ABSTRACT

Title of Document: ESSAYS ON DEBT CRISES IN INTEGRATED ECONOMIES

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This dissertation thesis analyzes different aspects of the 2008-2013 debt crisis in the European Monetary Union (EMU): a) the sovereign debt market in the EMU before the crisis and, b) the spillover effects of the crisis on the real sector around the world.

Chapter 1 provides an overview of the recent history of the EMU and highlights the contribution of this thesis to the literature.

Chapter 2 studies the behavior of sovereign spreads of EMU countries and their apparent disconnection with country-specific fundamentals before the Eurozone debt crisis. We test three characteristics of spreads: i) a lower 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, GDP growth rate, and public debt is weaker, and their

cross-country variance is statistically lower than the cross-country variance of spreads from non-EMU countries between 1999 and end-2005. Without excluding alternative explanations for the behavior of pre-crisis sovereign spreads, these results are consistent with the existence of creditor moral hazard in the EMU's sovereign bond market before the crisis.

Chapter 3 is coauthored with Dr. Stijn Claessens and Dr. Hui Tong. We analyze through what channels the EMU crisis has affected firm valuations and what the efficacy of various policy interventions to mitigate the crisis has been. We do so using stock price responses for 3045 non-financial firms in 16 countries to policy measures announced at four key events in 2010 and 2011. Using pre-crisis benchmarks, we separate effects arising from changes in financing conditions from trade effects and examines if bank or trade linkages propagated shocks across borders. We find that measures impacted financially-constrained firms more, particularly in creditor countries with greater bank exposure to peripheral Euro countries. Trade linkages with peripheral countries played a minor role, although Euro exchange rate movements led to some differential effects. This study concludes that interventions were mostly geared towards preserving creditor banks' ability to finance local firms.

ESSAYS ON DEBT CRISES IN INTEGRATED ECONOMIES

By

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Dedication

In memory of my father Miguel Arcángel Zuccardi.

After 20 years from your departure, my heart is still missing you!

In memory of my grandparents Pedro and Virgelina, and my uncle Vicente.

To my loving ones: my mom Blanca Nelly, my siblings Miguel, Daisy, and Karen, and *mi amor* Alexandra.

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Chapter 1: Introduction

In 1999, 11 countries of the European Union (Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain) embraced further economic and financial integration and established the European Monetary Union (EMU or Eurozone). The main expectations of this newly created single-currency area were to a) make the European Union's single market more efficient, b) facilitate international trade of goods, services, and financial assets, c) increase transparency in the price setting process, and d) reduce the vulnerability of Eurozone countries to external economic shocks. Since then, the Eurozone has grown to 17 members, with Greece, Slovenia, Cyprus, Malta, Slovakia, and Estonia joining at later stages.

For almost a decade, the EMU was considered a symbol for successful market integration without major macroeconomic, financial, external or sectorial shocks. In 2008 the situation changed and since then the EMU has lived through the most complex period in its history. Between 2008 and 2013, the Eurozone has faced both financial and public debt crises that have led to the exclusion of several EMU countries from the international capital markets or have forced them to pay high premia to borrow from those markets. As a consequence, countries like Greece, Ireland, Portugal, and Cyprus, and the banking sector of Spain have requested financial assistance from the European Commission, the European Central Bank (ECB), and the International Monetary Fund (IMF). Furthermore, the group of countries referred by the financial press as "Peripheral Euro Countries" (PEC) - Greece, Ireland, Italy, Spain, and Portugal - has implemented austerity measures in

order to consolidate their public accounts and to maintain the stability of their economies.

Overall, this ongoing crisis period has led to difficult economic and social circumstances for most of the EMU area: at the end of 2012, Eurozone countries have reached average levels of public deficit and debt of 3.7% and 90.6% of GDP, respectively. At the same time, output growth of the region has been anemic, with -1% growth for the same year. Moreover, the EMU unemployment rate has reached 12.2% in May 2013, with the most critical situations taking place in Greece and Spain, struggling with unemployment rates of 26.8% and 26.9%, respectively.

The European Monetary Union is considered the most interesting experiment of financial and economic integration in history. The introduction of a single currency, a common central bank, and the process of legal harmonization, among other policies, have made the Eurozone one of the most financially integrated regions in the world (measured by different *de jure* and *de facto* indicators). Before the start of the EMU crisis, most of the literature studying that region focused on the benefits of this integration process, particularly highlighting the role that the elimination of the currency risk, the reduction of transaction costs, and the increment of liquidity in financial markets played on the behavior of the financial assets' prices, the cross-border capital flows, and the intraregional trade. Yet, the crisis has unveiled several weaknesses of the EMU integration process and has become an opportunity to better understand other dimensions of financial integration, such as its economic costs, its effects on market participants' expectations, the transmission channels for cross-

border spillover of shocks in integrated economies, the institutional structure needed to deal with shocks under financial integration, among others.

The purpose of this dissertation thesis is to contribute to these newly arising research questions by analyzing key aspects of the EMU crisis. In particular, we study the effect of EMU's currency area on its member countries' sovereign bond market (Chapter 2), and analyze the transmission channels for the worldwide spillover of the EMU crisis (Chapter 3). Although this document cannot cover all topics related to the crisis (since it is complex and still unfolding), we consider that the aspects studied here are important in order to understand the causes and dynamics of the crisis. Furthermore, our findings give novel insights to mechanisms that are working in integrated economies during periods of economic distress. We believe that this newly gained understanding is relevant for designing institutions and policies that help minimize the undesired effects of adverse shocks in the future.

The remainder of this dissertation thesis is divided in two parts: Chapter 2, titled "Sovereign Spreads in the Eurozone: Is Market Discipline Working?", studies the behavior of sovereign spreads of EMU countries and their apparent disconnection with country-specific fundamentals before the EMU debt crisis. Since 1999 until the start of the crisis in 2008, sovereign spreads of Eurozone countries were low and close together, and not highly responsive to member countries' macroeconomic fundamentals. The elimination of currency risk due to the introduction of the Euro, the reduction of transaction costs for trading financial assets due to the process of legal harmonization among Eurozone members, and the constitution of a larger (more liquid) market for sovereign borrowing with the establishment of the Euro area were

the main hypotheses suggested by the literature to explain the behavior of pre-crisis sovereign spreads. Without excluding those possible explanations, this chapter explores whether the behavior of pre-crisis spreads could also be related to the existence of creditors' expectations of bailouts in case of an economic crisis scenario. In particular, we test whether pre-crisis spreads exhibit three features that the literature has associated with the existence of those expectations: 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 information of 31 countries (10 of them from the EMU area) and monthly data from January 1996 until March 2008, Chapter 2 finds that: First, pre-crisis sovereign spreads of EMU countries are, on average, lower in comparison with spreads of non-EMU countries. Second, spreads of EMU countries have a weaker relationship with macroeconomic fundamentals such as fiscal balance, public debt, and GDP growth rate. In particular, spreads are less sensitive to larger levels of public debt when the country is an EMU member. Third, the cross-country variance of EMU spreads is statistically lower than the variance of non-EMU spreads between 1999 and end-2005. These results are valid after controlling for country fundamental indicators and global market conditions, and remain robust also after controlling for indicators capturing currency risk, liquidity (size) of the bond market, financial integration indicators, and the general demand for financial assets from those countries (an "exuberance" effect). In conclusion, without excluding other hypotheses suggested by the literature for the behavior of pre-crisis sovereign spreads, the results of this

chapter are consistent with the existence of creditor moral hazard in the EMU's sovereign bond market before the crisis.

Chapter 3, titled "Saving the Euro: Mitigating Financial or Trade Channels?", was written with Dr. Stijn Claessens and Dr. Hui Tong from the Research Department of the International Monetary Fund. This chapter studies how the EMU crisis affected global corporate valuation, particularly for EU firms, and how policy interventions may have mitigated (or not) international spillovers of the crisis. Using information for 3045 non-financial firms from 16 countries, we classify those firms based on pre-crisis benchmark indicators regarding their dependence on external finance, and financial and trade linkages with the group of peripheral Euro countries (PEC). Later, we evaluate how those indicators can explain the reaction of stock returns of those firms for four key events of the EMU crisis between 2010 and 2011: i) the establishment of the € 750 billion bailout fund for countries in crisis (May 10, 2010); ii) the public disagreement among EMU economic authorities on private sector participation in the first bailout for Greece (June 8-10, 2011); iii) the announcement of the second bailout for Greece (July 19-21, 2011); and iv) the announcement of new terms for the second bailout for Greece (October 25-27, 2011).

We identify the financial and trade channels to be the main transmission channels for spillovers of the EMU crisis around the world. In particular, we find that the crisis had a larger impact on firms with greater ex-ante financial constraints (i.e., a larger indicator of dependence on external finance), and especially so in creditor countries more financially exposed to peripheral Euro countries through bank claims. Trade linkages with peripheral Euro countries play a minor role, by affecting the

demand for exports, with differential effects across exporting firms in Euro vs. non-Euro areas, possibly because of the effects of Euro exchange rate changes vis-à-vis third (non-Euro) countries.

The main conclusion of Chapter 3 is that EMU policy makers did take into account potential effects on both the soundness of their local banks as well trade with PEC when they planned (or reverted course on) various support measures. Also, from the perspective of saving the Euro, it appears most important (under the eyes of financial markets) to address spillovers through cross-border banking exposures.

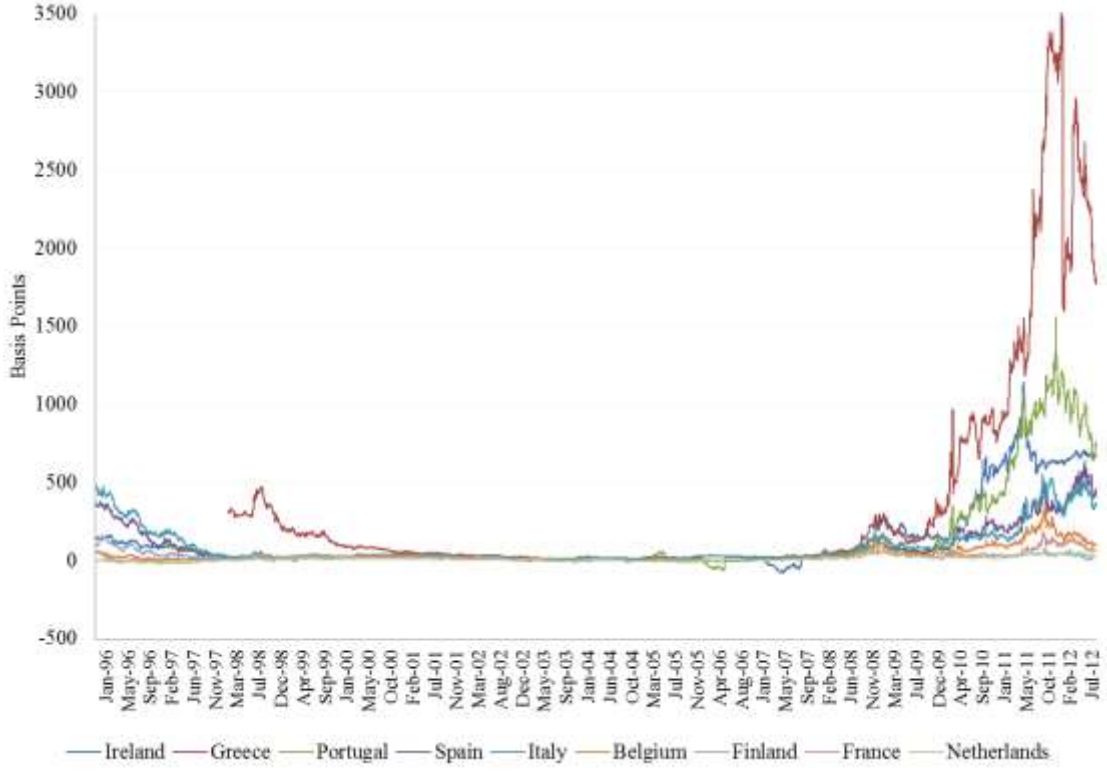
Overall, the results of this dissertation thesis shed light on the mechanics of different economic phenomena that arise in integrated economies during periods of economic distress. Therefore, the findings presented in this document add valuable information to the debate on which elements should be taken into account in the design of macroeconomic policies to deal with future crises in the EMU area.

Chapter 2: “Sovereign Spreads in the Eurozone: Is Market Discipline Working?”

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).

Figure 1: Sovereign Bond Spreads of selected EMU countries



Note: Spreads of 10-year sovereign bonds over German bonds.
Source: Bloomberg. Author's calculations.

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. First, the elimination of currency risk due to the introduction of the Euro has, in general, facilitated the integration of EMU financial markets, which is reflected in prices of financial assets (Fratzscher, 2002); second, the financial liberalization (i.e., legal harmonization) has reduced barriers and transaction costs to trade with assets from different countries, producing a price convergence of sovereign bonds and making spreads' behavior depend more on supranational policies (i.e., a common monetary policy) and global conditions than on individual countries' performances (Attinasi et al., 2009; Lane, 2006; Kaminsky and Schmukler, 2003); third, the access to a larger (and more liquid) financial market has reduced borrowing costs particularly for countries with a previously small capital market size (Gomez-Puig, 2006). Although these hypotheses have analyzed the pre-crisis spreads' convergence observed in Figure 1, they have not been able to explain why spreads did not seem to reflect macroeconomic weaknesses observed in several EMU countries before 2008.[1]

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

[1] 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.

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 chapter 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 intrinsic higher risk (based on macroeconomic fundamentals). Under arbitrage conditions, this behavior brings prices of risky bonds closer to prices of

bonds with lower risk, which is reflected in a faster reduction of spreads. 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). 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" 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.[2]

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

[2] For a detailed review of the literature of international moral hazard, see Roubini and Setser (2004), Chapter 3.

explain bond pricing dynamics when creditors have expectations of bailout.[3] 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.[4]

Relative to the existing literature, this paper stresses two important points. First, it shows that, in addition to country- and market-specific characteristics, and

[3] 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.

[4] 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.

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 European Monetary Union.

We believe the results of this chapter to be relevant because 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 chapter is organized as follows: Section 2 explains why the EMU area could change investors' incentives to lend and to monitor EMU countries. Section 3 establishes the theoretical framework, the econometric strategy, and describes the data we used for the empirical analysis. Section 4 presents the tests results and Section 5 concludes.

European Monetary Union and Investor 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.[5] This association seems natural given that, under its role of preserving the stability of the global financial system, the IMF becomes 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 European Monetary Union, 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

[5] See Dell'Ariccia et al. (2006), Evrensel and Kutan (2004, 2006), Lee and Shin (2008), and Corsetti, Guimaraes and Roubini (2006).

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 measures: de jure and de facto indicators.[6] Figure 2A displays the de jure indicator - the Chinn and Ito (2006) index.[7] There, we see that countries in the EMU area significatively 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).[8] The figure shows that

[6] 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.

[7] 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).

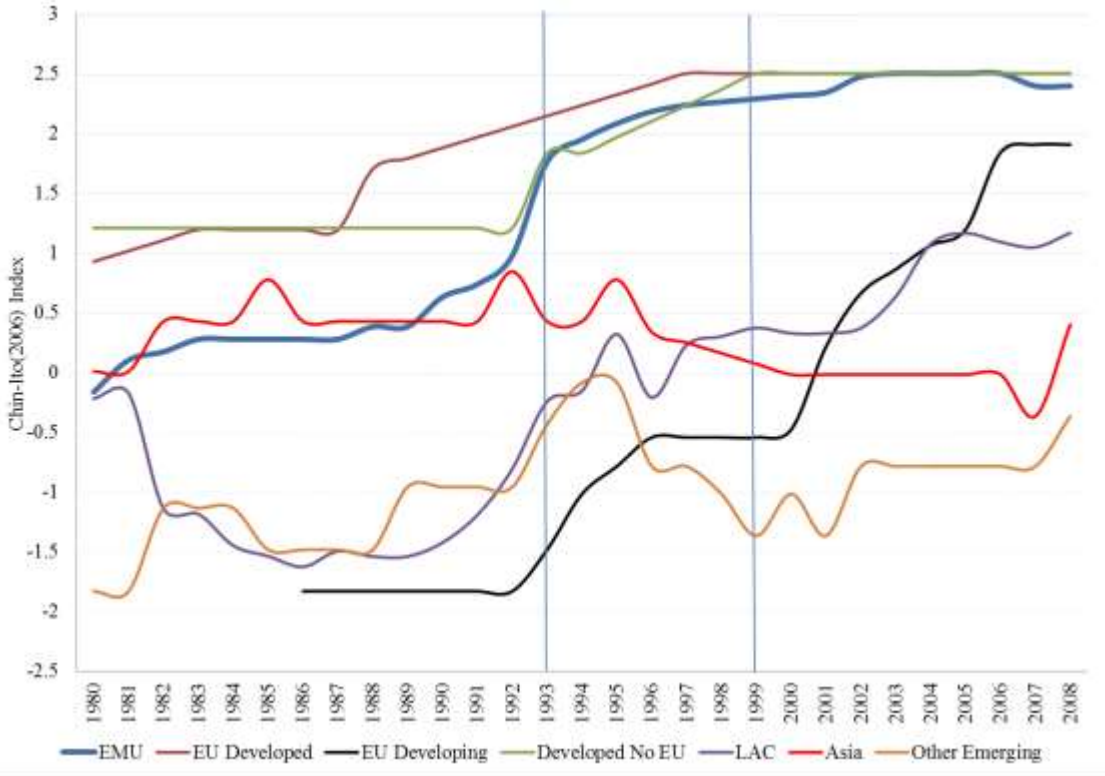
[8] The *de facto* financial integration indicator captures the "intensity" of a country's financial integration with other countries (multilateral) because it computes the size of international assets and liabilities in proportion to its economy (GDP).

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

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.

