Risk transfer and implicit insurance: The effect of banks' downgrades on sovereign debt

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Abstract

The latest crisis has demonstrated the close link between the financial sector and sovereign debt risk. Safety nets have regain importance in the public agendas, since they imply a risk transfer from banks to governments. In order to quantify this effect, I propose an event study to assess the effects on sovereign bond spreads, of downgrades on banks' stand alone ratings. I find a positive and significant association, i.e. downgrades lead to an increase in sovereign spreads. This effect is significantly larger when bank's default risk is high enough (i.e. downgrades within speculative grades). These results suggest that ratings convey additional information about banks' health to the market. Finally, including banks' systemic size into the analysis allows to test if banks are regarded as 'Too Big to Fail'. Results suggest that larger banks cause a wider increase in sovereign spreads (consistent with the idea that banks are still insured by governments). Nevertheless, in distressed economies there seems to be evidence consistent with the idea that some banks might have become 'Too Big to Save'.

Keywords: Sovereign Debt, Financial Crisis, Implicit Insurance, Market Discipline, Credit Ratings, Too-Big-to-Fail, Too-Big-to-Save.

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1 Introduction

During the last crisis many financial institutions were under severe distress. Explicit safety nets (e.g. deposit insurance schemes) and implicit guarantees (in the form of 'Too Big to Fail'-*TBTF*) became more important for banks and other thrift institutions.

Governments around the globe decided to bailout banks, providing liquidity support, recapitalization programs, nationalizing banks, or simply offering larger guarantees on their liabilities, extending the safety nets coverage. But these bailout policies come at a cost for governments. Bank's financial instability was passed on to governments, leading to a sovereign debt crisis (Dieckmann and Plank, 2012; Acharya et al., 2014). This situation further worsened banks financial health (Acharya and Rajan, 2013; Gennaioli et al., 2014; Acharya and Steffen, 2015).

Sovereign credit risk is a relatively new problem. Before the 2007-2008 crisis there was no sign of it. Nevertheless, it seems that the health of the financial system has a direct consequence on sovereign debt risk, and both are tightly related. Acharya et al. (2014) argue that large bailouts are likely to be funded with new debt, diluting existing debt-holders value. A good example of this situation is the case of Ireland. After the Irish government announced a full insurance on all deposits for all major banks (September, 2008), there was a steep increase in the Irish sovereign CDS spread. On the other hand Iceland seems to be an interesting counter-factual: when it was clear that the Icelandic government was not going to bailout the financial system, spreads fell significantly (Acharya et al., 2014).

Additionally, the sovereign crisis might cause an additional problem, since an impairment on governments' fiscal capacity might jeopardize their ability to further protect financial institutions. This is particularly relevant for distressed, highly indebted economies running large fiscal deficits. Under this new scenario, larger banks might simply become 'Too Big to Save' (*TBTS*). This hypothesis implies that banks might be so large (or governments so financially distressed) that they are less likely to be bailed out (Rime, 2005; Allen et al., 2011; Bertay et al., 2013; Demirgüç-Kunt and Huizinga, 2013; Zaghini, 2014).

As a result from this situation, regulators have been requested to take action to tackle this problem, directly intervening banks' size. This is reflected in the following excerpts: "in the absence of effective market discipline on bank systemic size, public policy [...] is required to bring down bank systemic size [...] regulation can take the form of quantitative limits on bank size"(Huizinga and Demirgüç-Kunt, 2011), or "neutralizing the long-term threat to financial stability of too big to save banks, however, will require a separate antidote [...] policymakers need to take a play from the antitrust handbook and break up any firm that is too big to save"(Millstein, 2011). Nevertheless, carving up large banks (specially when they are international banks) might not make them safer, but just the opposite. Many small banks can generate a deep crisis just as one large bank can since the risk on their balances is in general more concentrated. A clear example of this situation occurs in Spain where the two largest banks (Santander and BBVA) were not as affected by the crisis as many other small 'Cajas' that eventually needed to be rescued (Dewatripont, 2014). Then market's expectations on potential bailouts, and the size of it, might be a useful tool for regulators.

The regulatory implications of these problems are significant, since the social costs of implicit insurance is deeper when the government is under financial distress (Acharya and Yorulmazer, 2007). Finding the proper way to deal with these problems requires first a deeper understanding of these issues: to what extent is there a risk-transfer from banks to sovereigns?, what is the magnitude of such risk-shift? Do all banks affect similarly sovereigns? Does the market perceive larger banks are still implicitly insured? Do market participants consider some banks might be are *TBTS*?

In order to complement the existing literature I propose an event study similar to Ongena et al. (2003), and Afonso et al. (2012). I examine the effect of Moody's downgrades on banks' financial strength ratings (Moody's Investors Service, 2013), a standalone rating, on sovereign bond spreads, for a number of Western Europe countries during the last financial crisis. Banks' downgrades are considered as a signal of increased default risk (Billett et al., 1998). In addition focusing on a crisis periods, allows for better quality in the rating process (Bar-Isaac and Shapiro 2013 show that rating agencies' incentives to issue accurate ratings is countercyclical). The event study methodology allows me to clearly quantify the effect of an increase in bank risk on sovereigns bonds while reducing endogeneity problems associated with the causality channel. If there exists a risk transfer, or pass-through, from the financial system to sovereign debt, we should expected an increase in spreads after a downgrade on a bank. Downgraded banks have higher default risk, increasing the need of potential bailouts (or other forms of government support). If these are financed with new debt, there would be a dilution on existing debt-holders, increasing their risk exposure. These is consistent as well, with the idea that debt-to-GDP is an important short-run determinant of sovereign yields (Poghosyan, 2014).

Additionally, since the risk transfer proposal is consistent with the idea of future bailout expectations (Dieckmann and Plank, 2012) we can take a step forward and try to explain whether banks are still regarded as *TBTF* by the market, or if some of them have become *TBTS*. If markets consider that some banks are not longer implicitly supported by governments (as stated by the *TBTS* hypothesis) the effect on spreads should not be significantly larger for bigger banks (since the bank is not expected to receive a bailout, sovereign debt levels should not change as much). On the other hand, the *TBTF* hypothesis would always imply that downgrades on larger banks would have a stronger effect on sovereigns (Dieckmann and Plank, 2012; Acharya et al., 2014).

The evidence from the event study suggests a significant risk transfer from banks to sovereigns. The average change in daily sovereign spreads after a downgrade is about 2.11 basis points -bps- (for the Euro-area countries in the sample). If we split downgrades between those leading to speculative grades (or that deepens the bank into this category), and those in which the bank remains within investment grade category, results change somehow. Downgrades in which the bank remains within investment grade category (i.e. low risk downgrades), do not imply a statistically significant change in spreads (less than 1 bps). But for speculative downgrades (i.e. high risk downgrades), the average effect on the daily change of spread rises to 2.99 bps (for the Euro-area countries in the sample). In general, each downgraded notch implies an average increase in spreads of 1.3 bps. Whenever downgrades occur on a distressed economy, they lead to an additional increase (over non-distressed economies) of 2.04 bps on spreads, i.e. for distressed countries, the risk-transfer implies a more severe problem to the government. The main results and conclusions remain mostly unchanged after a battery of robustness checks.

Additionally, results also suggest that creditors are still expecting a bailout for these banks, and the expected value of being bailed out is positive and larger for bigger banks. Particularly when a bank with systemic size of at least 50% is downgraded, there is an additional effect of 2.06 bps on spreads over smaller banks[1]. If we set this size threshold at 100% systemic size, the additional effect on spreads is about 2.32 bps. In general it seems that as the size of downgraded bank increases, the effect on spreads is significantly larger. These results are consistent with the idea that the market considers that large banks are still implicitly insured by governments. Nevertheless analyzing downgrades of systemically large banks in distressed economies, I find different results, i.e. the effect on spreads of downgrades to large banks located in GIIPS economies is lower that the average effect. Particularly if a downgrade (within speculative grades) on a bank with systemic size larger than 100% occurs on a distressed economy, there is a significantly lower impact on spreads. This would be consistent with the belief that some banks located in distressed countries, might be considered as *TBTS* by the market. Finally the cross-sectional analysis confirms that downgrades on larger banks induce

[1]Systemic size is measured as the ratio of bank's total liabilities to home country's GDP.

a wider increase in spreads, while downgrades on systemically larger banks are less harmful in terms of risk transfer (even after controlling for other bank's characteristics). This analysis also allows to test for the existence of a 'Too Many to Fail' ($TMTF$) situation, when multiple downgrades occur. But I find that this is not the case, at least for the sample used.

This paper contributes to the existing literature in several ways. First, using a novel approach I am able to confirm and quantify the degree of risk transfer between banks and sovereigns. To the extent of my knowledge, this is the first paper that relates banks' rating downgrades to sovereign bond spreads, increasing our understanding on the relationship between the financial sector and government debt. In the same line, using an event study allows to reduce more severe endogeneity problems that other methodologies might have[2]. An additional advantage of the methodology is the neat way to interpret the results in terms of changes in spreads. Another novel feature is the use of banks' standalone rating downgrades as a signal of increased default risk, a documented fact in the literature. Results complement the literature on the utility of credit ratings, and the information transmission to the markets. Finally, I contribute to the literature on implicit guarantees and public provision of funds to the financial system. Using an European sample poses several improvements as well: it allows for the existence of 'systemic banks' (a feature that a US sample might not permit). It allows for heterogeneity as well as it enhances the comparability of the results. Even though there is evidence of the existence implicit safety nets to the banking system, I do find results consistence with the existence of $TBTS$ banks in distressed economies.

The rest of the paper is organized as follows: Section 2 presents a literature review. Section 3 explains the methodology and data used. Section 4 presents the empirical results and section 5 concludes.

2 Literature Review

2.1 Sovereigns Spreads

The literature of sovereign yield determinants is widespread. Bulow and Rogoff (1989) argue that borrowers' reputation is not an important determinant on international loans, but the existence of legal penalties in the case of default are. Duffie et al. (2003) emphasize the importance of political events and foreign currency reserves on sovereign prices. Amira (2004) finds that macroeconomic variables (such as inflation, fiscal imbalance or GDP) partially explain spreads. Hilscher and Nosbusch (2010) find that terms of trade and other fundamentals have

[2] However we can not be sure that they are completely overcome as argued by Roberts and Whited 2012

significant explanatory power for emerging markets' sovereign spreads. Bernoth and Erdogan (2012) argue that changes in macroeconomic fundamentals and risk-pricing are important determinants of European sovereign yields. On a related work Bernoth et al. (2012) suggest that after the financial crisis Germany gained a 'safe-heaven status'. Finally, a recent paper by Poghosyan (2014) finds that, even though in the long run sovereign yields (for advanced economies) are determined mainly by growth potential, in the short-run debt-to-GDP is more important.

2.2 Sovereigns and the Financial Sector

Acharya and Rajan (2013) present a theoretical model in which myopic and highly indebted governments have incentives to increase sovereign debt holding by their own banks, in order to signal a high cost of default. This would explain the large amount of sovereign holdings by banks in distressed economies. This increases the vulnerability of their financial system.

Gennaioli et al. (2014) develop a model in which sovereign default deteriorates domestic banks' balance sheet. They argue that countries with more developed financial institutions have banks with larger sovereign holdings, such that when governments default, the consequences on the financial are greater. Additionally, the authors confirm these predictions empirically.

Additionally Acharya and Steffen (2015) find a "carry trade" behavior when analyzing bank risk taking. The authors analyze the risk passage from sovereigns to banks, and find that bank stock returns are positively related to sovereign bond holdings from peripheral countries (GIIPS) while negatively related to German bonds. Banks increased long-term periphery sovereign holding using short-term debt. This explains the later deterioration of bank's soundness as the risk of sovereigns soared.

