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The Impact of Sovereign Credit Signals on Bank Share Prices during the European Sovereign Debt Crisis

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Abstract

The ongoing financial crisis has drawn attention to the role of credit rating agencies (CRAs). We investigate the relative impacts of sovereign actions by different CRAs on the share prices of major European banks during the financial crisis. We examine how bank abnormal returns are affected by sovereign rating changes, watch and outlook announcements, to capture how the crisis spills over across countries and from the sovereign to the financial sector. We find that CRAs' signals affect share prices, although there is no evidence that CRA actions are the dominant force leading to falling share prices during the crisis.

JEL classification: G15; G21; G24.

Keywords: European sovereign debt crisis; Credit signals; Spillover effect; Credit outlook/watch; Bank shares.

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1. Introduction

The European sovereign debt crisis has dominated international financial market sentiment in recent times. Policy makers and regulators emphasise the close interconnection between financial institutions and sovereigns during the financial crisis, which are considered a source of economic problems in many countries (e.g. Bank of England, 2011; IMF, 2011). There remain widespread concerns over the transmission of the debt crisis from sovereigns to the financial sector. One major channel for this is the European banking sector holdings of government debt of the home country and of other countries (e.g. Greece and Italy). Spillover effects across European countries became more likely as the crisis progressed. This study investigates possible links between sovereign rating actions and bank share prices across Europe during the recent sovereign debt crisis.

Credit ratings are heavily used in financial markets and regulation, and the recent financial crisis triggered increased scrutiny of the relative performance of credit rating agencies (CRAs) (e.g. Bank of England, 2010, 2011; IMF, 2010). There is an ongoing debate on issues of revenue versus reputation (e.g. Mathis et al., 2009), the CRAs' business models and rating shopping (e.g. Bolton et al., 2012; Jiang et al., 2012), and the role that competition should play in the credit rating market (e.g. Becker and Milbourn, 2011; Doherty et al., 2012). In the context of the US subprime crisis, the CRAs were viewed as guilty of assigning excessively high ratings. In contrast, criticism of CRAs during the European sovereign debt crisis was more focused on the extent and timing of downgrades, which worsened the crisis. This promoted a surge of calls and regulatory changes to reduce the impact of rating actions in financial markets, especially the mechanistic reactions induced by the regulatory certification role, hardwiring and cliff effects (e.g. Cantor et al., 2007; Tang, 2009; Sufi, 2009).[1] Some proposals from European politicians were extreme to the extent of suggesting giving sovereigns more advance warning of rating actions, and presenting CRAs from issuing negative sovereign rating actions for countries in international financial assistance programmes.

Three main factors motivate issuers and investors to employ multiple ratings (e.g. Skreta and Veldkamp, 2009; Bongaerts et al., 2012). (i) Information production: investors are averse to uncertainty, which can be reduced by adding extra ratings, while issuers obtain multiple ratings to address any information gaps

[1] A formal European Union (EU) regulation on CRAs entered into force in December 2009, and CRAs are now subject to legally binding rules based on the IOSCO Code of Conduct Fundamentals for CRAs. Within the EU, the responsibility for the registration and regulation of CRAs was handed to the European Securities and Markets Authority (ESMA) in July 2011. Ratings issued outside the EU can be used for regulatory purposes by regulated entities in the EU by means of either endorsement or certification with ESMA. The Basel Committee also reviewed the role of external ratings in its capital adequacy regulations, mainly to incorporate the IOSCO Code in the eligibility criteria.

across agencies. (ii) Rating shopping: issuers shop for additional rating(s) in the hope of improving their ratings. (iii) Regulatory certification: financial regulations rely heavily on credit ratings to identify both the suitability and riskiness of investment, and ratings play a role in regulatory capital adequacy requirements, therefore a third agency can play the role of tiebreaker.

Currently, three CRAs dominate the credit rating industry, with Moody's (S&P) accounting for 36.9% (42.3%) of the market, while Fitch's share is 17.9%, based on the number of ratings reported by the ten registered Nationally Recognized Statistical Rating Organization (NRSROs) at year-end 2010 (SEC, 2011). The market for government security ratings is controlled by these CRAs (99.3% at year-end 2010). Fitch began assigning ratings to sovereign issuers in August 1994, but Fitch has grown into a credible agency competing with Moody's and S&P, the two longer-standing incumbents in the sovereign rating sector. Government securities ratings as a proportion of total ratings at year-end 2010 were 38.5%, 44.2% and 16.7% for Moody's, S&P and Fitch, respectively (SEC, 2011). The common practice by financial regulators and the majority of academic studies to treat the ratings from major CRAs equally is questionable (see Livingston et al., 2010). Our investigation provides significant insights on how the markets perceive and evaluate the credibility of sovereign credit signals by each of the main three CRAs during the European sovereign debt crisis.

Sovereign ratings for developed countries have long been associated with high investment grade ratings along with high levels of stability. It was mainly the emerging economies that experienced poor credit rating quality and ratings instability. However, this situation has changed rapidly in the last four years, to the extent that the IMF (2010) highlights that sovereign default was the most pressing risk facing the global economy. The BIS (2011) emphasises concerns about euro area sovereign debt problems spreading from Greece, Ireland and Portugal to Italy and Spain, and leading to tighter funding conditions for European banks and affecting pricing in euro area markets. The deterioration in sovereign creditworthiness adversely impacts European banks' funding costs and market access. Sovereign debt problems can affect banks through various channels, including: (i) direct losses on sovereign debt holdings, (ii) lower collateral values for wholesale and central bank funding, (iii) reduced benefits that banks derive from government guarantees, and (iv) lower bank ratings.