Figure 2: Financial Integration Indicators

Figure 2A: *De Jure* Indicator



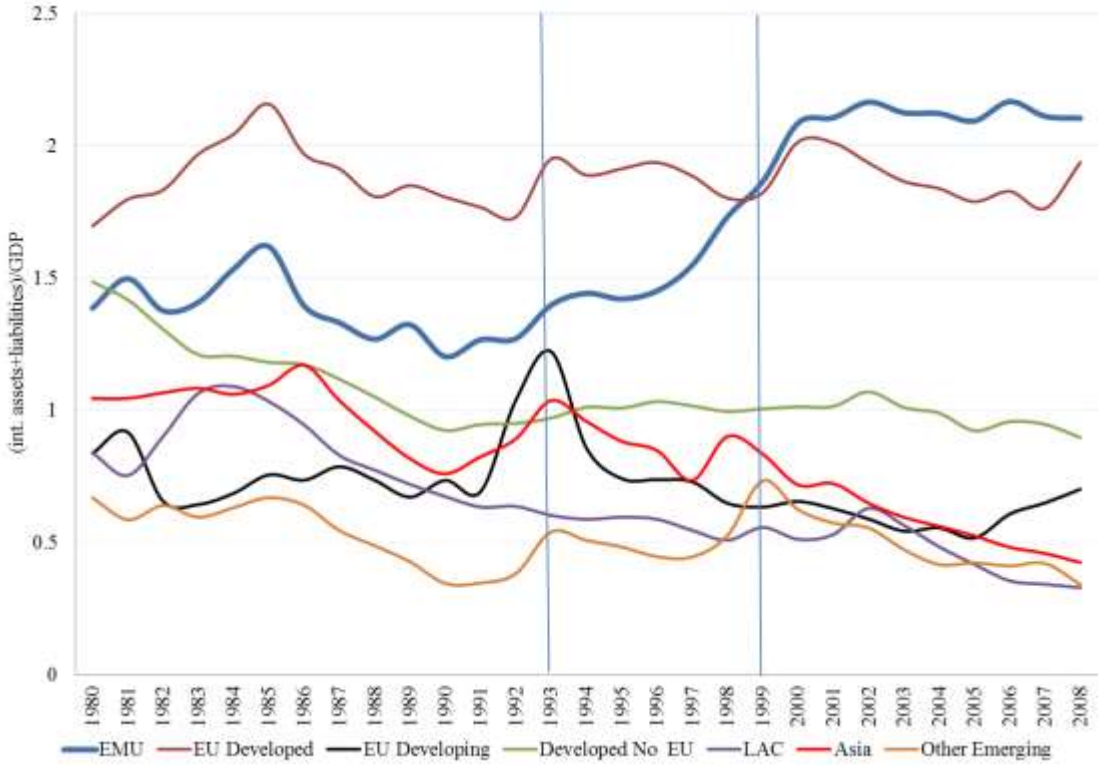
assets and liabilities around the world over the world's GDP. In other words, the measure of financial integration for country *i* shown in Figure 2B is given by:

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

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 number of 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 2B: *De Facto* Indicator



Source: For *De Jure* indicator, Chinn and Ito (2006). For *De Facto* indicator, Lane and Milesi-Ferreti (2007). 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.[9] One can see that in 1997 countries that later constituted the EMU zone did not have particularly strong financial links with other members of the EMU:

[9] For country *i*, the *de facto* financial integration indicator of country *i* with region *K* is calculated as:

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

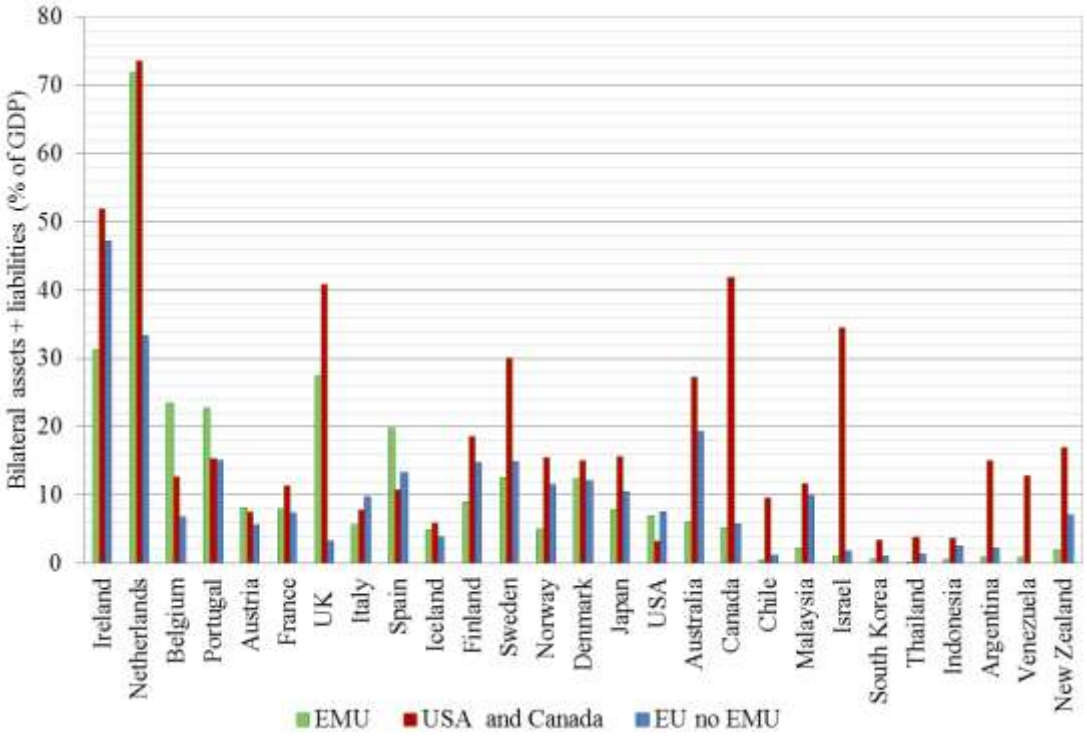
where *i* represents country *i*, *j* represents a country *j* that is member of region *K*, $A_{ij,t}$ is the total value of international assets of country *i* in country *j* for period *t*, $L_{ij,t}$ is the total value of international liabilities of country *i* with country *j* for period *t*, and $GDP_{i,t}$ 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.

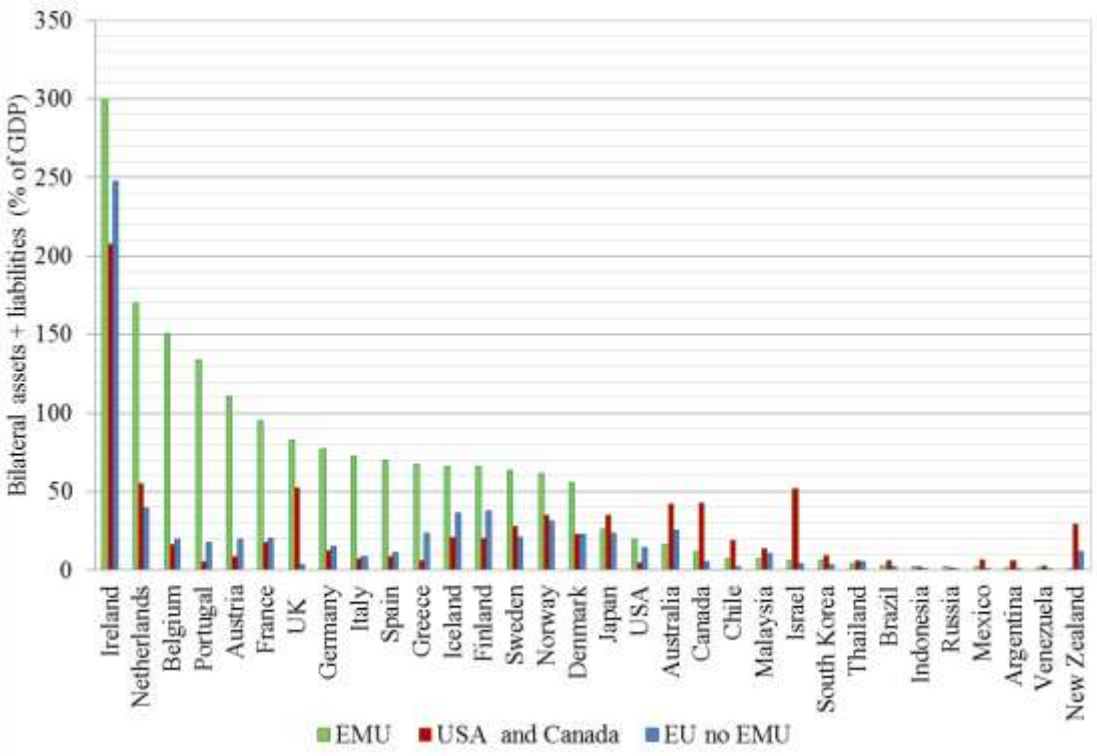
on average, future EMU countries showed a financial integration indicator with the EMU area, USA and Canada, and the EU but non-EMU area of 22.2%, 23.3%, and 17% of GDP, respectively. However, by 2008, there had been a clear increase in financial links among EMU members in comparison to the other zones: 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.

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

1997



2008



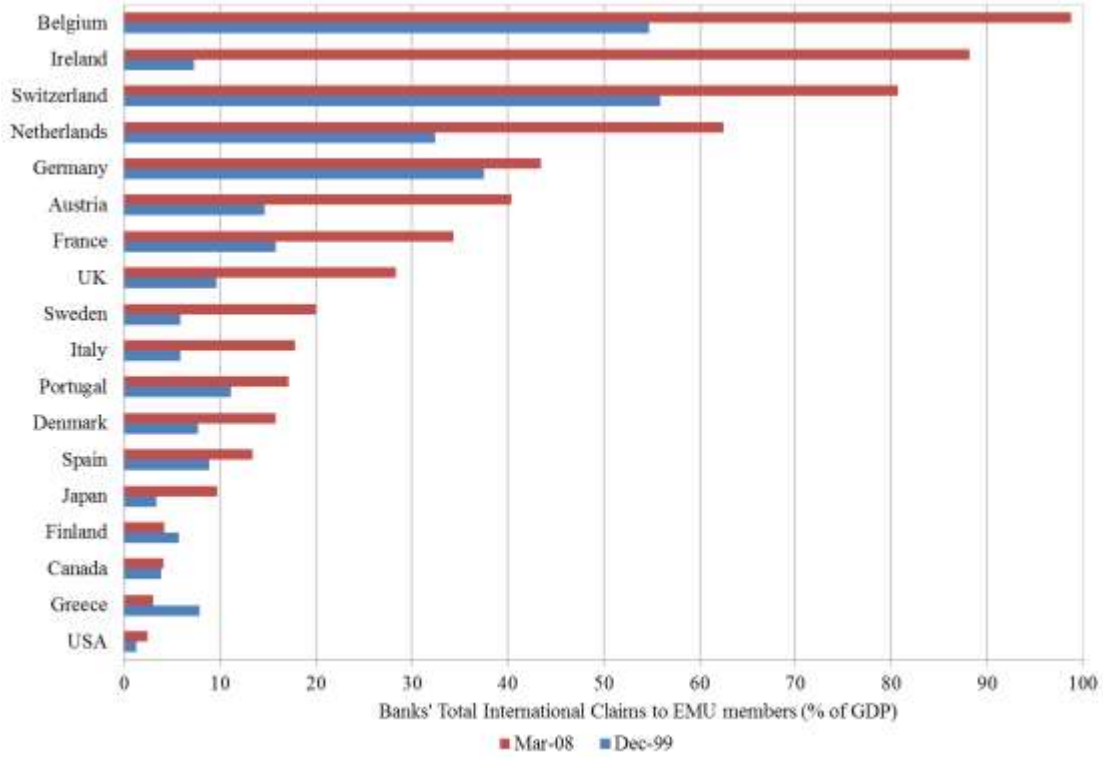
Note: No available information for Germany, Greece, Russia, Brazil, and Mexico in 1997.
Source: IMF-CPIS. Author's calculations.

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.[10] 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

[10] 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.

Belgium, Ireland, and Netherlands even exhibited levels of bank exposure of over 60% of GDP.

Figure 4A: Bank Exposure to the EMU Area

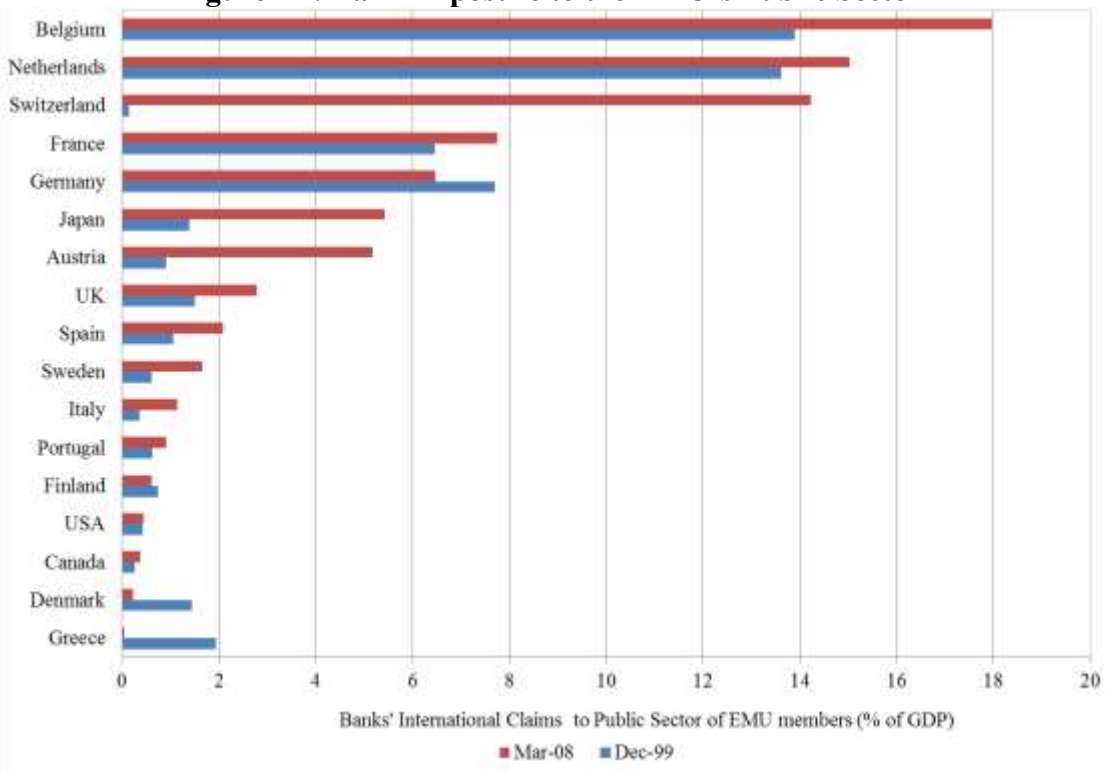


Note: Data for Germany is Foreign Claims (available data since March 2005). For France, data since June 2003. For Greece, data since December 2003.
Source: BIS and IMF-WEO. Author's calculations.

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.[11]

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



Note: 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.

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

[11] 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.

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).[12] In other words, EMU countries in strong economic position might be extending "implicit guarantees" to weak EMU countries in case of a financial distress.[13]

Under these circumstances, it can be expected that investors internalize these "implicit guarantees" in their valuations of sovereign bonds, stimulating investors' reckless 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

[12] 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.

[13] 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 does 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.

that the largest EMU economies (i.e., Germany and France) violated the SGP fiscal limits since 2003-2004 with no consequences.[14]

Framework and Data

Specification

Basic Structure[15]

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 θ_i.

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 λ 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 θ_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 λ is identical across countries.

On the other side, 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:

[14] 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).
[15] This section is based on Dell'Ariccia et al. (2002).

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

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

where R_i is the gross interest rate that country *i* promises to pay the lender in case of no default.[16] 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 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 arbitrage condition:

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

Consequently, R_i is given by:

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

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

$$s_i = R_i - R^*$$

$$s_i = R^* \frac{(1-\lambda)\theta_i}{1-(1-\lambda)\theta_i} \tag{3}$$

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.

[16] 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 $\lambda\theta_i$).

(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 θ_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 (creditor) 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 moral hazard. 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[17]). In addition, we assume that θ_i does not directly depend on *b*, ruling

[17] 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

out the second channel in which the expectation of rescue package has a direct effect on the probability of crisis.[18] 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), we test the following implications of investor moral hazard:[19]

1. **Hypothesis 1 (Level Test):** Holding constant the set of fundamentals $X=(x_1', x_2', \ldots, x_k')'$, 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 hypothesis is that, under investor moral hazard, if the perceived probability of bailout rises, then lenders could expect that the recovery

---

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*.

[18] 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 θ_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 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.

[19] See details in Dell'Ariccia et al. (2002), Appendix II.

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. **Hypothesis 2 (Slope Test):** Holding constant the set of fundamentals $X=(x_1', x_2', \ldots, x_k')'$, 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 $\partial\theta_i/\partial x_{ij}>0$).

   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 less incentives to carry out prudent lending policies such as avoiding to lend 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. **Hypothesis 3 (Variance Test):** Holding constant the set of fundamentals $X=(x_1', x_2', \ldots, x_k')'$, 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.

Hypothesis 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.

Econometric Setup

In order to test the hypotheses 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:

$$y_{it} = \alpha + x_{it}\beta + \vartheta_i + \varepsilon_{it} \tag{5}$$

for $i=1,\ldots,N$ and $t=1,\ldots,T_i$, 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., $log(Spread_{it})$), x_{it} is a set of independent variables that includes both country-specific macroeconomic fundamentals and global market indicators, α and β are parameters, ϑ_i is an unobserved country specific effect, and ε_{it} is an error term. Let us assume that the country-specific effect ϑ_i is independent and identically distributed with mean zero and variance σ_ϑ^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 ε_{it} has an autoregressive structure AR(1) given by:

$$\varepsilon_{it} = \rho\varepsilon_{it-1} + \eta_{it} \tag{6}$$

where $|\rho|<1$ and η_{it} is an error term that is independent and identically distributed with mean zero and variance σ_η^2 (i.e., $\eta_{it} \sim iid(0, \sigma_\eta^2)$).[20]

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:

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

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

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

Consequently, we test whether β_1 has a negative value. In terms of hypothesis testing, we have:

$$H_0: \beta_1 = 0$$
$$H_a: \beta_1 < 0$$

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.

[20] 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.

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^f_{it} is the subset of independent variables x_{it} that represents the country i's macroeconomic fundamentals, and γ captures the interaction effects between x^f_{it} and d_{it}. This term γ represents the average change in the slope coefficient of x^f_{it} 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^f_{kit} is given by:

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

If international lenders reduce monitoring on fundamental x^f_{kit}, then we expect that parameter γ_k has a contrary sign to the the sign of parameter β_k. This result represents that the relationship between x^f_{kit} 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 β^0 captures both the parameters associated with independent variables x_{it} and the slope change parameter γ 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:

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

and

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

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

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

Under investor 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 Σ_u (i.e., $u_i \sim iid(0,\Sigma_u)$), and ε_{it} is a random term with the following autoregressive structure:

$$\varepsilon_{it} = \rho\varepsilon_{it-1} + \eta_{it} \tag{6}$$

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}.[21] 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 it 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 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

[21] The term z_{it} also includes a vector of ones in order to capture the country specific random effect ϑ_i specified in equation (5).

was exposed to the "treatment". In order to do that, this methodology considers two steps: a) 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 b) 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".[22]

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 $i=1,\ldots,N$ and $t=1,\ldots,T_i$, 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 ϑ_i is a fixed effect. In addition, we include a parameter φ_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 ε_{it} to be independent and identically distributed with mean zero and variance σ_ε^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.

[22] For more details on this methodology see Wooldridge (2002), chapters 10 and 11, and Laporte and Windmeijer (2005).

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. 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.[23]

As independent variables, we include the following information:

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

[23] 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.

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 $Pr.(F \leq 0.91061) = 0.08$.

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).[24]

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).[25]
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[26]), c) outstanding

[24] 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.

[25] 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.

[26] 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.

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 "exuberance" effect[27]), 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).

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.