On the other hand, Dieckmann and Plank (2012) find a risk transfer from the private to the public sector. They analyze sovereigns CDS spreads for a set of countries, and argue that the health of their own financial system is an significant determinant on the CDS price. The more important the financial system, the more explanatory power (particularly for EMU countries). This risk transfer is consistent with the idea that the markets expect bailouts to the bank sector.

Finally Acharya et al. (2014) find an interesting relationship between sovereigns and bailouts in the financial system. They develop a theoretical model argue that there is a feedback effect related to a double debt-overhang problem. In this context, distressed banks lead to bailouts by the government increasing sovereign risk. This in turn erodes the value of government bond holdings by banks. They test their model analyzing the relationship between bank's CDS and sovereigns CDS spreads. They find that after the first waive of bailouts after the financial crisis, these two variables are significantly related. This is a clear example of how bank's bailouts (or potentially a promise of bailout) have an important impact on sovereigns. After the rescue, sovereign's CDS is a significant determinant of banks' CDS spread.

2.3 Banks, sovereigns and rating agencies

One could argue that rating agencies can not transmit new data to the market, since it should be aware of all the information agencies use in their calculation. Nevertheless this might not be the case for banks, since it is an inherently opaque industry. Morgan (2002) analyzed rating agencies (Moody's and S&P) discrepancies on ratings. He finds that agencies tend to disagree more when rating banks due to their opaqueness. This means that ratings might be able to convey additional information to the market.

When considering government debt, Amira (2004) finds that Moody's and S&P ratings have some explanatory power to predict sovereign yields. But, considering an historical perspective, Flandreau et al. (2011) argue that rating agencies do not have a superior forecasting ability to assess sovereign risk. On the other hand Afonso et al. (2012) arrive to a different conclusion. They use an event study to assess the effect of downgrades, upgrades and outlook changes, on sovereign debt and CDS spreads. The authors find a significant reaction to announcements from S&P, Moody's and Fitch (particularly important for downgrades). Additionally they find that ratings announcements do not seem to be anticipated on the previous months.

Regarding agencies incentives to provide high quality information, Bar-Isaac and Shapiro (2013) develop a very useful theoretical model. They analyze how these incentives change with the business cycle, and find that due to reputation issues, agencies tend to release higher quality ratings (i.e. more accurate) during recessions than in booms.

Packer and Tarashev (2011) provide some interesting facts with respect to bank ratings. For instance, after the last financial crisis all major agencies have implicitly agreed that European largest banks' creditworthiness has been reduced. This agreement seems to be greater than before, since implicit government support (which difficult to estimate) seems to be impaired, leaving banks exposed. The authors also recognize the different approaches used by the three main credit rating agencies. For instance they argue that Moody's standalone rating is based on "forward-looking assessments of capital ratios, based on embedded expected losses", while Fitch focuses more on off-balance sheet items.

Finally there are several studies that relate banks' ratings with market discipline and safety-nets. For instance Billett et al. (1998) use Moody's downgrades as a proxy for "discrete changes in bank risk" in order to study how banks change their liability structure to evade market discipline. Or Rime (2005) that analyzes ratings from Fitch and Moody's to assess if implicit insurance push banks' ratings upward.

2.4 Safety Nets and Market Discipline

Consider market discipline, as a market-based incentive system to prevent risk taking from banks. Here, bank's creditors are able to penalize risky behavior by demanding higher interest rates for their funds, or simply by denying these funds to risky bank.

Now consider banks' unstable structure. The maturity mismatch between assets and liabilities, leaves the system subject to potential pure panic runs (Diamond and Dybvig, 1983). Safety nets arise then to reduce or eliminate the consequences of pure panic (inefficient) bank runs, and to insure small depositors.

If market discipline is to be a useful tool, we need that stakeholders face potential losses. The same safety-nets that help to prevent panics (e.g. deposit insurance schemes) might jeopardize market discipline worsening the moral hazard problem (i.e. creditors do not monitor banks, hence they undertake excessive risk).

Billett et al. (1998) use an event study and find that after suffering downgrades, banks change their liabilities structure, i.e. they increase their proportion of insured deposits (decreasing their share of uninsured debt). Hence they would face lower market discipline since the insurance "shields banks from the full cost of market discipline". The regulatory environment might undermine the effectiveness of market discipline.

Demirgüç-Kunt and Huizinga (2004) analyze deposit insurance schemes around the world, and find that banks' creditors have lower incentives to monitor banks whenever insurance schemes are more generous. Baier et al. (2012) arrive to similar conclusions. On the other hand, Martinez-Peria and Schmukler (2001) suggest that despite deposit insurance schemes, depositors still exert some market discipline.

2.4.1 'Too Big to Fail'

The moral hazard problem is exacerbated when banks are regarded as *TBTF*. The rationale is as follows: if creditors expect bailouts for banks under financial distress, their incentives to monitor risk are low. Banks have strong incentives to increase size, becoming *TBTF*. When banks do not face the downward risk of their investment (as with any other type of insurance) they have incentives to undertake more risk[3]. Hence they become riskier, so their incentives to grow larger increase in order to ensure the implicit guarantee. This is the vicious circle pointed by Ennis and Malek (2005).

One of the seminal papers is presented by O'Hara and Shaw (1990). They use an event study, and find that banks considered to be *TBTF* had a positive wealth effect when the comptroller of the currency announced that some large banks might receive financial support if needed[4]. This is an example of market reaction to bailout expectations.

Penas and Unal (2004) follow a different approach and study the reaction of bond prices whenever there are M&A announcements. They find strong support for the *TBTF* hypothesis: when a merger leads to a sufficiently large size, there is a reduction in the cost of debt. This does not occur for mergers between small banks (leading to a new small or medium size bank) or to mergers of banks that were already big.

2.4.2 'Too Big to Save'

Allen et al. (2011) consider a different scenario. Whenever governments are in financial distress they might not honor their guarantees and larger banks may simply become *TBTS*. Under this perspective, the state of public finances might restraint the set of possible actions to solve banks' distress. Countries in a monetary union would face additional problems since they loose their ability to monetize their guarantees by printing money and diluting the real value of their debt[5].

Rime (2005) analyses the information contained in banks' ratings (by Moody's and Fitch), and finds no evidence to support the idea that some banks are too-big-to-be-rescued. Particularly, he finds no important relationship between banks' liabilities-to-GDP ratio (as a measure of their systemic importance) and the corresponding rating issued for that particular bank.

Later, Demirgüç-Kunt and Huizinga (2013) test the *TBTS* hypothesis analyzing banks' equity prices and the mean annual CDS spread. They find that market value was severely damaged (and CDS spreads increased) for 'systemically large' banks. The negative effect was

[3]Merton (1977) demonstrates the correspondence between loan guarantees and put options. Greater volatility implies a larger value for the option. This means that in order to maximize the value of the insurance agents increase the level of risk of their assets.

[4]In 1984, after the bailout of Continental Illinois Bank, the comptroller of the currency (testifying at the Congress) admitted that if needed larger banks would be granted financial aid. On that session congressman McKinney admitted that "We have a new kind of bank. It is called too big to fail."

[5]The same situation arises if we consider a small country that issues debt in foreign denominated currencies. Such was the case of Iceland, which had deposits denominated in foreign currency.

larger when the 'systemic bank' was located in a country with a large fiscal deficit or a high level of sovereign debt. The 'systemic' importance is measured as the 'Total Liabilities-to-GDP' ratio. Additional support for the *TBTS* hypothesis comes from Bertay et al. (2013). They find that systemically large banks present lower returns with no corresponding risk reduction with respect to smaller banks. In addition *TBTS* banks face higher funding costs and deposit withdrawals (measures of market discipline).

The implications of this hypothesis are completely different from the usual moral hazard problem imposed by the *TBTF*. *TBTS* banks should have incentives to lower their size in order to avoid penalizations by the market. Bertay et al. (2013) argue that poor governance makes banks insensitive to market discipline. Then a different set of regulations would be needed. For instance, impose limits to banks' size or force them to split and reduce their size and operations (Huizinga and Demirgüç-Kunt, 2011). But if banks are still protected by the implicit insurance, forcing them to reduce their size will not take care of the incentive's problem caused by the *TBTF* subsidy.

3 Data and methodology

3.1 Data

Using Datastream I gather information for daily yields to redemption for 10 year sovereign bonds for a set of countries. Datastream calculates these yields using the price of a single underlying bond. For all the countries analyzed, there exists a 10 year bond, so results are comparable. Datastream uses a benchmark bond for this estimation that is reviewed each month. In general it is represented by the latest issue or the most representative one, within that maturity.

The timespan goes from January, 3^{rd} 2005, until December, 31^{st} 2013. The countries under analysis are Belgium, France, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Switzerland and UK. Additionally, I use German yields to construct the spreads over a benchmark bonds. Since Germany is regarded as a 'safe heaven' (Bernoth et al., 2012), it might be used as a 'risk-less' rate. Additionally it is useful to control for common shocks across countries. Due to currency exchange concerns, I also analyze separately the subsample of euro-area countries, i.e. leaving out the UK and Switzerland. I end up with a panel of 23,460 country-day observations on the 'Full-Sample' and 18,768 for the 'EMU-Sample'.

Some of these European countries were under severe financial distress, with high ratios of government debt to GDP and high borrowing costs (as compared to a safer option, e.g.

German bonds). These elements limit governments ability to bailout banks, setting the proper environment for a *TBTS* situation to arise.

Using the research and ratings module from Moody's, I hand collected a series of 'Bank Financial Strength Rating' (*BFSR*) downgrades. *BFSR* is an assessment of banks' intrinsic or standalone strength. It does not consider any form of external support (capital injections, asset purchases, etc) which is difficult to measure. It is the main input to obtain the final rating for debt issued by a bank. As in Billett et al. (1998) I use Moody's downgrades as an indicator of increasing risk for banks. I collected information on all downgrades, for all registered banks within the set of countries in the sample, for the time period under analysis. I end up with 476 downgrades. There are 283 cases in which more than one bank is downgraded on a single day in the country, and only 193 cases in which the bank was the only one downgraded on the day (i.e. downgrades occur either for individual banks, or for a group of banks.). There are 253 days in which at least one downgrade occurs (193 observations with a single downgrade, and 60 observations with multiple downgrades).

I also follow a common practice, and transform the standalone grade into a numeric variable (from $A = 1$, to $E = 13$) and classify downgrades according to it. The average grade after a downgrade lies between $C-$ and $D+$, and the average amount of downgraded notches is 1.5 . There are cases in which a downgrade leads to a speculative grade, and some of them keep the bank within investment grade leading to classify them between 'investment' or 'speculative' downgrades. In 127 days, these downgrades led to a speculative grade in terms of the *BFSR*, i.e. lower or equal than $D+$ (the standalone equivalent to a *ba1* 'all in-rating' for Moody's). Table 1 presents this information.

When on a single day and within the same country, several banks are downgraded, it is classified as investment or speculative, depending on the situation of the largest bank in the group (as measured by the size of its liabilities). If the grade of the largest bank is speculative, regardless of the rest of the banks grade, the downgrade is classified as a speculative one. I present two different alternatives to classify the grade in these cases: as the simple mean of the grades for all banks downgraded on the day (for each country), or alternatively as the weighted average of the grades (using as coefficients the relative size of each bank). Table 2 presents a summary of the days with downgrades, and 'speculative' downgrades (using the three alternatives).

The accounting data for banks was collected from Bankscope. Merging the information on downgrades with the accounting data for the corresponding banks followed a manual process, since Moody's does not provide any standard code to identify banks. Annual data for countries' GDP comes from Eurostat. Then using both data sources, I calculate the 'systemic size' for each bank-year.

