Pulled down by the state: the effect of sovereign shocks on banks' health in the European sovereign crisis*

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Abstract

The European crisis in the late 2000s has revealed a vicious circle between the financial health of governments and banks, reflecting banks' holdings of sovereign debt and government commitments to financial bailouts. Understanding the linkages between sovereign and banking risk is a central element of an effective macroprudential policy framework. However, identifying the direction of causality between the two is a major challenge. I tackle this problem by compiling a timeline of news between 2004 and 2013 and separating them into news that primarily affect banks, primarily affect governments, or impact both. The shocks identified by this narrative approach are used as instruments in a TSLS regression that estimates the effect of sovereign Credit Default Swaps (CDS) spreads on banking CDS spreads. The analysis relies on a panel of daily CDS banking and sovereign spreads for ten Euro Area countries between 2004 and 2013. I find that the impact is heterogeneous across space and time. In particular, shocks to sovereign CDS spreads in Periphery countries significantly increase the banking CDS spreads in these countries during the financial crisis. No such link is found for the Core countries. Finally, I show that policy decisions such as the intervention by Mario Draghi in July 2012 affect the transmission, and that the subsequent introduction of Outright Monetary Transactions by the European Central Bank broke the sovereign-bank nexus.

Keywords: Euro Zone Crisis, Feedback Loop, Panel Data, Instrumental Variables estimation, Financial Crises, Banks

JEL codes: C23, C26, E44, F42, G01, G21

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1 Introduction

The Eurozone sovereign crisis that started in the late 2000s brought the interconnection between sovereigns and banks into sharp focus. The sovereign crisis in periphery countries (in particular Greece, Portugal, and Italy) has been the main driver of the banking crisis. The two-ways linkages between sovereigns and banks have led to a "diabolic loop" where financial stress of sovereigns led to financial stress of banks, and vice versa, thereby amplifying the risk of default in the aftermath of shocks (Acharya *et al.* (2015)). Given banks' large holdings of sovereign debt, the fall in sovereign bond prices fueled an increase of banking risk stemming from capital losses and a reduced credibility of governments' bailout guarantees (Altavilla *et al.* (2016)). Financial stress in banks raised, in turn, the default risk of governments that could be compelled to bail out banks. This feedback loop amplified the Eurozone sovereign crisis until it peaked in 2011, when the interest differentials between sovereign bonds of the crisis countries and the German Bund widened and became more volatile. Only the announcement of a buyer of last resort program, the Outright Monetary Transactions program (OMT), by the European Central Bank (ECB) in July 2012 effectively broke the loop and led to a decrease in the differentials by restoring the maneuvering space of governments and banks.

A major challenge for researchers analyzing the sovereign-bank diabolic loop is to determine the direction of causality. Addressing this challenge is important as the appropriate policy measures depend on whether, to which extent, and in which countries the sovereigns affect banks and vice versa (Altavilla *et al.* (2016), Acharya *et al.* (2015), De Marco (2016)).

In this paper, I assess the impact of sovereign risk on banking risk through an identification approach that involves two steps. I first compile a novel timeline of daily news that represent shocks to the sovereigns' liabilities or the banks' liabilities. I base my work on the methodology of Brutti & Saure (2015) who use news to identify shocks specific to Greece during the Greek crisis. Based on this original database of news, I follow the narrative strategy introduced by Romer & Romer (1989) to separate news into shocks specific to banks, shocks specific to governments, and shocks common to both. In the second step, I use a Two-Stage Least Squares (TSLS) model to estimate the effect of sovereign CDS spreads on banking CDS spreads. CDS spreads on government securities are widely used in the literature as a proxy for sovereign risk (Pan & Singleton (2008)). I take advantage of the shocks specific to governments and build three instrumental variables. Then I use them to purge the endogenous variation from the CDS sovereign spreads in the first stage of the TSLS.

The model is estimated on a panel of daily data for ten Euro Area countries from 2004 to 2013. Following Battistini *et al.* (2014), I divide the European countries into Core and Periphery countries. I also distinguish different subperiods before, during, and after the financial crisis. I use two different time intervals to define the crisis period: from 2007 to 2012 (the period in which the

exposure of banks to domestic sovereign debt started to increase in the Euro Area, Battistini *et al.* (2014)) and from 2009 to 2012 (the period of the sovereign debt crisis, after the Greek elections in October 2009).

The analysis shows that the news shocks from the timeline are good instruments for the sovereign CDS spreads. Additionally, there is a strong impact of sovereign CDS spreads on the banks' CDS spreads. In particular, I find that in Periphery countries during the restricted sovereign crisis period (2009-2012) the effect of an increase of 100 basis points in the sovereign CDS spread causes an increase of more than 21 basis points in the banks' CDS spread, controlling for financial market volatility and countries' debt burden. These results are in line with the previous literature. For instance, Altavilla *et al.* (2016) find that a 100 basis points increase in the domestic sovereign risk of Periphery countries causes an increase of 31.5 basis points in the CDS premium of a bank with a median exposure to sovereigns. My analysis also shows that while the link from sovereign to banks CDS spread is found in Periphery countries during the crisis, it is absent before and after the crisis. In addition, I do not find evidence for a link in Core countries, both in the crisis period and in normal times. This is in line with Buch *et al.* (2013) who do not find significant sovereign to banks spillover effects in Germany during the crisis.

The analysis highlights the importance of carefully identifying the causality between sovereign and bank CDS spreads. Estimates based on ordinary least squares indicate that there is an effect from sovereign risk to banks even after the ECB policy interventions, and this effect is observed in Core countries as well. These results change substantially when applying my narrative identification strategy in a TSLS framework. In particular, I find no effect after 2012 once reverse causality bias is eliminated.

The results of my paper emphasize that a policy institution in charge of banking and financial stability has to closely follow shocks on sovereign risk, since more than one fifth of the effect of the sovereign shock is transmitted to the financial sector in crisis periods. If the effect is strong enough, it can effectively influence the pass-through of the sovereign shock to the real economy through banks. During the crisis, individual interventions by single governments in the Eurozone were not useful in breaking the linkage between sovereign risk and banking risk. This suggests that more policy coordination among Euro area member states, for instance through the completion of the Banking Union, is the right path to enhance macrofinancial stability and loosen the banking-sovereign nexus.

The rest of the paper is structured as follows. Section 2 presents the relevant literature and positions the paper in the current debate. Section 3 describes the data. Section 4 explains my identification strategy and the empirical framework. The results are presented in Section 5; section 6 discusses their policy implications. Section 7 concludes.

2 Related literature

The contribution of this empirical paper is based on an identification strategy that uses the narrative approach with panel data. I compile an original list of news selected from different sources and I use them as instruments in a TSLS model. To my knowledge, this is the first work that applies this approach to the analysis of the European crisis.

The idea of using news as instruments for shocks of interest is not new. Romer & Romer (1989) introduced the narrative approach with an analysis of postwar US monetary policy. They use the historical record to isolate large monetary shocks not caused by any change in fundamentals to test the real effects of monetary policy. The narrative approach applied to a timeline of daily news has been used also by Brutti & Saure (2015) to identify financial shocks, that originated in Greece during the European sovereign crisis, and then spilled over to other Euro Area countries. Both these papers use a VAR model to analyze the propagation of the identified shocks.[1] Erce (2015) analyzes sovereign CDS drivers using a Generalized Least Squares panel data approach. He uses CDS spreads in levels to model the vicious circle between bank and sovereign risk in the Euro Area, showing that sovereign risk has a stronger feedback effect on the banking sector, than vice versa. I use a similar panel approach, since this methodology gives more room to explain potential heterogeneity than a VAR (Erce (2015)). Bocola (2016) studies how news of a future sovereign default hampers financial intermediation in a business cycle model where banks are exposed to domestic sovereign debt. Durdu *et al.* (2013) suggest that unexpected news shocks, that determine shifts in expectations regarding the future path of public sector expenditures and output growth, have influenced sovereign bond spreads during the crisis. I take inspiration for these two studies to justify the use of three instruments based on unexpected news shocks to estimate sovereign risk. Zoli (2013) uses good and bad news dummies to estimate the change in the 10-year Italian government bond spreads over the German Bund. I use a similar approach but I have a longer timeline of news (Zoli (2013) uses the period 2008-2012, while my data go from 2004 to 2013) and I do not distinguish between good and bad shocks. Moreover, I cover a larger group of countries (ten Eurozone countries) while Zoli (2013) focuses on Italy.

Although this paper concentrates on the transmission of the sovereign risk to the banks, the feedback loop has a central role in my analysis since it is the source of the reverse causality that would bias a standard OLS estimation. Acharya *et al.* (2014) is one of the first papers to model the feedback loop between banks and sovereigns. It finds empirical evidence for the direct feedback between financial and sovereign risk. They assume a closed-economy model and use data from banking CDS spreads and sovereign CDS spreads over 2007-2010 to show that the announcements of bailouts were associated with a widening of sovereign CDS spreads and narrowing of banking

[1] Others used VARs to explore spillover effects during the European crisis: Diebold & Yilmaz (2009), Favero & Giavazzi (2012),Favero (2013), Heinz & Sun (2014). King (2009) uses news about bank rescues between 2008 and 2009 for an event study analysis on the impact of government bailouts of banks on the financial markets.

CDS spreads, followed by a co-movement between banking and sovereign CDS spreads. Acharya & Steffen (2015) explain the dynamics of banking risk in the Euro Area between 2010 and 2013 as a carry trade between peripheral European countries and Germany. Another early work on the sovereign-bank nexus is the empirical analysis by Mody & Sandri (2012). They use a panel analysis on weekly data to study the development of the financial crisis in Europe into a sovereign crisis. Their paper is in contrast with Reinhart and Rogoff,who assess that fiscal crisis follows banking crises (Reinhart & Rogoff (2011), Reinhart & Rogoff (2009)). Mody & Sandri (2012) shows that, when a sovereign crisis follows a banking crisis, the perpetuation of a twin crisis is due also to the mutual reinforcement of sovereign and banking risk. It is then incorrect to divide the phase of the banking crisis from the sovereign one.

To prove their point Mody & Sandri (2012) build a first timeline of the European crisis. They divide the crisis in different stages marked by important events: the subprime crisis in July 2007 started the global financial crisis, the Bear Stearns rescue in March 2008 marked the beginning of a separate banking-sovereign crisis in Europe, the Anglo Irish Nationalization in January 2009 and finally the first Greek bailout in May 2010 worsen the feedback loop between banks and sovereigns. Their focus is on the passage from the subprime crisis to the first phase of the European crisis, while the sovereign crisis that developed after 2009 is not studied in detail. In contrast, my paper focus on the effects of sovereign shocks on banking risk. In this sense I continue the study of the crisis, going more in detail after 2009 and looking also at the period after the Dragi speech in July 2012. I choose the Draghi speech as a significant event to end the crisis because the OMT announcement was effective in decreasing the bond spreads in the Periphery countries. Altavilla *et al.* (2016) show that the announcement decreased Italian and Spanish 2-year sovereign bond yields by about 2 percentage points while leaving unchanged German government bonds of the same maturity.

My paper contributes to the literature that analyze the impact of a change in sovereign risk on banking risk. Bocola (2016) builds a theoretical framework for describing the macroeconomic implications of this mechanism. He models sovereign credit risk in a business cycle model where banks are exposed to domestic government debt. News about a future sovereign debt default prevent the optimal functioning of financial intermediation. This happens because sovereign risk increases the funding costs for banks and generates a precautionary motive for banks to deleverage. Whenever assets need to be rescheduled or written off, domestic banks are usually the first to be hit by the negative shock. BIS (2011) recognizes four main channels through which a deterioration in the creditworthiness of a sovereign can have an impact on the banking system: the negative impact of sovereign exposures on banks' assets, the decrease of the value of banks' collateral, the negative effects on the country's economy in case of a sovereign downgrade and the reduction in government guarantees for banks. In the extreme case of a sovereign restructuring, their adverse impact on domestic economies is given to a large extent to the disruption of domestic financial

system, as assessed by IMF (2002). This paper presents an overview of the similarities in the effects of sovereign restructuring on financial sector distresses in the debt restructurings of four emerging economies (Russia, Ukraine, Ecuador and Pakistan).

Bank's sovereign debt home bias has a central role in the transmission of domestic sovereign risk to domestic banks. Acharya *et al.* (2014) and Battistini *et al.* (2014) document how the high exposure of their sample banks to their own sovereign, correlates positively with increase in yields. Home bias in the Euro Area grew overtime during the crisis, with potential negative effects for debt sustainability: Asonuma *et al.* (2015) find that home bias could give countries more fiscal breathing space as an immediate effect, but it delays fiscal consolidation, worsening the sovereign debt sustainability until a breaking point. For this reason, this paper focuses on the sovereign-bank nexus in a closed economy setting.