We investigate the relative effects of sovereign credit signals by S&P, Moody's and Fitch on the share prices of European banks during the 2007-2011 financial crisis. We aim to discover, despite the ongoing criticisms of the CRAs, how markets participants perceive the relevance of their credit signals. It has generally been found in the literature that markets respond more to negative sovereign credit signals than to positive sovereign credit signals, which implies that only rating downgrades convey new information to the market

(Brooks et al., 2004; Hill and Faff, 2010). There is also evidence of negative sovereign credit signals for one country having significant detrimental spillover effects into other nearby countries and financial markets (Gande and Parsley, 2005; Ferreira and Gama, 2007; Arezki et al., 2011).

To the best of our knowledge, this is the first paper that examines the effect of sovereign credit signals on bank share prices. We evaluate these effects both for banks in the same country as the sovereign, and also on banks from other countries. In addition, we investigate the relative impact of three types of credit signals: rating changes, outlook signals and watch events.[2] The outlook and watch signals have been found to be at least as important as rating changes in their market impact (e.g. Kaminsky and Schmukler, 2002; Sy, 2004; Hill and Faff, 2010; Afonso et al., 2012). However, most prior research on CRAs' actions has focused on rating changes.

The main results are as follows. The univariate analysis show that negative sovereign credit signals by S&P quickly and significantly spillover into the share prices of European banks, in the expected direction. The spillover effect is less immediate around the time of negative sovereign credit signals by Moody's, but still significant. The effects are weaker for Fitch in comparison, but still significant. The regression analysis controls for event country, banks and time fixed effects, as well as for lagged credit signals, and we find that negative credit signals by S&P and Moody's have a significant and negative spillover effect on the bank share prices, whereas the spillover from Fitch news is insignificant. The results show that negative changes to outlook and watch are important as well as actual downgrades, and the spillover effects are more pronounced when credit signals are clustered, compared to independent.

The remainder of the paper is organised as follows. Section 1 reviews the relevant literature, Section 2 discusses the sovereign credit rating data, and Section 3 explains the methodology. Section 4 presents the empirical results and Section 5 concludes the paper.

2. Literature review

2.1. The effect of the financial crisis on European sovereigns and banks

Following the collapse of Lehman Brothers in September 2008, many governments in the euro area and elsewhere committed large resources to guarantee and rescue financial institutions. This led to increasing public debt and thereby higher risk of sovereign default. Mody (2009) finds that governments' exposures to financial sector weakness became more prominent as the crisis progressed. Investors perceived this as a credit risk transfer from the banking sector to governments, and thereby sovereign debt spreads widened while risk spreads

[2] Outlooks reflect a CRA's medium-term (one to two years) view on the development of a credit rating, while watchlists are stronger indications focused on a typical ex-ante target horizon of three months.

of financial institutions narrowed (Ejsing and Lemke, 2011). For example, sovereign bond spreads for Ireland started to increase after the government extended a guarantee to the banking system. The cost of insuring against sovereign risk, as implied by credit default swap (CDS) premia, substantially increased for most European countries. For example, the senior five-year CDS premia on debt issued by the UK, US, France, Germany, Greece and Spain increased from 9, 8, 10, 7, 22 and 18 basis points in January 2008 to 93, 43, 95, 50, 762 and 269 basis points in June 2010, respectively (Bank of England, 2010).

Sovereign debt concerns then raised doubts about the strength of some European banks, including those in France, Germany and the UK. Blundell-Wignall (2012) finds that banks are heavily exposed to the sovereign debt of their own country. For example, the exposure of Greek banks to Greek sovereign debt represented 212% of their Tier 1 capital, while in Italy, Portugal and Spain, the equivalent figures were 161%, 130% and 152%, respectively, as of December 2011. Globally, banks faced a tough refinancing challenge, with at least US$5 trillion of medium to long-term funding maturing between 2010 and 2013 (Bank of England, 2010).

There are many potential channels through which sovereign credit news may spillover across countries due to the globalized nature of modern financial markets. Ferreira and Gama (2007) and Sy (2009) provide in-depth analysis of such channels, including rating-based triggers arising in banking regulation, investment mandates (see Cantor et al., 2007) and European Central Bank (ECB) collateral rules. One main channel through which sovereign risk may spillover to financial sectors across countries is where domestic banks hold foreign sovereign debt (Arezki et al., 2011). An increase in a given sovereign's risk will likely affect the stability and profitability of banks in other countries holding this debt, and this was the case in Europe during 2007-12. Bank of England (2010) indicated that a default by Greece or another sovereign could lead to the collapse of many European banks. Blundell-Wignall (2012) finds that the cross-border exposure of European banks to sovereign debt of Greece, Italy, France and Spain are substantial at US$ 30564m, US$ 181587m, US$ 142714m, and US$ 78988m, respectively, as of September 2011. Table 1 shows the exposures of banks in the countries shown to the sovereign debt of Greece, France, Ireland, Italy, Portugal and Spain as a percentage of Tier 1 capital. The exposure of EU banks to the sovereign debt of Spain and Italy are large at 19% and 25% respectively of core Tier 1 capital in Europe as a whole as of December 2011. The countries with big investment banks (Germany, Belgium, Luxemburg, Italy and France) are the most exposed to Spain and Italy.

2.2. The market impact of sovereign rating signals

Sovereign ratings are opinions of the CRAs on the ability and willingness of governments to meet their financial commitments. The sovereign rating is a ceiling for the ratings assigned to non-sovereign issuers within

the country, although the ceiling is no longer applied in an absolute sense by the largest three CRAs. Non-sovereigns rarely pierce the sovereign ceiling, and Borensztein et al. (2013) refer to the sovereign ceiling 'lite'. Bank ratings are particularly sensitive to sovereign rating migrations (e.g. Shen et al., 2012).