To analyze the effect of downgrades on sovereigns, I follow Afonso et al. (2012), using the yield spread over a benchmark bond (in this case the yield for German' sovereign). First I consider the effect of downgrades on the 'Full-Sample', and then I only consider the 'EMU-Sample' (leaving out the UK and Switzerland). In general results will be qualitatively very similar.

Finally we need to make some comments on the spreads' behavior. Looking at Figure 1, we should notice that these processes do not seem to be stationary. Using a unit-root test we can not reject the hypothesis that the variable, in levels, has a unit-root. So I compute the first difference of spreads to work with this variable. Table 3 presents some summary statistics for the daily change in spreads for each country in the sample.

3.2 Event study methodology and hypotheses

I use the event study methodology to test the effect of bank's downgrades on sovereigns. Additionally I assess whether banks' size is an important factor. Finally I also distinguish between troubled and more stable economies in the analysis.

The methodology is used to evaluate if abnormal returns are a consequence of a given event. One of its many advantages is the simplicity to interpret the results (Corrado, 2011). Kothari and Warner (2007) present a summary of the classic approach: the analysis of the residuals from an estimated model using an estimation window around the event date (known as the event window).

Nevertheless, I follow a different approach that is similar to Ongena et al. (2003) and Afonso et al. (2012). The main reason to depart from the traditional approach and use this alternative methodology, is that the estimated market model for normal returns has to be constructed using dates in which no event takes place. Since there are not enough observations between events to do this, the model would be contaminated with previous events, hence I rely on the observed sovereign spreads (Afonso et al., 2012).

In this regression analysis I use as dependent variable the change in 10 year sovereign spreads between the day of the event and the following day. The independent variable is the corresponding first lag. In order to account for the effect of the downgrades, I use dummy variables. This variable is equal to one on the day of the event, and zero otherwise. This dummy captures the abnormal return on the corresponding day. Additionally we can use a set of dummy variables in the days that follow and precede the event. Adding the corresponding coefficients from the regression, results in the cumulative abnormal returns (CAR) for the corresponding event window. Given the panel of data, it is possible to use country fixed effects to control for unobserved heterogeneity among countries. Additionally I also introduce year fixed effects to account for unobserved variables affecting countries throughout time.

$$\Delta S_{i,t} = \alpha_i + y_t + \beta \Delta S_{i,t-1} + \sum_{k=-\tau}^{+\tau} \gamma_k \delta_{i,(t+k)} + \varepsilon_{i,t} \tag{1}$$

Where $\Delta S_{i,t}$ is the change on spreads for country *'i'*, between day *'t+1'* and *'t'*. The variable α_i stands for the country fixed effects, while y_t represents the year fixed effects. The variable $\delta_{i,(t+k)}$ is the event dummy that takes value one if there is an event in country *'i'*, on day *'t'*, with an event window of size *'k'*. Finally $\epsilon_{i,t}$ is an error term assumed to be normally distributed with zero mean. The cumulative abnormal return CAR[-1,+1] is given by:

$$CAR_{i,t}\,(-1,+1) = \gamma_{i,-1} + \gamma_{i,0} + \gamma_{i,+1}$$

The significance of the cumulative effect is assessed with the usual test for joint significance of regression coefficients.

I expect that downgrades on banks' ratings lead to an increase in sovereign spreads.

H_{1a}**:** *Downgrades on* BFSR *leads to an increase in sovereign spreads. This implies a risk transfer to the sovereigns, from the financial sector.*

In order to differentiate between investment and speculative downgrades I modify equation (1) to capture this difference:

$$\Delta S_{i,t} = \alpha_i + y_t + \beta \Delta S_{i,t-1} + \sum_{k=-\tau}^{+\tau} \gamma_k^I \delta_{i,(t+k)}^I + \sum_{k=-\tau}^{+\tau} \gamma_k^S \delta_{i,(t+k)}^S + \varepsilon_{i,t} \tag{2}$$

In this case $\delta_{i,(t+k)}^I$ represents the dummy variable that accounts for investment downgrades, while $\delta_{i,(t+k)}^S$ stands for the speculative downgrades variable. I expect that the effect on sovereigns, should be stronger when the downgrade leads to a 'speculative' grade rating (or deepens the bank into it).

H_{1b}**:** *Downgrades on* BFSR *leading to speculative grade or deepening banks into this category, should have a higher impact on sovereign spreads. This means that the risk transfer is more significant when the financial sector is regarded as riskier.*

The methodology allows to quantify the magnitude of the sovereign reaction in terms of increases in spreads[6].

3.3 Including the effect of size

In order to assess the market's perception on the *TBTF* hypothesis, I include the systemic size in the analysis. For this purpose I follow two different strategies.

First I include an additional term in equation (1): the interaction between the downgrade dummy and the size of the downgraded bank. If on the corresponding day, more than one bank is downgraded, I use the size of the largest one[7]. The *TBTF* hypothesis would predict that, in response to market's expectations on banks' bailouts, downgrades on larger banks should lead to a wider increase on sovereigns spreads.

Second, given that the relationship between systemic size and the probability of being bailed out does not have to be linear, I construct a set of four dummy variables to represent the systemic size of banks (greater or equal than 10%, 25%, 50% and 100%). I interact these dummies (one at the time) with the downgrades dummies. Given the assumptions of the *TBTF* hypothesis I expect that the effect on spreads is higher for larger banks.

$$\Delta S_{i,t} = \alpha_i + y_t + \beta \Delta S_{i,t-1} + \gamma \delta_{i,t} + \eta \delta_{i,t} size_{X\%} + \varepsilon_{i,t} \tag{3}$$

The variable $size_{X\%}$ represents the systemic size of the downgraded bank (either in level, or using the aforementioned thresholds). The value and direction of η in the following expression is the object of analysis. No we can formulate the next hypothesis:

H_2**:** *Downgrades on* BFSR *for larger banks should have a significantly stronger effect on sovereign spreads if markets consider that these banks are still implicitly insured.*

3.4 Distinguishing the effects on troubled economies

Then I propose an alternative regression set in order to assess the differential effect of downgrades, for different economies. In this environment I differentiate between GIIPS and non-

[6] The total effect for a particular day would be given by $\frac{\partial \Delta S}{\partial \delta} = \frac{\gamma_k}{1-\beta}$ where β is the coefficient for lagged change in spreads

[7] Alternatively I use a different approach to measure the 'size' when there are multiple downgrades on a single day. I compute it as the average size among all downgraded banks on a particular date. Final conclusions remain mostly unchanged.

GIIPS, using a dummy variable.

$$\Delta S_{i,t} = \alpha_i + y_t + \beta \Delta S_{i,t-1} + \gamma \delta_{i,t} + \eta \delta_{i,t} size_{X\%} + \phi \delta_{i,t} GIIPS + \varphi \delta_{i,t} size_{X\%} GIIPS + \varepsilon_{i,t} \quad (4)$$

In this setting we are able to separate the effects of downgrades depending on the size of the bank, the economy in which the bank is located, and the possible interactions. Then we can state some additional hypotheses:

H_3: *Downgrades on* BFSR *to banks located in more distressed economies, will have a larger impact on sovereigns*

H_4: *Downgrades on* BFSR *to systemically larger banks, that are located in more distressed economies, will have a lower impact on sovereigns if banks are regarded as* TBTS

3.5 Cross-sectional analysis

Finally, as a complementary test I perform a cross section analysis similar to the traditional event study methodology Kothari and Warner (2007). The idea is to analyze how the effect of events on sovereign spreads are related to bank's characteristics.

For the cross section of sovereigns, the abnormal spreads are regressed across a set of bank's attributes, to understand how these characteristics affect the risk transfer. In order to do this first I need to get the abnormal reaction on spreads for each downgrade. Thus I create 253 dummy variables, one per day with event. The corresponding coefficient in the regression analysis will correspond to the abnormal spread (AR) on the corresponding day, and is the dependent variable in the cross-sectional analysis.

Then I introduce the following banks' characteristics: size (measured as the natural logarithm of total assets), systemic size (measured as the total liabilities to GDP ratio), equity to total assets ratio (as presented in Bankscope), return on average assets (as presented in Bankscope), and the liquid assets to customer and short term funds ratio (as presented in Bankscope). Additionally I include a dummy to distinguish speculative downgrades, and the amount of downgraded notches in the corresponding downgrade.

Finally given that for a set of days more than one downgrade occurs, but there is a single coefficient for the corresponding abnormal return on the day, I might be able to test whether there is a *TMTF* behavior. If this is the case, whenever more than one bank is downgraded we should expect a wider increase in spreads.

Simply including a dummy variable for these cases might not be correct, since sometimes one of the downgraded banks is systemically large. For this reason I create a dummy (*TMTF*) that equal one whenever there is more than one downgraded bank, and no bank has a systemic size larger than 50%[8]. Alternatively I use a different dummy ($TMTF_{alt}$) that equals one whenever there is more than one downgrade and the sum of the size of all downgraded banks is lower than 50%.

This alternative approach allows me to assess if there is a *TBTF* subsidy (examining the effect of size), or some banks might be *TBTS* (analyzing the effect of systemic size), and if there is a *TMTF* situation (evaluating the corresponding dummy).

Then I run a simple OLS, using year and country dummies, where $AR_{i,t}$ stands for the abnormal spread generated by a downgrade on bank i on day t.

$$\begin{aligned} AR_{i,t} =& \alpha_i + y_t + \beta\, Size_{i,t} + \gamma\, Sys.Size_{i,t} + \delta\, Equity_{i,t} + \eta\, ROAA_{i,t} \\ &+ \vartheta\, Liq_{i,t} + \lambda\, TMTF_{i,t} + \mu\, Spec_{i,t} + \rho\, Notches_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{5}$$

4 Empirical results

4.1 Effect of downgrades on sovereign

Figure 2 depicts the average effect of downgrades on the change in spreads, presenting a $[t-5, t+5]$ window around the event day. In general it seems that after the event, there is an increase in sovereign spreads. Figures 3a to 3j present the same information by country.

I proceed with the regression analysis, using all downgrades to *BFSR* in the full sample to assess their effect on the change in spreads. Then I consider only the results using the subsample of 'EMU' countries. The corresponding results are presented in Table 4. The variable of interest, 'Downgrades', has the expected sign and it is significant both in statistical terms (at a 10% level), and in economic terms as well (when considering the 'Full-sample'). The estimated coefficient for a downgrade is 0.0144%. Considering that the mean daily change in spreads is (for all statistical purposes) zero, the effect of the downgrade is economically important. Analyzing the 'EMU-sample', I find that the variable of interest is not only larger

[8]Alternatively I use different thresholds, i.e. 25% and 10% and the main conclusions hold. These cases are not tabulated.

in economic terms, but also statistically significant at a 5% level. The coefficient for the change in spread is 0.019% (almost 2 bps) on the day following the announcement.

Comparing the results from the 'Full-sample' and the 'EMU-sample', we might notice that the downgrade coefficient for the subsample is more important in statistical terms. Since the spreads for Switzerland and the UK might change due to 'exchange' reasons, the series might be more volatile, increasing the corresponding standard errors.

Additionally, note that the full effect of downgrades, is actually given by the expression $\frac{\gamma_{i,k}}{1-\beta}$. Then, the total effect of downgrades on spreads is around 1.6 bps for the 'Full-sample' and 2.11 bps for the 'EMU-sample'. This means that downgrades on *BFSR* imply an increase in the sovereign spreads, as expected.

Results suggest that hypothesis H_{1a} is fully supported analyzing the 'Full-sample' or just the 'EMU-sample'. It is worth mentioning that the time period under analysis is characterized by high volatility (the main reason to use time fixed effects). Winsorizing data to reduce the effect of spurious outliers would yield similar results (presented in a subsequent subsection).