[27] 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	p75	Max
Dependent Variable								
Sovereign Bond Spreads	2321	281.7	745.9	0.02	21.4	76.5	256.1	6858.8
Macroeconomic Fundamentals								
Public Debt (1)	2321	53.0	26.6	5.9	36.7	45.9	64.0	146.2
Fiscal Balance (1)	2321	-1.2	3.0	-9.0	-3.0	-1.4	0.1	16.3
GDP (2)	2321	3.4	2.8	-15.2	2.0	3.4	5.0	11.6
Reserves (1)	2321	10.4	10.3	0.1	2.9	7.1	14.8	59.0
Inflation	2321	3.6	3.6	-2.2	1.7	2.6	4.1	40.9
Global market Indicators								
VIX	2321	20.1	6.7	10.8	14.4	19.6	25.0	38.4
US FED Interest Rate (%)	2321	3.6	1.8	1.0	1.8	3.9	5.3	6.6
TED Spreads	2321	0.4	0.3	0.1	0.2	0.3	0.5	1.9
Further indicators								
Credit Rating (IIR) (1-100)	2321	69.9	20.3	14.5	51.3	75.3	88.6	95.2
Outstanding Government's Debt Securities (US$ millions)	2321	35891	40377	411	6104	22569	53691	264566
National Stock Market Index (2005=100)	2321	96.2	49.8	14.7	64.9	87.6	118.4	532.6
Financial Integration Indicator (Lane-Milesi)	2321	1.10	0.86	0.23	0.49	0.80	1.48	7.55

Note: Monthly data from Jan 1996 to Mar 2008 for 31 countries: Argentina, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Colombia, Czech Republic, Denmark, Finland, France, Greece, Hungary, Ireland, Italy, Malaysia, Mexico, Netherlands, Norway, Peru, Philippines, Poland, Portugal, Russia, South Africa, Spain, Sweden, Thailand, Turkey, and United Kingdom.

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

Empirical Results

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.[28]

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

[28] 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.

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.

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.[29]

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

[29] 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.

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. 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.[30]

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.

[30] 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***	-0.9136***	-0.8971***	-0.8973***	-0.9073***	-0.9168***	-0.9228***	-0.8226***
	[0.2178]	[0.2183]	[0.2170]	[0.2170]	[0.1948]	[0.1933]	[0.1919]	[0.1933]
Public Debt (1)	0.8150***	1.8701**	1.2607	1.2634	1.7733**	1.7476**	2.3043***	2.1208***
	[0.2900]	[0.8462]	[0.8593]	[0.8597]	[0.7840]	[0.7900]	[0.7946]	[0.7921]
Square Public Debt (1)		-0.7322	-0.4704	-0.4727	-0.4291	-0.4053	-0.7208	-0.653
		[0.5498]	[0.5527]	[0.5531]	[0.5157]	[0.5149]	[0.5151]	[0.5125]
Fiscal Balance (1)			-6.0288***	-5.9957***	-5.6018***	-5.5324***	-5.4659***	-5.3235***
			[1.8044]	[1.8228]	[1.6710]	[1.6621]	[1.6571]	[1.6451]
GDP (2)				-0.1727	-0.5446	-0.6107	-0.8618	-0.8584
				[1.3028]	[1.2847]	[1.2799]	[1.2720]	[1.2690]
Credit Rating (IIR)					-0.0408***	-0.0411***	-0.0420***	-0.0396***
					[0.0041]	[0.0041]	[0.0041]	[0.0041]
Liquidity						0.0089	0.0051	-0.0287
						[0.0521]	[0.0518]	[0.0524]
Nat Stock Market Index							-0.4373***	-0.4227***
							[0.1031]	[0.1030]
Financial Int. (Lane-Milesi)								-0.0748***
								[0.0240]
Reserves (1)	1.0096	1.0531	1.17	1.1809	-0.4706	-0.4544	-0.4724	-0.9085
	[0.9990]	[1.0009]	[0.9877]	[0.9903]	[0.8271]	[0.8516]	[0.8513]	[0.8501]
Inflation	1.4476	1.7444	2.0582*	2.0494*	2.1341*	2.1496*	1.8557	2.0581*
	[1.1561]	[1.1802]	[1.1803]	[1.1829]	[1.1510]	[1.1438]	[1.1375]	[1.1356]
VIX	0.0273***	0.0273***	0.0270***	0.0270***	0.0307***	0.0310***	0.0307***	0.0298***
	[0.0028]	[0.0028]	[0.0028]	[0.0028]	[0.0028]	[0.0028]	[0.0028]	[0.0028]
US FED Interest Rate	-0.0547**	-0.0543**	-0.0510**	-0.0506**	-0.0508**	-0.0499**	-0.0478**	-0.0456*
	[0.0248]	[0.0249]	[0.0249]	[0.0251]	[0.0247]	[0.0243]	[0.0239]	[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***	2.7157***	2.7969***	2.7995***	2.7046***	2.6221***	2.5085***	3.1979***
	[0.3202]	[0.3954]	[0.3921]	[0.3926]	[0.3491]	[0.5847]	[0.5804]	[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

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 no 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.[31] Consequently, this result suggests that the correlation between spreads and fiscal balance is lower for EMU area member countries.

[31] 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

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.

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.[32] 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.[33] 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.[34]

[32] The coefficient of squared public debt is still negative (not significant) but its value fell 49% in comparison with the results from Table 2.

[33] A similar result is found by Bernoth et al. (2012) in a study of primary market's sovereign spreads for European countries.

[34] 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.

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.

Results with Mixed Models

Table 4 displays estimations of equation (9) using mixed models.[35] 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.[36] 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.

[35] 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.

[36] 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

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.

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.

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.[37] 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

[37] 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.

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.

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***	-3.6258***	-4.5721***	-5.4979***	-5.6248***	-5.5267***	-5.6910***	-5.7318***
	[0.6328]	[0.8064]	[0.7889]	[0.8668]	[0.8684]	[0.8671]	[0.8735]	[0.8696]
Public Debt (1)	1.3525	-1.85	-2.6488*	-2.7121**	-3.3848***	-3.1018**	-1.9047	-1.8121
	[0.9930]	[1.2968]	[1.3651]	[1.3020]	[1.0738]	[1.1310]	[1.1813]	[1.1886]
Pub. Debt*Eurozone	2.0725***	7.6087***	9.4396***	9.8289***	10.4708***	10.4194***	10.4817***	10.6779***
	[0.7428]	[1.7929]	[1.8711]	[1.6598]	[1.7142]	[1.6910]	[1.5995]	[1.5340]
Square Public Debt (1)		2.1420***	2.5397***	2.5064***	3.0849***	3.0000***	2.3533***	2.3214***
		[0.6700]	[0.6412]	[0.5858]	[0.5078]	[0.5297]	[0.5444]	[0.5684]
Sq. Pub. Debt*Eurozone		-3.7951***	-4.6163***	-4.5477***	-5.0373***	-5.0148***	-5.0656***	-5.2004***
		[1.0634]	[1.1693]	[1.0244]	[1.1036]	[1.0731]	[0.9826]	[0.9177]
Fiscal Balance (1)			-5.4895*	-4.5967	-6.2315**	-5.9825**	-5.2751*	-5.7166*
			[2.8535]	[2.8608]	[2.5444]	[2.6074]	[2.6511]	[2.9246]
Fiscal Bal.*Eurozone			12.8285**	10.5218**	10.0031**	9.2474**	9.9728**	10.3627**
			[4.9864]	[4.6465]	[4.6760]	[4.3650]	[4.1461]	[4.0465]
GDP (2)				-1.4714	-1.2906	-1.6004	-1.4655	-1.7245
				[1.1326]	[1.1348]	[1.1653]	[1.2897]	[1.2350]
GDP*Eurozone				20.8389***	17.9288***	17.8654***	18.3347***	18.4198***
				[5.6999]	[5.9312]	[5.8179]	[5.8725]	[5.7935]
Credit Rating (IIR)					-0.0363***	-0.0410***	-0.0446***	-0.0471***
					[0.0125]	[0.0129]	[0.0128]	[0.0137]
Liquidity						-0.098	-0.0953	-0.0953
						[0.1159]	[0.1152]	[0.1137]
Nat Stock Market Index							-0.4852***	-0.4987***
							[0.1640]	[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***	4.4737***	4.7882***	4.8231***	4.8869***	5.6917***	5.3276***	5.3911***
	[0.6968]	[0.6714]	[0.6676]	[0.6555]	[0.6680]	[1.2357]	[1.2482]	[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.[38] 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.

Variance Test

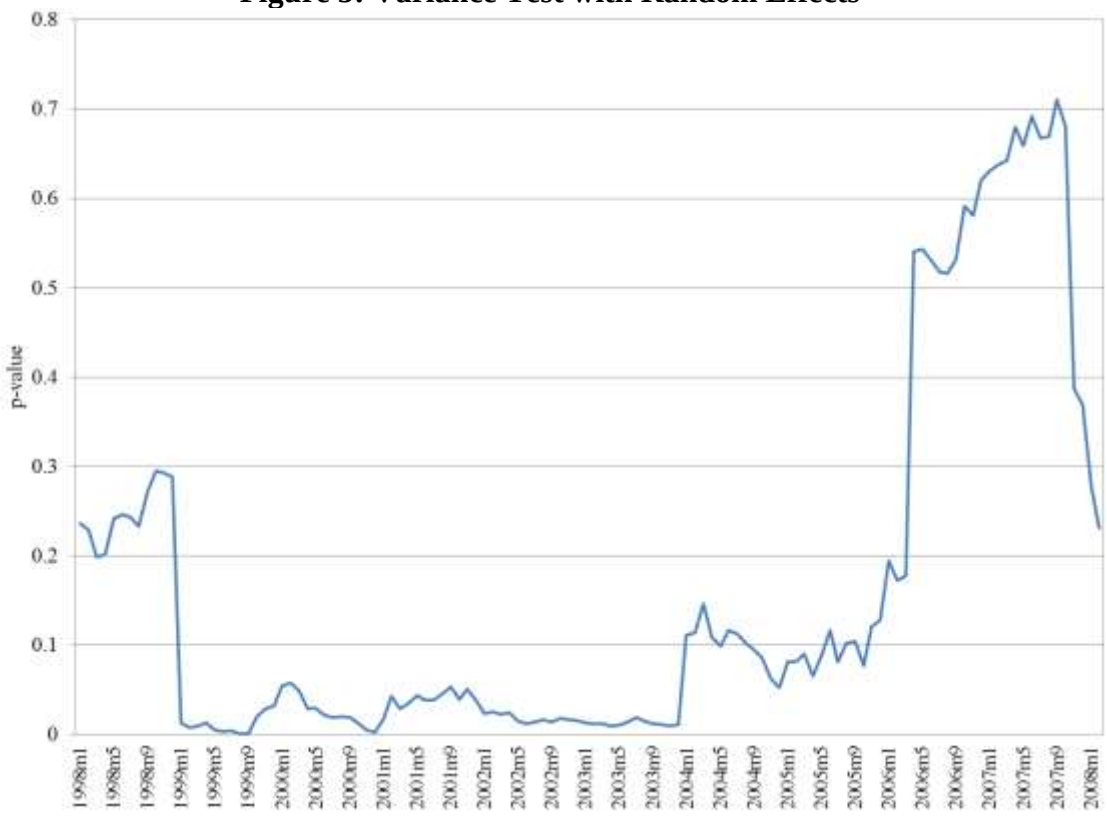
In order to test whether there is a difference between cross-country variances of spreads for EMU member countries and for non-EMU countries, we first calculated the fitted values of spreads for the parameterization of column 8 in Tables

[38] 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.

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.

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.

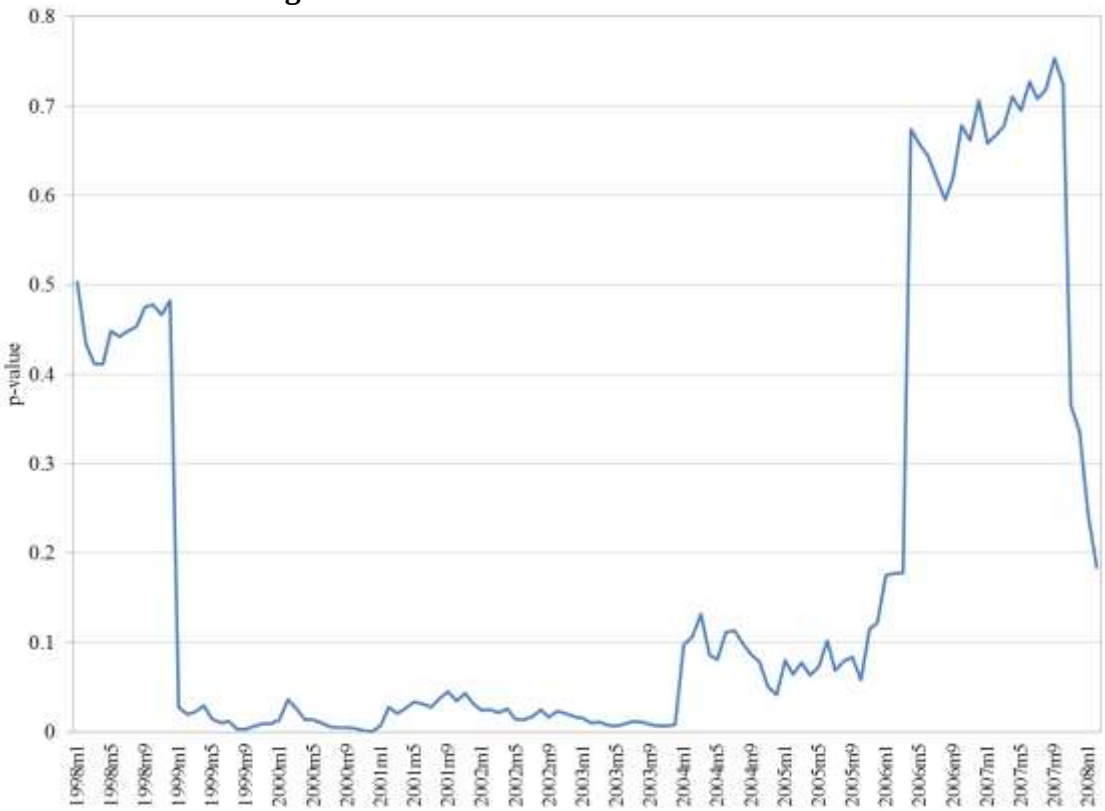
Figure 5: Variance Test with Random Effects



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



Source: Author's calculations

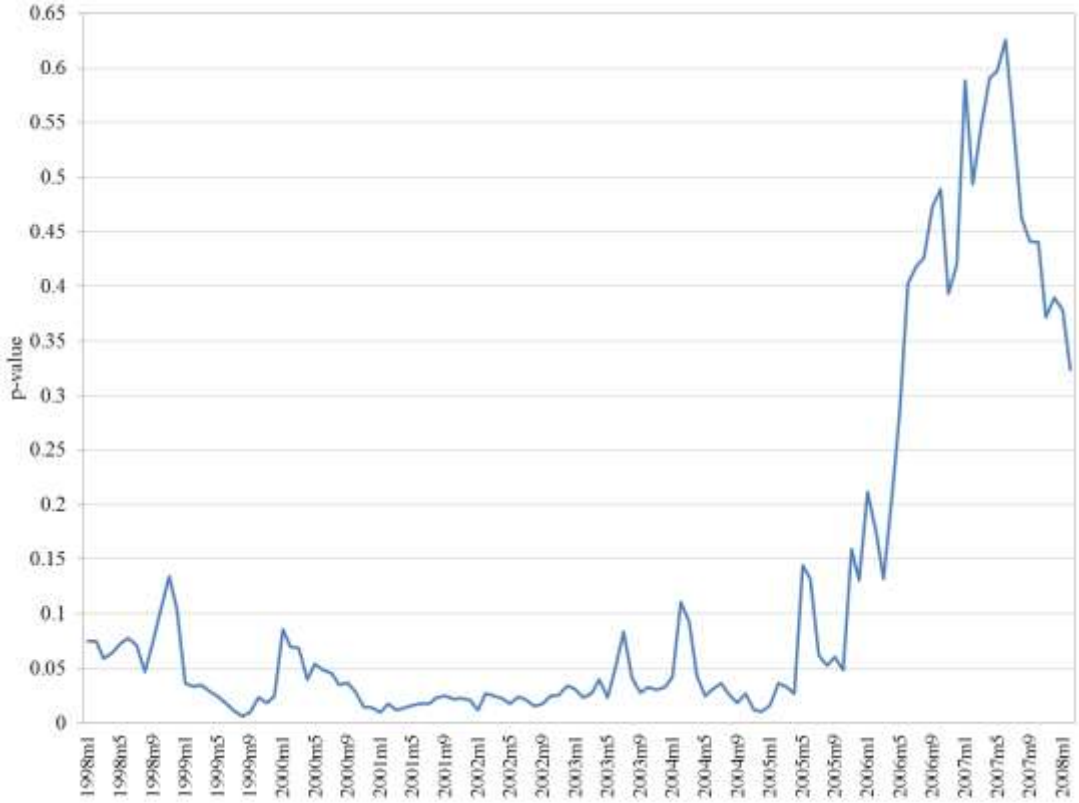
Finally, Figure 7 shows the p-value of the variance test with the difference-in-difference approach. At 10% significance, we see that spreads of EMU member countries were close together even before the start of the EMU area, probably reflecting some anticipated convergence of spreads in expectation of 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 moral hazard explained in subsection *Basic Structure.*

Figure 7: Variance Test with Difference in Difference



Source: Author's calculations

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).[39] This variable of GDP volatility 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.[40] 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,[41] 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 positive and significant for both the general sample and EMU members, and the square of public debt is negative (although not significant).

[39] We also calculated and estimated the models using a 3-year, 4-year, and 5-year rollover window.
[40] Similar results can be found using a 3-year, 4-year, or 5-year windows.
[41] In column 2, the Wald test for fiscal balance is equal to 2.78, with p-value of 9.52%.