3 Data

I build a panel dataset for sovereign and banking risk using data for ten countries of the Euro Area. The proxy for sovereign risk is the sovereign CDS spread for each country. The proxy for banking risk is the aggregate value of the CDS spreads of the main banks of each country weighted for their assets. I choose the CDS premium mid[2] and I use CDS with MM restructuring clause[3] , when available, and CDS denominated in Euro with a 5-year maturity, which is considered the most liquid (Ballester *et al.* (2013)). All CDS data are from Datastream. Tables 1 and 2 list all my sources.

I use daily data that go from mid-February 2004 to the third week of October 2013. This period of study allows me to cover various phases of the European crisis. 2004-2007 is the "pre-crisis period". The crisis period, from 2007 to 2012, consists of various events. In August 2007 the subprime crisis spread from the United States to other countries. After the two main European crisis come: the Irish crisis (in 2009) and the Greek one (in 2010). In 2011 there is the worsening in the sovereign crisis and the contagion to Portugal, Italy and France. This series of interconnected crises was accompanied by several European resolutions until the "Whatever it takes" speech by Mario Draghi in July 2012.

[2]The mid price for a CDS spread is the mid-rate spread between the entity and the relevant benchmark curve expressed in basis points.

[3]The choice of the restructuring type (definition of what constitutes a default) is based on regional preferences. Concretely, my first choice was the modified-modified restructuring clause. Where the MM clause was not available, I took the fully restructured clause or other clauses. The majority of European default swaps are transacted according to the modified-modified restructuring clause. See also Packer & Zhu (2005).

3.1 Banking risk

Table 3 in the Appendix show all the banks included in the sample by country along with their coverage periods. I select the banks by the sample drawn by the European Banking Authority (EBA) for carrying out stress tests in 2011 , to which are the banks with the highest total asset value in each country as representative of the large financial institutions in Europe (Ballester *et al.* (2013)). Among the 91 participants to the stress tests in 2011, only 38 banks are involved in a CDS issued by third parties. Complete data series for banking CDS spreads are more difficult to obtain than those of sovereign CDS data.[4]

There are different ways to measure financial risk at a country level. Mody & Sandri (2012) use a measure of the prospects of the financial sector as a proxy for financial risk. The index is the ratio of the equity index of the country's financial sector to the overall equity index. Since I am specifically interested in the risk of default for banks, I do not use a general index of financial riskiness. Instead, I took the average of the CDS spread by bank weighted by the ratio of the assets of each bank with respect to the GDP of the country to which the banks belongs to build an indicator of banking risk by country:

$$CDS_{it}^{B} = \sum_{c=1}^{n} w_{itc} B_{itc} \tag{1}$$

Where w_{itc} is the asset/GDP ratio for each bank, B_{itc} is the CDS of each bank c in country i at time t, and CDS_{it}^{B} is the aggregate banking CDS spread for country i at time t. Data about banking risk-weighted assets are from the EBA report of the EU-wide stress test in 2011 (EBA (2011)). Risk-weighted assets are a measure of banks' assets or off-balance sheet exposures weighted for risk. A riskier asset is apportioned a higher weight, while less risky assets receive lower weights. This measure was implemented by the Basel framework (BIS (2010)).

3.2 Sovereign risk

There are two methods used widely in the literature to measure sovereign risk. It can be measured using the yield spreads between government bonds and a benchmark safe asset or using sovereign CDS spreads. Sovereign yield spreads in the Euro Area are built using government bonds with ten years maturity and the German Bund as the benchmark asset. Bond spreads are the most direct measure of the sovereign risk but it would not allow me to include Germany in my sample of countries. Germany has been one of the most stable countries during the crisis, so it is essential

[4]The time series for Irish banks are shorter and concentrated between 2007 and the end of 2010. On the other hand, data on banks in Greece is available from the end of 2005. The data series on Dexia, Banco Popolare and Rabobank end in September 2010.

to consider it. The sovereign CDS spreads are an alternative widely used in the literature, as explained by Pan & Singleton (2008).

The countries in my dataset are Austria, Belgium, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain and Greece.[5] Table 4 shows the countries included in the sample and the coverage period of sovereign CDS for each country. The first year of coverage of sovereign CDS spreads for some countries starts after the coverage of banking CDS. This is the case of France, Netherlands, Spain and Ireland. The data series of sovereign CDS spreads for Greece ends the 23rd of February 2010 because Greece started the debt restructuring process the next day, and the sovereign CDS for Greece went out of the market.

3.3 Descriptive statistics

Figure 1 presents the correlation of the sovereign CDS and banking CDS in each Eurozone country of my sample. The relationship is linear in most of the cases, with the exception of Greece, Belgium and Portugal.[6] The summary statistics of sovereign CDS spreads and banking CDS spreads in Table 5 and Table 6 give more details about cross-country heterogeneity. Germany, France, Netherlands, and Austria have average sovereign CDS spreads lower than 50 basis points, while Italy, Portugal, and Spain all have spreads that are higher than 100 basis points. Greece has to be treated with caution, since it is an outlier in terms of sovereign risk as Figure 2 and Table 5 show, having average CDS spreads more than six times higher than in Spain or Italy, and the highest volatility. Greek government debt is excluded from the financial markets after February 23 2010, when the spread reached the level of 14904.36 basis points. Banking CDS spreads follow, in general, the same pattern: countries with higher sovereign spreads have also higher banking CDS spreads (Figures 2 and 3). In comparing the information in Table 5 and 6 we see that the CDS values of some of the core countries reflected the financial crisis that they experienced. However, in their case the banking crisis was not linked to a sovereign crisis. Netherlands average banking CDS spread was at 84.93 basis points, while its sovereign CDS spread was at 34.37. The banking CDS spread for Austria was at 93.22 basis points on average, while the sovereign CDS spread was at 35.37 basis points. The banking risk in these countries did not influence the risk of default of the country itself, due to better fundamentals and better fiscal stability than in the case of Core countries. Greece is the worst country in terms of sovereign risk, followed by Portugal and Ireland. The data series for Ireland ends on April 21, 2011, given that the main Irish banks after that

[5] I consider the countries that entered the Eurozone before the European Crisis (2008), so I do not include Latvia, Estonia, Slovakia, Malta and Cyprus. I also do not include Luxembourg, Finland and Slovenia, because of a lack of CDS data.

[6] Data for Belgium reflect the specific dynamics of the country during the crisis. First, Belgium experienced a major financial crisis in 2008-2010 (high banking CDS spreads, low sovereign CDS spreads). Then it experienced a political crisis and it had a caretaker government until the end of 2011 (high sovereign CDS spreads, low banking CDS spreads). As soon as the main parties reached an agreement to form a new government, 10-year bond yields and sovereign CDS spreads fell sharply.

date exited from the financial markets. The Periphery countries have higher banking CDS spreads because of the linkage between sovereigns and banking. Due to home bias, the main investors in domestic bonds are the domestic banks, so countries with higher sovereign risk of default also have more fragile banks.

A peculiarity of the European crisis is that it was a sum of subsequent crises in different countries. Figure 2 and Figure 3 show the development of sovereign CDS spreads and banking CDS spreads over time, respectively. It is possible to distinguish the various phases of the crisis: until the beginning of 2008 there is little movement in the CDS spreads, when both the CDS spreads of the sovereigns and of the banks are close to each other, and very close to zero. Mody & Sandri (2012) associate the widening in the spreads starting at the beginning of 2008 to the rescue of Bear Sterns in March 2008. From that point on, all sovereign spreads increased due to the weaknesses of their own banking sectors. The Anglo Irish nationalization in January 2009 was the first big episode of the crisis. At the end of the same year Greece revealed that the official statistics about the government deficit and debt were incorrectly reported, and in 2010 the Greek sovereign and banking spreads start to rise (y axis on the right-hand side of Figure 2), followed by Portugal, Ireland (which was already fragile) and Spain. Ireland had a second peak at the beginning of 2011, and Portugal in 2012, which was the worst moment of the crisis. Sovereign and banking CDS spreads of the same country peaked at the same time.

Figures 4 and 5 show how the CDS spread distributions are right-skewed, with higher concentration of low spreads during normal times, and a long tail during crisis times.

The heterogeneity in sovereign CDS spreads can be attributed not only to the developments of the banking sector in each country, but also to each country's fundamentals, especially the debt-to-GDP ratio and the current deficit (Figure 6). Starting from 2008, the debt-to-GDP ratio began to grow in response to the crisis, especially in Greece, Ireland, Spain and France. This situation is similar looking at deficit-to-GDP ratio. Not only Ireland had the biggest bailout in 2009[7], but also the other countries have a significant increase in deficit in the same period, as a first response to the crisis in 2008.[8]

Also the banking CDS spread is related to factors other than sovereign risk. To control for financial variables other than the banking CDS spread I use the VIX index. The VIX is the volatility index of the Chicago Board Options Exchange, which shows the market's expectation of 30-day volatility. It is a widely used measure of global market sentiment: an increase in the VIX index indicates a decrease in the risk appetite of market participants. This uncertainty should reflect a higher risk for the financial sector and banks.[9] As Figure 7 shows, the VIX index experienced some sudden

[7] The Anglo Irish nationalization contributed to an increase of 32% in the government budget deficit in one year

[8] For summary statistics of the debt-to-GDP ratio and the government deficit see Tables 7 and 8.

[9] Recently Hyun Song Shin (Shin (2016)) suggested that after the global financial crisis the VIX lost his role of "barometer of risk appetite" and it was substituted by the dollar (BIS, 2016). As an alternative market parameter

increases during the most troubling moments of the crisis such as 2009, mid-2010 and the end of 2011.

4 Methodology

4.1 Identification of exogenous shocks

The main issue in studying the relationship between sovereign risk and banking risk is identifying the exogenous shocks which determine the initial step of the loop. I use the narrative approach (Romer & Romer (1989), Brutti & Saure (2015)) to identify exogenous shocks on banking risk and on government risk respectively. In this approach, the identification is based on an analysis of the historical record.

Romer & Romer (1989) pointed out that "problems can arise when isolating the shocks, due to the judgmental and retrospective nature of the selection process." To prevent bias in the selection process, as in Brutti & Saure (2015) I refer to various timelines of the European crisis to determine which events can be considered shocks to the sovereign CDS risk or to the banking CDS risk. I also divide the events in the timeline I build into 8 categories: monetary policy (MONP), policy action and regulation (POLA), social unrest (SOCU), change in rating (RATE), general economic news (ECON), evolution of market sentiment (MARK), events occurring in countries that are not part of my sample (FORA), political statements regarding non-committing intentions (POLI).[10] Table 2 lists my sources. In particular, I refer to:

- The ECB Key Dates of the European crisis: it is my main source. It contains mostly political news shocks (POLI and POLA) coming from the European institutions, the monetary policy shocks (MONP) from the ECB, the most important RATE news (sovereign or banking downgradings) and the FORA news (Lehman Brothers bankruptcy, for instance).

- Eurostat publications: I refer to the publication dates of news releases about the European economy. These publications report data on the quarterly growth of GDP, debt to GDP ratio and government deficit. If the forecast of the government debt to GDP ratio is revised upwards or downwards from one issue to the next, I consider the change as news for the country. These news goes into the ECON category.

for European banks I use the STOXX 600 Banks, a price index specific for European banks. The results remain similar and consistent. See also EBA (2015). Zoli (2013) show how the VIX index is related to sovereign and banking risk in Europe during the crisis.

[10] Brutti & Saure (2015)have also a ninth category, "news on private companies" that I don't have in my database. The only news about private companies I have in my timeline are those about banks: I put them into the "general economic news" category.

- World Economic Outlook: I use the publication date of the World Economic Outlook from January 2004 to October 2013. The WEO reports data by country. As I do with the Eurostat news releases, if the 1-year forecast of the government debt to GDP ratio is revised upwards or downwards from one issue to the next, I consider the change as an event that can give rise to a shock. These news ale also categorized as ECON.

- Brutti & Saure (2015): I use the timeline of news in the paper as a model to build my new timeline. It contains all the news categories, but they regard only Greece.

- Bruegel's Crisis Timeline: I use it as a check for political shocks.

- Newspapers timelines: I refer to the Wall Street Journal's Europe Debt Crisis Timelines, the Financial Times Interactive Timeline, the Telegraph's Irish Crisis Timeline and the Reuters Europe's Debt Crisis Timeline. I use them as a second check on my main sources and to add financial market news or social unrest news that are less covered by institutional sources. I also refer to the online database LexisNexis for more precision. As a further comparison I refer to the narrative of the European crisis in Brunnermeier *et al.* (2016a).

Table 9 presents a sample of the events that I collected. The table reports in the first two columns the category of the event and its date, or, in case it happened on a Sunday or a banking holiday, the date of the first business day after the event. The third column provides information on whether it is a sovereign shock, a banking shock, or both. The description of the event is in the last column. Some of the events pertain to one country only, and they will cause a direct shock only in that specific country. For instance, the approval of Italy's austerity package on the 29th July 2010 is a national sovereign shock that pertains only to Italy. Other events can cause shocks that affect simultaneously more countries. Lehman Brothers bankruptcy is a shock that hit the financial markets directly, and so the banking risk, and it affected all countries at the same time. This means that in my database I will have shocks to different countries occurring at the same time. In particular, I have 436 events that give rise to 2175 shocks.