As previously commented, some of these downgrades lead the rating from A to A- rank, so that the financial institution is still a in a strong position (i.e. the risk of default, and the contagion effect to sovereign would be low). It is reasonable that a bank that is still within the 'investment grade' category does not cause an important impact on sovereign spreads since the risk of default (and the subsequent risk transfer) is relatively low. A bank that is in a solid position is less likely to need financial support by the government. For this reason I separate the downgrades into two different groups: those in which the institution remains within the investment grade category, and the rest in which the downgrade leads to a speculative grade category. Figure 4 presents the average effect on the change in spreads, of 'speculative' downgrades, within a $[t-5\ ,\ t+5]$ window. Like before, it seems that after a 'speculative' downgrade, there is a significant increase in spreads. Figures 5a to 5i present the same information at the country level.

I repeat the same type of analysis but using a different set of dummy variables. Table 5 presents the corresponding results. The difference in behavior between 'investment' and 'speculative' downgrades, is evident. When analyzing the 'Full-sample', the effect of downgrades for institutions with investment grade is not significant. The coefficient is economically small, around 0.0054%. If we examine speculative downgrades the coefficient seems to be more important in economic terms (2.34 bps) as well as in statistical terms (at a 5%). When analyzing the 'EMU-sample', the coefficient of investment downgrades is not statistically significant, nor economically important (with a coefficient that implies an increase of only 0.0086% for spreads). For the case of speculative downgrades, the effect is statistically significant (at a 5%) with a coefficient of 0.0269%.

Again the full effect on spreads is given by the expression $\frac{\gamma_{i,k}}{1-\beta}$, so that investment downgrades imply an increase of 0.96 bps, while speculative downgrades imply an increase of 2.99 bps on spreads. This last effect in daily spread changes, is clearly economically significant.

When analyzing sovereigns spreads, there seems to be a differential effect for downgrades depending on the final situation of banks' *BFSR*. The effect is more important when downgrades lead to a speculative grade (or deepens such status). This means that the riskier the bank, the larger the risk transfer to the sovereigns, as it was expected.

I extend the analysis assessing the cumulative abnormal returns for a wider set of event windows: CAR [t-1, t+1] and CAR [t-3, t+3][9]. Table 6 presents the main results for these alternative cases.

The 3-days CAR (one day after plus one day after the event) for the 'Full-sample', clearly shows that the effect of investment downgrades is not statistically different from zero. The economic effect is unimportant as well. For the case of the 'EMU-sample', investment downgrades are still not significant in statistical terms, even though the effect seems to be larger in economic terms (1.76 bps increase in spreads for a three days period). When analyzing speculative downgrades the 3-days CAR for the 'Full-sample' is 0.0346%, which is significant in statistical terms at a 5% level. For the 'EMU-sample' the situation is similar. The cumulative effect over 3 days is 4.36 bps with a P-value of 0.0226.

It seems that in the very short term around the event day, the effect of investment downgrades is irrelevant for spreads. Whenever there is a speculative downgrade, the effect is very important, i.e. there is an significant risk transfer.

Turning the attention to the 7-days CAR we see that for 'investment' downgrades the effect, using the Full and EMU samples, is not important (neither statistically, nor economically). Additionally, the effects of speculative downgrades are not statistically significant (even though the economic effect is significantly higher than the investment downgrades). The evidence shows that the abnormal effect that a downgrade generates on sovereigns, is concentrated around the event date, and is not distributed throughout a long period of time. It seems that the risk transfer takes place within a short period around the event date.

Finally it is worth analyzing two different alternative approaches to assess the effect of downgrades. Tables 7 and 8 present the results using an alternative regression: grade (higher

[9] I analyze the CAR [t-5, t+5] as well and find that the effect of the events is not significant. Results are not tabulated.

numeric value relates to a lower grade, i.e. higher risk) and downgraded notches, instead of the 'downgrade-dummy'. For the first case it seems clear that the worse the final grade (high numeric value) after a downgrade, the higher the increase in sovereign yields (spreads). This reaction in sovereigns is statistically significant at a 5% (considering both the Full and EMU samples). Additionally the deeper the downgrade (more downgraded notches) the higher the effect on sovereigns. This relationship (significant at a 5%) means that for each downgraded notch there is an increase in spreads of 0.93 and 1.3 bps for the Full and EMU samples respectively.

In general these findings support the idea that downgrades on banks financial strength (a proxy for an increase in banks' risk) have a substantial effect on sovereign spreads (a significant risk transfer). When analyzing downgrades within the range of speculative grades, the effect becomes significantly larger. This effect is highly concentrated in a short period of time around the event. The abnormal reaction of sovereigns is short-lived, and disappears when analyzing wider event windows. These findings are also supported when considering the final grade after the downgrade, or the number of downgraded notches. All these findings provide a strong support for hypotheses H_{1a} and H_{1b} (irrespective of the sample used, Full or EMU). There seem to be a significant risk transfer from banks to governments, whenever banks' default risk is increased.

4.1.1 Robustness - Going from investment to speculative grade

Within the speculative grade downgrades, we are including two different cases. First, those cases in which the bank was downgraded from investment to a non-investment grade (at least D+ in terms of the *BFSR*). Additionally it also includes downgrades for banks that were already within the speculative grade. For this reason I include an additional dummy (First-Speculative, δ^{first}) variable that takes value one whenever the downgrade leads to a speculative grade from an investment grade, and zero otherwise.

The idea is to test whether speculative downgrades are different when they occur within the range of speculative grades compared to those cases in which there is a newly speculative-grade bank. In the following equation, I capture the additional impact of becoming a speculative grade (beyond the effect of other 'already speculative grade' banks):

$$\Delta S_{i,t} = \alpha_i + y_t + \beta \Delta S_{i,t-1} + \gamma^I \delta^I_{i,t} + \gamma^S \delta^S_{i,t} + \lambda \delta^{FS}_{i,t} + \varepsilon_{i,t}$$

Table 9 presents the results for the daily change in spreads. The additional dummy for 'first time speculative' ($\delta_{i,t}^{FS}$) has a positive coefficient when analyzing the Full and EMU samples. This means that bank's downgrades leading to speculative grade (from an investment grade) are more harmful for sovereigns than the average downgrade within the speculative grade. Nevertheless, this additional effect is not different from zero in statistical terms. Then I conclude that the differential effect of becoming a speculative grade bank is not an important factor driving the results.

4.1.2 Robustness - Alternative classification for speculative grade

As stated in previous sections I introduce two alternative ways to separate speculative from investment downgrades for those cases in which more than one bank is downgraded on the day. So far I considered a downgrade as speculative when the largest downgraded bank have indeed a speculative grade. I propose two alternatives: using the simple mean grade (of all downgraded banks in that day), or using the weighted average grade (with weights being related to banks' total liabilities size).

Tables 10 and 11 present the corresponding results for the second and third speculative grade definitions respectively.

It is clear that all the conclusions from previous sections remain mostly unchanged regardless of the definition we use to define 'speculative' downgrades. The effect that is obtained from downgrades leading to speculative grade might be stronger for different definitions. Nevertheless it remains significant for all the possible cases, and with similar coefficients. For this reason, throughout the rest of the analysis, I will use the first 'speculative grade' definition.

4.2 The effect of banks' size

As explained before in the following analysis, whenever there is more than one downgrade, I will consider the size of the largest bank downgraded on the day (always within the same country). Results will remain mostly unchanged if we consider the average size of all banks (in the country) downgraded on the corresponding date.

4.2.1 The linear case

First, I proceed to analyze the effect of systemic size in a linear way, interacting bank' size (liabilities-to-GDP ratio) with the downgrade dummy. If the *TBTF* hypothesis holds, then we should expect that the larger the downgraded bank, the wider the increase on spreads. On the other hand, if the *TBTS* hypothesis holds, we would find a low non-significant (or even negative) coefficient.

Table 12 presents the results for the general downgrade analysis. When considering the 'Full-sample', it seems to be the case that downgrades on larger banks lead to a wider increase in spreads. On the other hand, results from the 'EMU-sample', suggest that even though the coefficient of interest (the interaction term) is larger than before, it is not statistically different from zero. A priori there seems to be mixed evidence for the $TBTF$ hypothesis.

As in previous sections, I split downgrades between investment and speculative grades. In this case, it seems that only investment downgrades are significant for large banks (analyzing the 'Full-sample'). Interestingly speculative downgrades on larger banks do not have a statistically significant effect on spreads. This means that downgrades on larger banks imply an additional effect (with respect to downgrades on smaller banks) on spreads only when their risk of default is not very large. Nevertheless, the effect of speculative downgrades on larger banks seem to be economically large. Table 13 summarizes these results. Just like in the previous case the evidence regarding the effect of bank' size on sovereigns and market's perception on potential bailouts, is mixed.

Nevertheless, it might be the case that the effect is not linear. Then I segment banks into different 'size' categories in the following subsection.

4.2.2 Non-linear case: Segmenting systemic size

In order to test for non-linearities regarding the effect of size, I create four set of dummies for the systemic size. Variables Size 10%, 25%, 50% and 100% take the value one if the systemic size of the downgraded bank is greater or equal than the corresponding percentage (10%, 25%, 50% or 100% respectively). If there is more than one downgrade, I consider the size the largest bank (in the following subsection I explore a different alternative). Using this methodology we are able to disentangle the effect caused by larger banks as opposed to smaller ones with a non-linear setting.

Tables 14 and 15 present the information for the Full and EMU samples, considering interactions with the 'downgrade' dummy (with no distinction between investment and speculative downgrades).

In the first case it seems that the additional effect of being systemically large is important. Note first that the downgrade dummy is still significant, regardless of the size of the downgraded bank. Then note that as we increase the size of the downgraded bank, the additional effect on sovereigns seems to be larger in economic terms. In fact when the bank is sufficiently large, the effect becomes statistically significant. For banks with 50% or 100% systemic size, this additional effect is 2.06 and 2.32 bps, significant at the 10% and the 1% respectively. This supports the idea that downgrades on the large banks generate a wider increase in spreads, which in turn implies that larger banks are in general supported by the implicit insurance.

These previous interpretation is confirmed when looking at 'EMU-sample'. In this case when introducing the size dummies for 50% and 100% the effect seems to be both statistically and economically significant again. This means that downgrades on larger banks lead to an important additional increase in sovereigns spreads. Particularly, the regression coefficient for the interaction term for banks with 'systemic size' larger than 50%, implies an additional effect on sovereigns of 2.68 bps (significant at a 5%). For the case of banks with size larger than 100%, this interaction coefficient implies an extra increase of 2.69 bps on sovereign spreads (significant at a 5%). This evidence is consistent with the *TBTF* problem, i.e. markets are still discounting a bailout to these larger banks, reflecting the risk transfer from banks to governments.

As before I proceed to split downgrades between speculative and investment grade. Tables 16 and 17 present the corresponding results for the Full and EMU samples.

As before, note that the effect of downgrades (speculative) is significant, regardless of the size of the bank. For the 'Full-sample', like in the previous case, increasing the size of the downgraded bank leads to a higher increase in spreads. For speculative downgrades, the additional effect is statistically significant when the bank has size larger than 50%. This additional effect is 6.55 bps and significant at a 1%. Nevertheless for speculative downgrades, when the banks' size is larger than 100%, the effect is not statistically significant. For these larger banks, the additional effect of investment downgrades is statistically significant.

If we turn our attention to the 'EMU-sample', the main conclusions do not change. The additional effect for speculative downgrades when the bank has size larger than 50% is 6.61 bps (significant at a 1%). When the downgrade (investment or speculative) occurs on banks with systemic size over 100% the additional effect is not statistically significant. Nevertheless the coefficient is economically large.

These results confirm the previous evidence on the *TBTF* hypothesis, while leaving at the same time, some room for the existence of too-big-to-rescue banks (when splitting investment and speculative downgrades). In general it seems that downgrades on larger banks have indeed a more important effect on spreads. This means that markets are discounting a potential bailout by the government to larger banks. Nevertheless these findings do not rule out the existence of *TBTS* banks, i.e. the expected bailout for larger banks might not be as larger. In fact there is evidence consistent with this hypothesis as well.