Prior literature demonstrates that sovereign rating news does affect financial markets. The fact that markets react to sovereign credit signals implies that CRAs possess private information, not previously priced in the market. Negative rating events impact own-country equity and bond markets and cause significant spillovers to other countries' equity and bond markets, while upgrades have limited or insignificant impact (e.g. Kaminsky and Schmukler, 2002; Brooks et al., 2004; Sy, 2004; Gande and Parsley, 2005; Ferreira and Gama, 2007; Hill and Faff, 2010; Afonso et al., 2012). Negative credit announcements are typically more informative than positive ones, given the stronger negative reputational effects for an agency being tardy in the case of downgrades. Issuers may have no incentive to leak negative news prior to a downgrade, while they do so for positive news prior to an upgrade.

Alsakka and ap Gwilym (2013) provide evidence of the effects of European sovereign rating signals on exchange rates for the period 2000-2010. They also identify strong spillover effects in the foreign exchange market during the financial crisis period. Arezki et al. (2011) examine the spillover effects of sovereign rating news on CDS spreads and stock market indices for selected European countries during 2007-2010. They find that rating downgrades lead to significant spillovers across countries. Afonso et al. (2012) find evidence of significant spillover effects of sovereign rating news from the three major CRAs (pooled together) for bond markets for 24 European countries during 1995-2010.

3. Credit data

3.1. Credit rating agencies and rating scale

We investigate abnormal stock returns for a set of European banks at the times of all sovereign credit signals for European countries by S&P, Moody's and Fitch during the period 1st January 2007 to 19th September 2011. The credit dataset includes long-term (LT) foreign-currency (FC) sovereign ratings, outlooks and watchlists. The set of countries includes all EU members, and Iceland due to its recent difficulties. However, several countries did not receive any sovereign credit signal up to the end of the sample period (although they have subsequently), e.g. Germany, Luxembourg and Netherlands. Therefore, the final sets of countries only include those that have received at least one credit rating signal by any CRA (See Row 1 of Table 2).[3] The study

[3] The sample includes the following countries: Belgium, Bulgaria, Cyprus, Czech, Estonia, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and U K.

focuses on all sovereign credit signals, not only the credit rating level. The rating data is collected from S&P, Moody's and Fitch publications. We identify actual rating changes according to mapped 20-point numerical ratings, a rating scale that only includes actual ratings (AAA/Aaa = 20, AA+/Aa1 = 19, AA/Aa2 = 18 …CCC-/Caa3 = 2, CC/Ca, SD-S/C = 1) by notches on the basis of daily intervals. To identify positive and negative credit signals we use a 58-point numerical rating scale; a comprehensive credit rating (CCR) scale that incorporates both the actual ratings and credit outlook and watch, as follows: AAA/Aaa = 58, AA+/Aa1 = 55, AA/Aa2 = 52 …CCC-/Caa3 = 4, CC/Ca, SD-D/C = 1, and we add '+2' for positive watch, '+1' for positive outlook, '-1' for negative outlook, '-2' for negative watch, and '0' for stable outlook and no watch/outlook assignments (Sy 2004).[4] A positive credit signal moves up the 58-point scale e.g. to 46 from 43, and a negative credit signal moves down the 58-point scale.

We also employ a logit-type transformation of the above 58-point numerical rating scale to address possible non-linearity, as follows (Sy, 2004):

$LCCR_t = \ln [CCR_t / (59 - CCR_t)]$

CCR_t is the rating according to the 58-point numerical rating scale. In this case, a change in the logarithmic comprehensive 58-point numerical rating defines the event of interest: 'positive', an upgrade resulting from an upward move in the letter credit rating of the sovereign and/or from a favourable signal in the credit outlook/watch; 'negative', a downgrade resulting from a downward move in the letter credit rating of the sovereign and/or from an unfavourable signal in the credit outlook/watch.

Outlook and watch signals are defined as follows. *Negative watch* signals include placing sovereign *s* on watch for possible downgrade, and the action of confirming the rating of sovereign *s* after being on watch for possible upgrade. *Positive watch* signals include placing sovereign *s* on watch for possible upgrade, and the action of confirming the rating of sovereign *s* after being on watch for possible downgrade. *Negative outlook* signals contain changes to negative outlook from stable/positive outlook, and changes to stable outlook from positive outlook. *Positive outlook* signals contain changes to positive outlook from stable/negative outlook, and changes to stable outlook from negative outlook. f

3.2. S&P credit signals

The S&P credit data includes sovereign credit signals for 19 countries, 10 of which are in the Euro-Zone, eight other European Union members and Iceland. There are 102 S&P credit signals for the 19 countries

[4] Using the *CCR* rating scale, the same numerical score may represent different credit status. For example, issuers rated AAA with negative watch and AA+ with positive outlook carry the same numerical score '56'. However, migrations between such states (with the same numerical score) would be extremely unlikely and there are no such cases in the data sample.

during this relatively short time period. There are 40 (8) downgrades (upgrades) by S&P (Rows 3 + 12 + 13 and 2 + 11 of Table 2), most of which are by one notch. However, there are two cases of three-notch rating changes in the sample period, where S&P downgraded Greece twice in April 2010 and June 2011. There are seven cases of two-notch downgrades, e.g. Portugal was downgraded to BBB from A- in March 2011. Estonia and the Czech Republic were both upgraded by two notches in August 2011. The dataset also comprises: 47 (15) negative (positive) outlook adjustments; and 26 (0) negative (positive) watch announcements (see Rows 6 + 12, 5 + 11, 9 + 13 and 8 of Table 2). There is only one occasion, ever, when S&P has placed a sovereign on watch for possible upgrade (Ukraine for one week in July 2010) and this does not meet our sampling criteria.