Table 10 presents the categorization of shocks as banking shocks, sovereign shocks, or both and their corresponding frequencies. Sovereign shocks are more frequent than banking shocks. Some categories have only news that primarily affect banks, others have only shocks that primarily affect governments. Some categories have shocks that impact both, in the same time or in different moments.

- The ECON category contains only shocks to the sovereign sector. It includes the shocks that pertain to the European Union or the Euro Area as a whole, which I built from the WEO and Eurostat news releases on the state of the European Economy. These are events that describe the state of the economy of a country, so they can be an indicator of the country's risk, but not necessarily a direct indicator of a country's bank riskiness.

- SOCU also gives rise to sovereign shocks only because they can directly affect the sovereign risk of a country, and indirectly the banking risk of default, depending on the sovereign exposure of domestic banks.

- RATE contains both independent sovereign shocks and independent banking shocks. In fact, a rating agency can change the rating of a single bank, without changing the rating of the sovereign risk of the bank's origin country in the same rating action. Similarly, the rating of a sovereign can be changed independently from the rating of its banking sector.

- MONP events deserve a special note: since monetary policy operations determine the interest rate, they can directly affect both the banking CDS spread and the sovereign CDS spread. Those shocks are a source of endogeneity between the variables.

- The same is true for some policy actions (or intentions), included in the categories POLA and POLI. Certain policy actions taken by European policymakers can simultaneously influence both sovereign risk and banking risk. This is the case, for instance, in the adoption of the Euro Plus Pact on the 25th of March, 2011. This was a commitment of the European Union member states to implement structural reforms regarding competitiveness, sustainability of public finances, and financial stability. Another example are the bail outs of the Irish banks by the Irish government in 2010.

As a consequence of the last two points, I exclude the entire category of Monetary policy events (MONP) and some shocks categorized as POLA or POLI shocks, and I create a smaller group of events that cause only one kind of shock at the time. For my analysis I will only use this restricted sample of shocks.

4.2 IV analysis with narrative strategy

I use a TSLS model to analyze the effect of an increase in the sovereign CDS spread on the banking CDS spread. Due to the endogeneity among those two variables, I need an appropriate identification strategy to eliminate reverse causality between sovereign and banking risk. The exogenous instruments Z_{it} are based on the shocks originated from the events in my timeline. The first instrument is a dummy used as indicator for the sovereign shocks:

$$shock_{it}^{S} = \begin{cases} 1 \; if \; there \; is \; a \; soveregin \; shock \; in \; country \; i \; at \; day \; t \\ 0 \; otherwhise \end{cases} \tag{2}$$

The second instrument is an index which is the ratio of number of shocks per week to the number of working days in the week. I set the number of working days, n, equal to five. This is an indicator of the volatility of the news and of uncertainty in the financial markets.

The index is a backward moving average on a weekly time span. I adopt this methodology because I assume that agents consider news shocks that happened in previous days, without forming any specific expectation about events occurring in the next days. The index is built as follows:

$$SF_{it}^{S} = \frac{shock_{it}^{S} + shock_{it-1}^{S} + ... + shock_{it-n+1}^{S}}{n} \tag{3}$$

Where SF_{it}^{S} is the index that measures the average number of sovereign shocks per day in a week, $shock_{it}^{S}$ is the sovereign shock at time t in country i and n is the number of working days.

The third instrument is the interaction term between the dummy for the sovereign shock and the shock frequency index. The rationale is that the impact of a shock can change if the shock comes in tranquil times or in unstable times.

As shown in Figure 8, the average number of sovereign shocks per day in a week increases over time: it is 0.33 in 2004, that corresponds to a bit more than one shock every working week. It increases at a peak of 1 per day in a week by the end of 2009 (and in 2011) and it remained at around 0.65 per day in a week in 2010 and thereafter.

The period of higher instability seems to correspond to the periods of stronger correlation between the banking and the sovereign risk: from the end of 2009 to 2012.

The first-stage equation of my TSLS model is:

$$CDS_{it}^{S} = \alpha + \beta_1 shock_{it}^{S} + \beta_2 SF_{it}^{S} + \beta_3 SF_{it}^{S} * shock_{it}^{S} + X_{it} + \mu_i + \tau_t + \varepsilon_{it} \tag{4}$$

Where CDS_{it}^{S} is the sovereign CDS spread of country i in day t, $shock_{it}^{S}$ is the sovereign shock for country i in day t, SF_{it}^{S} is the weekly frequency of the shocks, X_{it} is a vector of controls, μ_i are the country fixed effects and τ_t the time fixed effects.

The second-stage regression is:

$$CDS_{it}^{B} = \gamma \hat{CDS}_{it}^{S} + X_{it} + \mu_i + \tau_t + \varepsilon_{it} \tag{5}$$

Where CDS_{it}^{B} is the banking CDS spread in country i at time t, $\hat{CDS}_{it}^{S}$ is the fitted value of sovereign CDS for country i in day t from the first-stage regression, γ is the coefficient that measures the effect of the sovereign CDS spread on the banking CDS spread, my coefficient of interest. X_{it} are the controls,[11] μ_i and τ_t are the country and time fixed effects.

[11] My controls are the VIX index and the debt/GDP

4.3 Discussion of the identification strategy

The confusion between sovereign shocks and banking shocks is not the only potential source of reverse causality. Different shocks occurring at the same time could be another issue for identification: spillovers, that can spread from one country to another through the strong financial and trade linkages of the EU members, are also a source of endogeneity. Cross border investments in sovereign bonds from more indebted (and potentially more fragile) countries spread throughout the European Union, and faster throughout the Euro Area during the crisis. To avoid potential biases in my analysis due to spillover effects, I use a database of daily data. High-frequency data allows me the possibility of disentangling the immediate effect of the daily shock on the banking and sovereign CDS spreads before other secondary effects are registered.

A possible shortcoming of this approach is that I can identify the frequency of the shocks, but not their magnitude. For instance, Lehman Brothers' bankruptcy had alone a crucial impact on the financial markets during the crisis, causing panic reactions. On the other hand, many small steps were needed to reassure the markets about a resolution of the crisis, but each of these individually had a minimal impact on the level of sovereign or banking risk. This means that I need as many shocks as possible to find and not simply some big shocks with long lasting effects.

Figures 9 and 10 well illustrate this issue. Figure 9 shows the total number of sovereign shocks by country and year while Figure 10 does the same for banking shocks. Two points stand out. First, the total number of sovereign shocks in my dataset is higher than the number of banking shocks. While there are on average at least ten sovereign shocks per country each year (during the crisis the number increases over 30 shocks per year in some cases), the maximum number of banking shocks are, on average, much lower than 10.[12] Second, the heterogeneity of the shocks among countries is greater in case of sovereign shocks. This is an important point to raise with respect to the use of a panel data approach with fixed effects, as I do. Country fixed effects are almost non-existent in the case of banking shocks so it is recommendable to use a different approach. The scarce variability in shocks to banks by country is possibly explained by my data sources. I rely mostly on timelines of policy institutions, that does not give me enough details about the situation of single banks during the crisis. Many shocks that affect banks are affecting the European financial system as a whole or regards resolutions addressed to all Eurozone countries. For this reason, this paper will focus on the study of the identification of the channel of transmission of the sovereign risk to the banking sector. I leave to future research the compilation of a more detailed dataset of banking news and the possibility of expanding my results.

[12] Only for Spain the maximum number of banking shocks is 14 in 2010.

5 Results

I divide the countries of my sample into a Periphery countries group (Portugal, Greece, Spain, Italy, Ireland) and a Core countries group (Austria, Germany, France, Netherlands, Belgium). I also divide the period covered into sub-periods: before the crisis (from 2004 to the end of July 2007, when the subprime crisis in the United States started to spread to other countries), after the crisis (from July 26 2012 to the end of my sample) and during the crisis. I consider two different periods to identify the crisis: from August 2007 to July 25 2012 and from October 2009 to July 25, 2007.[13] As Table 11 shows, the correlation between sovereign CDS spreads and banking CDS spreads seem to grow during the crisis period (from 0.15 to 0.8) and it remains high even after the Draghi speech in 2012. This is true especially in periphery countries for whom the correlation increases from 0.8 during the crisis to 0.95 after the Draghi speech. Instead, in the case of core countries, the crisis is the hardest shock: the correlation changes from -0.34 in 2004-2007 to 0.53 in 2007-2012 (or to 0.46 if we look at the shorter period 2009-2012), while after the Draghi speech the correlation does not increase so much as in the Periphery countries. With respect to the distribution of the shocks over time, Table 12 highlights that the sovereign shocks concentrate in the crisis period. However, the frequency of the shocks in each period is similar and always lower than 10 percent. I am assured that my results for the subperiods are not driven by an excessive amount of shocks during the crisis with respect to the non-crisis periods.

5.1 Panel results

The specification gives some interesting results as Tables 13 and 14 show. The first-stage results for the analysis in Table 14 are in Table 15.

Tables 13 and 14 present the results of the OLS model and the second-stage of a TSLS regression on the same country groups (core and periphery) for different time periods: from 2004 to 2013, before, during, and after the crisis. The results of the regression of the banking CDS spread on the sovereign CDS spread for Periphery and core countries on the entire time period is not very informative. The coefficient of the sovereign CDS spread is always significant, for both country groups, even though the significance is lower in the Core countries group. In the TSLS model, the instruments are strong only for the Periphery countries (the F-statistic is higher than 10 and the maximal IV relative bias is less than 5%, see Stock & Yogo (2005) and Staiger & Stock (1997)) while they are weak in case of the Core countries.

By dividing the sample into different time periods we can spot the different dynamics that occurred

[13] The first time interval considers the spillovers of the subprime crisis to Europe as the beginning of the crisis, while the second one considers the European sovereign crisis (which started at the end of 2009 after the election of a new Greek government lead by George Papandreou and the admission about the debt issues in Greece in November 2009).

during the 10-years period. From 2004 to the end of July 2007 the sovereign CDS spreads and the banking CDS spreads are not correlated. During the crisis, a significant positive correlation appears only for Periphery countries. The tests in Table 14 show that the instruments are strong. The maximum relative bias is also a measure of how strong the IV is. The maximum acceptable level for non-weak instruments is 10%.

In both definitions of crisis I consider, the instruments are strong and the sovereign spread is positively related to the banking CDS spread. The effect is higher for the longer time span case (from 2007 to 2009 the effect of an increase of 100 basis point in the sovereign spread causes an increase of 50 basis points in the banking CDS spread in the Periphery countries, while it rises only by 25 basis points from 2009 onwards).

The direction and the magnitude of the OLS and IV coefficients are similar but the TSLS model reports higher coefficients. Nevertheless, during the crisis the transmission of the sovereign shocks to the banks is worse than what the OLS estimation shows. The same is not true for the period after the crisis, starting on the 26th of July, 2012. The OLS coefficients are statistically significant, higher in absolute value and with a positive sign, meaning that the correlation between the banking CDS spread and the sovereign CDS spread after the Draghi speech became stronger. However, these results are affected by reverse causality. The TSLS regressions suggest that the action of the ECB, the Draghi speech and the subsequent launch of the OMT broke the channel of transmission of sovereign risk to the banking risk: the coefficient on sovereign risk is insignificant and the direction of the effect is reversed.

The results in column (9) of Table 14 deserve a special note. Due to multicollinearity in the first-stage regression, it is not possible to compute the weak identification test, even after partialling out the controls. After testing for multicollinearity in the first stage it results that the responsible for it is the instrument built as the interaction term between the dummy for sovereign shock and the weekly average number of shocks. I run the same TSLS regression after having dropped the interaction term. The coefficient of the sovereign CDS spread in the second stage remains insignificant, both with and without the control. Moreover, the instruments are strong (the maximum IV bias is lower than 10%) and they pass the Hansen overidentification test. The multicollinearity problem can arise only in this last stage for two reasons. The first is that both Ireland and Greece do not have data in 2012, so the analysis looses two of the most troubled countries during the crisis. The second is that after mid 2012 the situation on the financial markets started to normalize, the sovereign CDS spreads were lower and as a consequence there were less negative sovereign shocks at a country level, as shown also in Figure 10.

The stronger and more significant instrument to estimate the sovereign CDS spread is the average weekly frequency of the shocks if we consider the longer crisis period. After 2009 the sovereign shock itself is the stronger instrument to look at, as shown by the first-stage results in Table 15. This suggest that during the financial crisis the general increase in uncertainty about sovereign

stability was the main factor that influenced the change in sovereign CDS spreads. Still, after 2009 single sovereign shocks had a stronger impact on the dynamics of sovereign risk. In fact, Periphery countries like Greece, Portugal and Italy were hit by country specific shocks of stronger impact in that period.