With all the evidence gathered, we can not reject hypothesis H_2. In general, downgrades on larger banks have indeed caused an additional (and significant) increase in spreads. The evidence support the idea that larger banks transfer more risk to sovereigns than smaller ones, which implies that markets are still expecting bailouts for these banks. Nevertheless for downgrades that imply a higher default risk, the effect of size seems to be less significant. This indicates that some banks might be *TBTS*.

4.2.3 Robustness - Different definitions for 'size'

When creating the size dummies (the four different thresholds) I considered the size of the largest institution downgraded on the country for that date (when more than one downgrade occurs). Alternatively, we may consider the average size of all the banks downgraded that particular date[10].

Tables 18 and 19 present the results using all different size thresholds, for spreads using the 'EMU-sample', for all downgrades or alternatively splitting between investment and speculative[11].

Whenever the downgrades occur, the larger the average size of the downgraded banks, the greater the change in spreads. The additional effect seems to be statistically significant using size dummies for 50% and 100%, as before.

It is clear that using a different way to compute size thresholds does not change the major conclusions regarding the significance of size on the sovereigns' reactions. Downgrades on larger banks (either considering the size of the largest bank, or the average size of all downgraded banks on that date) generate a larger increase in sovereign spreads.

4.3 The financial situation of the country

An important factor in the analysis (particularly to assess whether banks are still regarded as *TBTF* or not) is the financial situation of the countries under consideration. Even though country fixed effects would, at least partially, take care of this I explicitly incorporate this into the regression analysis to assess whether there is a differential reaction for troubled economies.

For this purpose, I include an additional dummy in the regression to account for two different set of countries: troubled economies (Greece, Ireland, Italy, Portugal and Spain -

[10] I use a third alternative, i.e. the weighted average size. Results are qualitatively the same as the simple mean, hence they are not tabulated.

[11] Analyzing the 'Full-sample' leads to the same conclusions.

GIIPS), and sounder economies (Belgium, France, Netherlands, Switzerland and UK). First I use an alternative specification for equation (4):

$$\Delta S_{i,t} = \alpha_i + y_t + \beta \Delta S_{i,t-1} + \gamma \delta_{i,t} + \phi \delta_{i,t} GIIPS + \varepsilon_{i,t}$$

Table 20 presents the results when analyzing all downgrades together, or separating between investment and speculative, and analyzing only the 'EMU-sample'. First note that the downgrade dummy (and the speculative one) are significant for all types of economies. Then we can analyze the interaction terms with the GIIPS variable. For the case of general downgrades, it seems that the effect is significantly larger for troubled economies (2.04 additional bps). Then I split between speculative and investment downgrades. The additional effect of speculative downgrades in GIIPS is not statistically significant (even if the coefficient seems to be economically meaningful). On the other hand the additional effect of investment downgrades on GIIPS is significant (statistically and economically). This means that riskier downgrades have not an additional effect on troubled economies (probably because the government is unable to completely insure the bank), while the opposite holds for less risky downgrades. In general results suggest that downgrades affect significantly more troubled economies.

The evidence seems to support the idea that downgrades of banks located on distressed economies have a larger impact on sovereigns, i.e. the risk transfer is more of an issue in troubled countries. This supports hypothesis H_3.

Now I include different 'systemic size' thresholds to assess the effect of banks' size in distressed economies, as presented in equation (4). According to the *TBTS* banks hypothesis, the effect of downgrades on larger banks should be less important for troubled economies, since they are less likely to be able to bail out banks.

Table 21 presents the results for the effect on spreads of downgrades. First note that the effect of downgrades is significant regardless of the size of the bank and the economy in which it is located. Then note that downgrades occurring on troubled countries imply a significant incremental effect. This means that the risk transfer from banks to sovereigns is larger when the economy is under severe distress (confirming the previous result, further supporting hypothesis H_3). Regarding banks size, it seems that as we increase the size threshold under analysis (from 10% to 100%), the effect of downgrades becomes larger and ultimately significant (for size 100%). These results are consistent with the idea that banks are still regarded as *TBTF*, and any potential bailout would further weaken countries' financial situation. But note that the 'additional' effect of large banks on troubled economies, seems to be negative, although is not statistically different from zero. This might be an indication that larger banks might be regarded as *TBTS* in troubled economies.

Finally I split downgrades between investment and speculative. Table 22 presents the results. First of all note again, that the general effect of speculative downgrades is significant, regardless of the size and location of the bank. Then, as we increase the size of the downgraded bank, the effect becomes larger and significant for speculative downgrades. Note that the coefficients for the 25%, 50% and 100% size interactions, are significant and economically important. For instance, the additional effect of speculative downgrades on banks with size larger than 50% and 100% is 9.82 and 15.53 bps respectively. But the additional effect of these downgrades on large banks located on troubled economies is negative and significant. Particularly the additional effect of speculative downgrades on banks with size 50% and 100% in troubled economies is -4.48 and -17.3 bps respectively. This means that riskier downgrades on larger banks located in troubled economies are not as harmful for sovereigns. The risk transfer is lower in these cases. This might be explained because larger banks are regarded as *TBTS*. This gives support to hypothesis H_4. It seems that riskier downgrades on larger banks located in troubled economies do not imply an important risk transfer to sovereigns. This is consistent with the idea that such banks are not longer totally insured by the corresponding government due to its financial distress.

4.4 Winsorizing data

The period under consideration suffers from large volatility since it covers the last financial crisis. In order to prevent spurious inferences due to extreme outliers, I winsorize the data on the change of spreads at a 1% (for each tail).

Given the nature of the experiment conducted, some extreme values might be caused by the events under analysis. For this reason, as an additional approach, I winsorize only values in non-event days (or surrounding dates). Since results are qualitatively and quantitatively similar, I only present the results for the first approach.

When winsorizing data, all previous results and conclusions regarding the hypotheses analyzed are almost unchanged. The coefficients for event dummies and interactions (when considering size), and the corresponding significance levels, are in general slightly lower than the original analysis. But the magnitudes are not substantially different in statistical and economic terms. In fact when estimating the full effect of the events, the reaction seems to be larger. Tables 23, 24 and 25 summarize this information.

4.5 Using day fixed effects - Cross sectional analysis

In order to assess the strength of the results regarding the risk transfer, I repeat the analysis from equations (1) and (2) using day fixed effects. Using day fixed effects, allows me to capture changes in macroeconomic fundamentals and other unobserved shocks that might be affecting sovereign spreads (Acharya et al., 2014).

Table 26 presents the results using all downgrades, and splitting investment and speculative downgrades. Using this approach, the standard errors for the coefficients become significantly larger. Nevertheless speculative downgrades still imply a significant increase in sovereign spreads, enhancing the validity of previous conclusions. There is indeed an important risk transfer from the financial sector to sovereigns.

Finally I continue with the cross sectional analysis. I estimate the abnormal effect on spreads for each individual downgrade. For this procedure I estimate equation (1), but using one dummy per downgrade. The estimation is done using day fixed effects as before. The individual reactions constitute a vector with 253 elements, that represents the new dependent variable. Then I proceed with the estimation of the coefficients for equation (5).

Table 28 presents the results. I will focus on three main findings here. First note that the coefficient for size is both positive and statistically significant. This is a clear indication that downgrades on larger banks generate a significantly wider reaction on sovereign spreads, consistent with the $TBTF$ hypothesis. Additionally note that the coefficient for the systemic size is negative and marginally significant. This reaction is consistent with the $TBTS$ idea, i.e. downgrades on systemically larger banks would imply a lower effect on sovereigns since the implicit insurance for these banks is lower. Finally the coefficient for the $TMTF$ is negative and significant (both alternatives). This means that there is no evidence that multiple downgrades on relatively smaller banks generate a deeper risk transfer to sovereigns.

5 Conclusions

In this paper I examined the relationship between downgrades in bank financial strength ratings (*BFSR*), and sovereign spreads using the event study methodology. This analysis allows to estimate the risk shift from banks to governments, and quantify the effect. One of the main advantages of the event study methodology lies on its simplicity to interpret the results. Additionally, it allows to reduce endogeneity issues caused by reverse causality.

In principle, I expect that riskier banking systems would lead to an increase in spreads. Increasing banks' risk (proxied by downgrades on *BFSR*) translates into higher sovereign yields. This is consistent with the findings by Acharya et al. (2014) and Dieckmann and Plank (2012). This risk-transfer is mainly due to bailout expectations on banks. Segmenting these events between downgrades within investment and speculative grades, strengthens this explanation. Downgrades in the range of speculative grade generate a significantly larger reaction on sovereigns. This means that the risk transfer to sovereign spreads, is particularly important for riskier banks.

On a second step I introduce the systemic size of banks into the analysis to test whether larger banks generate a wider effect. If markets consider that larger banks are protected by the implicit insurance, I would expected that downgrades on them have a significant additional effect on spreads. I do find that in general downgrades on larger banks generate and additional and significant increase in yields. These results support the idea that as a general rule, larger banks are still regarded as being *TBTF*. Risk transfer from banks to governments is greater the bigger the bank, since it would imply a larger bailout. But when differentiating whether the downgrades occur in a troubled economy, I find evidence consistent with the idea that some banks might be regarded as *TBTS*. Riskier downgrades on larger banks located in distressed economies, generate a significantly lower reaction (as compared to downgrades on large bank located in more stable economies). Even if, as a general rule, larger banks are implicitly insured, we should recognize that this insurance dilutes as governments are financially distressed.

Finally I analyzed the cross section abnormal spreads. This test confirmed previous results, i.e. larger banks generate a wider increase in spreads, but there is evidence of *TBTS* situations as well. Additionally I failed to find evidence consistent with the *TMTF* case.

These results and conclusions are robust to a set of additional tests and the use of different variables. It is worth mentioning that the set of events chosen might have been, at least partially, anticipated by the market, i.e. the change in ratings for banks might be expected by the market. In fact, it is likely that this events are, at least to some extent, known beforehand by the market. This means that the reaction I capture is a noisy signal of the event (since part of the reaction occurred when the event was anticipated). Nevertheless the fact that I find a significant effect, strengthens the conclusions, i.e. despite this additional noise, the reaction is significant.

The contributions of the paper to the existing literature are multiple: first, it complements in a novel way previous research regarding the link between the financial system and sovereigns' default risk, particularly the transfer from banks to sovereigns. Additionally, and to the extent of my knowledge, it is the first paper to explicitly document the relationship between banks' downgrades and sovereign spreads. It also provides evidence on the use of ratings by the market to assess risk. The paper also allows to explicitly test if larger banks are still implicitly insured, and whether some of them have become *TBTS* or if there are cases in which distressed banks might be *TMTF*.

Bearing in mind the documented risk transfer from the financial system, and given that in general the market still expects a possible bailout on larger banks (even though some of them might have become *TBTS*), regulators should try to solve the usual moral hazard problem. Bail-in policies, or reforming resolution regimes for large banks are some possible alternatives. Even though forcing banks to reduce their size (e.g. by splitting) could be tempting for distressed economies, and it might help resolving (in the short term) the potential risk transfer issue, it might not be the optimal way to deal with this problem. This is because this type of regulation would not be taking care of the distorted incentives in the banking sector. Additionally, if bailout expectations are credibly reduced, market discipline would be a more effective regulatory tool reducing bank risk taking[12]. The risk transfer from banks to governments would be reduced as well. This would be true for two reasons: banks would be safer (there is less need for a bailout); and governments would indeed make credible commitments not to further bail out banks.