The majority of signals in this sample are announced in isolation, although combined-signals for a given sovereign (i.e. actual rating change and watch/outlook signal simultaneously) occur in 33.3% (34/102) of cases (see Row 14 of Table 2). Most signals are announced individually, i.e. for one sovereign on a given day, although multiple-sovereign events (i.e. credit signals for more than one sovereign in a given day) occur in 25.5% (26/102) of cases (see Row 16). All multiple sovereign events on a single day are of the same type i.e. they all are negative signals, or they are all positive signals, which avoids having positive and negative signals occurring on the same day for our event day analysis. As expected, negative credit signals dominate positive credit signals in the sample, due to the time window of 2007-11. 72.6% (74/102) of the observations are negative credit signals (see Rows 17 and 18 of Table 2). This reflects the downward pressure on sovereign ratings due to the increased indebtedness, larger deficits, slower economic growth and austerity measures across Europe at this time.

3.3. Moody's credit signals

The Moody's credit data includes sovereign credit signals for 17 countries, 11 of which are in the Euro-Zone, five other European Union members and Iceland. There are 84 Moody's credit signals for the 17 countries. There are 32 (5) downgrades (upgrades) by Moody's (Rows 3 + 12 + 13 and 2 + 11 in Table 2), most of which are by one notch. However, there are eight cases of two-notch downgrades, five cases of three-notch downgrades and two cases of four-notch downgrades. There is one case of a five-notch rating change when Moody's downgraded Ireland to Baa1 from Aa2 in December 2010. Each of the five upgrades in the sample was by one-notch. The dataset also comprises: 38 (11) negative (positive) outlook adjustments; and 20 (3) negative (positive) watch announcements (see Rows 6 + 12, 5 + 11, 9 + 13 and 8 of Table 2). Most signals in this sample are announced in isolation, although combined-signals for a given sovereign occur in 29.8% (25/84) of cases (see Row 14 of Table 2). The majority of signals are announced individually, although multiple-sovereign

events occur in 28.6% (24/84) of cases (see Row 16).[5] As expected, negative rating signals dominate positive rating signals in the sample; 76.2% (64/84) of the observations are negative signals (see Rows 17 and 18 of Table 2).

3.4. Fitch credit signals

The Fitch credit data includes sovereign credit signals for 17 countries, 9 of which are in the Euro-Zone, 7 other European Union members and Iceland. There are 80 Fitch credit signals for the 17 countries. There are 34 (9) downgrades (upgrades) by Fitch (Rows 3 + 12 + 13 and 2 + 11 in Table 2), most of which are by one-notch. However, there are six cases of two-notch downgrades and five cases of three-notch downgrades. There is one case of a four-notch rating change when Fitch downgraded Greece to CCC from B+ in July 2011. There are eight cases of a one-notch upgrade, and one case of a two notch upgrade. The dataset also comprises: 38 (14) negative (positive) outlook adjustments; and 10 (2) negative (positive) watch announcements (see Rows 6 + 12, 5 + 11, 9 + 13 and 8 of Table 2).

Most signals in this sample are announced in isolation, although combined-signals for a given sovereign occur in 33.8% (27/80) of cases (see Row 14 of Table 2). The majority of signals are announced individually, although multiple-sovereign events occur in 23.8% (19/80) of cases (see Row 16). All multiple sovereign events on a single day in this sample are of the same type i.e. they all are negative signals, or they are all positive signals. As expected, negative rating signals dominate positive rating signals in the sample. 66.3% (53/80) of the observations are negative credit signals (see Rows 17 and 18 of Table 2).

4. Methodology

4.1. Banks, share prices, abnormal returns and univariate analysis

We employ standard event study methodology to measure the reaction of bank share prices to sovereign credit signals. The sample comprises the European banks included in the 2011 EU stress test and their identity is gathered from SNL. There were a total of 91 banks, from 21 European countries included in the EU stress test. However, some are excluded either due to: (a) bank is not listed, hence no share price information; or (b) thinly traded shares. This reduces the sample to 51 banks, from 16 countries (see Table 3). The daily share prices are quoted in Euros and gathered using Thomson One Banker and spans 2nd January 2006 to 6th October

[5] There were two days in the sample period where Moody's assigned positive and negative signals to different sovereigns on the same day. On 23rd April 2009 Latvia and Lithuania were both downgraded by one and two-notches, respectively, with negative outlook. On the same day, Estonia was taken off negative watch and placed on negative outlook, with no rating change, which we consider to be a positive signal. On 5th April 2011 Portugal was downgraded with negative watch, while Bulgaria was taken off positive outlook and placed on positive watch. These five observations are taken out of the univariate analysis (see Sections 4.1 and 5.1) to avoid contaminating the results.

2011. The share price data spans a longer timeframe than the credit data in order to calculate the abnormal returns.

The mean-adjusted return is our measure of abnormal returns.[6] The mean daily return for each bank prior to a sovereign rating event is calculated using 200 daily observations for the period t = -230 to t = -30. This represents the expected daily return (ER). Daily abnormal returns (AR) are calculated for each day in the event window as follows:

$$AR_{it} = R_{it} - ER_{it} \quad (1)$$

i = 1, 51 (banks)

AR_{it} = abnormal return of bank i at time t.

R_{it} = log return of bank i at time t.

ER_{it} = expected return of bank i at time t.