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]
GDP Volatility		
Difference Actual GDP-Potential GDP		
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]
GDP Volatility		
Difference Actual GDP-Potential GDP		
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

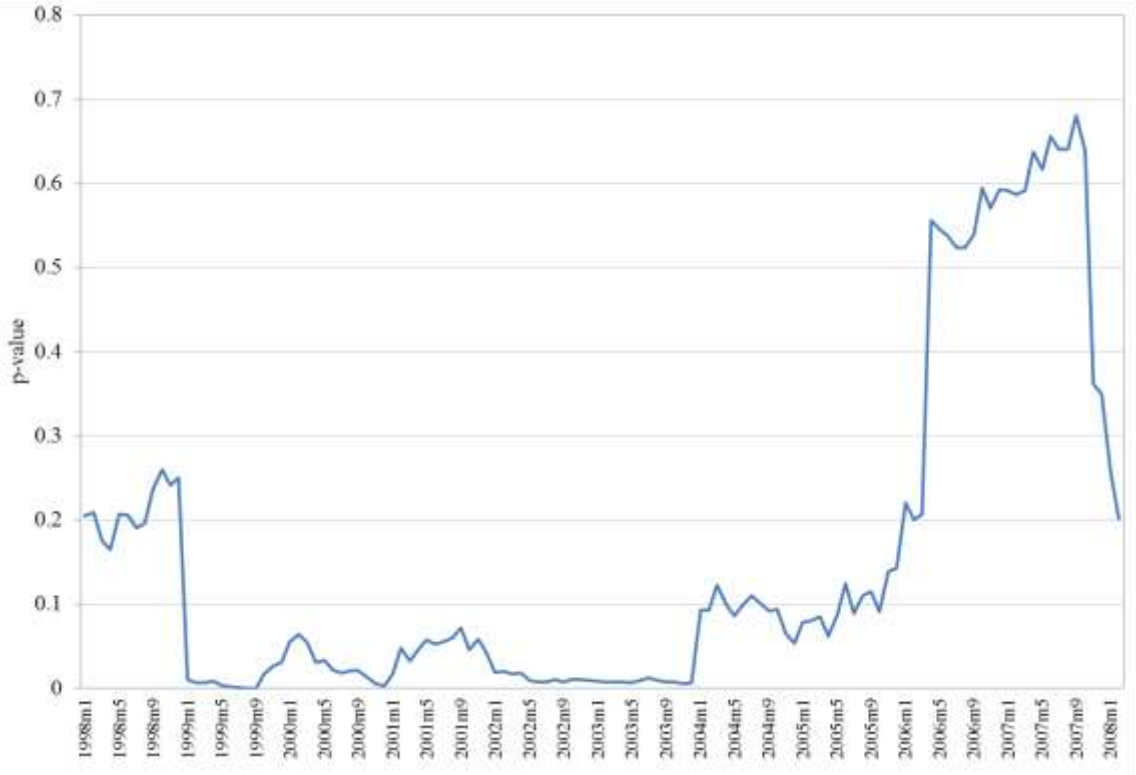
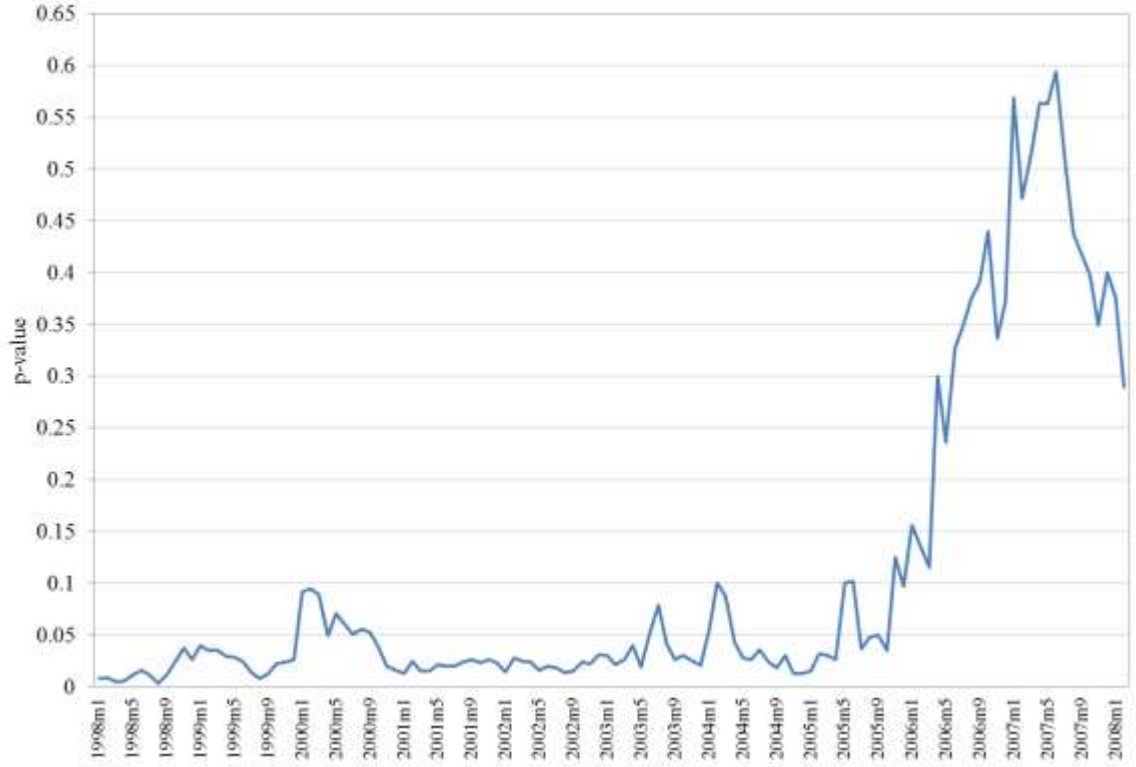


Figure 9: Variance Test Difference-in-Difference, with GDP Volatility



Source: Author's calculations

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. This behavior has been associated 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 chapter, 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 recklessly 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.

Chapter 3: "Saving the Euro: Mitigating Financial or Trade Spillovers?"

Introduction

Since late 2009, financial markets have been occupied with developments concerning the sovereign debt of Peripheral Euro Countries (Greece, Ireland, Italy, Portugal, and Spain, or PEC).[42] Events have led to a significant widening of bond yield spreads and higher risk premium on credit default swaps of PEC. And policy makers and financial markets have been concerned about the spillovers to other Eurozone countries through various channels that are affecting the viability of the Euro more generally.

European countries and international organizations have since early 2010 responded with a number of coordinated measures. Important region-wide steps were taken on May 10, 2010, when Europe's Finance Ministers approved a comprehensive rescue package worth €750 billion aimed at ensuring financial stability across Europe, including by creating the European Financial Stability Facility (EFSF). This boosted stock market indexes for periphery and core Eurozone countries by 10% and 8% respectively.

Differences among policy makers from various EU-countries as regards objectives and approaches have arisen, however, making markets question at times

[42] One can date the start of the Euro crisis as October 16, 2009, when incoming Greek Prime Minister George Papandreou told parliament "We have large hidden debts and spending," with the previous government's deficit of 6% GDP for 2009 revealed to have been massively underestimated.

the overall strategy. In June 2011, the crisis became even more intense with many concerns regarding the refinancing of Greek sovereign debt. As political disagreements surfaced, market concerns peaked again. Coordinated steps aimed to resolve the crisis were subsequently taken by the Eurozone countries. An important date was July 21, 2011, when the Euro area governments agreed on the terms for the second bail-out loan to Greece. Moreover, on October 27, 2011, the EU forged agreement with private banks on Greece debt reduction, which positively impacted markets.

The varying reactions of financial markets to these events and policy measures announced at them have made clear that there remain many questions on the best way to intervene in what has been a unique financial and sovereign crisis. This chapter aims to shed light on the best policy mix by analyzing through what channels the Euro crisis spilled over to the real sectors of various countries and how effective policies announced were in mitigating (or not) spillovers. In theory, crises may spillover to firms through at least two channels: a financial channel and a trade channel. The financial channel arises as banks in creditor countries exposed to sovereign risk, directly and indirectly, see their balance sheets impaired and have to cut back on lending ("deleverage") or, more generally, become reluctant to lend to (local) firms in the face of uncertainty. This in turn will hurt the performance of firms, especially those dependent on (bank) financing. The trade channel arises as affected countries reduce imports, which in turn implies lower firm sales and profitability in exporting countries.

Policy measures can mitigate these channels, but are likely to vary in their effectiveness. Public financial support for affected countries can help creditor banks as their asset values are enhanced, and thereby help banks to maintain financing to domestic firms. Support can also boost demand in affected countries, thus help to maintain their imports, and thereby the exports of firms. Our objective is to investigate through which of these two channels and to what degree the various policy measures have affected firms. This will allow for an assessment as to the efficacy of specific support measures. We also study two groups of firms: firms from around the world, and EU firms. Studying the first group informs us about the general channels of cross-border contagion. Studying the second group provides, beside a robustness test, insight on whether the measures helped to stabilize economic and financial conditions within the EU and the Eurozone.

Empirical work on the real impacts of the Euro crisis has been limited to date, in large part as the crisis is still evolving. There is, however, a literature that studies the global transmission of the (earlier) U.S. subprime crisis, which, although the evidence from studies is mixed, offers some lessons and methodological guidance. Some studies find that pre-crisis financial integration affected how the crisis impacted individual countries (e.g., Claessens et al., 2010; Milesi-Ferretti and Tille, 2011; Cetorelli and Goldberg, 2012; and Forbes, 2012). In contrast, Rose and Spiegel (2010, 2012) fail to find roles for country factors, including trade and financial linkages, in how countries were affected. A common feature of these studies, however, is the reliance on aggregate data. The mixed evidence on the role of country

factors and individual contagion channels is thus perhaps no surprise since the macro data reflect the aggregation of multiple underlying factors.

To separate the various channels, one could go to firm-level, micro data and use actual financial statements (see Forbes, 2004, 2012; and Claessens, Tong, and Wei, 2012).[43] For the current Euro crisis, however, firm-level evidence is limited, mainly because firm-level performance data on indicators such as profitability are released at low frequency with a long lag. Moreover, individual bank-level data on indicators such as exposure to affected countries are often missing, making analysis of specific channels difficult. And details on how policy measures are implemented are often lacking. The lack of suitable data in turn prevents the examination of actual responses of firms to the crisis and specific policy measures.

We overcome the lack of actual firm and bank data and policy measures by using firm-level stock price data and key event dates at which policy changes were announced, as well as benchmark characteristics of firms. Since stock prices are forward-looking, they can be expected to reflect the markets' reactions as to how firms may be affected by policies announced. And the benchmark characteristics allow one to trace the channels through which firms are affected. This approach has been used in similar ways to address these types of questions, as in Tong and Wei (2011), which examined the cross-country impact of the US subprime crisis.[44]

[43] Forbes (2004) studies how the 1997-98 Asian and Russian crises spread to other markets and Forbes (2012) analyze how the current Euro crisis spread. Claessens, Tong, and Wei (2012) examine how the 2007-2009 crisis affected firm performance and how various linkages propagated shocks across borders, by using accounting data for 7722 non-financial firms in 42 countries. There has been more analysis of the drivers of the recent trade retrenchment in 2008-2009, also using firm or sector level data (e.g., Alessandria et al., 2010; Behrens et al., 2010; Bems et al., 2010; Levchenko et al., 2010). And Duchin, Ozbas and Sensoy (2010) examine quarterly US investment from Q3, 2007 to Q3, 2008.

[44] They show evidence of liquidity crunches across emerging market economies by reporting that stock prices declined more for firms intrinsically more dependent on external finance for working capital.

We focus our analysis on four key events during the Euro crisis and related financial market responses, three with positive news and one with negative news. The first event is May 10, 2010, when the European Financial Stability Facility was established. This event was widely regarded as positive, with general, albeit not uniform increases in stock prices and an appreciation of the Euro.[45] The second, negative news event is from June 8 to 10, 2011, when there appeared to be public disagreements among core Eurozone countries on private sector participation in the resolution for Greek crisis, which created much turbulence in global financial markets.[46] The third event is July 19-21, 2011, when leaders of the Euro zone announced the terms of the second bail-out loan to Greece of €109 billion and the voluntary participation of private creditors. This agreement was welcomed by markets, in part because it eliminated some of the uncertainty generated by the contrasting public positions of the German government and the ECB about private participation in the program.[47] The fourth event is Oct 25-27, 2011, when the EU forged the Greek bond deal involving a fifty percent haircut, a resolution also viewed favorably by financial markets.

[45] Stock market indexes for periphery and core Eurozone countries increased by 10% and 8% respectively, while the Euro appreciated on May 10, 2010 by 2% against the dollar.

[46] On June 8, 2011, German Finance Minister Schäuble called for a Greek debt rollover into 7-year maturities. But on June 10, ECB President Trichet ruled out ECB participation in any debt rollover constituting default. Analysts noted the entrenched stand-off, and were unsure about the Greece crisis resolution. From June 7 to 10, the stock market indexes for periphery and core Eurozone countries decreased by 2.3% and 1.3% respectively, while the Euro depreciated by 2.2%.

[47] We use as the event window July 19 to 21, 2011, as the agreement became partially known before the announcement in the evening of July 21 (e.g., at about 2pm on July 21, the draft agreement was already published by the *Telegraph*). Capital markets partially anticipated the agreement starting July 19 due to two pieces of news: i) a comment of Mr. Ewald Nowotny, governor of the Austria's Central Bank, that a short-term selective default situation would not have major negative consequences, appearing to signal a softening of the ECB position about default scenario; and ii) reports on July 20 that Eurozone policymakers requested a delay of the Eurozone Summit in order to agree on private participation in the bail-out package.

We examine whether and how the policy measures (or reversal thereof) at these key event dates affected firm-level stock returns in the Eurozone and other countries. We do this for 3045 firms in 16 countries. For the positive news events, when policy measures were adopted, (the first, third and fourth events), we find that stock prices particularly increased for more financially–constrained firms and in countries where banks had large pre-crisis claims on peripheral Eurozone countries. Trade linkages with peripheral countries played a minor role, although Euro exchange rate movements led to some differential effects in some cases. For the negative news event, when some policy measures were reversed (the second event), we find effects similar to those of May 10, 2010, but with opposite signs: financially-constrained firms in countries with more exposed banks suffered more as did firms in sectors that exported more to peripheral countries.

These results are very robust. They carry through when we perform weighted regressions, to control for differences in sample size across countries, and when we analyze abnormal stock returns. The financial channel becomes even stronger when we focus on firms from the EU only, consistent with EU policy makers being mostly focused on assisting their firms. And the results carry through when we include various control variables, such as proxies for demand channels and movements in countries' sovereign CDS spreads. Moreover, results are preserved when we use bank exposure to public sectors in Greece, Ireland and Portugal only (rather than exposures to all sectors), suggesting that sovereign risks importantly drove financial spillovers and policy responses.

Collectively, our findings confirm that the European sovereign debt crisis spilled over to the real economy in other countries mostly through financial channels and only somewhat through trade channels, and more so for EU firms. And they show that policy measures at various dates mainly helped (or failed) to support creditor banks and mitigate the adverse effects on domestic financing conditions in core countries. These results show that policy makers considered reducing cross-border financial spillovers among closely-integrated countries the most important to preserve the benefits from integrated financial markets and a single currency.

Our analysis relates to studies on pre-crisis Eurozone integration since it highlights the possible costs of and risks in a unified currency zone during periods of financial stress. Some of these studies focus on how a common currency influences financial integration (e.g., Frankel and Rose, 2002; Codogno et al., 2003; Manganelli and Wolswijk, 2004; and Sgherri and Zoli, 2009). These papers document how sovereign bond spreads converged among Euro countries between 1999 and 2008, with the decline in spreads associated with increased international market liquidity and risk diversification, but little with country-specific factors, such as public debt. On the channels of integration, Kalemli-Ozcan et al. (2010) find that the Euro's impact on financial integration is mainly through the elimination of currency risk, but not through trade. Bris, Koskinen and Nilsson (2009) find that the Euro increased corporate valuation more for firms from Euro countries with less credibility in their previous exchange rate policy.[48]

[48] Mainly countries that devalued during the Exchange Rate Mechanism crisis of 1992/93: Finland, Italy, Ireland, Portugal, and Spain.

Our study also relates to the literature on links between sovereign and private borrowings. Earlier studies documented negative "spillover" effects of sovereign credit risk on firms' access to international capital markets, mainly for emerging markets (e.g., Ferri et al., 2001; Borensztein et al., 2007; and Arteta and Hale, 2008).[49] So far, this literature has focused largely on the effects of government's actions on corporations in their own country. Our study shows that sovereign crises can also affect foreign firms with financial and trade linkages with the countries in crises, and shows the specific role of a currency union.

Our work further relates to the growing literature on the Euro crisis. Early studies of the Euro crisis focused on how risk evolved in the banking sector and spilled onto sovereigns (Eichengreen et al., 2009; and Mody 2009). More recently, Horvath and Huizinga (2011) perform an event study of the May 2011 EFSF announcement. Their focus, however, is on the effects on banks' share prices and CDS spreads and on sovereign CDS spreads, and whether the EFSF benefitted banks or PEC-sovereigns. And Popov and Van Horen (2012) examine how syndicated lending by European banks varies with balance sheet exposure to PEC sovereign debt. In this analysis, we focus instead on the channels through which sovereign risk is transferred to the non-financial sector, studying how creditor banks can work as amplification channels.[50]

[49]In this literature, the main channels through which governments may transmit credit risks to the private sector are: reduced public spending, increases in taxes, and capital controls. These government actions can affect firms' expected returns, reduce their collateral value, and increase firm-level borrowing costs.

[50] Related work on cross-border banking spillovers but using aggregate data is Kaminsky and Reinhart (2003), who studied how a common lender propagated problems across multiple countries during the East Asian crisis.

Finally, our study relates to the recent literature on crisis contagion through equity markets. For instance, Bekaert et al. (2011) analyze the transmission of the 2007-2009 financial crisis by examining country-industry equity portfolios in 55 countries.[51] They did not study the Euro crisis, however, which started only in 2010. We also explore higher-frequency (daily) movements at the firm level, which allows us to more directly identify the effects of policy announcements.

The rest of the chapter is structured as follows. We describe our data and methodology in Section 2. Section 3 presents results for the four key events during the Euro crisis. Section 4 reports results for robustness check of our main results. Section 5 then concludes.

The Framework and Data

Building on the existing literature, we aim to distinguish, by using firm-level stock price data, the transmission channels through which the crisis in peripheral Euro countries spilled over to the rest of the world. We examine two channels through which the crisis may have spilled over: a financial channel and a trade channel. We employ a consistent framework to distinguish the impacts of these two channels. To isolate transmission through the finance channel, we make use of the following idea: if the availability of credit plays an important role for firm performance, a shock to the supply of external financing should be reflected in the performance of those firms that rely more on external finance (for investment) relative to those firms that rely less on external financing. Similarly, if trade were to be an important factor, a shock

[51] Hau and Lai (2012) also examine the role played by equity funds in the propagation of the 2007-2009 crisis.

to demand leading to a change in imports should be reflected in the performance of those firms that rely more heavily on exports to peripheral Euro countries relative to those firms that rely less on such exports. And markets should reflect performance differences in firms' stock prices whenever there is news (positive or negative) about the supply of external financing or trade prospects.

Basic Specification

The basic empirical strategy is to check whether *ex ante* classifications of firms in terms of their intrinsic characteristics – degree of financial dependence and exposure to trade - help to explain changes in their stock price performance following key events in the European sovereign debt crisis. To proxy the intrinsic financial dependence, we use the approach of relying on the sector characteristics of U.S. firms, which are arguably exogenous to our sample of firms (see Rajan and Zingales, 1998; note that we do not include U.S. firms in our regressions). And for trade linkage, we use pre-crisis actual trade exposures at the country-sector level. Specifically, our empirical model is given by the following equation:

$$\text{Stock Return}_{i,j,k} = \beta \text{Financial Dependence}_{j} + \lambda \text{Trade Linkage}_{j,k} + \text{Control}_{i,j,k} + e_{i,j,k} \quad (18)$$

where *i* stands for company, *j* for sector, and *k* for country. Note that this is a pure cross-sectional regression for each key event in the European sovereign crisis and that the key regressors are pre-determined (in 2006). We add firm size (log assets in US dollar) as our base control variable.