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[12]This would be true even if market participants can not influence banks' behavior. If they signal a particular bank as riskier, the regulator can monitor such banks more thoroughly, inducing banks to modify their risk strategy.

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Tables

Table 1: Summary statistics - Grades & Notches

Variable	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**
Grade	476	8.75	2.48	2	1 3
Notches	476	1.53	0.85	1	6

Note: The mean grade lies between $C-/D+$, i.e. within investment grades.

Table 2: Days with events by country

Market	**Downgrades**	**Speculative 1**	**Speculative 2**	**Speculative 3**
Belgium	13	4	4	4
France	32	14	16	15
Greece	9	6	7	6
Ireland	29	16	16	13
Italy	62	42	45	38
Netherlands	15	6	6	6
Portugal	16	14	15	11
Spain	27	13	14	13
Switzerland	15	0	0	0
UK	35	12	14	11
Total	**253**	**127**	**137**	**117**

Note: Speculative 1, 2 and 3 are defined according to the largest bank rating on that day, the mean rating, and the weighted average rating, respectively.

Table 3: Summary statistics - Daily change in spreads

Market	N	Mean	Std.Dev	Min	Max
$\Delta Spread$ (%) - Overall	23460	0.0008	0.2164	-27.446	7.03
$\Delta Spread$ (%) - Belgium	2,346	0.00026	0.04205	-0.29300	0.32400
$\Delta Spread$ (%) - France	2,346	0.00027	0.02826	-0.28700	0.27200
$\Delta Spread$ (%) - Greece	2,346	0.00274	0.65277	-27.44600	7.03000
$\Delta Spread$ (%) - Ireland	2,346	0.00073	0.09114	-1.21270	0.82300
$\Delta Spread$ (%) - Italy	2,346	0.00087	0.07479	-0.77500	0.59500
$\Delta Spread$ (%) - Netherlands	2,346	0.00013	0.01790	-0.12300	0.15300
$\Delta Spread$ (%) - Portugal	2,346	0.00182	0.13170	-1.65460	1.75900
$\Delta Spread$ (%) - Spain	2,346	0.00093	0.07469	-0.81800	0.43000
$\Delta Spread$ (%) - Switzerland	2,346	0.00024	0.03839	-0.25220	0.17200
$\Delta Spread$ (%) - UK	2,346	0.00006	0.03235	-0.23690	0.23620

Table 4: All downgrades - 1 day Analysis

Variable	(1)	(2)
$\Delta Spread_t$	0.0993***	0.1001***
Downgrades	0.0144*	0.0190**
Constant	0.0001	0.0002
N	23450	18760
$AdjR^2$	0.0107	0.0111

Estimated using country-year fixed effects
Regression (2) does not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 5: Investment vs Speculative - 1 day Analysis

Variable	**(1)**	**(2)**
$\Delta Spread_t$	0.0993***	0.1001***
Investment	0.0054	0.0086
Speculative	0.0234**	0.0269**
Constant	0.0001	0.0002
N	23450	18760
$Adj R^2$	0.0107	0.0111

Estimated using country-year fixed effects
Regression (2) does not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 6: CAR - Alternative windows

	(1)		**(2)**	
	CAR	**P-value**	**CAR**	**P-value**
[t-1,t+1] - Investment	0.0048	0.6919	0.0176	0.1523
[t-1,t+1] - Speculative	0.0364	0.0408	0.0436	0.0226
[t-3,t+3] - Investment	0.0011	0.9469	0.0085	0.6437
[t-3,t+3] - Speculative	0.0438	0.211	0.054	0.1754

Estimated using country-year fixed effects. Regression (2) does not include UK nor Switzerland
Note: Computed using country and year fixed effects

Table 7: Numeric Grade - 1 day Analysis

Variable	**(1)**	**(2)**
$\Delta Spread_t$	0.0993***	0.1001***
Numeric grade	0.0018**	0.0022**
Constant	0.0001	0.0002
N	23450	18760
$Adj R^2$	0.0107	0.0111

Estimated using country-year fixed effects
Regression (2) does not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 8: Notches - 1 day Analysis

Variable	**(1)**	**(2)**
$\Delta Spread_t$	0.0994***	0.1001***
Notches downgraded	0.0084**	0.0117**
Constant	0.0001	0.0002
N	23450	18760
$AdjR^2$	0.0107	0.0111

Estimated using country-year fixed effects
Regression (2) does not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 9: 1^{st} time speculative - 1 day Analysis

Variable	**(1)**	**(2)**
$\Delta Spread_t$	0.0993***	0.1001***
Investment	0.0054	0.0086
Speculative	0.0227**	0.0233**
First Spec.	0.0017	0.0094
Constant	0.0001	0.0002
N	23450	18760
$AdjR^2$	0.0107	0.011

Estimated using country-year fixed effects
Regression (2) does not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 10: Investment vs Speculative (2^{nd} definition) - 1 day Analysis

Variable	**(1)**	**(2)**
$\Delta Spread_t$	0.0993***	0.1001***
Investment	0.0051	0.0082
Speculative	0.0223**	0.0260**
Constant	0.0001	0.0002
N	23450	18760
$AdjR^2$	0.0107	0.0111

Estimated using country-year fixed effects
Regression (2) does not include UK nor Switzerland
2^{nd} definition: mean rating of downgraded banks on a given day
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 11: Investment vs Speculative (3^{rd} definition) - 1 day Analysis

Variable	**(1)**	**(2)**
$\Delta Spread_t$	0.0993***	0.1001***
Investment	0.0038	0.006
Speculative	0.0268**	0.0309**
Constant	0.0001	0.0002
N	23450	18760
$Adj R^2$	0.0107	0.0111

Estimated using country-year fixed effects
Regression (2) does not include UK nor Switzerland
3^{rd} definition: weighted average rating of downgraded banks on a given day - Weights depending on size
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 12: Linear relationship w/ size

Variable	**(1)**	**(2)**
$\Delta Spread_t$	0.0993***	0.1001***
Downgrade	0.0143*	0.0188**
Down. x Size	0.0091*	0.0131
Constant	0.0001	0.0002
N	23450	18760
$Adj R^2$	0.0107	0.0111

Estimated using country-year fixed effects
Regression (2) does not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 13: Linear relationship w/ size - Speculative downgrades

Variable	**(1)**	**(2)**
$\Delta Spread_t$	0.0993***	0.1001***
Investment	0.0052	0.0083
Speculative	0.0233**	0.0269**
Spec. x Size	0.0389	0.04
Invest. x Size	0.0045*	0.0037
Constant	0.0001	0.0002
N	23450	18760
$Adj R^2$	0.0106	0.011

Estimated using country-year fixed effects
Regression (2) does not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 14: Non linear relationship w/ size

Variable	**(1)**	**(2)**	**(3)**	**(4)**
$\Delta Spread_t$	0.0993***	0.0993***	0.0993***	0.0993***
Downgrade	0.0143*	0.0144*	0.0144*	0.0144*
Down. x Size-10%	0.0069	-	-	-
Down. x Size-25%	-	0.0062	-	-
Down. x Size-50%	-	-	0.0186*	-
Down. x Size-100%	-	-	-	0.0209***
Constant	0.0001	0.0001	0.0001	0.0001
N	23450	23450	23450	23450
$Adj R^2$	0.0107	0.0107	0.0107	0.0107

Estimated using country-year fixed effects - Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 15: Non linear relationship w/ size - EMU

Variable	**(1)**	**(2)**	**(3)**	**(4)**
$\Delta Spread_t$	0.1001***	0.1001***	0.1001***	0.1001***
Downgrade	0.0188**	0.0188**	0.0189**	0.0189**
Down. x Size-10%	0.0078	-	-	-
Down. x Size-25%	-	0.0085	-	-
Down. x Size-50%	-	-	0.0241**	-
Down. x Size-100%	-	-	-	0.0242**
Constant	0.0002	0.0002	0.0002	0.0002
N	18760	18760	18760	18760
$Adj R^2$	0.0111	0.0111	0.0111	0.0111

Estimated using country-year fixed effects. Regression do not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 16: Non linear relationship w/ size - Speculative downgrades

Variable	**(1)**	**(2)**	**(3)**	**(4)**
$\Delta Spread_t$	0.0994***	0.0994***	0.0993***	0.0993***
Investment	0.0052	0.0052	0.0054	0.0053
Speculative	0.0233**	0.0233**	0.0235**	0.0234**
Spec. x Size-10%	0.0163	-	-	-
Inv. x Size-10%	0.0015	-	-	-
Spec. x Size-25%	-	0.0212	-	-
Inv. x Size-25%	-	-0.0006	-	-
Spec. x Size-50%	-	-	0.0590***	-
Inv. x Size-50%	-	-	0.0059	-
Spec. x Size-100%	-	-	-	0.0472
Inv. x Size-100%	-	-	-	0.0144*
Constant	0.0001	0.0001	0.0001	0.0001
N	23450	23450	23450	23450
$Adj R^2$	0.0106	0.0106	0.0107	0.0106

Estimated using country-year fixed effects - Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 17: Non linear relationship w/ size - EMU - Speculative downgrades

Variable	**(1)**	**(2)**	**(3)**	**(4)**
$\Delta Spread_t$	0.1001***	0.1001***	0.1001***	0.1001***
Investment	0.0084	0.0083	0.0086	0.0084
Speculative	0.0268**	0.0268**	0.0270**	0.0269**
Spec. x Size-10%	0.017	-	-	-
Inv. x Size-10%	0.0012	-	-	-
Spec. x Size-25%	-	0.0223	-	-
Inv. x Size-25%	-	0.0006	-	-
Spec. x Size-50%	-	-	0.0595***	-
Inv. x Size-50%	-	-	0.0089	-
Spec. x Size-100%	-	-	-	0.0465
Inv. x Size-100%	-	-	-	0.0163
Constant	0.0002	0.0002	0.0002	0.0002
N	18760	18760	18760	18760
$Adj R^2$	0.011	0.011	0.011	0.011

Estimated using country-year fixed effects. Regression do not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 18: Alternative size threshold - Non linear relationship w/ size - EMU

Variable	**(1)**	**(2)**	**(3)**	**(4)**
$\Delta Spread_t$	0.1001***	0.1001***	0.1001***	0.1001***
Downgrade	0.0188**	0.0189**	0.0189**	0.0189**
Down. x Size-10%	0.0074	-	-	-
Down. x Size-25%	-	0.0054	-	-
Down. x Size-50%	-	-	0.0231**	-
Down. x Size-100%	-	-	-	0.0239***
Constant	0.0002	0.0002	0.0002	0.0002
N	18760	18760	18760	18760
$Adj R^2$	0.0111	0.0111	0.0111	0.0111

Estimated using country-year fixed effects. Regression do not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 19: Alternative size threshold - Non linear relationship w/ size - EMU - Speculative downgrades

Variable	**(1)**	**(2)**	**(3)**	**(4)**
$\Delta Spread_t$	0.1001***	0.1001***	0.1001***	0.1001***
Investment	0.0059	0.0059	0.006	0.0059
Speculative	0.0308**	0.0307**	0.0309**	0.0309**
Spec. x Size-10%	0.0215	-	-	-
Inv. x Size-10%	-0.0045	-	-	-
Spec. x Size-25%	-	0.0226	-	-
Inv. x Size-25%	-	-0.0054	-	-
Spec. x Size-50%	-	-	0.0585***	-
Inv. x Size-50%	-	-	0.0057	-
Spec. x Size-100%	-	-	-	0.0581
Inv. x Size-100%	-	-	-	0.0114
Constant	0.0002	0.0002	0.0002	0.0002
N	18760	18760	18760	18760
$Adj R^2$	0.011	0.011	0.011	0.011

Estimated using country-year fixed effects. Regression do not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 20: GIIPS Analysis - 1 day Analysis - EMU