The event days are defined by the sovereign credit actions. The abnormal returns are based primarily on possible international spillovers i.e. the impact of a credit event for sovereign A on banks in countries B, C, D, etc. We calculate cumulative abnormal returns (CARs) over pre-event (-10, -1), event (0, +1) and post-event (+2, +11) windows, where 0 represents the actual event day, t = 0. Gande and Parsley (2005) suggest the short two-day (0, +1) event window to reduce contamination from other credit events. The pre-event (-10, -1) window captures any market anticipation of rating announcements (Hull et al., 2004), and the post-event (+2, +11) window captures possible longer term or delayed impacts of the sovereign credit events on the bank share prices. Standard errors are calculated following Boehmer et al.'s (1991) standardized cross-sectional test, to account for event induced variance.[7]

The sample contains high volume of negative signals for relatively few countries in a short period. This gives rise to a large number of clustered events, where a sovereign credit signal (at time t = 0) is preceded by other credit signals in the ten trading days before it, either by the same agency or by another. The same issue arises if sovereign credit signals occur during the post-event window. In our robustness checks, we split the sample into independent and clustered sovereign credit signals (see Gande and Parsley, 2005; Hill and Faff, 2010), in order to account for the clustering of events. An independent event is defined as sovereign s experiencing a credit signal while no other credit signal is given to sovereign s by any of the three CRAs (S&P, Moody's and Fitch), within the (-10, +11) window (21 trading days). We only split the sample into independent

[6] We also use the raw return as measure of abnormal return for univariate analysis and regression analysis. The results tables are not presented here in the interests of brevity, but are available on request from the authors. We find no material differences in the inferences.

[7] We utilize the Dow Jones Stoxx Europe 600 index to calculate the standardized residual.

and clustered sub-samples for negative credit signals. Rows 19 and 20 of Table 2 show that clustered events represent about half of all events for each CRA.

4.2. Regression model

We conduct multivariate analysis of the factors that affect the CARs of banks around sovereign credit signals. The models are as follows:

$$CAR_{it} = \alpha + \beta_1 \Delta LCCR_{st} + \beta_2 Lag\Delta LCCR_{bt} + \beta_3 CCR_{bt} + \beta_4 CCR_{st} + \gamma Co_s + \lambda Ba_i + \xi y_t + \varepsilon_{it} \qquad (2)$$

CAR_{it} is the mean-adjusted cumulative abnormal return of bank *i* in the event time *t*: (0, +1). $\Delta LCCR_{st}$ is the 1-day change in the transformed 58-point rating (see Section 2.1) for sovereign *s* at event date *t*. For ease of interpretation, the absolute value of $\Delta LCCR_{st}$ is used in the regression. *Lag* $\Delta LCCR_{bt}$ is the cumulative change in the LCCR of the sovereign rating of the bank's country (assigned by the 'event agency') during the ten days (-10, -1) preceding the event at date *t*. This is included to control for banks that may be reacting to credit signals for their home sovereign rather than the spillover effects. CCR_{bt} (CCR_{st}) are the levels of the bank's country (*b*) (and event country (*s*)) comprehensive credit rating. These are used as a proxy to control for the financial conditions of bank country (*b*) and event country (*s*). This allows the impact of sovereign news to vary with the credit rating (i.e. the financial position) of the bank's country and event country under consideration. The regression controls for the event country, bank and time fixed effects with Co_s: a full set of event country dummies; Ba_i: a full set of bank dummies; y_t: a full set of year dummies.

In the second element of the analysis, we distinguish between the effects of different types of negative credit signals across CRAs (joint downgrade and negative outlook/watch signals (combined-signals), rating downgrade, negative outlook actions and negative watch announcements) as follows:

$$\begin{aligned} CAR_{it} = {} & \alpha + \beta_1 NOD_{st} + \beta_2 NWD_{st} + \beta_3 NW_{st} + \beta_4 DN_{st} + \beta_5 Lag\Delta LCCR_{bt} + \\ & \beta_6 CCR_{bt} + \beta_7 CCR_{st} + \gamma Co_s + \lambda Ba_i + \xi y_t + \varepsilon_{it} \end{aligned} \qquad (3)$$

NOD_{st} is a dummy variable taking the value of 1 if sovereign *s* is downgraded and simultaneously placed on negative outlook at time *t*, zero otherwise. NWD_{st} is a dummy variable taking the value of 1 if sovereign *s* is downgraded and simultaneously placed on negative watch at time *t*, zero otherwise. NW_{st} is a dummy variable taking the value of 1 if sovereign *s* experiences a negative watch action at time *t*, zero otherwise. DN_{st} is a dummy variable taking the value of 1 if sovereign *s* is downgraded at the time *t*, zero otherwise. CAR_{it} ($CARR_{it}$), *Lag* $\Delta LCCR_{bt}$, CCR_{bt} (CCR_{st}), Co_s, Ba_i and y_t are included as for Model (2). We do not include the 'solo' negative outlook signal (i.e. with no rating change) in Model (3) because this is taken as the reference category.

We anticipate that negative credit signals will negatively affect the returns of the banks. In order to obtain robust estimators to any potential heteroscedasticity and/or autocorrelation in the residuals, a White correction is performed on the standard deviation of the estimated coefficients in all equations (Gande and Parsley, 2005; Ferreira and Gama, 2007; Arezki et al., 2011).