The main result is then that the effect of sovereign CDS spread on the banking CDS spread in normal times is not significant, while the sovereign CDS spread has a positive and significant effect on the banking CDS spread during the crisis. This is true especially for Periphery countries, while I do not find a significant relationship between sovereign CDS spreads and banking CDS spreads for Core countries.

5.2 Robustness checks

As a robustness check I test whether adding the debt-to-GDP ratio as an exogenous variable in the model changes the significance of my instrument. The debt-to-GDP ratio is correlated with the sovereign risk, to the extent that it is one of the determinants of the sovereign risk ratings by rating agencies. However, one can expect that this control should not influence the results, because the debt-GDP ratio does not change as fast as the sovereign spread. Some studies showed that during the crisis the sovereign CDS spreads were very different from their theoretical value as dictated by fundamentals (Durdu *et al.* (2013)).

The results for these regressions are shown in Table 16 and 17. The coefficients on the sovereign CDS spreads in the OLS and TSLS models are closer in magnitude than in previous estimations. Moreover, the results for the entire time period presented in columns (1) and (2) show that the Periphery countries group is the only one significantly interested by the sovereign-bank link. Both in the OLS regression and in the TSLS the effect of the banking CDS spreads on sovereign CDS spreads is positive and significant only for Periphery, but the coefficient is higher for the TSLS model (an increase of 100 basis points in the sovereign CDS spread translates in an increase of more than 30 basis points in the banking CDS spread). The instruments are strong, with a maximal IV relative bias of 5 percent.

Looking at the subperiods, the instruments are strong and significant only for the crisis period starting in 2009. Although the instruments are exogenous in all models, they are weak in the specification covering the period 2007-2012. The inclusion of the debt-to-GDP ratio might increase the precision of the results and might erode the explanatory power of the instruments on the longer period. The sovereign debt crisis started in 2009 in Europe.[14] It is possible that although there were already some sovereign shocks recorded, they were not as strong as those that arrived after

[14]Before 2009, sovereign fragility was the consequence of financial bailouts from the European governments (in Ireland for instance).

2009, when the ratings of many sovereigns fell and there was rising risk of contagion. The first-stage results for Table 17 are in Table 18.

As a second check I exploit the presence of three instruments to vary my model. Tables 19 and 20 show that using the sovereign shock as an exogenous regressor instead of using it as an instrument does not change my results. The remaining instruments (the weekly frequency of the shocks and the interaction term) are still exogenous and strong and their effect remains similar to the previous tests in terms of sign and significance. They are a bit less strong (10 percent of relative bias). The sovereign CDS spread has the same coefficient in the second stage. The first-stage results of the TSLS model are in Table 20.

6 Policy implications

The analysis of this paper has two policy implications that can be explored further.

First, I identify the channel of transmission of the sovereign risk of default to the bank risk of default, using news on events as exogenous shocks to identify the episodes of higher sovereign risk. This can be useful for institutions whose goal is to maintain financial and banking stability on the markets. Sovereign risk is transmitted to banks during crisis periods, and the European case shows in particular that even small sovereign shocks, if too frequent, can cause tensions in the banking sector.

Second, I show the role of a common policy maker for the Euro Area, like the ECB, in breaking the sovereign-bank linkage and in normalizing the stresses in the markets. This suggests that in case of systemic crises in a currency union as the Euro Area the intervention of a single country is not enough to have a significant effect on the markets, and arrive to a solution of the crisis.

The results of my paper contributes to the policy discussion about the control of the transmission of sovereign risk to the banks. As my data show, the sovereign risk increased during the crisis (Altavilla *et al.* (2016), Acharya & Steffen (2015)), especially in weaker countries in the Euro Area, and it also varies considerably from one country to another (Brunnermeier *et al.* (2016b)). Looking at the banking-sovereign nexus, the transmission of banking risk to sovereign risk has been addressed by the first two pillars of the European Banking Union: common supervision and common resolution of troubled banks. However, conversely, the debate regarding how to block the direct transmission of sovereign risk to banks is open. In November 2015, the European Commission proposed to create a European Deposit Insurance Scheme (EDIS), with the intention of providing a stronger and more consistent insurance cover for all the retail depositors in the banking Union (Commission (2015)).

Another option (that does not exclude the Deposit Insurance Scheme) aims to reduce the banks' exposure to sovereigns, weighting the sovereign risk of sovereign bonds by country. Brunnermeier

et al. (2016b) propose to create a synthetic euro-wide "safe asset" by securitizing a GDP-weighted pool of euro area government bonds. The senior tranche obtained for the securitization of this portfolio is proposed to be an instrument called the European Safe Bond or ESB (see also Pagano (2016)). However, Andritzky *et al.* (2016) point out that the introduction of risk-based large exposure limits would imply substantial portfolio shifts for banks, while additional capital requirements would imply rather small additional capital buffers, while being easier to implement. Lanotte *et al.* (2016) add that the microeconomic and macroeconomic costs of a reform of the current prudential rules could be higher than the benefits. Moreover, finding the appropriate methodology to compute the sovereign creditworthiness might be challenging.

My paper shows that the introduction of the OMT program in 2012 and the creation of the banking union, although incomplete, has been effective resolutions to stop the most virulent phase of the sovereign-bank nexus. After July 2012 there is no evidence that new sovereign shock affected directly the banking risk. This suggests that stronger cooperation between countries is the right approach to strengthen the stability of financial markets and public finances in the Eurozone. Discussing about long-term solutions such as a different weighting of sovereign risk and how this could be smoothly implemented is important not only for the future of the Eurozone but also for the global financial system. For the time being, the best way to reduce the riskiness of the sovereign-bank nexus in the Eurozone is to strengthen the public accounts and to complete the Banking Union.

7 Conclusions

This paper identifies a causal linkage between the sovereign risk of default and the banking risk of default during the Eurozone crisis. The identification of the transmission channel is not straightforward, as the presence of the diabolic loop makes the computation of a clean measure of the effect of a sovereign shock on the banking risk during the crisis challenging.

To quantify the sovereign-bank nexus I use a TSLS model with exogenous instruments. To identify exogenous shocks to the sovereign sector I compile an original timeline of daily news that covers the period from 2004 to 2013. I follow the narrative approach to identify which of them are pure sovereign shocks and which are shocks common both to banks and sovereigns. I use only the pure shocks to build three exogenous instruments to estimate sovereign CDS spread in the first stage.

I use a panel of daily data for ten Euro Area countries with a time coverage that goes from 2004 to 2013. I run my analysis on a Periphery countries group and a Core countries group for three periods: before, during and after the crisis.

The model is identified and the instruments are valid for Periphery countries only during the crisis period, not in normal times, while for Core countries I never find a significant sovereign-banking

nexus even during the crisis period. In line with the current literature I find that an increase of 100 basis points in the sovereign CDS spread in periphery countries causes a significant increase in the bank CDS spread of at least 21 basis points.

The results of my paper suggest that an institution in charge of maintaining banking and financial stability has to follow closely shocks that increase sovereign risk, even if they are small, since they can be transmitted to the financial sector in crisis periods. During the crisis individual interventions by single governments in the Eurozone were not useful to break the linkage between sovereign risk and banking risk. This suggest that more policy coordination among Euro Area member states, for instance through the completion of the Banking Union, is the right path to enhance stability and loosen the banking-sovereign nexus.

References

Acharya, Viral, & Steffen, Sascha. 2015. The greatest carry trade ever? understanding eurozone bank risks. *Journal of financial economics*, 215–236.

Acharya, Viral, Drechlser, Itamar, & Schnabl, Philipp. 2014. A pyrrhic victory? bank bailouts and sovereign credit risk. *Journal of finance*.

Acharya, Viral, Eisert, Tim, Eufinger, Christian, & Christian, Hirsch. 2015 (March). *Real effects of the sovereign debt crisis in eueuro: Evidence from syndacated loans*. Unpublished.

Altavilla, Carlo, Pagano, Marco, & Simonelli, Saverio. 2016 (May). *Bank exposures and sovereign stress transmission*. Working Paper 11. European Systemic Risk Board.

Andritzky, Jochen, Gadatsch, Niklas, Korner, Tobias, Schafer, Alexander, & Schnabel, Isabel. 2016. Removing privileges for bank' sovereign exposures - a proposal. *European economy*, **2**(1), 139–152.

Asonuma, Tamon, Bakhache, Said, & Hesse, Heiko. 2015. *Is banks' home bias good or bad for publc debt sustainability?* IMF Working Paper 44. International Monetary Fund.

Ballester, Miquel Laura, Casu, Lukac Barbara, & Gonzales-Urteaga, Ana. 2013. *Bank cds spreads and banking fragility*. universidad de Valencia.

Battistini, Niccolo', Pagano, Marco, & Simonelli, Saverio. 2014. Systemic risk, sovereign yields and bank exposures in the euro crisis. *Economic policy*, April, 203–251.

BIS. 2010 (December). *Basel iii: A global regulatory framework for more resilient banks and banking systems*. Tech. rept. Bank of International Settlements. December 2010, revision June 2011, Basel Committee on Banking Supervision.

BIS. 2011 (July). *The impact of sovereign credit risk on bank funding conditions*. CGFS Papers 43. Bank of International Settlements. Committee on the Global Financial System.

Bocola, Luigi. 2016. The pass-through of sovereign risk. *Journal of political economy*, **124**(4), 879–926.

Brunnermeier, Markus K., James, Harold, & Landau, Jean-Pierre. 2016a. *The euro and the battle of ideas*. Princeton University Press.

Brunnermeier, Markus K., Garicano, Luis, Lane, Philip R., Pagano, Marco, Reis, Ricardo, Santos, Tano, Thesmar, David, Van Nieuwerburgh, Stijn, & Vayanos, Dimitri. 2016b. The sovereign-bank diabolic loop and esbies. *American economic review papers and proceedings*, **5**(106), 506–5012.

Brutti, Filippo, & Saure, Philip. 2015. Transmission of sovereign risk in the euro crisis. *Journal of international economics*, November, 231â248. University of Zurich an Study Center Gerzensee.

Buch, Claudia, Koetter, Michael, & Ohls, Jana. 2013. *Bbank and sovereign risk: A granular view.* Bundesbank Discussion Papers 29/2013. Deutsche Bundesbank.

Commission, European. 2015 (November). *Updated version of first memo published on 15/04/2014 - banking union: restoring financial stability in the eurozone.* European Commission Factsheet. http://europa.eu/rapid/press-release$_{M}EMO-15-6164_{e}n.htm?locale=en$.

De Marco, Filippo. 2016 (February). *Bank lending and the sovereign debt crisis.* Boston College working paper.

Diebold, Francis X., & Yilmaz, Kamil. 2009. Measuring financial asset return and volatility spillovers, with application to global equity markets. *The economic journal*, January, 158–171.

Durdu, C Bora, Nunes, Ricardo, & Sapriza, Horacio. 2013. News and sovereign default risk in small open economies. *Journal of international economics*, **91**, 1–17.

EBA. 2011 (July). *European banking authority 2011 eu-wide stress test aggregate report.* Tech. rept. European Banking Authority.

EBA. 2015 (December). *Risk assessment of the eueurope banking system.* Tech. rept. European Banking Authority.

Erce, Aitor. 2015. *Bank and soveloops risk feedback loops.* Working Paper 1. European Stability Mechanism.

Favero, Carlo A. 2013. Modelling and forecasting government bond spreads in the euro area: a gvar model. *Journal of econometrics*, **177**(2), 343–356.

Favero, Carlo A., & Giavazzi, Francesco. 2012. Reconciling var based and narrative measures of the tax multiplier. *American economic journal: Economic policy*, **2**(4), 1â28.

Heinz, Frigyes F., & Sun, Yan. 2014. *Sovereign cds spreads in europe - the role of global risk aversion, economic fundamentals, liquidity, and spillovers.* IMF Working Paper 17. International Monetary Fund.

IMF. 2002. *Sovereign debt restructurings and the domestic economy experience in four recent cases.* Tech. rept. International Monetary Fund.

King, Michael R. 2009 (September). *Time to buy or just buying time? the market reaction to bank rescue packages.* BIS Worling Papers 288. Bank of International Settlements.

Lanotte, Michele, Giacomo, Manzelli, Maria, Rinaldi Anna, Marco, Taboga, & Pietro, Tommasino. 2016. Easier said than done? reforming the prudential treatment of banksâ sovereign exposures. *European economy*, **2**(1), 73–103.

Mody, Ashoka, & Sandri, Damiano. 2012. The eurozone crisis: how banks and sovereigns came to be joined at the hip. *Economic policy*, **27**(70), 199–230.

Packer, Frank, & Zhu, Haibin. 2005 (March). *Contractual terms and cds pricing.* Bis quarterly review. Bank of International Settlements.

Pagano, Marco. 2016. The sovereign-bank nexus and the case for euroeuro safe bonds. *European economy*, **2**(1), 129–138.

Pan, Jun, & Singleton, Kenneth J. 2008. Default and recovery implicit in the term structure of sovereign cds spreads. *The journal of finance*, **63**(5), 2345–2384.