Variable	**(1)**	**(2)**
$\Delta Spread_t$	0.1001***	0.1001***
Downgrade	0.0061*	-
Down. x GIIPS	0.0184*	-
Investment	-	-0.0025
Speculative	-	0.0189*
Spec. x GIIPS	-	0.0102
Inv. x GIIPS	-	0.0188***
Constant	0.0002	0.0002
N	18760	18760
$Adj R^2$	0.0111	0.011

Estimated using country-year fixed effects. Regression do not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 21: GIIPS Analysis - Non Linear relationship w/ size - EMU

Variable	**(1)**	**(2)**	**(3)**	**(4)**
$\Delta Spread_t$	0.1001***	0.1001***	0.1001***	0.1001***
Downgrade	0.0058*	0.0059**	0.0058**	0.0056**
Down. x GIIPS	0.0186*	0.0185*	0.0187*	0.0188*
Down. x Size-10%	0.0124	-	-	-
Down. x Size-10% x GIIPS	-0.0087	-	-	-
Down. x Size-25%	-	0.0154	-	-
Down. x Size-25% x GIIPS	-	-0.0129	-	-
Down. x Size-50%	-	-	0.019	-
Down. x Size-50% x GIIPS	-	-	0.013	-
Down. x Size-100%	-	-	-	0.0284***
Down. x Size-100% x GIIPS	-	-	-	-0.009
Constant	0.0002	0.0002	0.0002	0.0002
N	18760	18760	18760	18760
$Adj R^2$	0.011	0.011	0.0111	0.011

Estimated using country-year fixed effects. Regression do not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 22: GIIPS Analysis - Non Linear relationship w/ size - EMU - Speculative downgrades

Variable	**(1)**	**(2)**	**(3)**	**(4)**
$\Delta Spread_t$	0.1001***	0.1001***	0.1001***	0.1001***
Speculative	0.0191*	0.0190*	0.0190*	0.0190*
Investment	-0.0027	-0.0026	-0.0027	-0.0026
Spec. x GIIPS	0.01	0.01	0.0102	0.0101
Inv. x GIIPS	0.0188***	0.0188***	0.0190***	0.0189***
Spec. x Size-10%	0.0319	-	-	-
Spec. x Size-10% x GIIPS	-0.023	-	-	-
Inv. x Size-10%	0.004	-	-	-
Inv. x Size-10% x GIIPS	-0.0062	-	-	-
Spec. x Size-25%	-	0.0563*	-	-
Spec. x Size-25% x GIIPS	-	-0.0464	-	-
Inv. x Size-25%	-	0.0046	-	-
Inv. x Size-25% x GIIPS	-	-0.0094	-	-
Spec. x Size-50%	-	-	0.0884***	-
Spec. x Size-50% x GIIPS	-	-	-0.0403***	-
Inv. x Size-50%	-	-	0.0073	-
Inv. x Size-50% x GIIPS	-	-	0.0068	-
Spec. x Size-100%	-	-	-	0.1400***
Spec. x Size-100% x GIIPS	-	-	-	-0.1559***
Inv. x Size-100%	-	-	-	0.0044
Inv. x Size-100% x GIIPS	-	-	-	0.0414***
Constant	0.0002	0.0002	0.0002	0.0002
N	18760	18760	18760	18760
$Adj R^2$	0.0108	0.0108	0.0108	0.0108

Estimated using country-year fixed effects. Regression do not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 23: Winsorizing - 1 day Analysis

Variable	**(1)**	**(2)**	**(3)**	**(4)**
$\Delta Spread_t$	0.2610***	0.2710***	0.2610***	0.2710***
Downgrade	0.0110*	0.0138*	-	-
Investment	-	-	0.0031	0.0049
Speculative	-	-	0.0189*	0.0207*
Constant	0.0001	0.0002	0.0001	0.0002
N	23450	18760	23450	18760
$AdjR^2$	0.0723	0.079	0.0723	0.079

Estimated using country-year fixed effects
Regressions (2) and (4) do not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 24: Winsorizing - Linear relationship w/ size

Variable	**(1)**	**(2)**	**(3)**	**(4)**
$\Delta Spread_t$	0.2610***	0.2710***	0.2610***	0.2710***
Downgrade	0.0110*	0.0137*	-	-
Down. x Size	0.006	0.0075	-	-
Investment	-	-	0.003	0.0047
Speculative	-	-	0.0189*	0.0206*
Spec. x Size	-	-	0.0281	0.0289
Invest. x Size	-	-	0.0026	0.0001
Constant	0.0001	0.0002	0.0001	0.0002
N	23450	18760	23450	18760
$AdjR^2$	0.0722	0.0789	0.0723	0.079

Estimated using country-year fixed effects
Regressions (2) and (4) do not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 25: Winsorizing - Non linear relationship w/ size - EMU - Speculative downgrades

Variable	**(1)**	**(2)**	**(3)**	**(4)**
$\Delta Spread_t$	0.2711***	0.2711***	0.2710***	0.2710***
Investment	0.0048	0.0048	0.0049	0.0048
Speculative	0.0206*	0.0205*	0.0207*	0.0207*
Spec. x Size-10%	0.0135	-	-	-
Inv. x Size-10%	-0.0025	-	-	-
Spec. x Size-25%	-	0.0173	-	-
Inv. x Size-25%	-	-0.0045	-	-
Spec. x Size-50%	-	-	0.0466***	-
Inv. x Size-50%	-	-	0.0034	-
Spec. x Size-100%	-	-	-	0.0101
Inv. x Size-100%	-	-	-	0.0088
Constant	0.0002	0.0002	0.0002	0.0002
N	18760	18760	18760	18760
$AdjR^2$	0.0789	0.0789	0.0791	0.0789

Estimated using country-year fixed effects. Regression do not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 26: Using day fixed effects - 1 day Analysis

Variable	**(1)**	**(2)**	**(3)**	**(4)**
$\Delta Spread_t$	0.0919***	0.0901***	0.0919***	0.0901***
Downgrade	0.0223	0.0352	-	-
Investment	-	-	0.0302	0.0549
Speculative	-	-	0.0145*	0.0201**
Constant	0.0017	-0.0022**	0.0017	-0.0022**
N	23450	18760	23450	18760
$AdjR^2$	0.0477	0.0547	0.0477	0.0547

Estimated using country-day fixed effects
Regressions (2) and (4) do not include UK nor Switzerland
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 27: Cross section univariate analysis

Variable - AR	**Coef.**
Size	0.0006**
Systemic size	0.0131***
Equity ratio	0.0009*
Liquidity ratio	0.0001
$ROAA$	-0.0059
Notches	0.0104**
Speculative	0.0158**
$TMTF$	0.0027
$TMTF_{alt}$	-0.0166**

Abnormal spreads estimated using country-day fixed effects
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table 28: Cross section multivariate analysis

Variable - AR	**(1)**	**(2)**	**(3)**
Size	0.0084**	0.0113***	0.0104**
Systemic size	-0.0151	-0.0217*	-0.0207*
Equity ratio	0.001	0.0015	0.0013
$ROAA$	-0.0068	-0.0054	-0.0054
Liquidity ratio	0	0	0
Notches	-	0.0089	0.0083
Speculative	-	0.0161	0.0153
$TMTF$	-	-0.0283**	-
$TMTF_{alt}$	-	-	-0.0289**
Country dummy	y	y	y
Year dummy	y	y	y
$AdjR^2$	0.0847	0.1070	0.1035

Abnormal spreads estimated using country-day fixed effects
Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Figures

Figure 1: Spreads by Country

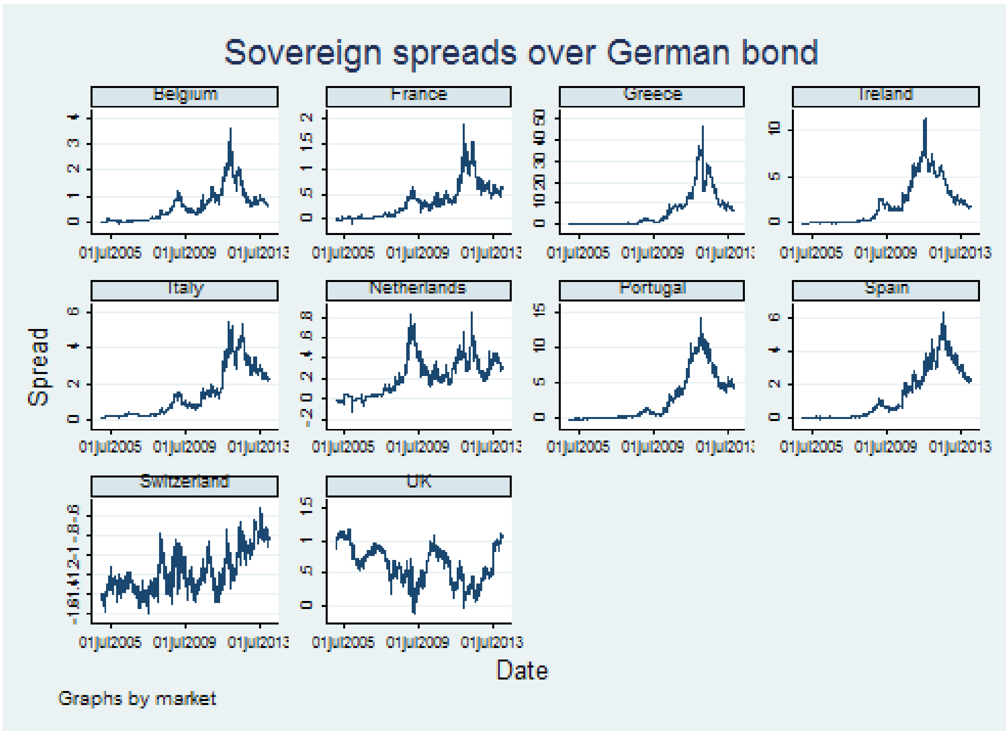


Figure 2: Change in spreads - All downgrades - Mean effect

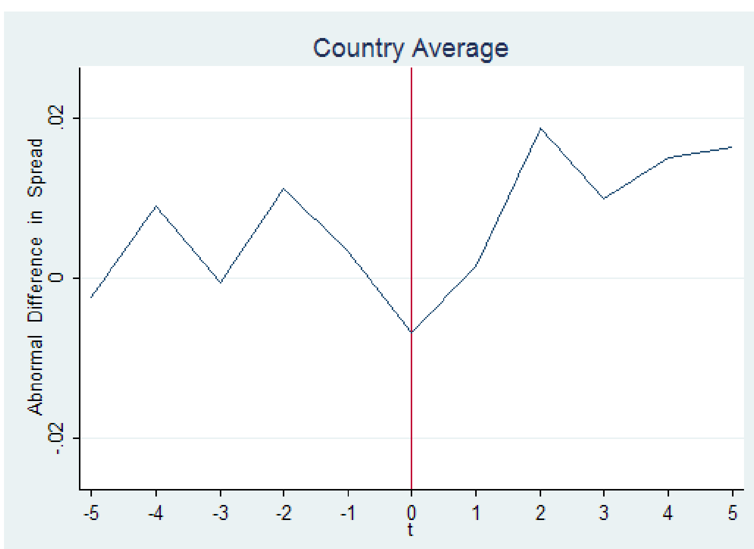
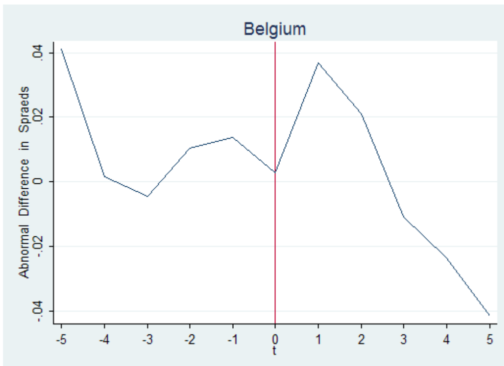
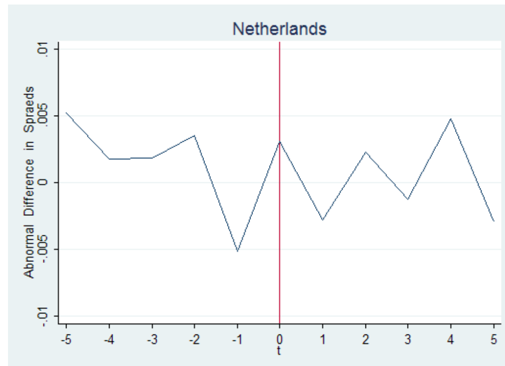