Any significant effect of credit rating news on banks' abnormal return is valid only if sovereign credit signals can be viewed as exogenous to the dependent variable (banks' abnormal return). This raises the question of what drives the sovereign credit signals. In other words, what determines cross-country/bank variation in the sovereign credit news. The sovereign credit signals in a particular country could be driven by some omitted variables that can also affect banks' abnormal returns. To tackle any concerns about the endogeneity of sovereign credit signals from a variety of angles (similar to Becker and Milbourn, 2011), Models (2) and (3) control for country, bank, and time fixed effects, ruling out any overall time trends or purely cross-country and cross-bank explanations. Also, we use CCR_{bt} and CCR_{st}, the levels of the bank's country and event country comprehensive credit rating, as a proxy controlling for all omitted financial, economic, political variables that may affect both sovereign credit signals and banks' abnormal returns (e.g. Bannier et al., 2010; Prati et al., 2012). Further, we use a very short event window, eliminating the effects of several other factors that may impact banks' abnormal returns, particularly given the fact that sovereign credit actions for each given issuer are infrequent (See Table 2).

5. Empirical results

5.1. Univariate analysis

This section discusses the results on banks' share price reactions to S&P, Moody's and Fitch sovereign credit signals, which are presented in Tables 4, 5 and 6, respectively.

5.1.1. S&P positive credit signals

Panel A of Table 4 presents the bank CARs for periods around positive credit signals. For the whole period, we report that the pre-event CAR is -0.52% and significant, and the post-event CAR is -0.15% and significant. The event window CAR is -0.05% and insignificant. The results show that the CAR in the event window is negative but much weaker than the pre and post-event returns, which suggests that the positive credit signals as a whole have a modest effect on the bank share prices.

We also split the positive signals by year in Panel A of Table 4. The CARs are all positive for 2007 and 2009 events, with event window CARs of 0.73% and 0.53%, respectively. Both coefficients are not as strong as

the pre-event window CARs of 1.78% and 1.31%, respectively, but the t-statistic is stronger in 2009. The pre and post-event window CARs in 2011 display the largest negative values of -3.79% and -1.17%, respectively, which are both significant. The event window CAR of -0.32% is insignificant, which again provides evidence that the share prices react very modestly to positive sovereign credit signals.

5.1.2. S&P negative credit signals

Panel B of Table 4 presents the bank CARs around negative sovereign signals for the whole time period and also annual sub-samples. The event window CAR is -0.77% and strongly significant. This CAR is larger than the pre and post-event window CARs of -0.61% and -0.24%, respectively, which are also significant. Bank share prices reacted negatively to these credit signals, the smaller CAR in the pre-event window indicates that the markets did not fully anticipate the rating news, and the credit signals contained new information. The negative S&P sovereign signals were less informative in 2007 than in the sample as a whole. The CARs are more negative in 2008 compared to 2007, with pre-event and event window CARs of -3.15% and -1.47%, respectively, both significant. The post-event CAR is insignificant in 2008. There is evidence of a strong market reaction to negative S&P sovereign signals in 2009. We find the opposite in 2010, where the event window CAR is insignificant, whilst the pre-event CAR is -0.47% and significant and the post-event CAR is 0.34% and significant. In 2011, the post-event CAR is the most negative at -2.17% and significant, compared to the pre-event and event CARs of -0.90% and -0.41%, respectively, both significant.

Panel C of Table 4 presents the CARs around independent negative sovereign credit signals. For the whole sample of independent negative events, the pre-event CAR is -0.55% and significant, and is larger than the event window CAR of -0.22%, which is also significant. This suggests that the markets did anticipate the sovereign credit signals but not fully, since the event itself still caused a reaction. The results of Panel C are quite consistent with Panel B. Panel D of Table 4 presents the CARs around clustered negative signals. We report pre-event, event and post-event CARs of -1.57%, -1.20% and -0.90%, respectively, which are all significant. The size of these coefficients suggests strong market reactions to clustered credit signals.

It could be argued that the independent events would have a stronger market impact than the clustered events, since independent events should provide more new and valuable information since they are more unexpected. Clustered events are expected to deliver news which is in the same direction, and so after the initial movement one might expect no further market impact. However, this is not what we find. The results of Panels C and D show that the markets react more strongly to clustered S&P rating events than to independent events. The explanation can be drawn from the credit data itself. The severe negative credit signals experienced by

Greece, Iceland, Ireland, Portugal and Spain, by all three agencies in this time period, are often clustered in time. The significantly negative pre-event CAR suggests that the banks were already facing downward pressure on their share prices and it is obviously not only S&P credit actions that are driving the prices down.

Panel E of Table 4 presents the CARs surrounding the S&P negative signals to Greece, Ireland, Italy, Portugal and Spain only. The reason for focusing on signals for these countries specifically is because they have been in the spotlight of the sovereign debt crisis. There have been a total of 31 credit signals by S&P for these countries since 2009 (no signals in 2007 and 2008), 30 of which were negative signals.[8] The pre and post-event CARs are -0.22% and -0.44%, respectively, and significant. The event window CAR is much stronger at -0.99% and significant. These results are expected to be strong due to the severity of the actions applied to these sovereign ratings. The CARs in Panel E are not as strong as in Panel D which is mainly attributable to the very strongly negative CARs in 2008 in Panel D, while there are no observations in 2008 in Panel E.

Panel F of Table 4 presents the CARs around negative outlook and watch signals only, to investigate whether bank share prices have reacted more strongly to these types of signals compared to actual downgrades. The event window and post-event CARs are both -0.46% and significant, which are weaker than the pre-event CAR of -0.84%. S&P negative outlook and watch signals alone do not have as strong impact as actual downgrades and downgrades combined with negative outlook and watch. Comparing Panels B to F of Table 4 we find that the clustered events have the strongest negative event window CAR. The pre-event window CAR is larger than the event window CAR for the independent, clustered and negative outlook and watch events, which suggests prior negative market sentiment. The post-event CARs are generally weaker than the event window CARs.