Reinhart, Carmen M., & Rogoff, Ken S. 2009. *Banking crises: an equal opportunity menace.* NBER Working Paper 14587. National Bureau of Economic Research.

Reinhart, Carmen M., & Rogoff, Ken S. 2011. From financial crash to debt crisis. *American economic review*, **(5), .**(101), 1676â706.

Romer, Christina, & Romer, David. 1989 (May). *Does monetary policy matter? a new test in thespirit of friedman and schwartz.* NBER Working Paper Series 2966. National Bureau of Economic Research, 1050 Massachusetts Avenue Cambridge, MA 0218.

Shin, Hyun Song. 2016 (November). *The bank/capital nexus goes global.* BIS report. LSE conference.

Staiger, Douglas, & Stock, James H. 1997. Instrumental variables regression with weak instruments. *Econometrica*, **65**(3), 557–586.

Stock, James H., & Yogo, Motohiro. 2005. *Testing for weak instruments in linear iv regression.* Vol. Identification and Inference for Econometric Models: Essays in Honor of Thomas J. Rothenberg. Cambridge University Press. Chap. 5.

Zoli, Edda. 2013. *Italian sovereign spreads: Their determinants and pass-through to bank funding costs and lending conditions.* Working Paper 84. International Monetary Fund.

A Figures

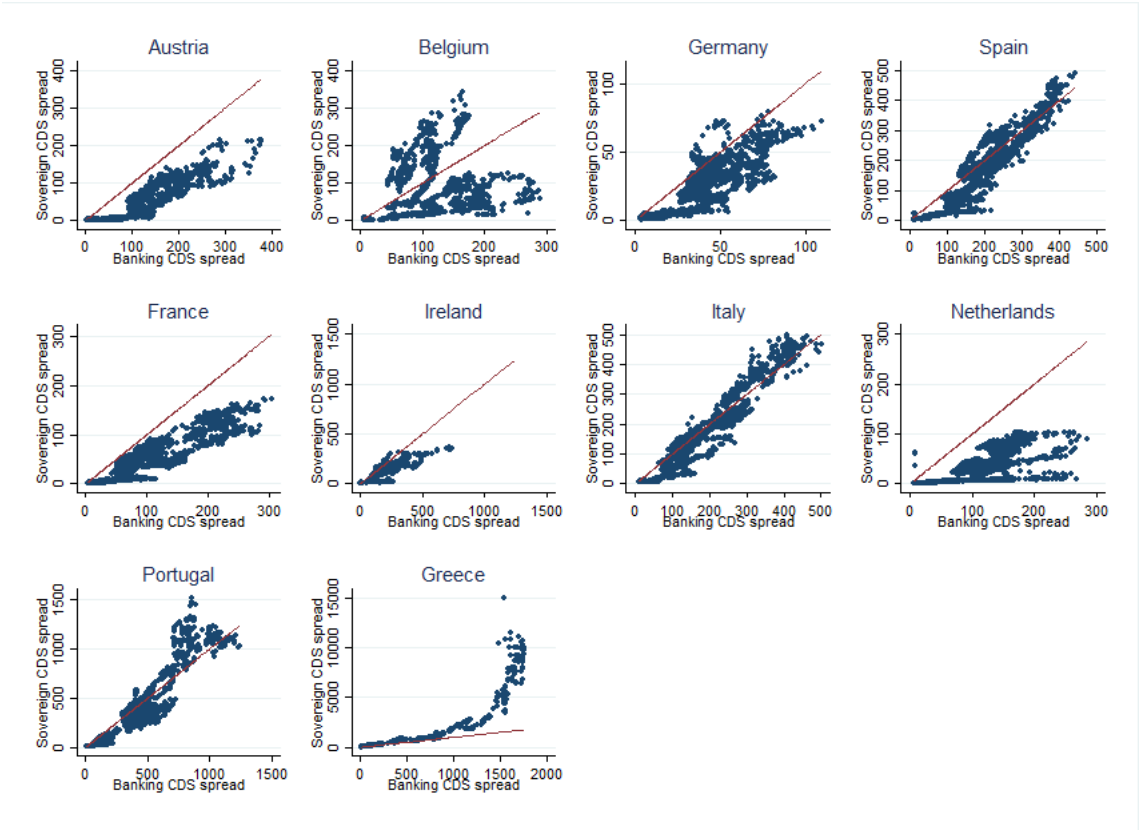

Figure 1: Banking and sovereign CDS spreads by country

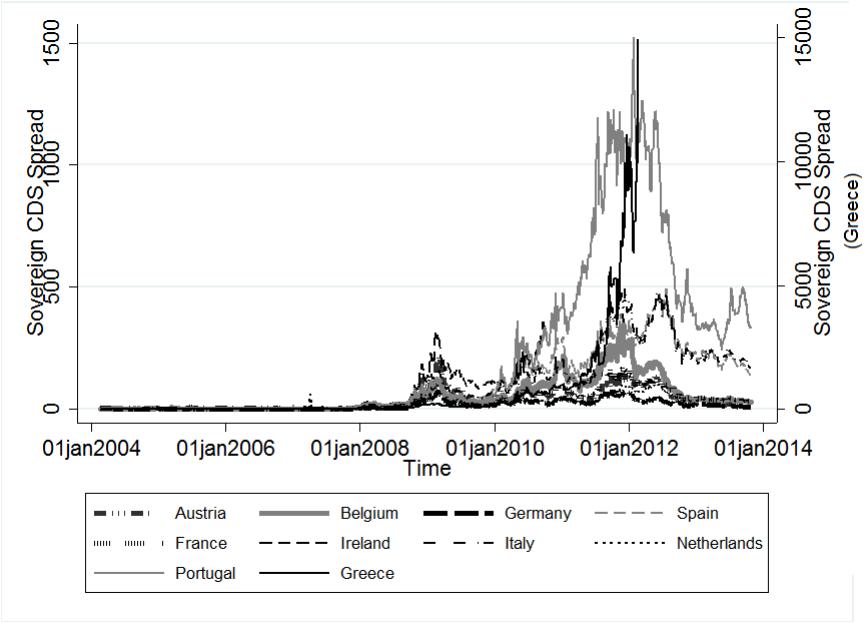

Figure 2: Sovereign CDS spreads in selected Eurozone countries, 2004-2013

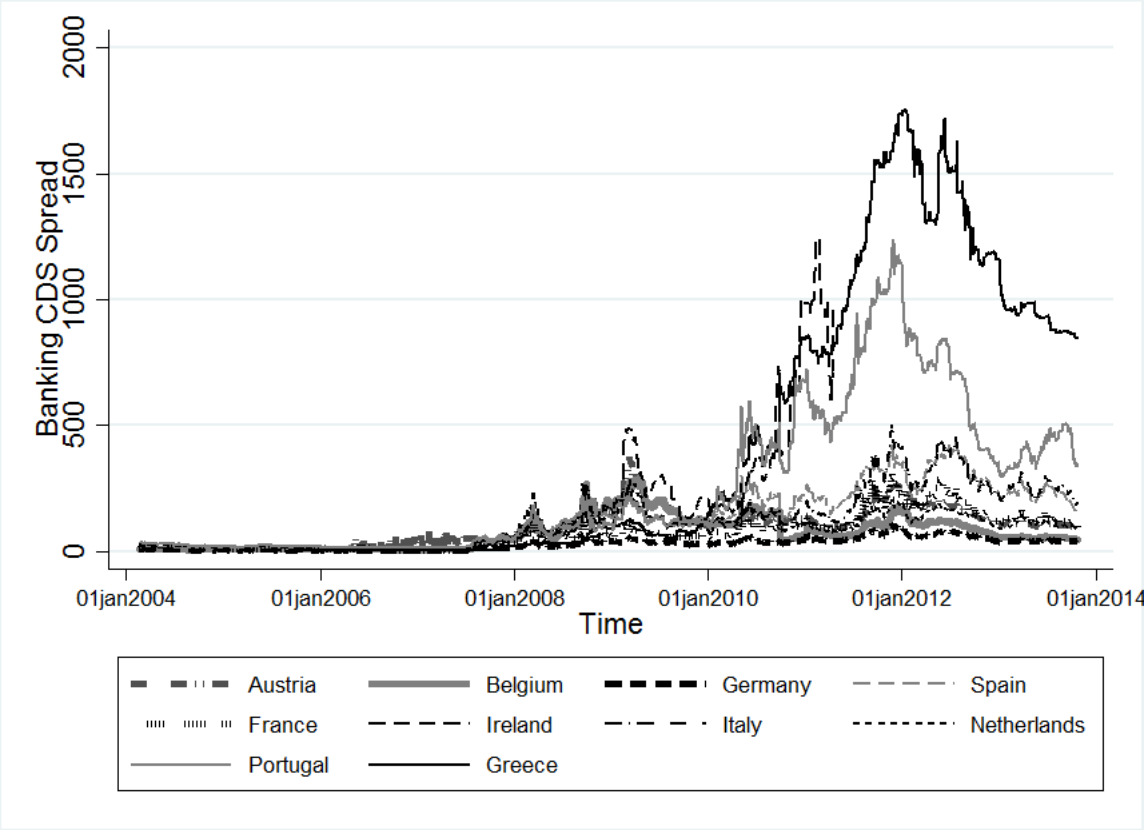

Figure 3: Banking CDS in selected Eurozone countries, 2004-2013

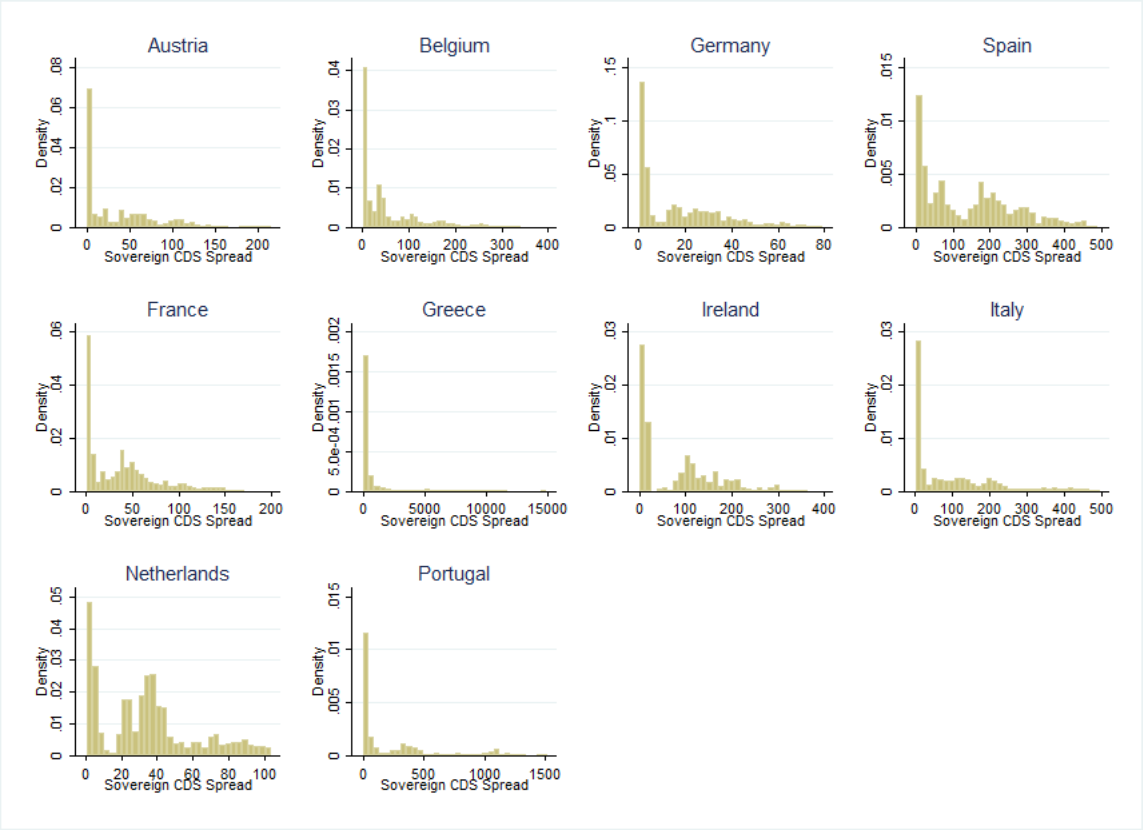

Figure 4: Density of banking CDS spreads by country

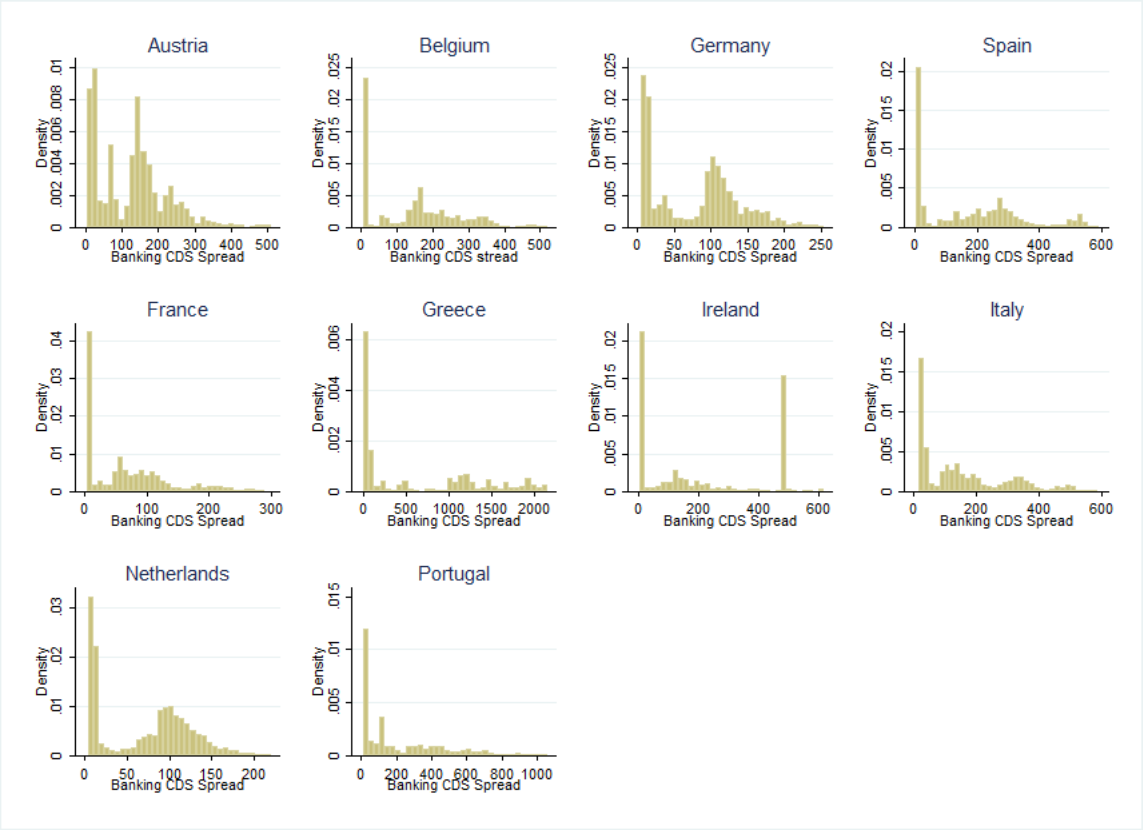

Figure 5: Density of sovereign CDS spreads by country

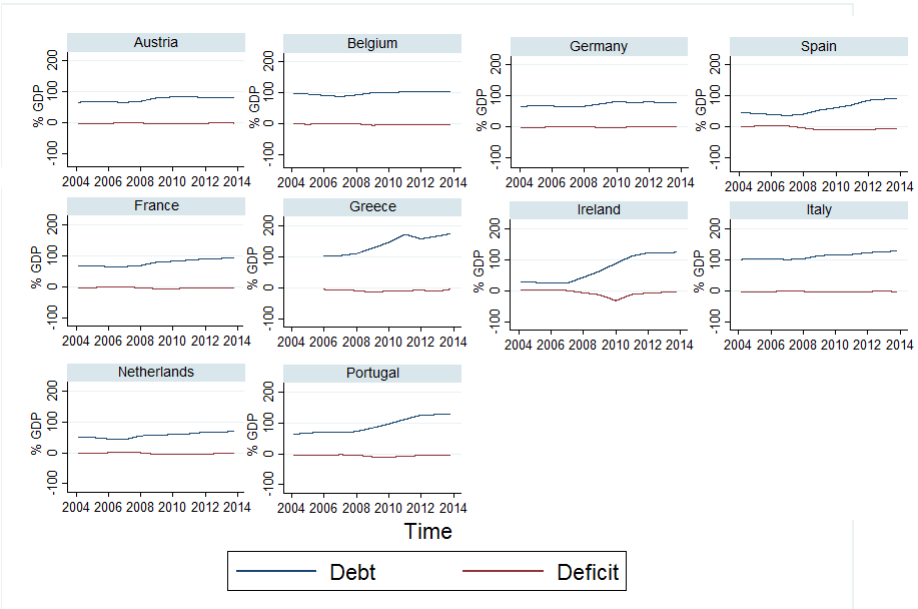

Figure 6: Government debt and deficit for selected Eurozone countries, 2004-2013 (% of GDP)

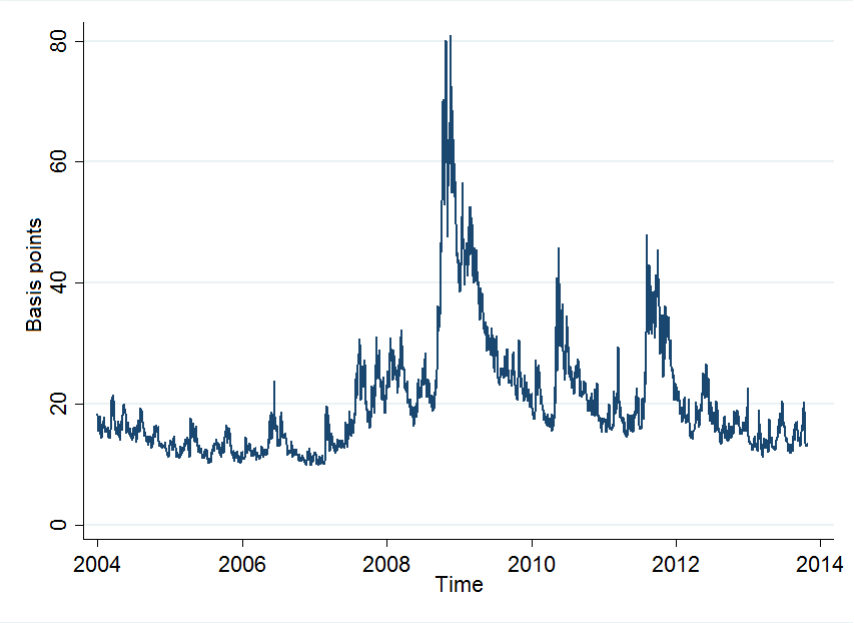

Figure 7: VIX index, 2004-2013

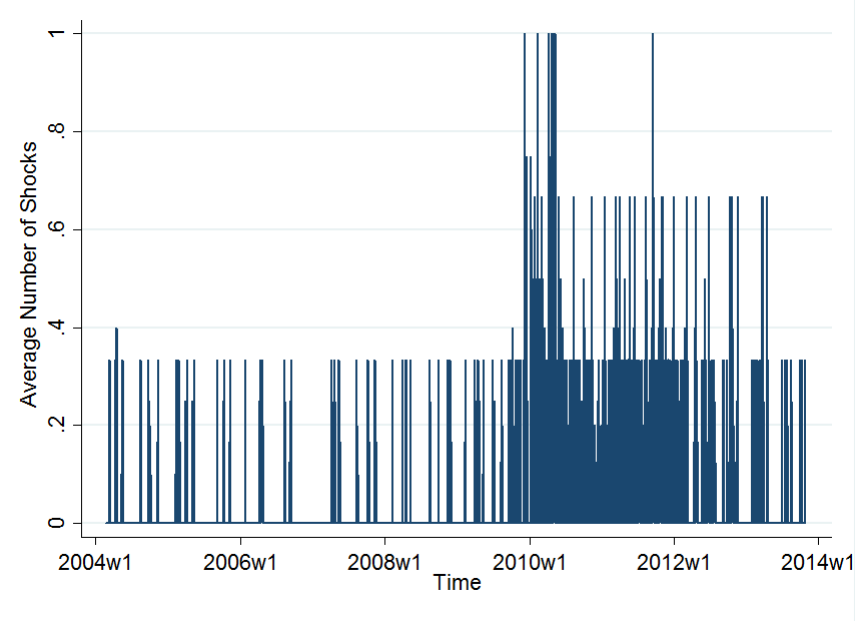