We start by assuming the same β and λ for all countries in order to estimate average effects, but next allow for variations across countries. To study how the

pattern of pre-crisis financial exposure to peripheral Euro countries affects the extent of a liquidity crunch, we consider the interaction between a country's financial exposure and its firms' dependence on external finance. In other words,

$$\beta_k = \beta_1 + \beta_2 \text{Financial Exposure}_k \tag{19}$$

where *Financial Exposure*$_k$ is country *k*'s banking sector exposure to peripheral Euro countries. The slope coefficient, β_2, then captures the extent to which financial exposure affects the severity of the external-financing supply shock.

Related to the trade channel, we include an interaction term of trade linkage with the Euro dummy. That is,

$$\lambda_k = \lambda_1 + \lambda_2 \text{Eurozone}_k \tag{20}$$

The slope coefficient, λ_2, then captures the extent to which the severity of the trade shock depends on Eurozone membership.

Event Selection

There certainly have been many events related to European sovereign crisis between October 2009 (the start of the Euro sovereign debt crisis) and December 2011. Of these, we choose in the following way four key events to examine the spillover channels. We started with examining the three-day change in the five-year Greek sovereign CDS spread. (We find similar patterns when we examine the change in the average sovereign CDS spread of PEC.) As seen in Figure 10, over the period from October 2009 to December 2011, the three largest drops in the spread occurred on May 10, 2010, July 21, 2011, and October 27, 2011. Hence we selected these three positive news events. As for the second event (June 8-10, 2011), the sovereign CDS spread increased by 11.5 percentage points during a 3-day window, a large increase

after a relatively low volatility period from July 2010 to May 2011.[52] The second event can thus been seen as a major negative event. Figure 11 plots the five-year Greek CDS spread (in levels) for narrower windows around each of the four events. It shows again the large movements in financial markets at the time of these events.

For these four events, we further confirm that they satisfy the following criteria: i) news of the event was on the front page of the *Financial Times* and the *Wall Street Journal*; ii) the event was the major news item during the time-window (i.e., no other major news from world markets occurred during or just before that period); and iii) the event was not much anticipated (for instance, there was no major leakage of the news in the media related to the event's timing or magnitude). Also, as there was little prior change in the Greek sovereign CDS spread, we are confident that these four events were not fully anticipated by the market.

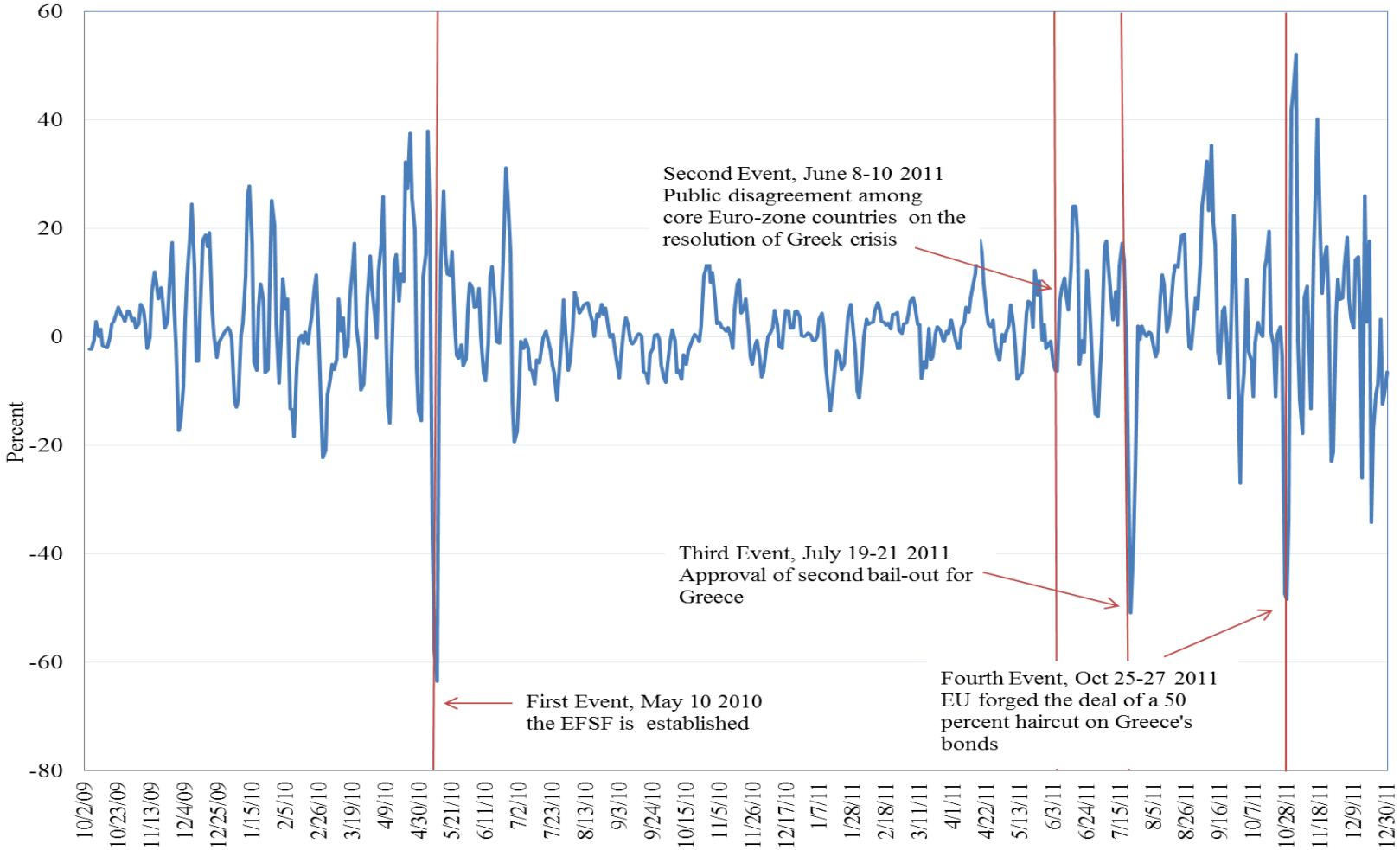
Key Data

We describe here the definitions of our dependent variable, the change in stock price, and the two sectorial benchmark indicators for external financing and trade sensitivity. We also discuss data used to measure the linkages of countries with peripheral Euro countries.

Percentage change in stock price. The stock price index is from Datastream and is the total rate of return index, i.e., adjusted for dividends, and action such as stock splits and reverse splits.

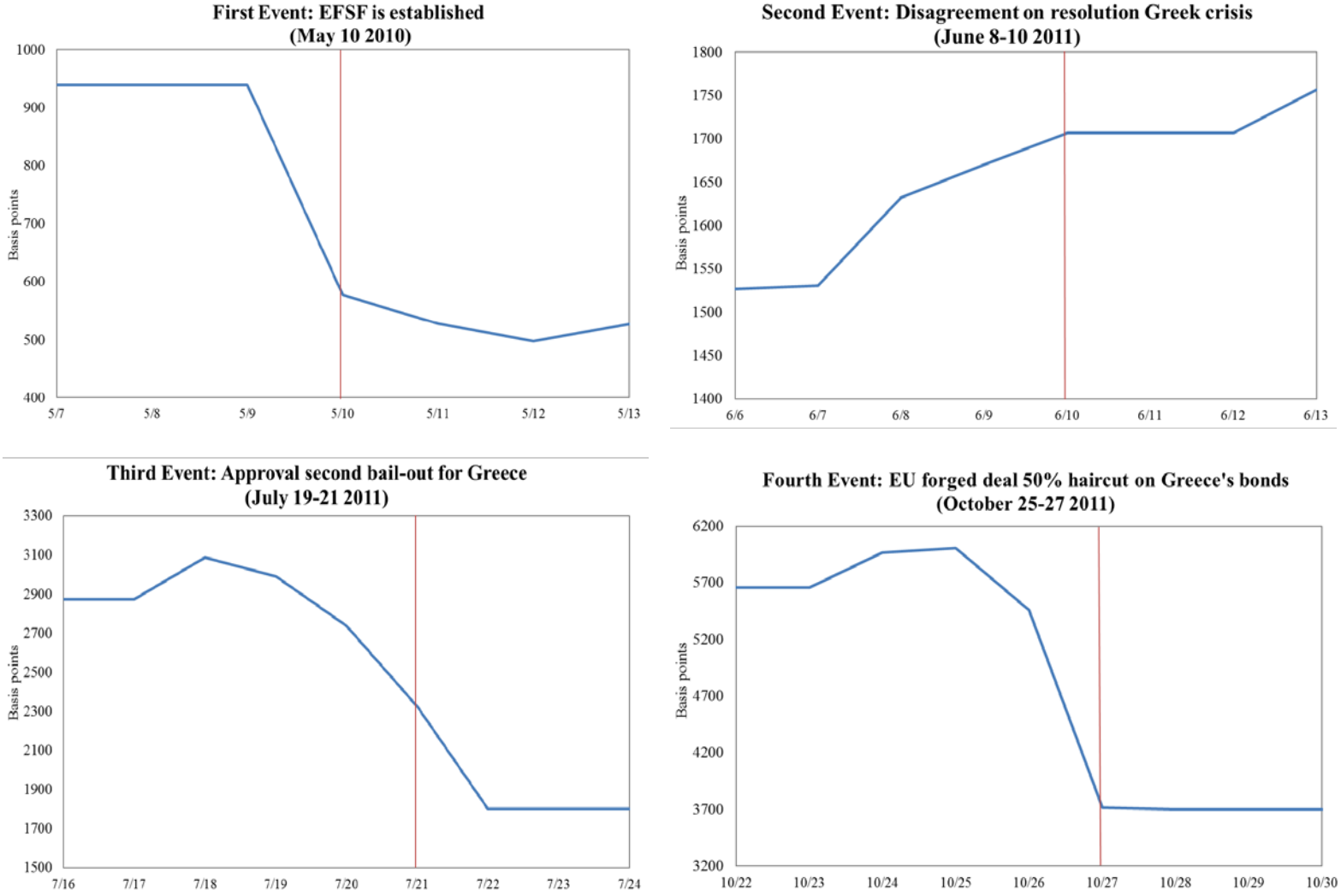
[52] Similar results are found if a one-day or a two-day change in the average sovereign CDS spread is calculated. Note also that we do not test whether events related to the European sovereign crisis affect the sovereign CDS spread of Greece. Rather we examine how these events may affect firms in other countries. As such, there is no obvious selection bias.

Figure 10: Three-day Change in the Greek Sovereign CDS Spread



Note: We calculate the 3-day change as 100*ln(CDS spread in t/CDS spread in t-3), where the CDS spread is the five-year Greek sovereign CDS spread.

Figure 11: Greek Sovereign CDS Spread



Financial dependence index. We construct a sector-level proxy of a firm's intrinsic dependence on external finance for investment following a methodology of Rajan and Zingales (1998):

$$\text{Dependence on external finance for investment} = \frac{\text{capital expenditures} - \text{cash flow}}{\text{capital expenditures}} \quad (21)$$

where *cash flow = cash flow from operations + decreases in inventories + decreases in receivables + increases in payables*. All the numbers are based on U.S. firms, which are judged to be least likely to suffer from financing constraints (during normal times) relative to firms in other countries. While the original Rajan and Zingales (1998) paper covers only 40 (mainly 2-digit SIC) sectors, we expand the coverage to around 110 3-digit SIC sectors.

To calculate this benchmark, we take the following steps. First, every firm in the COMPUSTAT USA is sorted into one of the 3-digit SIC sectors. Second, we calculate the ratio of actual dependence on external finance for each firm from 1990-2006. Third, we calculate the sector-level median from firm ratios for each 3-digit SIC sector that contains at least 5 firms. The median value is then chosen to be the index of demand for external financing in that sector. Conceptually, the Rajan-Zingales index aims to identify sector-level features, i.e., which sectors are naturally more dependent on external financing for their business operation. The index could be seen as a "technical feature" of a sector, almost like a part of the production function. It does not consider which firms are more or less liquidity constrained within a sector.

Trade Exposure. Trade exposure captures a country's exports to peripheral Euro countries (Greece, Ireland, Portugal, Italy and Spain). To construct this variable, we use data on bilateral exports at the 4-digit SIC sector-level for year 2006. Then trade exposure is defined as:

$$\text{Trade Exposure}_{j,k,cg} = \frac{\text{Sector } j\text{'s total exports from country } k \text{ to country } cg}{\text{Sector } j\text{'s total exports from country } k} \quad (22)$$

for exports of sector *j* in country *k* to country group *cg* (Peripheral Euro Countries). Data for 2006 are retrieved from the United Nations Commodity Trade Statistics Database (UN Comtrade).

Bank Lending Exposure. Banking lending exposure captures the pre-crisis linkage of country *k* with peripheral Euro countries through credit exposure. To construct this variable, we use information on the "consolidated foreign claims by nationality of reporting banks, immediate borrower basis", as published by the Bank of International Settlements (BIS), for the fourth quarter of 2006. We then calculate a creditor country's relative banking system exposure as:

$$\text{Bank Exposure}_{k,cg} = \frac{\text{Total foreign claims of country } k \text{ on country } cg}{\text{Total foreign claims of country } k} \quad (23)$$

where *k* is a creditor country and *cg* is the debtor country group of interest, such as peripheral Euro countries. We use a relative measure to account for the fact that some countries are more active in international lending. Our sample includes a total of 16 reporting countries.

Control Variables. As noted, we include variables to control for basic firm characteristics. One is firm size, measured by the log of book assets in US dollars. Note that size may also proxy for the degree to which the firm is active internationally through trade and FDI in periphery countries.[53]

Key Hypotheses

With this framework and data, we aim to test the following three hypotheses:

H1: News about the Euro crisis will change the stock returns of financially-dependent firms more. That is, $\beta > 0$ when there is positive, and $\beta < 0$ when there is negative news.

H2: News about the Euro crisis will change the stock returns of financially-dependent firms more in countries with larger bank exposure to peripheral Euro countries. That is, $\beta_2 > 0$ when there is positive, and $\beta_2 < 0$ when there is negative news.

H3: News about the Euro crisis will affect the stock returns more of firms with more trade exposure to peripheral Euro countries. That is, $\lambda_1 > 0$ when there is positive, and $\lambda_1 < 0$ when there is negative news.

H4: News about the Euro crisis will affect the stock returns of firms from Eurozone countries with trade exposure to peripheral Euro countries differently of firms from non-Eurozone countries. Specifically, if the bailout helps stabilize the crisis, it may cause the Euro to appreciate and consequently reduce the

[53] We also included a proxy for demand sensitivity as an additional control variable to capture a firm's relative sensitivity to a contraction in aggregate consumer demand. However, this variable is always insignificant and therefore did not include it in the reported estimations.

competitiveness of Euro-area exporting firms. This would mean that $\lambda_2 < 0$ when there is positive news and $\lambda_2 > 0$ when there is negative news.

Basic Statistics

Table 8 shows the number of non-financial firms included in the sample, classified by country of origin. Our sample includes 3045 firms from 16 advanced and emerging economies. We select these countries as they have BIS data on cross-border bank claims.[54]

Table 8: Number of Listed Firms

Country	# of firms	Country	# of firms
Australia	182	Germany	236
Austria	29	Japan	1296
Belgium	43	Mexico	22
Brazil	63	Netherlands	50
Canada	283	Sweden	120
Chile	13	Switzerland	93
Denmark	43	Turkey	68
France	169	United Kingdom	335
TOTAL			3045

Source: Worldscope.

Table 9 reports summary statistics for our key dependent and explanatory variables. The statistics show that, on average, the stock prices of individual firms increase at the announcements of the €750 billion bail-out fund for countries in crisis (May 10, 2010), the second bail-out for Greece (July 19-21, 2011), and the new terms for the second bail-out for Greece (October 25-27, 2011). In contrast, firms' stock

[54] We did not include US firms as they serve as benchmarks and may dominate the sample of firms.

prices dropped in general when there was public disagreement among core Euro countries on private sector participation in Greek assistance (June 8-10, 2011). Table 2 also shows the heterogeneous response of prices to those events: the change in prices ranges in May 2010 between -13.3 to 13.7 percent; June 2011 -15.6 to 17.19 percent; July 2011 -13.7 to 17.2 percent, and October 2011 -15.4 to 18.8 percent.

Table 9 also shows some of the heterogeneity in the firms we study, with large variations in size. For example, the firm at the 75th percentage is eight times larger than that at the 25th percentile. There is also much variation in our sectorial and country variables. For example, external financing sensitivity varies between 0 and 1, with a standard deviation of 0.32. Trade exposure to peripheral Euro countries varies between 0 and 0.96 across sector-country pairs, with a standard deviation of 0.1. Banking exposure to peripheral Euro countries varies between 0.01 and 0.20 across creditor countries, with a standard deviation of 0.05. This makes these variables good indicators to identify the channels by which the firm-specific responses in stock prices may arise.

Empirical Results

We first examine how various firm and sector features affect changes in firm's stock price around the announcement of the €750 billion bail-out fund (May 10, 2010). We present our basic regression results in Table 10, which cluster standard errors at the US SIC 3-digit sector.[55]

[55] R-squared values in our estimations are generally low. However, this is typical for event studies as it is hard to explain stock prices.

Table 9: Summary Statistics

Variables	Obs	Mean	St Dev	Med	p25	p75	Min	Max
Firm level								
Change in Stock Price								
1. Event May 10 2010	3045	2.26	3.91	1.72	0.00	4.26	-13.35	13.74
2. Event June 8-10 2011	3043	-0.43	3.87	0.00	-2.03	1.09	-15.62	17.19
3. Event July 19-21 2011	3042	0.45	4.25	0.00	-1.19	1.98	-13.72	17.24
4. Event Oct 25-27 2011	3042	1.00	4.45	0.16	-0.83	2.77	-15.34	18.78
Firm Size (log in US Dollars)	3045	12.51	2.08	12.39	11.25	13.79	2.64	19.49
Sector level								
External Financial Dependence	110	0.29	0.32	0.23	0.00	0.42	0.00	1.00
Country-sector level								
Trade Exposure to PEC	1130	0.07	0.10	0.03	0.01	0.11	0.00	0.96
Country level								
Bank Exposure to PEC	16	0.08	0.05	0.06	0.06	0.11	0.01	0.20

Note: Bank exposure is defined as a country's bank foreign claims on Peripheral Euro Countries (PEC) over the country's total bank foreign claims. Trade exposure is defined as a country's exports of a certain sector to PEC over the country's total exports in the same sector. External Financial Dependence is a sector's intrinsic dependence on external finance for capital expenditures as in Rajan and Zingales (1998).
Sources: Worldscope, BIS Consolidated Banking Statistics and United Nations Commodity Trade Database.