5.1.3. Moody's positive credit signals

Panel A of Table 5 presents bank CARs around positive credit signals by Moody's. For the whole period, we report that the pre-event, event and post-event CARs are -0.05%, -0.05% and -2.28%, respectively, with the latter two being significant. The post-event CAR is far larger than the pre-event and event window CARs, which suggests that positive signals by Moody's have a slight positive impact on the bank share prices, in the very short term. We also split the positive signals by year in Panel A of Table 5. The event window CARs are negative and significant in 2008 and 2011, and positive and significant in 2010. The pre-event window CAR

[8] The one positive signal is when Greece's sovereign rating was changed to BBB+ with negative outlook, from BBB+ with negative watch on 16th March 2010.

is positive and insignificant in each year apart from 2011 where it is -0.75% and significant. The post-event window CARs are all significant and negative.

5.1.4. Moody's negative credit signals

Panel B of Table 5 presents the bank CARs around negative signals by Moody's. The event window CAR is -0.17% and significant, which is weaker than the post-event window CAR of -1.08%. The pre-event window CAR is positive and insignificant. Bank share prices fell in reaction to negative signals by Moody's, but the CAR in the post-event window may indicate a persisting impact or delayed response. The annual subsamples in Panel B show that the event window CAR is negative and significant only in years 2008 and 2011. The pre-event window CAR is negative and significant in 2007, 2008 and 2011. The pre-event window CAR is very strongly positive and significant in 2009, while the post-event CARs are only negative and significant in 2008 and 2011. Panel B shows that the markets reacted modestly to negative credit signals made by Moody's, with some mixed evidence on the market's anticipation. The event window CAR is only stronger (more negative or less positive) than the pre and post-event window CARs in 2009 and 2010.

Panel C of Table 5 presents the CARs around independent negative signals by Moody's. The event window CAR is -0.11% and significant, while the pre-event window CAR is positive and significant at 0.51%. The results demonstrate a modest negative impact on bank share prices due to independent negative signals by Moody's, and no indication of market anticipation of the signals. Panel D of Table 5 presents the CARs around clustered Moody's signals. The event window CAR is negative and significant at -0.44%, but is weaker than the post-event CAR. The results for the clustered negative signals by Moody's draw similar implications to Panels B and C, whereby the signals negatively impact the banks' share prices, but there seem to be stronger on-going impacts or inefficiencies in reacting to credit signals made by Moody's. There is slightly more evidence of market anticipation for the clustered events compared to the independent events, but that would be expected to some extent by construction.

Panel E of Table 5 presents the CARs around the Moody's negative signals to Greece, Ireland, Italy, Portugal and Spain only. There have been a total of 31 credit signals by Moody's for these countries since 2007, 30 of which were negative signals.[9] The CARs are -0.28%, -0.24% and -0.06% and significant for the pre-event, event and post-event windows, respectively. The event window CAR has the strongest *t*-statistic. The results suggest that negative sentiment has prevailed prior to the negative credit signals by Moody's. The credit signals themselves still had a negative impact on the share prices, as well as lingering effects after the credit

[9] The one positive signal is when Greece's outlook was changed to positive on 11th January 2007.

announcements. Panel F of Table 5 presents the CARs around negative outlook and watch signals only. The pre-event and event-window CARs are insignificant, while the post-event window CAR is -0.64% and significant, suggesting very modest share price reactions to the negative outlook and watch signals.

The general pattern that emerges from the results of Panels B to F of Table 5 is that negative credit signals by Moody's have generally followed periods of positive (or very weak negative) bank CARs. This suggests that the markets did not anticipate the credit signals. The CARs are negative but modest in the event windows, suggesting that the markets did not react strongly immediately following the signals.

5.1.5. Fitch positive credit signals

Panel A of Table 6 presents the bank CARs around positive credit signals by Fitch. For the whole period, we report that the pre-event, event and post-event window CARs are -0.73%, -0.40% and -0.36%, and significant. The CARs become less negative from the pre-event window through to the post-event window, which suggests that the positive credit signals by Fitch had very modest effects in lowering the severity of negative returns from pre-event, to post-event. We also split the positive credit signals by year in Panel A of Table 6. The event window CARs are negative and significant in 2010 and 2011, positive and significant in 2008, while being insignificant in 2007 and 2009. The pre-event window CARs are negative and significant in 2007, 2008, 2009 and 2011, while insignificant but negative in 2010. The post-event window CARs are positive and significant in 2008, 2009 and 2010, while they are negative and significant in 2007 and 2011.

5.1.6. Fitch negative credit signals

Panel B of Table 6 presents the bank CARs around Fitch negative signals by Fitch for the whole time period and annual sub-samples. The event window CAR is negative and significant, but the CAR is weaker than the pre-event CAR. Bank share prices have fallen in reaction to negative credit signals by Fitch, but the pre-event CAR is stronger which indicates pre-existing market sentiment. The annual subsamples in Panel B show that the event window CAR is negative and significant only in years 2008 and 2011, while it is positive and significant in years 2007 and 2010. The event window CAR is insignificant in 2009. The pre-event window CAR is negative and significant in 2007, 2008 and 2011, while it is insignificant in 2009 and 2010. The post-event window CAR is negative and significant in years 2008, 2010 and 2011, while it is strongly positive and significant in 2009. The post-event window CAR is insignificant in 2007. The results of Panel B show a mixed reaction to Fitch signals.