Figure 8: Number of shocks per day in a week

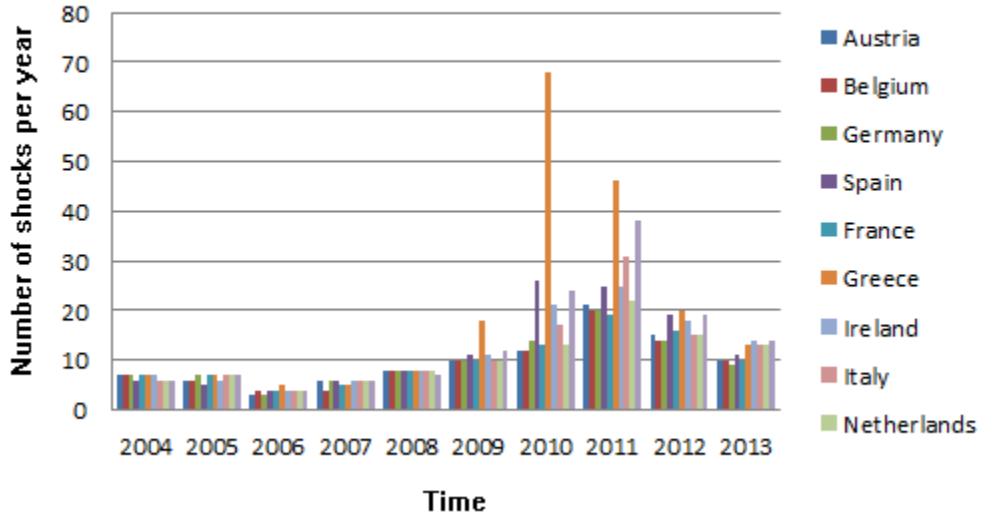

Figure 9: Sovereign shocks by country and year

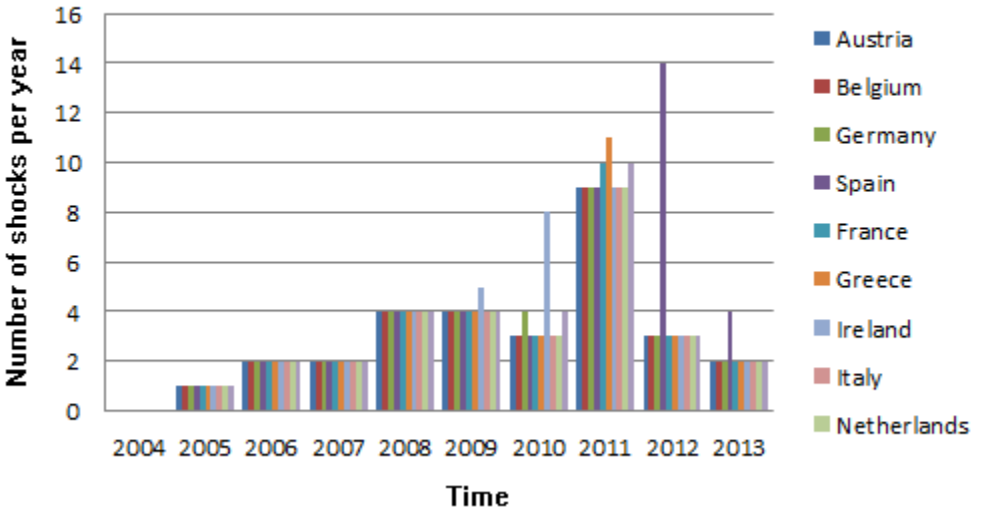

Figure 10: Banking shocks by country and year

B Tables

Variable	Data source
Sovereign CDS spreads	Datastream
Banking CDS spreads	Datastream
Risk-weighted assets	2011 EBAEU-wide stress tests
Debt/GDP	Eurostat
Government deficit	Eurostat
VIX index	IMF
News	Wall Street Journal Financial Times Reuters ECB Bruegel IMF, WEO

Table 1: Data sources

Source	Comments
The Wall Street Journal: Europe's Debt Crisis	http://online.wsj.com/public/resources/documents/info-EZdebt0210.html
The Wall Steeet Journal: Spain Debt Crisis	http://online.wsj.com/articles/SB10001424052748704904604576335131728074142
The Wall Street Journal: Portugal Debt Crisis	http://online.wsj.com/articles/SB10001424052748704904604576335101867151090
The Financial Times Interactive Timeline: Greek Debt Crisis	http://www.ft.com/intl/cms/s/0/003cbb92-4e2d-11df-b48d-00144feab49a.html#axzz3SZ8FAIRS
Reuters Timeline: Euro Zone Debt Crisis	http://www.reuters.com/article/2010/06/10/us-eurozone-events-idUSTRE6593G320100610
Bruegel Euro Crisis Timeline	http://www.bruegel.org/2015/09/euro-crisis/ (Prepared by Christophe Gouardo and Jean Pisani-Ferry. Updated by the Bruegel's research team)
European Central Bank: Key Dates of the Financial Crisis	https://www.ecb.europa.eu/ecb/html/crisis.en.html
International Monetary Fund: WEO Publications	https://www.imf.org/external/ns/cs.aspx?id=29
Eurostat News Releases	http://ec.europa.eu/eurostat/publications/collections/news-releases
Telegraph's Irish Crisis Timeline	http://www.telegraph.co.uk/finance/financialcrisis/8419616/Irelands-banking-crisis-timeline.html
Brutti, Filippo and Sauré, Philip (2015): Table A1, Appendix E	Transmission of Sovereign Risk in the Euro Crisis, *Journal of International Economics*, Volume 97, Issue 2, November, Pages 231–248

