ECB	European Central Bank
EFSF	European Financial Stability Fund
EMU	European Monetary Union
EU	European Union
IFS	International Financial Statistics (IMF's database)
IMF	International Monetary Fund
SGP	Stability and Growth Pact
WEO	World Economic Outlook (IMF's database)

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