Table 10: Event Analysis I, Financial and Trade Channels
Event: Launch of a €750 bn. economic package from the EU and the IMF (May 10 2010)

General Sample

VARIABLES	(1) No interaction	(2) Bank Exposure	(3) Trade Exposure	(4) Sector Fixed Effects	(5) Country Fixed Effects	(6) Country & Sector Fixed Effects
Financial Dependence (Rajan and Zingales (1998))	0.57	0.10	-0.43		-0.027	
	[0.36]	[0.55]	[0.49]		[0.55]	
Financial Dependence*Bank Exposure to PEC		6.97*	11.9***	13.0***	7.13*	7.77*
		[4.14]	[3.53]	[3.99]	[4.11]	[4.00]
Firm Size (Total Assets)	0.32***	0.30***	0.31***	0.29***	0.38***	0.36***
	[0.033]	[0.037]	[0.036]	[0.037]	[0.034]	[0.034]
Trade Exposure to PEC	5.25***	3.74***	6.51***	5.54***	0.36	-0.98
	[1.09]	[1.34]	[1.40]	[1.44]	[1.54]	[1.55]
Euro Dummy (Euro=1 if country is part of Euro zone)			3.59***	3.40***		
			[0.70]	[0.63]		
Euro Dummy*Trade Exposure to PEC			-6.60***	-6.04***	-2.12	-1.41
			[1.94]	[2.14]	[2.21]	[2.23]
Bank Exposure to PEC		4.04**	-16.1***	-13.6***		
		[1.97]	[4.75]	[4.35]		
Constant	-2.31***	-2.27***	-1.46**			
	[0.48]	[0.51]	[0.58]			
Observations	3,045	3,045	3,045	3,045	3,045	3,045
R-squared	0.047	0.054	0.072	0.119	0.165	0.205

Note: Dependent variable is stock return measured as the log difference in the closing price from May 8 (Friday) to 10, 2010. Bank exposure is defined as a country's bank foreign claims on peripheral Euro countries (PEC) over the country's total bank foreign claims. Trade exposure is defined as a country's exports of a certain sector to peripheral Euro countries (PEC) over the country's total exports in the same sector. External Financial Dependence is a sector's intrinsic dependence on external finance for capital expenditures as in Rajan and Zingales (1998). No. of countries: 16. Standard errors are clustered by US SIC 3-digit sector. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

In Column 1, we show that the coefficient on external financial dependence is positive, albeit insignificant. This means that the event had more impact on firms from industries with higher financing needs for capital expenditures. This suggests that the announcement led banks to more willingly supply external financing to local firms as they had less concerns about their balance sheets. We find strong evidence that the impact of the event is more pronounced for large firms and firms with larger trade exposure to peripheral Euro countries. This suggests that the announcement of the bail-out fund implied improved expectations about the pace of the recovery of aggregate demand in those countries. Therefore, large firms and firms from countries and sectors that have larger trade linkages to peripheral Euro countries stood to benefit more, reflected in a large increase of their stock prices.

To evaluate the importance of the cross-border financial channel, we add the interaction of the financial dependence index with country bank exposure in Column 2. We find this interaction to be positive and significant. That is, the stock returns are higher for firms with higher natural external financial dependence located in countries whose banking systems are more exposed to peripheral Euro countries. This suggests that, as the creation of the €750 billion bail-out fund was expected to enhance the value of claims on the peripheral countries, banks' balance sheets were strengthened, which in turn allowed banks to more easily finance firms.

In Column 3, we explore further the importance of trade as a transmission channel. We include in our regression a dummy variable "Euro dummy" which equals 1 if the country is part of the Eurozone and zero otherwise. In addition, we interact the Euro dummy and the trade exposure to peripheral Euro countries. We

expect differences between Euro and non-Eurozone countries in the importance of trade for two reasons. On the one hand, Euro countries are more closely integrated with peripheral Euro countries through trade and financial linkages and these firms and their stock prices could thus be expected to gain more at the time of the event. On the other hand, since the Euro appreciated around the time of the event, Euro firms could be expected to experience lower stock price movements as they did lose competitiveness at the same time.

We find the coefficient on the Euro dummy to be positive and significant, suggesting that markets expected the policy measures to improve economic prospects in the Eurozone. However, the coefficient on the interaction between the Euro dummy and the country's trade exposure is significantly negative. That is, stock prices of Eurozone firms with trade exposure to peripheral Euro countries increased less than those of non-Eurozone firms with similar trade exposure (the overall effect for Eurozone firms is actually about zero, 6.6 - 6.51). This could be due to the adverse effect of the concurrent Euro appreciation. So, while the policy measures benefited firms from say both Japan and France that export to peripheral Euro countries, as reflected by the positive coefficient of trade exposure, because of the simultaneous appreciation of the Euro, this event benefitted Japanese exporters more than French exporters.

In Columns 4, 5 and 6, we include sector fixed effects, country fixed effects, and both sector and country fixed effects, respectively, in order to control for unobserved characteristics at industry and country levels (but then we drop the respective sector and country benchmark characteristics). The main result is that the

financial channel remains statistically very significant: firms from industries with higher external financial dependence in countries whose banking system is more exposed to peripheral Euro countries tend to have larger stock price increases in response to the event. With respect to the trade channel, we find the coefficient of the Euro dummy to be positive and significant and the coefficient of the interaction between this dummy and trade exposure to be negative (although, perhaps not surprising, it becomes insignificant when country fixed effects are included). This result suggests that the Euro-appreciation effect becomes less important after controlling for country characteristics.

Based on the results in Column 6, the stock return of a firm from the "Manufacturing of Medical and Surgical instruments" sector (with financial dependence at the 75th percentile) in the United Kingdom (with bank exposure at the 75th percentile) was 0.22 percent higher than that of a firm from the "Pulp, Paper, and Paperboard Mills" sector (with financial dependence at the 25th percentile) in Canada (with bank exposure at the 25th percentile). The difference (0.22 percent) is large compared to the average increase in stock prices (2.26 percent). In contrast, the trade channel is neither statistically or economically significant.

In Table 11, we report the results of our estimations for the second event: public disagreement among core Eurozone countries on the resolution for Greek crisis (June 8-10, 2011), which was generally perceived negatively by markets. In Column 1, we find a negative and significant coefficient for external financial dependence, suggesting that firms from sectors with larger external financial needs are, in general,

more vulnerable to these kinds of negative events, and therefore show larger drops in their stock prices.

In Column 2, we add the interaction between financial dependence and bank exposure to peripheral Euro countries. Again, the drop in stock prices is more pronounced for firms from industries with greater financial dependence, particularly in countries whose banking systems are more exposed to those countries. This suggests that these events led to concerns about the ability of banks in creditor countries to continue to finance firms, especially those with greater external financing needs. In addition, trade exposure is negative and significant in Column 2. That is, firms from countries and sectors with larger trade linkages to peripheral Euro countries were thought to be more vulnerable, with their stock prices falling more.

In Column 3, we examine further the trade channel by including an interaction between the Euro dummy and trade exposure. The coefficient for the Euro dummy is significantly negative (-3.63), as is the coefficient of trade exposure (-5.08). The coefficient for the interaction term is significantly positive (6.59), probably because the Euro depreciation at the same time improved the competitiveness of firms from the Eurozone over other firms.[56] Consequently, markets expected higher profits for Eurozone area firms compared to non-Eurozone firms.

[56] The overall effect of trade exposure is positive but insignificant for Eurozone firms (i.e., 1.51 = -5.08+6.59, with an F-test of 0.28).

Table 11: Event Analysis II, Financial and Trade Channels
Event: Public disagreement among core Eurozone countries on the resolution for Greek crisis (June 8-10 2011)
General Sample

VARIABLES	(1) No interaction	(2) Bank Exposure	(3) Trade Exposure	(4) Sector Fixed Effects	(5) Country Fixed Effects	(6) Country & Sector Fixed Effects
Financial Dependence (Rajan and Zingales (1998))	-0.37*	0.19	0.73*		0.41	
	[0.21]	[0.35]	[0.40]		[0.46]	
Financial Dependence*Bank Exposure to PEC		-7.81**	-12.9***	-12.9***	-8.62*	-9.31*
		[3.63]	[3.79]	[4.15]	[4.53]	[4.78]
Firm Size (Total Assets)	-0.0041	0.0074	-0.0048	-0.0042	-0.053	-0.047
	[0.046]	[0.043]	[0.045]	[0.044]	[0.040]	[0.044]
Trade Exposure to PEC	-2.84***	-2.29***	-5.08***	-7.08***	-2.21**	-3.69***
	[0.83]	[0.76]	[0.91]	[1.13]	[0.92]	[1.37]
Euro Dummy (euro=1 if country is part of Euro zone)			-3.63***	-4.23***		
			[0.47]	[0.51]		
Euro Dummy*Trade Exposure to PEC			6.59***	8.30***	3.25*	4.47**
			[1.72]	[1.78]	[1.65]	[1.89]
Bank Exposure to PEC		-0.25	20.2***	25.0***		
		[2.10]	[3.74]	[4.07]		
Constant	-0.071	-0.23	-1.05			
	[0.64]	[0.65]	[0.68]			
Observations	3,043	3,043	3,043	3,043	3,043	3,043
R-squared	0.007	0.009	0.028	0.073	0.079	0.109

Note: Dependent variable is stock return measured as the log difference in the closing price from June 7 to 10, 2011. Bank exposure is defined as a country's bank foreign claims on peripheral Euro countries (PEC) over the country's total bank foreign claims. Trade exposure is defined as a country's exports of a certain sector to peripheral Euro countries (PEC) over the country's total exports in the same sector. External Financial Dependence is a sector's intrinsic dependence on external finance for capital expenditures as in Rajan and Zingales (1998). No. of countries: 16. Standard errors are clustered by US SIC 3-digit sector. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

In Columns 4, 5, and 6 we include sector, country and both sector and country fixed effects, respectively, to control for unobserved characteristics at country and industry levels. In all specifications, we find the financial channel to be important in explaining the behavior of stock prices around the event, with coefficients all negative and significant. In addition, and different from the results in Table 10, trade exposure is negative and significant in all three specifications, and the coefficient on the interaction of trade exposure and Euro dummy is positive and significant. The main message is that both financial and trade channels for transmitted shocks from peripheral Euro countries to the real sectors of other economies.

Based on Column 6 of Table 11, the stock price of a firm from the "Manufacturing of Medical and Surgical Instruments" sector (with financial dependence at the 75th percentile) in the United Kingdom (with bank exposure at the 75th percentile) falls 0.27 percent more than that of a firm from the "Pulp, Paper, and Paperboard Mills" sector (with dependence at the 25th percentile) in Canada (with bank exposure at the 25th percentile). This difference (0.27 percent) is again large compared with the average fall in stock prices (0.43 percent).

For non-Euro firms, the economic impact of the trade channel is similar to that of the financial channel. Based on Column 6, the stock price of a firm from the "Manufacturing of Equipment for Construction" sector in Switzerland (trade exposure at the 75th percentile of 9.9 percent) was 0.34 percent lower than that of a firm from the "Rolling, Drawing, and Extruding Nonferrous Metals" sector in Australia (trade exposure at the 25th percentile of 0.6 percent). For firms from the Euro area, however, the economic impact of the trade channel is much less important

(actually it switches sign). For example, the stock return of a firm from the "Production of Electronic Components" sector in the Netherlands (trade exposure of 18.5 percent at the 75th percentile among Euro countries) was only 0.08 percent higher than that of a firm from the "Production of Industrial Inorganic Chemicals" sector in Belgium (trade exposure of 8.4 percent at the 25th percentile among Euro countries).

In Table 12, we report the results of our estimations for the third event, the approval of the second bail-out package for Greece (July 19-21, 2011), which was generally perceived positively by financial markets. Similar to the first event (the creation of the €750-billion bail-out fund), we find positive effects for the financial channel in all specifications, and they remain significant when we include country and sector fixed effects. With respect to the trade channel, we find a positive and significant coefficient for the Euro dummy, suggesting that capital markets expected this decision to improve economic prospects of the Euro area especially. However, the interaction term between trade exposure and the Euro dummy is insignificant, suggesting that, for this event, the trade channel was not a key transmission mechanism.

Table 12: Event Analysis III, Financial and Trade Channels
Event: Approval of second bail-out for Greece (July 19-21 2011)

General Sample

VARIABLES	(1) No Interaction	(2) Bank Exposure	(3) Trade Exposure	(4) Sector Fixed Effects	(5) Country Fixed Effects	(6) Country & Sector Fixed Effects
Financial Dependence (Rajan and Zingales (1998))	0.64***	0.55	0.20		-0.46	
	[0.23]	[0.62]	[0.55]		[0.45]	
Financial Dependence*Bank Exposure to PEC		2.30	5.83	7.47	9.46*	9.87*
		[6.45]	[5.65]	[6.01]	[5.22]	[5.60]
Firm Size (Total Assets)	0.14***	0.11***	0.12***	0.15***	0.15***	0.15***
	[0.039]	[0.042]	[0.039]	[0.048]	[0.042]	[0.044]
Trade Exposure to PEC	3.07***	0.81	1.67	0.75	1.27	0.25
	[1.06]	[1.26]	[1.60]	[1.33]	[1.38]	[1.26]
Euro Dummy (Euro=1 if country is part of Euro zone)			1.86***	1.64**		
			[0.69]	[0.79]		
Euro Dummy*Trade Exposure to PEC			1.37	2.31	-1.08	-0.036
			[2.33]	[2.70]	[2.01]	[2.10]
Bank Exposure to PEC		7.89***	-6.76	-5.70		
		[2.59]	[4.70]	[4.99]		
Constant	-1.70***	-1.86***	-1.15*			
	[0.53]	[0.56]	[0.60]			
Observations	3,042	3,042	3,042	3,042	3,042	3,042
R-squared	0.011	0.020	0.028	0.073	0.085	0.119

Note: Dependent variable is stock return measured as the log difference in the closing price from July 18 to 21, 2011. Bank exposure is defined as a country's bank foreign claims on peripheral Euro countries (PEC) over the country's total bank foreign claims. Trade exposure is defined as a country's exports of a certain sector to peripheral Euro countries (PEC) over the country's total exports in the same sector. External Financial Dependence is a sector's intrinsic dependence on external finance for capital expenditures as in Rajan and Zingales (1998). No. of countries: 16. Standard errors are clustered by US SIC 3-digit sector. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

In Table 13, we report the results for the October 25-27, 2011 event. We use a 3-day window, from the closing of Oct 24 to the closing of Oct 27, to take into account potential leakage of news before the announcement the night of Oct 26.[57] Similar to the first and third events, we find positive effects for the financial channel in all specifications, which also remain significant when we include country and sector fixed effects. With respect to the trade channel, we find no consistent result for trade exposure to periphery European countries, suggesting that, for this event, the trade channel was not a key transmission mechanism.

Robustness Checks

In this section, we conduct some robustness checks, including examining an EU-only sample, abnormal stock returns and performing weighted regressions. In addition, we revisit our main results taking into account financial and trade exposure to only Greece, Ireland and Portugal, and evaluating the financial channel using information of bank exposure to the public sector.

[57] Between October 25 and 26, there was some speculation about the participation of private creditors in write-offs and the level of the EFSF. Since the announcement was at the night of Oct 26, the window Oct 24 (closing) to 27 (closing) fully captures this event.

Table 13: Event Analysis IV, Financial and Trade Channels
Event: the EU forged the deal of a fifty percent haircut of Greece's bonds (October 25-27 2011)

General Sample

VARIABLES	(1) No Interaction	(2) Bank Exposure	(3) Trade Exposure	(4) Sector Fixed Effects	(5) Country Fixed Effects	(6) Country & Sector Fixed Effects
Financial Dependence (Rajan and Zingales (1998))	0.092	-0.82	-0.85		-0.65	
	[0.41]	[0.52]	[0.52]		[0.60]	
Financial Dependence*Bank Exposure to PEC		12.9***	13.1***	12.6***	10.4***	9.66***
		[2.79]	[2.97]	[3.48]	[3.31]	[3.59]
Firm Size (Total Assets)	0.22***	0.20***	0.20***	0.20**	0.25***	0.25***
	[0.064]	[0.069]	[0.069]	[0.080]	[0.060]	[0.071]
Trade Exposure to PEC	2.36***	0.95	1.17	2.53**	-2.53**	-1.50
	[0.75]	[0.84]	[0.99]	[1.18]	[0.97]	[1.08]
Euro Dummy (Euro=1 if country is part of Euro zone)			0.23	0.57		
			[0.58]	[0.61]		
Euro Dummy*Trade Exposure to PEC			-0.85	-1.99	3.27**	2.40
			[1.54]	[1.76]	[1.56]	[1.86]
Bank Exposure to PEC		2.34	1.45	-0.19		
		[1.66]	[3.70]	[3.86]		
Constant	-1.96**	-1.75*	-1.72*			
	[0.87]	[0.94]	[0.93]			
Observations	3042	3042	3042	3042	3042	3042
R-squared	0.013	0.020	0.020	0.061	0.044	0.080

Note: Dependent variable is stock return measured as the log difference in the closing price from October 24 to 27, 2011. Bank exposure is defined as a country's bank foreign claims on peripheral Euro countries (PEC) over the country's total bank foreign claims. Trade exposure is defined as a country's exports of a certain sector to peripheral Euro countries (PEC) over the country's total exports in the same sector. External Financial Dependence is a sector's intrinsic dependence on external finance for capital expenditures as in Rajan and Zingales (1998). No. of countries: 16. Standard errors are clustered by US SIC 3-digit sector. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

European Union Sample

In Table 14, we repeat the analyses of Tables 10 to 13, but focus on firms from the EU, as these firms can be expected to be more affected by the events, both as they have closer financial and trade links with the affected countries and as support may disproportionally help their own banking systems.[58] We report specifications that include both country and sector fixed effects. Columns 1 to 4 report the results for the four respective events.

For the 1st event, the interaction between financial dependence and bank exposure is positive and significant. Particularly, the stock return of an European firm from the "Manufacturing of Medical and Surgical instruments" sector (financial dependence at the 75th percentile) in Germany (bank exposure at the 75th percentile among the Eurozone) is 0.66 percent larger than that of a firm from the "Pulp, Paper, and Paperboard Mills" sector (dependence at the 25th percentile) in Austria (bank exposure at the 25th percentile). The difference (0.66 percent) is large compared to the average increase in the Eurozone (3.4 percent).

Column 2 reports the results for the 2nd event. In general, it confirms the financial channel to be the main transmission channel of shocks from PEC to the rest of the EU: stock prices fall more for financially-constrained firms, especially in countries whose banking system is more exposed to PEC. In Column 3 and 4, we replicate the analysis for the 3rd and 4th events. Again the interaction term between the financial dependence index and the country's banking system exposure is positive and significant.

[58] The countries included are: Austria (29 firms), Belgium (43 firms), Denmark (43 firms), France (169 firms), Germany (236 firms), Netherlands (50 firms), Sweden (120 firms), and the UK (335 firms).