Table 2: News sources, detail

Country	Bank	Time period
Austria	Erste Group Bank	02/20/2004-10/25/2013
	Raiffeisen Zentralbank	02/20/2004-10/25/2013
Belgium	Dexia	02/20/2004-09/30/2010
	KBC Bank	02/20/2004-10/25/2013
France	BNP Paribas	02/20/2004-10/25/2013
	Société Génerale	02/20/2004-10/25/2013
	Crédit Agricole	02/20/2004-10/25/2013
Germany	Deutsche Bank	02/20/2004-10/25/2013
	Landesbank Baden-Württemberg	02/20/2004-10/25/2013
	Commerzbank	02/20/2004-10/25/2013
	HSH Norbank	02/20/2004-10/25/2013
Greece	National Bank of Greece	12/14/2007-10/25/2013
	Alpha Bank	10/01/2010-25/10/2013
	EFG Eurobank Ergasias	10/24/2005-10/25/2013
Ireland	Allied Irish Banks PLC	12/14/2007-04/21/2011
	Bank of Ireland	09/13/2010-09/30/2010
	Irish Life and Permanent	02/20/2004-09/30/2010
Italy	Unicredit	02/20/2004-10/25/2013
	Intesa San Paolo	02/20/2004-10/25/2013
	Banca Monte dei Paschi di Siena	02/20/2004-10/25/2013
	UBI Banca	02/20/2004-10/25/2013
	Banco Popolare	02/20/2004-09/30/2010
Netherlands	ING Bank	02/20/2004-10/25/2013
	Rabo Bank	02/20/2004-09/30/2010
	ABN AMRO	02/20/2004-10/25/2013
Portugal	Banco Espirito Santo	02/20/2004-10/25/2013
	Banco Comercial Português	02/20/2004-10/25/2013
	Banco de Sabadell	09/29/2005-10/25/2013
Spain	Banco Popolar Español	02/20/2004-10/25/2013
	Bankinter	07/19/2005-10/25/2013
	Banco Santander	02/20/2004-10/25/2013
	BBVA	02/20/2004-09/30/2010

Seniority (the order of repayment in the event of a default) is labelled as "Senior" for almost all the banks. Seniority is labelled as "Senior" and the other is "Subordinated" for one part of the sample of the banks Intesa San Paolo, EFG Euro Bank, Banca MPS, Banco Comercial Portugues, Banco de Sabadell. Dexia, Rabo Bank an ABN AMRO have unknon seniority.

Table 3: Banks by country and data coverage of their CDS spreads

Country	Time period
Austria	02/20/2004-10/25/2013
Belgium	02/20/2004-10/25/2013
France	08/16/2005-10/25/2013
Germany	02/20/2004-10/25/2013
Greece	02/20/2004-02/23/2010
Ireland	10/24/2006-09/30/2010
Italy	02/20/2004-10/25/2013
Netherlands	10/23/2006-10/25/2013
Portugal	02/20/2004-10/25/2013
Spain	10/23/2006-10/25/2013

Table 4: Data coverage of sovereign CDS spreads

Variable	Mean	Std. Dev.	Min	Max
Belgium	51.22	66.30	0.78	341.98
Austria	35.37	41.53	0.37	215.77
Germany	17.19	17.60	0.44	79.29
Ireland	81.74	83.94	1.29	363.59
Greece	638.64	1776.377	3.19	14911.74
Spain	143.26	121.86	1.77	492.07
France	38.71	39.19	0.37	171.56
Italy	104.78	122.82	3.89	498.66
Netherlands	34.37	26.79	0.77	103.96
Portugal	230.23	339.30	1.46	1521.45

Table 5: Sovereign CDS spreads by country, 2004-2013

Variable	Mean	Std. Dev.	Min	Max
Belgium	71.55	64.67	4.83	289.09
Austria	93.22	71.28	2.60	378.04
Germany	29.35	22.70	2.64	109.25
Spain	128.70	114.86	7.93	444.21
France	72.29	68.66	4.45	304.87
Ireland	144.22	238.98	1.19	1240.82
Greece	484.91	558.97	2.86	1756.27
Italy	122.58	114.92	9.79	501.11
Netherlands	84.51	63.43	5.65	286.32
Portugal	254.93	293.70	11.40	1238.63

Table 6: Aggregate banking CDS spreads by country, 2004-2013

Variable	Mean	Std. Dev.	Min	Max
Austria	75.61	6.23	64.80	84.09
Belgium	97.07	5.72	85.51	106.37
France	85.72	10.61	73.92	104.0
Germany	70,83	5.96	63.46	80.25
Greece	138.99	25.85	103.1	173.25
Ireland	66.71	39.64	26.39	129.84
Italy	110.73	8.64	99.73	128.6
Netherlands	59.38	7.75	47.66	72.7
Portugal	93.68	25.70	64.54	142.94
Spain	59.44	18.5	38.88	97.96

Table 7: Debt/GDP by country. 2004-2013

Variable	Mean	Std. Dev.	Min	Max
Austria	-2.82	1.14	-5.3	-1.3
Belgium	-2.53	1.76	-5.5	0.3
France	-4.35	1.58	-7.2	-2.3
Germany	-1.55	1.46	-4.1	0.3
Greece	-10.11	2.36	-15.2	-6.1
Ireland	-8.08	9.61	-32.4	2.8
Italy	-3.46	0.88	-5.3	-1.5
Netherlands	-2.29	2.14	-5.5	0.2
Portugal	-6.31	2.37	-11.2	-3
Spain	-4.80	5.16	-11	2.2

Table 8: Government deficit by country, 2004-2013 (% of GDP)

Type of shock	Date	Sovereign/Bank	Description
ECON	**22/04/2010**	S	Eurostat says the Greek budget deficit in 2009 was wider than the goverment had estimated, and adds that is has reservations about the accuracy of Greek budget data that may lead to further upward revisions.
ECON	**23/04/2011**	S	EC data shows the Greek budget deficit jumped to 13.6% of gross domestic product in 2009. This is almost a full percentage point higher than the Greek government's projection in 12.7 per cent.
FORA	**17/03/2008**	B	Bear Sterns bankruptcy.
FORA	**15/09/2008**	B	Lehman Brothers files for bankruptcy.
MKT	**06/04/2010**	S	Greek government bond yields jump to 7.1% and the cost of insuring Greek government debt rockets, as market concerns accumulate over domestic capital flight and the country's ability to fund its budget deficit without aid from the IMF.
MKT	**25/05/2012**	B	Bankia's capital shortfall is estimated at €19bn, bringing the total cost of its rescue to €23.5bn (almost 2,5% of Spanish GDP).
MONP	**04/12/2008**	S-B	ECB decreases rates to 2.25% (75% bp)
MONP	**26/07/2012**	S-B	ECB President Mario Draghi says that the ECB, within its mandate, will do "whatever it takes to preserve the euro".
POLA	**02/12/2009**	B	EU creates new supervisory authorities on financial markets, banks and insurance companies.
POLA	**29/07/2010**	S	Italy's 25 billion euro (32.5 billion$) package of austerity measures is approved in the lower house, clearing its final parliamentary hurdle.
POLA	**11/03/2011**	S-B	Euro Area leaders agree on the "Pact for the Euro". The pact establishes stronger economic policy coordination for competitiveness and convergence and represents a strong political commitment by European heads of government.
POLI	**15/07/2011**	B	Stress tests published; the results of the second round of pan-European stress tests are made public.
POLI	**07/08/2011**	S	The ECB's Governing Council welcomes the announcements by Spain and Italy, in which they commit themselves to reform on fiscal and structural policies. The Governing Council stresses the importance of previous commitments made by the heads of state and government. The ECB also calls for the activation of the EFSF in the secondary market, once it becomes operational.
SOCU	**05/02/2010**	S	Spain attempts to raise the retirement age to 67 from 65, prompting a mass union demonstration agaist the government.
SOCU	**20/05/2010**	S	Thousands of Greek workers protest in Athens against cuts in wages and pensions.
RATE	**30/04/2012**	B	Standard and Poor's lowers the credit rating of 16 Spanish banks, including large international banks Santander and BBVA.
RATE	**01/04/2011**	S	Fitch Ratings cut Portugal's rating to BBB- from A-

Table 9: Sample of the events and their classification

Type of shocks	Sovereign shocks only	Banking shocks only	Both shocks
ECON	497	-	-
FORA	82	30	-
MKT	14	12	-
MONP	-	-	550
POLA	318	82	39
POLI	269	184	40
RATE	46	3	-
SOCU	9	-	-

Table 10: Classification of the shocks as banking shocks, sovereign shocks or both

Correlation coefficient (Bank CDS spread, Sovereign CDS spread)	All countries	Periphery	Core
Period			
2004-2013	0.772	0.782	0.671
February 2004-July 2007	0.146	0.003	-0.337
August 2007-July 25, 2012	0.792	0.798	0.538
October 2009-July 25, 2012	0.800	0.802	0.457
July 26, 2012-October 2013	0.967	0.952	0.569

Table 11: Correlation coefficient between banking and sovereign CDS spreads, 2004-2013

Period	Number of shocks	Total days	Frequency
2004-2013	1003	21061	4.76%
January 2004-July 2007	124	5918	2.10%
August 2007-July 25, 2012	752	12499	6.02%
October 2009-July 25, 2012	574	6749	8.5%
July 26, 2012-October 2013	127	2608	4.87%

Table 12: Number of sovereign shocks before, during, and after the crisis

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS	(9) OLS	(10) OLS
	2004-2013		2004-31Jul2007		31Jul2007-25Jul2012		1Oct2009-25Jul2012		26Jul2012-2013	
Bank CDS spread	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core
Sovereign CDS spread	0.244***	0.834*	0.407	-0.0116	0.223***	0.584	0.173***	0.522	0.847***	1.369***
	(0.0454)	(0.375)	(0.195)	(0.0835)	(0.0325)	(0.389)	(0.0205)	(0.441)	(0.0114)	(0.215)
VIX Index	2.364**	1.622	0.750**	0.297***	-1.263	1.183	6.452**	1.418*	-0.910	1.357***
	(0.560)	(1.017)	(0.239)	(0.0503)	(1.094)	(0.776)	(1.632)	(0.627)	(1.304)	(0.128)
Constant	86.69**	12.22	1.486	5.833***	218.1***	43.05**	157.7**	43.52	83.89**	26.99**
	(21.50)	(10.97)	(4.141)	(0.728)	(34.19)	(10.89)	(43.28)	(21.10)	(16.34)	(8.331)
Observations	9,514	11,547	2,606	3,402	5,914	6,495	3,084	3,665	978	1,630
R-squared	0.612	0.556	0.227	0.010	0.628	0.340	0.625	0.332	0.789	0.727
Number of countries	5	5	5	5	5	5	5	5	3	5

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 13: OLS regressions by country groups, 2004-2013

	(1) IV2	(2) IV2	(3) IV2	(4) IV2	(5) IV2	(6) IV2	(7) IV2	(8) IV2	(9) IV2	(10) IV2
	2004-2013		2004-31Jul2007		31Jul2007-25Jul2012		1Oct2009-25Jul2012		26Jul2012-2013	
Bank CDS spread	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core
Sovereign CDS spread	0.538***	1.058**	-0.322	-0.772	0.496***	0.659	0.245***	0.702	-0.032	-0.621
	(0.125)	(0.423)	(0.717)	(0.893)	(0.0968)	(0.406)	(0.0149)	(0.596)	(0.201)	(0.584)
VIX index	1.247***	1.292	0.721***	0.304***	0.125	1.154	4.778**	1.088		3.247***
	(0.409)	(0.990)	(0.217)	(0.0346)	(0.352)	(0.727)	(1.911)	(0.928)		(0.541)
Observations	9,514	11,547	2,601	3,397	5,914	6,495	3,084	3,665	978	1,630
Number of countries	5	5	5	5	5	5	5	5	3	5
Weak identification test (Cragg-Donald Wald F statistic)	16.058	5.289	8.546	2.922	71.724	4.214	21.613	23.259	.	4.713
Maximal IV relative bias	5%	30%	20%	30%	5%	30%	5%	5%		30%
Overidentification test (Hansen J statistic)	2.537	2.495	1.343	0.986	3.446	4.147	1.264	3.506	1.508	0.624
P-value	0.2812	0.2873	0.5110	0.6109	0.1785	0.1258	0.5314	0.1732	0.4706	0.7321

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The Weak identification test is not computed for Periphery countries in the last period due to collinearity problems. Only with this specification the instrument built as the interaction term between the weekly average number of shocks and the sovereign shock dummy creates collinearity in the first stage regression. Dropping that term, the multicollinearity disappears, the instruments are strong (Maximum bias at less than 10%) and the coefficient of the second stage is not significant.