Figure 3: Change in spreads - All downgrades

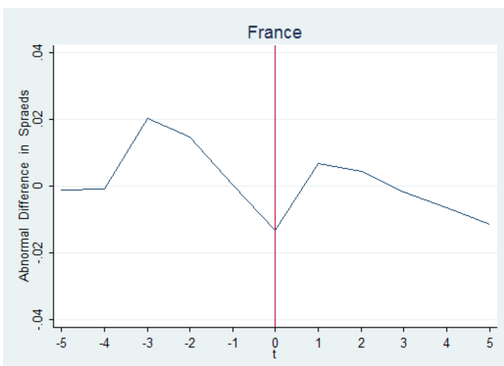
(a) Belgian spread



(b) Dutch spread

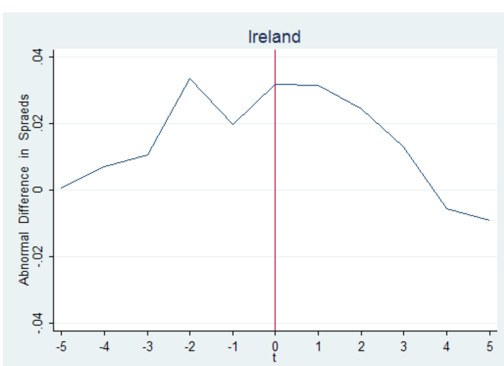


(c) French spread



(d) Greek spread

(e) Irish spread



(f) Italian spread

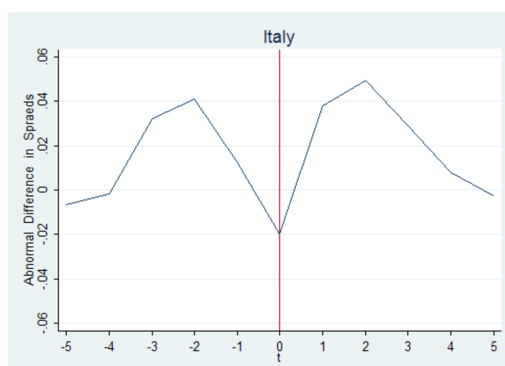
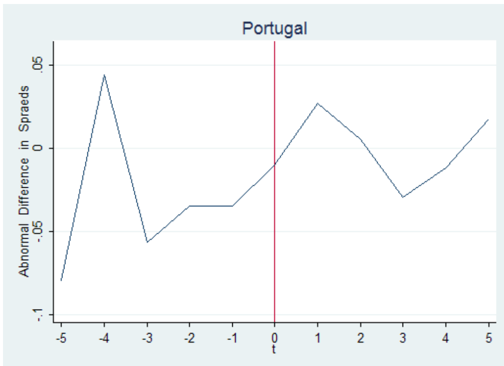
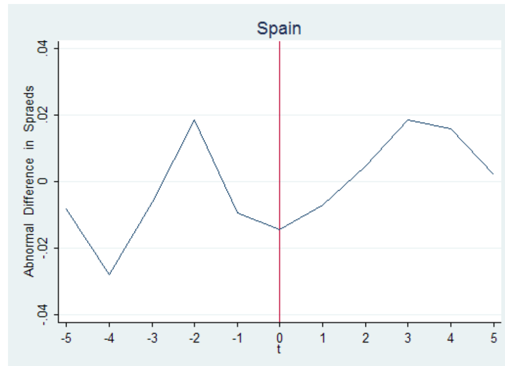


Figure 3: Change in spreads - All downgrades -*cont.*

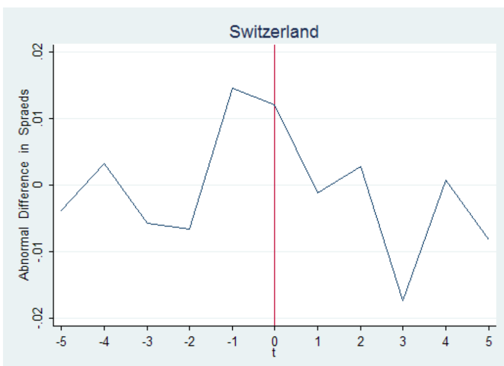
(g) Portuguese spread



(h) Spanish spread



(i) Swiss spread



(j) British spread

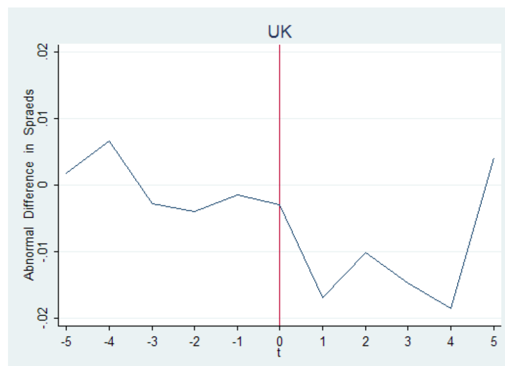


Figure 4: Change in spreads - Speculative downgrades - Mean effect

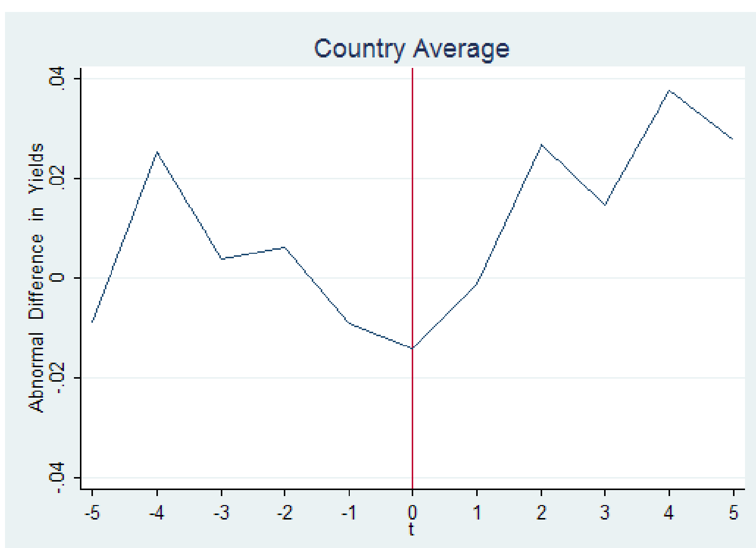
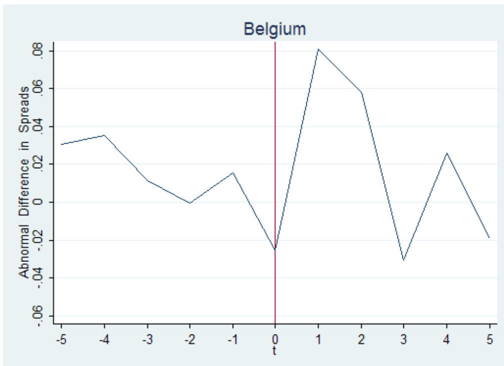
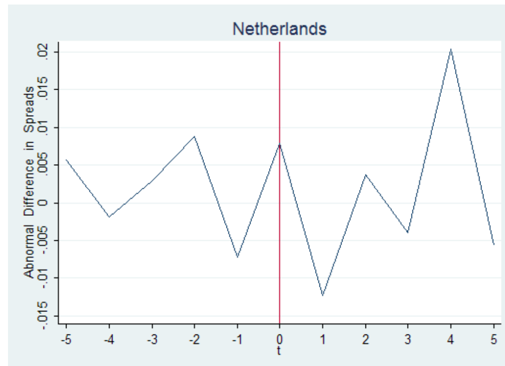


Figure 5: Change in spreads - Speculative Downgrades

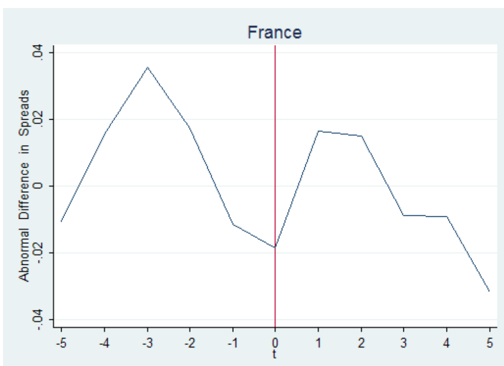
(a) Belgian spread



(b) Dutch spread

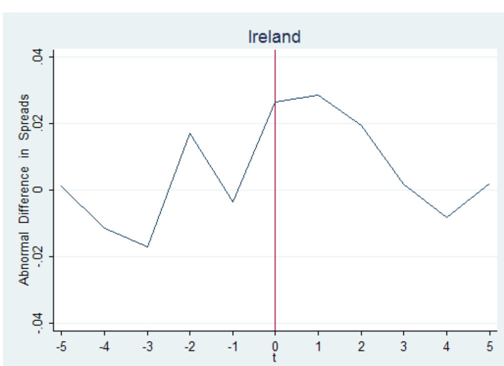


(c) French spread



(d) Greek spread

(e) Irish spread



(f) Italian spread

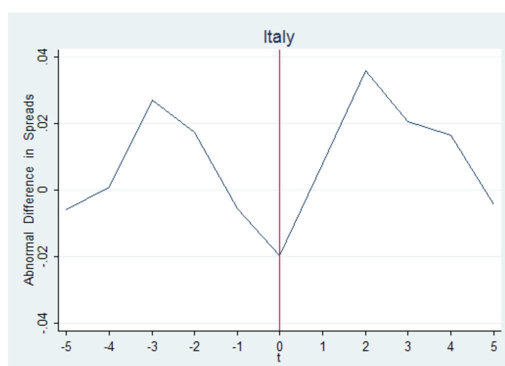
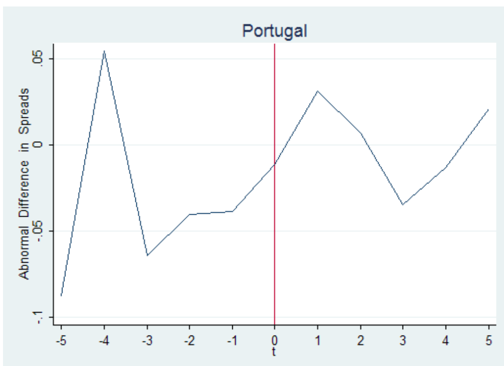
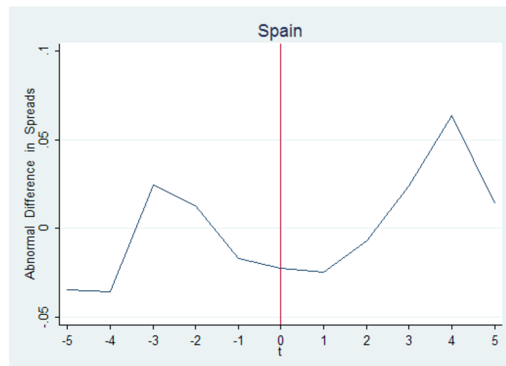


Figure 5: Change in spreads - Speculative Downgrades -*cont.*

(g) Portuguese spread



(h) Spanish spread



(i) British spread