Table 14: Financial and Trade Channels, EU Sample

VARIABLES	First Event: March 10, 2010	Second Event: June 8-10, 2011	Third Event: July 19-21, 2011	Fourth Event: October 25-27, 2011
Financial Dependence*Bank Exposure to PEC	19.8***	-14.0***	28.5**	20.4***
	[6.15]	[5.15]	[11.2]	[6.41]
Firm Size (Total Assets)	0.58***	-0.15**	0.26***	0.38***
	[0.082]	[0.075]	[0.076]	[0.11]
Trade Exposure to PEC	-1.19	-1.21	0.59	-0.77
	[1.82]	[1.37]	[1.02]	[1.22]
Country fixed effects	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes
Observations	1,025	1,025	1,024	1024
R-squared	0.233	0.145	0.152	0.133

Note: Bank exposure is defined as a country's bank foreign claims on peripheral Euro countries (PEC) over the country's total bank foreign claims. Trade exposure is defined as a country's exports of a certain sector to peripheral Euro countries (PEC) over the country's total exports in the same sector. External Financial Dependence is a sector's intrinsic dependence on external finance for capital expenditures as in Rajan and Zingales (1998). No. of countries: 8. Standard errors are clustered by US SIC 3-digit sector. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

The trade channel appears to be less important in transmitting shocks from peripheral Euro countries to the real sectors of other EU economies, as it is never statistically significant. Together, results suggest that the financial channel very importantly transmits shocks from peripheral Euro countries to other EU countries and that policy measures were most effective in mitigating this channel.

Abnormal Returns

To further evaluate the robustness of results, we conduct analyses using abnormal returns. We construct abnormal returns employing the market model, which assumes a stable linear relation between market and individual stock returns, and define abnormal returns as:

$$\text{Abnormal Return}_{i,j,k} = \text{Stock Return}_{i,j,k} - \text{Alpha}_i - \text{Beta}_i * \text{Market Return}_k \quad (24)$$

where *i* stands for company, *j* for sector, and *k* for country. We construct each firm's *Beta* based on the correlation of weekly firm-level stock returns and local market returns. We then construct each firm's *Alpha* as the average of the firm's weekly average return minus the *Beta* multiplied by the average market return. When constructing abnormal returns, we use *Alpha* and *Beta* estimated for normal times (i.e., year 2006) to avoid any impact of the crisis on the *Beta* estimations. We also winsorize the generated abnormal returns at the 1 percent level.[59] The results of this exercise are shown in Table 15.

[59] As *Alpha* is constructed from weekly data, we use (1/5)**Alpha* in constructing abnormal stock returns for the first event (May 2010), and (3/5)**Alpha* for the second (June 2011), third (July 2011) and fourth event (October 2011).

Table 15: Abnormal Returns

	First Event: March 10, 2010		Second Event: June 8-10, 2011		Third Event: July 19-21, 2011		Fourth Event: October 25-27, 2011	
VARIABLES	General Sample	EU Sample	General Sample	EU Sample	General Sample	EU Sample	General Sample	EU Sample
Financial Dependence (Rajan and Zingales (1998))	-1.07***	-1.64*	0.84**	1.47**	-0.47	-3.00*	-1.46***	-1.48
	[0.40]	[0.94]	[0.42]	[0.66]	[0.47]	[1.60]	[0.54]	[1.27]
Financial Dependence*Bank Exposure to PEC	10.2**	12.3	-12.9***	-14.3***	7.34	22.8**	13.8***	12.5
	[4.44]	[7.61]	[4.45]	[4.89]	[4.75]	[10.8]	[3.88]	[8.63]
Firm Size (Total Assets)	0.050	0.0026	0.0011	-0.017	-0.025	-0.042	0.0092	-0.0058
	[0.040]	[0.071]	[0.044]	[0.065]	[0.041]	[0.060]	[0.059]	[0.081]
Trade Exposure to PEC	2.28***	-0.44	-3.98***	0.47	-2.21*	1.01	-0.67	1.55
	[0.85]	[1.17]	[0.75]	[1.14]	[1.27]	[0.94]	[1.09]	[1.04]
Euro Dummy	1.46**		-3.59***		-0.42		-1.27*	
	[0.57]		[0.43]		[0.78]		[0.67]	
Euro Dummy*Trade Exposure to PEC	-5.16**		6.79***		3.49		-0.29	
	[1.98]		[1.74]		[2.30]		[1.69]	
Bank Exposure to PEC	-10.8**	-4.97	19.9***	0.68	0.59	-0.58	8.43**	1.61
	[4.19]	[3.17]	[3.86]	[2.63]	[5.19]	[3.42]	[3.81]	[4.44]
Constant	0.14	0.73	-0.81	-0.17	0.063	0.035	-0.82	-0.82
	[0.49]	[0.98]	[0.61]	[0.93]	[0.63]	[0.93]	[0.77]	[1.29]
Observations	2,926	961	2,924	961	2,923	960	2923	960
R-squared	0.006	0.002	0.025	0.007	0.004	0.013	0.010	0.007

Note: Bank exposure is defined as a country's bank foreign claims on peripheral Euro countries (PEC) over the country's total bank foreign claims. Trade exposure is defined as a country's exports of a certain sector to peripheral Euro countries (PEC) over the country's total exports in the same sector. External Financial Dependence is a sector's intrinsic dependence on external finance for capital expenditures as in Rajan and Zingales (1998). No. countries for General Sample is 16 and for EU sample is 8. Standard errors are clustered by US SIC 3-digit sector. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

In Column 1 of Table 15, we report results for the first event (May 2010). We find the coefficient for the interaction between financial dependence and bank exposure to be positive and significant, confirming the importance of the financial channel in explaining the behavior of non-financial firms' stock prices. In addition, Column 1 shows the coefficient for the interaction term between trade exposure and Euro dummy to be negative and significant. Similar to Table 10, this suggests that capital markets expected the policy measures to improve economic prospects in the Eurozone, but Eurozone exporting firms benefited less, possibly due to the drop in their relative competitiveness with respect to non-Eurozone exporting firms caused by the concurrent Euro appreciation. In Column 2, we examine the EU sample and again find financial dependence interacted with bank exposure to have a positive coefficient, albeit insignificant.

In Column 3, we examine results for the second event (June 2011) using abnormal returns. Similar to the results of Table 11, we find the coefficient for the interaction between financial dependence and bank exposure to be negative and significant, suggesting that bank exposure is an important transmission mechanism of this shock to non-financial corporations around the world. In addition, we find that the coefficient of trade exposure is negative and significant, confirming the negative effect that uncertainty regarding the public positions of economic policymakers produced on stock capital markets' expectations about economic prospects in the Eurozone. However, the interaction term between the Euro dummy and trade exposure is positive and significant, suggesting Eurozone exporting firms to be less affected by this shock, possibly as their competitiveness improved due to the

concurrent depreciation of the Euro. In short, results confirm that both financial and trade channels are important mechanisms for transmitting shocks from peripheral Euro countries to the real sectors of other economies.

In Column 4, we reexamine the EU sample for the second event (June 2011). Again, financial dependence interacted with bank exposure is significantly negative. In Columns 5 and 6, we investigate the third event (July 2011). Again we confirm our previous results of Table 12. Finally, in Columns 7 and 8, we study the fourth event (Oct 2011). Again the earlier results in Table 13 carry through. Overall, results with abnormal returns strongly support our earlier findings for the general and EU sample.

Weighted Regression

Our sample of non-financial firms is unequally distributed across countries (see Table 8). To avoid our estimations to be biased due to overrepresentation of some countries, we next conduct estimations considering the number of firms in each country. Specifically, we weight by the inverse of the square root of the number of companies per country, which makes countries overrepresented have less influence in the estimations. Overall, the weighted regressions, shown in Table 16, confirm the importance of the financial channel, but show the trade channel to be less pronounced.

Table 16: Weighted Regressions

VARIABLES	First Event: March 10, 2010		Second Event: June 8-10, 2011		Third Event: July 19-21, 2011		Fourth Event: October 25-27, 2011	
	General Sample	EU Sample	General Sample	EU Sample	General Sample	EU Sample	General Sample	EU Sample
Financial Dependence*Bank Exposure to PEC	13.2***	17.9**	-8.81**	-5.24	16.7***	32.1***	15.8**	27.1***
	[4.66]	[7.59]	[4.42]	[6.68]	[5.38]	[9.31]	[6.11]	[6.78]
Firm Size (Total Assets)	0.47***	0.62***	-0.063	-0.11	0.28***	0.28***	0.33***	0.35***
	[0.072]	[0.10]	[0.064]	[0.092]	[0.069]	[0.11]	[0.098]	[0.13]
Trade Exposure to PEC	-0.11	-2.97	-2.87*	-1.14	0.28	0.68	-1.87	-0.3
	[1.93]	[2.51]	[1.71]	[1.65]	[1.74]	[1.35]	[1.60]	[1.47]
Euro Dummy*Trade Exposure to PEC	-3.87		3.27		-0.90		2.45	
	[3.19]		[3.89]		[2.77]		[3.65]	
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,045	1,025	3,043	1,025	3,042	1,024	3042	1024
R-squared	0.288	0.283	0.125	0.167	0.237	0.190	0.136	0.194

Note: Bank exposure is defined as a country's bank foreign claims on peripheral Euro countries (PEC) over the country's total bank foreign claims. Trade exposure is defined as a country's exports of a certain sector to peripheral Euro countries (PEC) over the country's total exports in the same sector. External Financial Dependence is a sector's intrinsic dependence on external finance for capital expenditures as in Rajan and Zingales (1998). No. countries for General Sample is 16 and for EU sample is 8. Standard errors are clustered by US SIC 3-digit sector. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 16, Column 1 shows the results of these weighted regressions for the first event (May 10, 2010). As in Table 10, we find that the coefficient of the interaction term between financial dependence and bank exposure to peripheral Euro countries is positive and significant. Moreover, we find the interaction term between the Euro dummy and trade exposure to be negative (although it loses significance when controlling for country and sector fixed effects). These results thus confirm our previous findings for this event. Column 2 focuses on the EU sample and further confirms the role of financial exposure.

Column 3 reports the results of these weighted regressions for the second event (June 8-10, 2011). We find similar results as in Table 11: the financial channel is negative and significant. This result suggests that this event produced larger stock price falls for companies that are more financially constrained in countries whose banking system is more exposed to peripheral Euro countries. Results carry through when we limit the analysis to the EU sample (Column 4).

Columns 5 and 6 report the results for the third event (July 19-21, 2011). Similar to the results in Table 12, we find the financial channel to be the key transmission mechanism of this event to countries around the world and inside the EU. The results carry over when we examine the fourth event (Oct 25-27, 2011) in Columns 7 and 8.

Additional Robustness Checks

So far we have focused on the financial and trade channels. One natural question is whether results carry through if we also control for a demand channel. We therefore classify sectors as largely producing durable, semi-durable or non-durable goods to proxy for their sensitivity to demand. The classification follows Braun and

Larrain (2005) and Raddatz (2006) and is based on the Bureau of Economic Analysis's Industry Accounts. Durable goods are assigned a 1, semi durable goods a 0.5 and nondurable goods a 0.[60] We then include this variable and its interaction with bank exposure to PEC to control for the demand channel.

Also, we focused so far on how bank exposure to PEC affects stock prices in home countries. Another channel by which firms could be affected is through the sovereign debt in the home country, e.g., as the creditor countries assume some (contingent) liabilities. We hence include the change of sovereign debt credit default swap (CDS) spread over the event periods as an additional control variable. Moreover, we include its interactions with financial dependence and with durable goods. The specifications are otherwise similar to Table 15 (abnormal stock return for both the general sample and the EU sample).

We find (Table 17) that the durable goods variable interacted with bank exposure to PEC is mostly insignificant, although it is significantly positive in the third event for both the general and EU samples. The interaction of sovereign CDS spread with financial dependence is not significant for any specification. The interaction of sovereign CDS spread with durable goods is also insignificant for most specifications. These findings suggest that the four events do not affect stock prices through effects on home countries' sovereign debt. Most importantly, bank exposure to PEC interacted with financial dependence, our key explanatory variable, remains significant. And in some cases, it is even larger and more significant compared to Table 15.

[60] The semi-durable industries are clothing, footwear, and printing. Regression results are similar is we classify these as either durable or non-durable.

Table 17: Abnormal stock return, additional robustness checks

	March 10, 2010		June 8-10, 2011		July 19-21, 2011		October 25-27, 2011	
	General	EU	General	EU	General	EU	General	EU
Financial Dependence (Rajan and Zingales (1998))	-0.54	-1.12	0.55	-0.89	-0.18	-2.46	-1.22*	-0.24
	[0.47]	[1.05]	[0.36]	[1.96]	[0.38]	[1.72]	[0.73]	[1.39]
Financial Dependence*Bank Exposure to PEC	12.9**	16.7**	-16.1**	-20.2***	5.04	24.0***	13.8***	14.2*
	[5.30]	[7.30]	[7.20]	[7.58]	[3.93]	[8.32]	[4.59]	[8.47]
Firm Size (Total Assets)	0.049	-0.017	0.0037	-0.011	-0.028	-0.032	0.0095	0.013
	[0.040]	[0.072]	[0.048]	[0.066]	[0.040]	[0.059]	[0.058]	[0.081]
Trade Exposure to PEC	2.13**	-0.028	-4.82***	-0.77	-2.01	1.04	-0.14	0.47
	[0.90]	[1.23]	[0.78]	[1.06]	[1.31]	[0.94]	[1.04]	[0.99]
Euro Dummy	1.58**		-4.26***		-0.41		-1.32	
	[0.65]		[0.46]		[0.74]		[1.05]	
Euro Dummy*Trade Exposure to PEC	-5.06**		7.12***		3.68		-0.96	
	[2.01]		[1.80]		[2.24]		[1.67]	
Bank Exposure to PEC	-11.9**	1.32	25.3***	-5.49	-4.82	-9.03	10.3*	8.09
	[5.03]	[4.69]	[6.72]	[5.32]	[6.06]	[6.65]	[5.95]	[8.59]
Change of Sovereign CDS Spreads	-0.02	0.051	-0.037	0.048	-0.042	-0.56	-0.068	0.054
	[0.028]	[0.043]	[0.048]	[0.14]	[0.51]	[14.0]	[0.042]	[0.065]
Durable goods	-0.23	0.29	-0.23	-2.64*	-0.69**	-1.98	1.93***	1.46
	[0.39]	[0.90]	[0.29]	[1.45]	[0.27]	[1.24]	[0.47]	[1.14]
Durable goods*Bank Exposure to PEC	-0.82	-9.34*	3.82	1.83	8.41**	11.6*	-2.7	-4.19
	[3.76]	[5.04]	[4.82]	[4.77]	[3.24]	[6.37]	[3.45]	[7.41]
Financial Dependence* Change of Sovereign CDS Spreads	0.055	0.064	0.056	0.23	0.41	9.87	0.015	0.099
	[0.042]	[0.049]	[0.079]	[0.18]	[0.51]	[19.0]	[0.063]	[0.073]
Durable goods dummy* Change of Sovereign CDS spreads	-0.004	-0.059	-0.036	0.15	0.045	-9.32	0.088**	0.042
	[0.029]	[0.046]	[0.050]	[0.13]	[0.41]	[16.2]	[0.043]	[0.072]
Constant	0.11	0.88	-0.54	0.55	0.52	0.85	-2.23**	-1
	[0.72]	[1.49]	[0.68]	[2.01]	[0.63]	[1.42]	[0.93]	[1.35]
Observations	2,926	961	2,924	961	2,923	960	2,923	960
R-squared	0.008	0.008	0.035	0.032	0.007	0.019	0.018	0.018

Exposure to Greece, Ireland and Portugal

So far, policies have largely focused on dealing with the (sovereign debt) problems of PEC.[61] To evaluate the robustness of our main results, we redo our analysis evaluating how bank and trade exposures to Greece, Ireland, and Portugal (GIP) only impacted the stock prices of non-financial firms. (We are interested in these three countries, as they actually have required assistance from the European Union and the International Monetary Fund). We include two variables to measure bank exposures to GIP: i) bank exposure to all sectors, defined as the ratio of creditor country banking sector's foreign claims on GIP to its Tier-1 capital; ii) the share of bank exposure to GIP's public sectors, defined as the ratio of the creditor country banking sector's foreign claims on GIP's public sectors to its overall foreign claims on GIP. The (confidential) data for banks' consolidated ultimate-base foreign claims on GIP's public sector come from the BIS and the data for Tier-1 capital come from Bankscope.[62] Due to availability, data used for these calculations are based on Q2, 2009.

In Table 18, we show the results for our regressions using bank exposure to GIP for firms in the general sample and the EU sample respectively.[63] Column 1 (general sample) shows that for the first event, May 2010, the interaction term between financial dependence and bank exposure to GIP is positive and significant, suggesting finance to be an important transmission mechanism. Moreover, the

[61] In particular, the four events analyzed mainly relate to actions (or lack thereof) by EU policymakers as regards the Greek debt crisis, but those can be considered as indicative of approaches to the problems of other Eurozone economies in distress, such as Ireland and Portugal, which also undergo EU(-IMF) programs.
[62] See Cerutti (2013) for more details.
[63] Due to data limitations, we drop five countries (Australia, Brazil, Chile, Mexico and Turkey), but for this test include Italy and Spain, which gives 13 countries.

interaction of financial dependence and the share of bank exposure to the GIP public sectors is positive and significant, suggesting that exposure to public sector is a key component behind the transmission. Note that we do not include bank overall exposure to GIP, bank exposure to GIP public sector or financial dependence as control variables, as they are already fully covered by our country and sector fixed effects. In Column 2, we examine the EU sample only. Reassuringly, financial dependence interacted with bank exposure to GIP's public sector is again positive and significant, and about twice as large as in Column 1.

Columns 3 and 4 report the results for the second event, June 2011. In Column 3 (general sample), we find that the interaction term between financial dependence and bank exposure to GIP is negative and significant. Moreover, the interaction of financial dependence and the share of bank exposure to GIP public sector is also significantly negative, i.e., firms from countries with larger bank exposure to GIP's public sector display larger drops in prices. In Column 4, we focus on EU firms, and the interaction term between financial dependence and bank exposure to GIP's public sector becomes even more pronounced.

Columns 5 and 6 report the results for the third event, July 2011. For both general and EU samples, we find the interaction terms between financial dependence and bank exposure to GIP (All Sectors) to be positive and significant. The interaction terms between financial dependence and bank exposure to GIP's public sector are still positive but are now insignificant. One potential explanation for the weaker effect in late 2011 is that while markets' concerns focused initially on the public debts of GIP,

these concerns extended later on to these countries' financial and private sectors, reducing the relative sensitiveness to GIP's public debt.

When we examine the fourth event, October 2011 in Columns 7 (general sample) and 8 (EU sample), we find results comparable to those for the third event.