Table 14: TSLS, panel regression by country groups, second stage, 2004-2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	IV1	IV1	IV1	IV1	IV1	IV1	IV1	IV1	IV1	IV1
	2004-2013		2004-31Jul2007		31Jul2007-25Jul2012		1Oct2009-25Jul2012		26Jul2012-2013	
Sovereign CDS spread	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core
Dummy sovereign shock	277.919	7.457**	0.407	-0.620**	292.449	3.915	213.398**	12.529***	3.975**	1.119
	(222.293)	(3.224)	(1.077)	(0.257)	(214.536)	(3.094)	(83.381)	(4.784)	(1.962)	(1.104)
Weekly frequency mean of shocks	901.841*	54.544***	-1.016	0.718	802.572*	55.745***	-365.150	28.505***	-27.488***	-7.257***
	(546.164)	(15.158)	(0.727)	(0.562)	(453.761)	(17.379)	(338.214)	(9.737)	(3.991)	(1.965)
Dummy sovereign*Weekly frequency	-1077.225	-25.967**	-0.900	1.746	-1162.248	-11.179	-797.458***	-39.030**	-1.177	-1.519
	(871.897)	(11.750)	(4.018)	(1.533)	(865.911)	(11.933)	(304.289)	(16.137)	(6.288)	(3.359)
VIX index	3.465*	1.449***	-0.019	0.050***	-4.474	0.397	24.880	1.803***		0.951***
	(1.783)	(0.354)	(0.027)	(0.013)	(2.782)	(0.263)	(17.663)	(0.488)		(0.347)
Observations	9,514	11,547	2,601	3,397	5,914	6,495	3,084	3,665	978	1,630
Number of countries	5	5	5	5	5	5	5	5	3	5
F test of excluded instruments	16.06	5.29	8.55	2.92	71.72	4.21	21.61	23.26	3.3e+14	4.71
P-value	0.0107	0.0707	0.0326	0.1635	0.0006	0.0992	0.0062	0.0054	0.0000	0.0842

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 15: TSLS, panel regression by country groups, first stage, 2004-2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
	2004-2013		2004-31Jul2007		31Jul2007-25Jul2012		1Oct2009-25Jul2012		26Jul2012-2013	
Bank CDS spread	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core
Sovereign CDS spread	0.184***	0.433	0.350	0.0162	0.176***	0.288	0.156***	0.339	0.862***	1.305***
	(0.0199)	(0.297)	(0.276)	(0.0474)	(0.0161)	(0.437)	(0.00542)	(0.464)	(0.0223)	(0.208)
VIX Index	1.232	1.678	0.755***	0.342**	1.194***	1.550	7.151**	1.726*	-0.823	1.317***
	(0.812)	(0.946)	(0.129)	(0.0984)	(0.230)	(0.834)	(2.219)	(0.791)	(1.179)	(0.154)
Debt/GDP	6.798***	3.644***	-0.959	-0.234	8.496**	3.930	16.33**	5.646	2.095	-8.160
	(1.218)	(0.733)	(0.608)	(0.512)	(2.112)	(2.135)	(4.516)	(6.833)	(2.933)	(4.473)
Constant	-516.0***	-256.8**	78.08	21.87	-664.0**	-260.6	-1,680**	-414.3	-160.1	718.8
	(106.1)	(65.00)	(48.52)	(35.36)	(203.4)	(164.3)	(543.1)	(554.8)	(322.3)	(382.9)
Observations	9,514	11,547	2,606	3,402	5,914	6,495	3,084	3,665	978	1,630
R-squared	0.839	0.677	0.363	0.014	0.829	0.421	0.836	0.375	0.790	0.748
Number of countries	5	5	5	5	5	5	5	5	3	5

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 16: OLS regressions using Debt/GDP as independent variable, 2004-2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	IV2	IV2	IV2	IV2	IV2	IV2	IV2	IV2	IV2	IV2
	2004-2013		2004-31Jul2007		31Jul2007-25Jul2012		1Oct2009-25Jul2012		26Jul2012-2013	
Bank CDS spread	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core
Sovereign CDS spread	0.301***	0.304	-0.693	-0.0899	0.199***	0.153	0.204***	0.644	0.056	-0.648
	(0.0675)	(0.477)	(0.932)	(0.351)	(0.0356)	(0.645)	(0.0299)	(0.748)	(0.454)	(0.622)
VIX index	1.153**	1.803*	0.713***	0.312***	1.148***	1.654*	6.014***	1.184		2.976***
	(0.586)	(1.057)	(0.118)	(0.0785)	(0.262)	(0.960)	(1.742)	(1.228)		(0.269)
Debt/GDP	4.958***	4.085***	-1.085*	-0.214	7.972***	4.735	15.15***	2.003		-24.00
	(0.999)	(1.286)	(0.607)	(0.490)	(2.251)	(3.426)	(4.211)	(7.501)		(16.31)
Observations	9,514	11,547	2,601	3,397	5,914	6,495	3,084	3,665	978	1,630
Number of country	5	5	5	5	5	5	5	5	3	5
Weak identification test (Cragg-Donald										
Wald F statistic)	22.787	3.602	49.227	5.734	0.903	9.245	15.832	7.324	.	4.191
Maximal IV relative bias	5%	30%	5%	30%	30%	10%	5%	20%	.	30%
Overidentification test (Hansen J statistic)	4.428	3.892	0.442	1.157	3.762	3.728	3.323	3.207	2.754	0.721
P-value	0.1093	0.1428	0.8019	0.5607	0.1524	0.1550	0.1898	0.2011	0.2523	0.6972

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The Weak identification test is not computed for Periphery countries in the last period due to collinearity problems. Only with this specification the instrument built as the interaction term between the weekly average number of shocks and the sovereign shock dummy creates collinearity in the first stage regression. Dropping that term, the multicollinearity disappears, the instruments are weak (Maximum bias between 10% and 15%) but the coefficient of the second stage remains not significant.

Table 17: TSLS, panel regression by country groups, results using debt/GDP as independent variable, second stage, 2004-2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	IV1	IV1	IV1	IV1	IV1	IV1	IV1	IV1	IV1	IV1
	2004-2013		2004-31Jul2007		31Jul2007-25Jul2012		1Oct2009-25Jul2012		26Jul2012-2013	
Sovereign CDS spread	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core
Dummy sovereign shock	196.780	3.467	0.329	-0.728**	194.944	2.061	192.088**	9.571**	16.006***	1.280
	(141.624)	(2.537)	(0.925)	(0.309)	(127.764)	(2.772)	(76.844)	(4.370)	(0.762)	(1.377)
Weekly frequency mean of shocks	288.302*	19.594**	-0.981	0.588	157.717	19.330**	-366.190	15.595***	-17.121*	-7.103***
	(150.919)	(9.119)	(0.703)	(0.551)	(141.590)	(9.300)	(301.024)	(4.990)	(10.148)	(2.083)
Dummy sovereign*Weekly frequency	-737.386	-9.363	-0.635	2.135	-751.720	-3.338	-697.419**	-29.177*	-42.969***	-2.207
	(545.599)	(9.219)	(3.523)	(1.706)	(493.541)	(10.983)	(269.080)	(14.886)	(5.252)	(4.466)
VIX index	0.655	0.968***	-0.019	0.021	1.989*	0.768***	25.225	1.764***		0.851***
	(1.314)	(0.192)	(0.027)	(0.017)	(1.130)	(0.200)	(18.673)	(0.506)		(0.307)
Debt/GDP	15.282**	3.377***	-0.114	0.148***	21.899**	5.879***	24.0369***	11.843***		-8.106
	(6.890)	(0.673)	(0.182)	(0.014)	(9.908)	(1.422)	(7.499)	(4.115)		(7.095)
Observations	9,514	11,547	2,601	3,397	5,914	6,495	3,084	3,665	978	1,630
Number of countries	5	5	5	5	5	5	5	5	3	5
F test of excluded instruments	22.79	3.60	49.23	5.73	0.90	9.24	15.83	7.32	.	4.19
P-value	0.0056	0.1238	0.0013	0.0624	0.5140	0.0285	0.0110	0.0421	.	0.1000

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 18: TSLS, panel regression using debt/GDP as exogenous variable, first stage, by country groups, 2004-2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	IV1	IV1	IV1	IV1	IV1	IV1	IV1	IV1	IV1	IV1
	2004-2013		2004-31Jul2007		31Jul2007-25Jul2012		1Oct2009-25Jul2012		26Jul2012-2013	
Sovereign CDS spread	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core
Dummy sovereign*Weekly frequency	-737.386	-9.363	-0.638	2.125	-751.720	-3.338	-697.419**	-29.177*	-42.969***	-2.207
	(545.599)	(9.219)	(3.529)	(1.709)	(493.541)	(10.983)	(269.080)	(14.886)	(5.252)	(4.466)
Weekly frequency mean of shocks	288.302*	19.594**	-0.976	0.590	157.717	19.330**	-366.190	15.595***	-17.121*	-7.103***
	(150.919)	(9.119)	(0.700)	(0.554)	(141.590)	(9.300)	(301.024)	(4.990)	(10.148)	(2.083)
Dummy sovereign shock	196.780	3.467	0.330	-0.725**	194.944	2.061	192.088**	9.571**	16.006***	1.280
	(141.624)	(2.537)	(0.926)	(0.308)	(127.764)	(2.772)	(76.844)	(4.370)	(0.762)	(1.377)
VIX index	0.655	0.968***	-0.021	0.021	1.989*	0.768***	25.225	1.764***	6.233*	0.851***
	(1.314)	(0.192)	(0.026)	(0.017)	(1.130)	(0.200)	(18.673)	(0.506)	(3.575)	(0.307)
Debt/GDP	15.282**	3.377***	-0.117	0.147***	21.899**	5.879***	24.037***	11.843***	-33.939***	-8.106
	(6.889768)	(0.673)	(0.182)	(0.014)	(9.908)	(1.422)	(7.499)	(4.115)	(5.413)	(7.095)
Observations	9,514	11,547	2,606	3,402	5,914	6,495	3,084	3,665	978	1,630
Number of countries	5	5	5	5	5	5	5	5	3	5
F test of excluded instruments	2.32	2.58	1.70	3.10	1.23	2.38	20.69	7.68	1800.47	5.82
P-value	0.2148	0.1908	0.2916	0.1536	0.3826	0.2085	0.0078	0.0427	0.0006	0.0654

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 19: TSLS, panel regression by country groups, using debt/GDP and sovereign shocks as exogenous variables, first stage, 2004-2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	IV2	IV2	IV2	IV2	IV2	IV2	IV2	IV2	IV2	IV2
	2004-2013		2004-31Jul2007		31Jul2007-25Jul2012		1Oct2009-25Jul2012		26Jul2012-2013	
Banking CDS spread	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core	Periphery	Core
Sovereign CDS spread	0.278***	0.196	-0.584	-0.190	0.195***	-0.0653	0.211***	0.516	0.115	-0.667
	(0.0514)	(0.472)	(0.879)	(0.379)	(0.0359)	(0.638)	(0.0333)	(0.766)	(0.441)	(0.640)
Dummy sovereign shock	9.725***	1.933***	0.0853	-0.183	6.828	3.824***	4.959***	1.880***	2.242***	-0.160
	(1.079)	(0.578)	(0.220)	(0.137)	(6.789)	(1.025)	(1.354)	(0.721)	(0.690)	(0.369)
VIX index	1.165*	1.908*	0.735***	0.346***	1.157***	1.821*	5.831***	1.407	3.813***	2.992***
	(0.615)	(1.071)	(0.120)	(0.0851)	(0.268)	(0.964)	(1.701)	(1.313)	(1.320)	(0.267)
Debt/GDP	5.308***	4.453***	-1.070*	-0.203	8.050***	6.017*	14.98***	3.524	-23.29*	-24.16
	(0.971)	(1.326)	(0.597)	(0.485)	(2.205)	(3.636)	(4.212)	(8.200)	(13.24)	(16.70)
Observations	9,514	11,547	2,606	3,402	5,914	6,495	3,084	3,665	978	1,630
Number of country	5	5	5	5	5	5	5	5	3	5
Weak identification test (Cragg-Donald Wald F statistic)	2.316	2.578	1.704	3.103	1.233	2.380	20.686	7.681	.	5.818
Maximal IV relative bias	25%	25%	25%	25%	25%	25%	10%	25%	.	25%
Overidentification test (Hansen J statistic)	4.612	0.428	0.465	1.131	0.115	0.147	1.224	0.425	.	0.004
P-value	0.0318	0.5132	0.4953	0.2876	0.7343	0.7016	0.2685	0.5145	.	0.9492

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 20: TSLS, panel regression by country groups, results using debt/GDP and dummy sovereign shocks as independent variables, second stage, 2004-2013