Table 18: Bank exposure to GIP's Public Sector

	First Event:		Second Event:		Third Event:		Fourth Event:	
VARIABLES	General Sample	EU Sample	General Sample	EU Sample	General Sample	EU Sample	General Sample	EU Sample
Financial Dependence*Bank Exposure to GIP (All Sectors)	1.61**	1.88	-1.80**	-1.69	2.12**	3.15***	1.73*	2.24
	[0.75]	[1.18]	[0.90]	[1.26]	[0.98]	[1.17]	[0.97]	[1.77]
Financial Dependence*Bank Exposure to GIP's public sector	4.82**	8.67***	-5.48***	-7.07**	6.41	8.04	0.73	8.04**
	[2.08]	[3.23]	[1.95]	[3.02]	[4.41]	[6.94]	[3.39]	[3.51]
Firm Size (Total Assets)	0.41***	0.59***	-0.095**	-0.15**	0.15***	0.26***	0.28***	0.38***
	[0.035]	[0.074]	[0.048]	[0.074]	[0.048]	[0.070]	[0.077]	[0.11]
Trade Exposure to GIP	0.63	2.20	-2.71	-1.56	0.55	0.68	-0.037	-0.12
	[2.58]	[2.38]	[1.80]	[2.11]	[1.25]	[1.47]	[1.60]	[1.78]
Euro Dummy*Trade Exposure to GIP	-4.65		4.57		-4.43		5.15	
	[4.53]		[3.79]		[4.47]		[6.55]	
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,693	1,135	2,691	1,135	2,690	1,134	2,690	1,134
R-squared	0.214	0.235	0.109	0.138	0.119	0.151	0.082	0.121

Note: GIP countries include Greece, Ireland, and Portugal. Bank exposure to GIP (All sectors) is the ratio of total banking sector's foreign claims on GIP (public, financial, and non-financial sectors) over the Tier-1 capital of the banking sector. Bank Exposure to GIP's Sovereign Debt is the ratio of banking sector's foreign claims on GIP's public sector over total banking sector's foreign claims on GIP. Trade exposure is defined as a country's exports of a certain sector to peripheral Euro countries (PEC) over the country's total exports in the same sector. External Financial Dependence is a sector's intrinsic dependence on external finance for capital expenditures as in Rajan and Zingales (1998). No. countries for general sample 13. No. countries for EU sample is 10. Standard errors are clustered by US SIC 3-digit sector. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Conclusions

In this chapter, we study how the (ongoing) Euro crisis affected global corporate valuation, particularly for EU firms, and how policy interventions may have mitigated (or not) spillovers. We analyze two channels through which the crisis may have affected firms: a financial channel and a trade channel. To investigate the financial channel, we ask the question: if we classify manufacturing firms into different baskets based on their ex-ante sensitivity to shocks to external financing (in terms of investment needs), does this classification help us to explain the ex-post stock performance of these firms? Similarly, if we classify these firms based on their ex-ante exposure to trade, do firms in different groups perform differently during the crisis? To investigate the role of cross-border linkages, we include country-level financial linkages with peripheral Eurozone countries and Eurozone dummies, and interactions with our proxies for the financial and trade channels, into our regression framework.

We conduct our tests by examining stock price responses to four key events during 2010-2011 for 3045 non-financial firms from 16 countries. We find that the crisis had a larger impact on firms with greater ex-ante financial constraints, and particularly so in creditor countries more financially exposed to peripheral Euro countries through bank claims. Trade linkages with periphery Eurozone countries also played a role, but more minor, by affecting export demand, with differential effects across exporting firms in Euro vs. non-Euro areas, possibly because of the effects of Euro exchange rate changes vis-à-vis third (non-Euro) countries.

On balance, we conclude that policy makers did take into account potential effects on both the soundness of their local banks as well trade with peripheral Euro countries when they planned (or reverted course on) various support measures. From the perspective of saving the Euro, it appears most important, at least in the eyes of financial markets, to address spillovers through cross-border banking exposures.

It is important to point out, though, that this study is not meant to be a comprehensive assessment of the welfare effects of the Euro as a single currency or of the types of support measures undertaken or being considered. To do that, we need to evaluate not only the effects of the support measures announced on firms, but also the costs of the measures, such as their effects on households and others through, say, higher tax burdens. Furthermore, there can be differences between short and long-run benefits and costs of the Euro and support measures used, which would require analyses of both tranquil and crisis times to make a full assessment. We leave these questions as fruitful topics for future research.

Glossary

BIS	Bank of International Settlements
CDS	Credit Default Swap
CIPS	Coordinated Portfolio Investment Survey (IMF's database)
ECB	European Central Bank
EFSF	European Financial Stability Fund
EMU	European Monetary Union
EU	European Union
GIP	Greece, Ireland, and Portugal
IFS	International Financial Statistics (IMF's database)
IMF	International Monetary Fund
PEC	Peripheral Euro Countries (Ireland, Italy, Greece, Portugal, and Spain)
SGP	Stability and Growth Pact
UN	United Nations
WEO	World Economic Outlook (IMF's database)

Bibliography

Akitoby, Bernardin and Thomas Stratmann. 2006. Fiscal Policy and Financial Markets. IMF Working Papers 06/16, International Monetary Fund. Washington DC.

Alessandria, George, Joseph Kaboski, and Virgiliu Midrigan. 2010. The Great Trade Collapse of 2008–09: An Inventory Adjustment? *IMF Economic Review* 58: 254-94.

Alexopoulou, Ioana, Magnus Andersson and Oana Maria Georgescu. 2009. An empirical study on the decoupling movements between corporate bond and CDS spreads. ECB Working Paper 1085. European Central Bank. Frankfurt, Germany.

Ang, Andrew and Francis A. Longstaff. 2011. Systemic Sovereign Credit Risk: Lessons from the U.S. and Europe. NBER Working Paper No. 16982.

Arteta, Carlos, and Galina Hale. 2008. Sovereign Debt Crises and Credit to the Private Sector. *Journal of International Economics* 74 (1): 53-69.

Attinasi, Maria-Grazia, Cristina Checherita, and Christiane Nickel. 2009. What Explains the Surge in Euro Area Sovereign Spreads during the financial crisis 2007-09? ECB Working Paper 1131. European Central Bank. Frankfurt, Germany.

Baldacci, Emanuele, Sanjeev Gupta and Amine Mati. 2008. Is it (Still) Mostly Fiscal? Determinants of Sovereign Spreads in Emerging Markets. IMF Working Papers 08/259, International Monetary Fund. Washington DC.

Bayoumi, Tamim, Morris Goldstein, and Geoffrey Woglom. 1995. Do credit markets discipline sovereign borrowers? Evidence from the U.S. States. *Journal of Money, Credit and Banking* 27 (4): 1046-59.

Behrens, Kristian, Gregory Corcos, and Giodarno Mion. 2010. Trade Crisis? What Trade Crisis? National Bank of Belgium Working Paper No. 195.

Bems, Rudolfs, Robert C Johnson, and Kei-Mu Yi. 2010. Demand Spillovers and the Collapse of Trade in the Global Recession. *IMF Economic Review* 58: 295-326.

Bekaert, Geert, Michael Ehrmann, Marcel Fratzscher, and Arnaud Mehl. 2011. Global Crisis and Equity Market Contagion. NBER Working Paper No. 17121.

Bernal, Oscar, Kim Oosterlink, and Ariane Szafarz. 2010. Observing bailout expectations during a total eclipse of the sun. *Journal of International Money and Finance* 29: 1193-05.

Bernoth, Kerstin, Jurgen von Hagen and Ludger Schuknecht. 2012. Sovereign risk premiums in the European government bond market. *Journal of International Money and Finance*, doi:10.1016/j.jimonfin.2011.12.006.

Bolton, Patrick and Olivier Jeanne. 2010. Sovereign Default Risk in Financially Integrated Economies. Paper presented at the 11th Jacques Polak Annual Research Conference. International Monetary Fund.

Borensztein, Eduardo, Kevin Cowan, and Patricio Valenzuela. 2007. Sovereign Ceiling 'Lite'? The Impact of Sovereign Ratings on Corporate Ratings in Emerging Market Economies. IMF Working Papers 07/75, International Monetary Fund. Washington DC.

Braun, Matia, and Borja Larrain. 2005. Finance and the business cycle: international, inter-industry evidence. *Journal of Finance* 60: 1097 – 28.

Bris, Arturo, Yrjo Koskinen, and Mattias Nilsson. 2009. The Euro and Corporate Valuations. *Review of Financial Studies* 22 (8): 3171-209.

Cerutti, Eugenio. 2013."Banks' Foreign Credit Exposures and Borrowers' Rollover Risks: Measurement, Evolution and Determinants. IMF Working Paper 13/9, International Monetary Fund. Washington DC.

Cetorelli, Nicola, and Linda S. Goldberg. 2012. Banking Globalization and Monetary Transmission. *Journal of Finance* 67(5): 1811-43.

Chinn, Menzie and Hiro Ito. 2006. What matters for financial development? Capital controls, institutions, and interactions. *Journal of Development Economics* 81 (1): 163-92.

Claessens, Stijn, Giovanni Dell'Ariccia, Deniz Igan, and Luc Laeven. 2010. Lessons and Policy Implications from the Global Financial Crisis. *Economic Policy* 62: 269-93.

Claessens, Stijn, Hui Tong and Igor Zuccardi. 2013. Saving the Euro: Mitigating Financial or Trade Spillovers?. Mimeo. International Monetary Fund and University of Maryland.

Claessens, Stijn, Hui Tong, Shang-Jin Wei. 2012. From the Financial Crisis to the Real Economy: Using Firm-level Data to Identify Transmission Channels. *Journal of International Economics* 88: 375–87.

Codogno, Lorenzo, Carlo Favero, and Alessandro Missale. 2003. Yield spreads on EMU government bonds. *Economic Policy* 18 (37): 503-32.

Corsetti, Giancarlo, Bernardo Guimaraes and Nouriel Roubini. 2006. International lending of last resort and moral hazard: A model of IMF's catalytic finance. *Journal of Monetary Economics* 53: 441-71.

Dell'Ariccia, Giovanni, Isabel Schnabel, and Jeromin Zettelmeyer. 2002. Moral Hazard and International Crisis Lending: A Test. IMF Working Paper 02/181. International Monetary Fund. Washington DC.

Dell'Ariccia, Giovanni, Isabel Schnabel, and Jeromin Zettelmeyer. 2006. How Do Official Bailouts Affect the Risk of Investing in Emerging Markets? *Journal of Money, Credit, and Banking* 38 (7): 1689-14.

Diamond, Douglas W. and Philip H. Dybvig. 1983. Bank Runs, Deposit Insurance, and Liquidity. *Journal of Political Economy* 91(3): 401-19.

Dove, John. 2012. Credible Commitments and Constitutional Constraints: State Debt Repudiation and Default in Nineteenth Century America. *Constitutional Political Economy* 23(1): 66-93.

Duchin, Ran, Oguzhan Ozbas, and Berk Sensoy. 2010. Costly external finance, corporate investment, and the subprime mortgage credit crisis. *Journal of Financial Economics* 97: 418-35.

Eichengreen, B. and Ashoka Mody. 1998. What Explains Changing Spreads on Emerging Market Debt: Fundamentals or Market Sentiment. NBER Working Paper No. 6408.

Eichengreen, Barry, Ashoka Mody, Milan Nedeljkovic, and Lucio Sarno. 2009. How the Subprime Crisis went Global: Evidence from Bank Credit Default Swap Spreads. NBER Working Paper No. 14904.

Evrensel, Ayse and Ali Kutan. 2004. Testing Creditor Moral Hazard in Sovereign Bond Markets: A Unified Theoretical Approach and Empirical Evidence. Mimeo. Portland State University.

Evrensel, Ayse and Ali Kutan. 2006. Creditor moral hazard in stock markets: Empirical evidence from Indonesia and Korea. *Journal of International Money and Finance* 25: 640-54.

Ferri, Giovanni, Li-Gang Liu, and Giovanni Majnoni. 2001. The Role of Rating Agency Assessments in Less Developed Countries: Impact of the Proposed Basel Guidelines. *Journal of Banking and Finance* 25 (1): 115-48.

Forbes, Kristin. 2004. Asian Flu and Russian Virus: The International Transmission of Crises in Firm-Level Data. *Journal of International Economics* 63 (1): 59-92.

Forbes, Kristin. 2012. “The Big “C”: Identifying and Mitigating Contagion. MIT-Sloan School of Management working paper. Federal Reserve Bank of Kansas. Proceedings of Jackson Hole Conference 2012.

Frankel, Jeffrey, and Andrew Rose. 2002. An Estimate of the Effect of Currency Unions on Trade and Growth. *Quarterly Journal of Economics* 117 (2): 437-66.

Fratzscher, Marcel. 2002. Financial market integration in Europe: on the effects of EMU on stock markets. *International Journal of Finance and Economics* 7: 165-93.

Goldstein, Morris and Geoffrey Woglom. 1992. Market based fiscal discipline in Monetary unions: Evidence from the US Municipal Bond Market. In M. Canzoneri, V. Grilli and P. Masson (eds.), *Establishing a Central Bank*. Cambridge University Press, 1992.

Gomez-Puig, Marta. 2006. Size matters for liquidity: Evidence from EMU sovereign yield spreads. *Economics Letters* 90: 156-162.

Gonzalez-Rozada, Martin and Eduardo Levy Yeyati. 2005. Global Factors and Emerging Market Spreads. Business School Working Papers, Universidad Torcuato Di Tella.

Hau, Harald, and Sandy Lai. 2012. The Role of Equity Funds in the Financial Crisis Propagation. Swiss Finance Institute Research Paper No. 11-35.

Henning, C. Randall and Martin Kessler. 2012. Fiscal Federalism: US History for Architects of Europe's Fiscal Union. Working Paper WP 12-1. Peterson Institute for International Economics. Washington DC, January.

Heppke-Falk, Kirsten and Guntram Wolf. 2008. Moral Hazard and Bail-out in Fiscal Federations. Evidence from the German Lander. *KYKLOS* 61 (3): 425-46.

Horvath, Balint and Harry Huizinga. 2011. Does the European Financial Stability Facility bail out sovereigns or banks? An event study. CEPR Discussion Paper 8661.

Jeanne, Olivier and Jeromin Zettelmeyer. 2001. International Bailouts, Moral Hazard and Conditionality. CESifo Working Paper 563. Center for Economic Studies & Ifo Institute for Economic Research. Munich, Germany.

Kalemli Ozcan, Sebnem, Elias Papaioannou, and Jose Luis Peydro. 2010. What Lies Beneath the Euro's Effect on Financial Integration? Currency Risk, Legal Harmonization, or Trade? *Journal of International Economics* 81: 75-88.

Kamin, S. and K von Kleist. 1999. The evolution and determinants of emerging market credit spreads in the 1990s. BIS Working Paper 68. Bank of International Settlements, Switzerland.

Kaminsky, Graciela, and Carmen Reinhart. 2003. The Center and the Periphery: The Globalization of Financial Turmoil. NBER Working Paper No. 9479.

Kaminsky, Graciela, and S. Schmukler. 2003. Short-run pain, long-run gain: the effects of financial liberalization. NBER Working Paper No. 9787.

Lane, Philip. 2006. Global bond portfolios and EMU. *International Journal of Central Banking* 2(2): 1-24.

Lane, Philip and Gian Maria Milesi-Ferretti. 2007. The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970-2004. *Journal of International Economics* 73: 223-50.

Lane, Timothy and Steven Phillips. 2000. Moral Hazard: Does IMF financing encourage imprudence by borrowers and lenders? *Economic Issues* 28. International Monetary Fund. Washington DC.

Laporte, Audrey and Frank Windmeijer. 2005. Estimation of panel data models with binary indicators when treatment effects are not constant over time. *Economics Letters* 88: 389-96.

Larch, Martin, Paul van den Noord, and Lars Jonung. 2010. The Stability and Growth Pact: Lessons from the Great Recession. European Economy Series. Economic Papers 429. European Commission, Brussels, Belgium. December.

Lee, Jong-Wha and Kwanho Shin. 2008. IMF bailouts and moral hazard. *Journal of International Money and Finance* 27: 816-30.

Levchenko, Andrei A, Logan T Lewis, and Linda L Tesar. 2010. The Collapse of International Trade During the 2008–09 Crisis: In Search of the Smoking Gun. *IMF Economic Review* 58: 214-53.

Manganelli, Simone, and Guido Wolswijk. 2009. What Drives Spreads in the Euro Area Government Bond Market? *Economic Policy* 24 (58): 191-40.

McGuire, Patrick and Martijn Schrijvers. 2003. Common factors in emerging market spreads. BIS Quarterly Review, Bank for International Settlements, December.

Milesi-Ferretti, Gian Maria, and Cédric Tille. 2011. The Great Retrenchment: International Capital Flows During the Global Financial Crisis. *Economic Policy* 26 (66): 289-346.

Mody, Ashoka. 2009. From Bear Stearns to Anglo Irish: How Eurozone Sovereign Spreads Related to Financial Sector Vulnerability. IMF Working Papers 09/108. International Monetary Fund. Washington DC.

Noy, Ilan. 2008. Sovereign default risk, the IMF and creditor moral hazard. *International Financial Markets, Institutions & Money* 18: 64-78.

Popov, Alexander, and Neeltje Van Horen. 2012. The Impact of Sovereign Debt Exposure on Bank Lending: Evidence From the European Debt Crisis. Mimeo. ECB and University of Amsterdam.

Raddatz, Claudio. 2006. Liquidity needs and vulnerability to financial underdevelopment. *Journal of Financial Economics* 80: 677 – 22.

Reinhart, Carmen, Kenneth Rogoff, and Miguel Savastano. 2003. Debt Intolerance. *Brookings Papers on Economic Activity* 34: 1-74. Economic Studies Program. The Brookings Institution.

Reinhart, Carmen and Kenneth Rogoff. 2004. The Modern History of Exchange Rate Arrangements: A Reinterpretation. *Quarterly Journal of Economics* 119 (1): 1-48.

Remolona, Eli, Michela Scatigna, and Eliza Wu. 2007. Interpreting sovereign spreads. *BIS Quarterly Review*. Bank for International Settlements, March.

Remolona, Eli, Michela Scatigna, and Eliza Wu. 2006. The pricing of sovereign risk in emerging markets: fundamentals and risk aversion. Mimeo. Bank for International Settlements, Switzerland.

Rose, Andrew K., and Mark M. Spiegel. 2010."Causes and Consequences of the 2008 Crisis: International Linkages and American Exposure. *Pacific Economic Review* 15 (3): 340-63.

Rose, Andrew K., and Mark M. Spiegel. 2012. Cross-Country Causes and Consequences of the 2008 Crisis: Early Warning. *Japan and the World Economy* 24 (1): 1–16.

Roubini, Nouriel and Brad Setser. 2004. *Bailouts or Bail-ins? Responding to Financial Crises in Emerging Economies*. Institute for International Economics. Washington DC.

Sachs, Jeffrey. 1984. Theoretical Issues in International Borrowing. Princeton Studies in International Finance 54. Princeton: Princeton University Press.

Schulz, Alexander and Guntram Wolff. 2008. The German sub-national government bond market: structure, determinants of yield spreads and Berlin's forgone bail-out. Mimeo. November.

Sgherri, Silvia and Edda Zoli. 2009. Euro Area Sovereign Risk During the Crisis. IMF Working Paper 09/222. International Monetary Fund. Washington DC.

Tong, Hui, and Shang-Jin Wei. 2011. The Composition Matters: Capital Inflows and Liquidity Crunch During a Global Economic Crisis. *Review of Financial Studies* 24 (6): 2023-52.

Wooldridge, Jeffrey. 2002. Econometric Analysis of Cross Section and Panel Data. MIT press. Cambridge, MA.

Wyplosz, Charles. 2012. Europe's Quest for Fiscal Discipline. Mimeo. Graduate Institute of International and Development Studies. Geneva. Switzerland.