Panel C of Table 6 presents the CARs around independent negative signals by Fitch. The pre-event, event and post-event window CARs are -1.62%, 0.20% and 1.98% and significant. The pre-event window CAR suggests that there is pre-existing market sentiment prior to independent negative signals by Fitch. Panel D of Table 6 presents the CARs around clustered negative Fitch signals. The pre-event, event and post-event window CARs are negative and significant. The pattern of CARs suggests a market reaction to the clustered events by Fitch, bearing in mind that negative CARs in the pre-event window may be expected in this case.

Panel E of Table 6 presents the CARs around Fitch negative signals to Greece, Ireland, Italy, Portugal and Spain only. There have been a total of 25 credit signals by Fitch for these countries since 2007, with only three positive signals for Greece, Portugal and Ireland in March 2007, May 2007 and April 2011, respectively. The pre-event, event and post-event window CARs are -0.85%, -0.01% and 1.07%, where only the event window CAR is insignificant. The results suggest very little new information from the Fitch signals. Panel F of Table 6 presents the CARs surrounding negative outlook and watch signals only. The pattern in Panel F is similar to that in Panels B and C, and suggests little information arrival from these signals.

The pattern emerging from Panels B to F is that Fitch negative signals have followed periods of negative bank CARs, suggesting a pre-existing negative market sentiment.

5.2. Regression analysis

This section discusses the results of Models (2) and (3) which focus on negative credit signals only. Table 7 presents estimates of the coefficients of Model (2) using data for European sovereigns rated by S&P, Moody's and Fitch separately, for the period January 2007 to September 2011. The variable of interest is '*ΔLCCR*', representing the 1-day change in the transformed 58-point rating of sovereign *s* at event date *t*. The results provide evidence of unequal reactions to sovereign credit signals across the three CRAs. Negative credit signals by S&P are found to decrease the two day CAR (0, +1) around the event by 0.76%, whilst negative credit signals by Moody's are found to decrease the two day CAR by 0.87%. Negative credit signals by Fitch are not found to significantly affect the two day bank CAR. The information lead of S&P and Moody's is in line with suggestions by Cantor and Packer (1996 (for Moody's)) and Brooks et al. (2004 (for S&P)) that these CRAs' sovereign rating changes have the greatest effect on bond spreads and equity return, respectively.

The coefficient of the *Lag Event* variable (the control for event clustering in the sovereign rating of the bank's country) is insignificant in the cases of S&P and Moody's. This suggests that recent rating history does not affect the market reaction, which is consistent with the findings of Ferreira and Gama (2007). We also find that the event country's comprehensive credit rating (EC CCR) is negative and significant for S&P, which

implies that the lower the CCR of the event country, the stronger the effect of the negative news by S&P on the bank returns. This suggests that the impact of negative events by S&P is most marked for lower credit quality sovereigns. This finding resonates with events during the recent financial crisis, and is consistent with Table 1 showing that the cross-border exposures of European banks to the sovereign debt of Greece, Italy and Spain are quite substantial.

Table 8 presents estimates of the coefficients of Model (3), which splits the '*ΔLCCR*' in Table 7 into the different types of negative credit signals (combined-signals (downgrade plus negative outlook/watch), rating downgrade and negative watch announcements). The 'solo' negative outlook signal (i.e. with no rating change) is taken as the reference category.

For S&P, bank share prices react most significantly in the expected direction following sovereign downgrades (with no outlook/watch assignment). The downgrade and negative watch combined-signal has the second strongest impact, then the downgrade and negative outlook combined-signal. The bank's country's comprehensive credit rating (BC CCR) is positive and significant for S&P, which implies that the higher the CCR of the bank's country, the stronger the effect of the negative news by S&P on the bank returns. The event country's comprehensive credit rating (EC CCR) is negative and significant, which implies that the lower the CCR of the event country, the stronger the effect of the negative news by S&P on the bank returns. These two coefficients are consistent with a reality where downgrades for lower-rated European sovereigns (e.g. Greece and Portugal) had a large impact on bank share prices in richer countries (e.g. Germany) due to bank holdings of the debt of the peripheral countries.

For Moody's, the downgrade and negative watch combined-signal has the strongest coefficients. The downgrade and negative outlook combined-signal is the second strongest signal. The negative watch signal (with no rating change) is the third strongest followed by downgrades (with no outlook/watch assignment). The event country's comprehensive credit rating (EC CCR) is positive and significant, which implies that the lower the CCR of the event country, the weaker the effect of the negative news by Moody's on the bank returns.

For Fitch, we find that actual downgrades (with no outlook/watch assignment) have an insignificant effect on bank share prices. The downgrade and negative watch combined-signal has the strongest negative effect, followed by downgrade and negative outlook combined-signal and then the negative watch signal (with no rating change).

The results of Table 8 show substantial differences in how the markets react to different negative credit signals from the three agencies. For S&P, downgrades (with no outlook/watch assignments) have stronger

negative impacts than combined-signals and even stronger negative impact compared to negative outlook/watch signals (with no rating change). The results are different for Moody's where the banks' share prices are more strongly affected in the expected direction by combined-signals and negative watch signals, compared to 'solo' downgrades and 'solo' negative outlook. For Fitch, the downgrade and negative watch combined-signal has the strongest impact on the banks' share prices.

6. Conclusion

The European sovereign debt crisis brought increased attention to the role of credit rating agencies and the links between sovereign and banking risks during crises. This paper is the first to assess the reaction of the share prices of large European banks to European sovereign rating actions by Standard and Poor's, Moody's and Fitch for the period 2007-11. There is no clear evidence that sovereign rating actions are a driving force for falling bank share prices. Share prices fall significantly on the days of sovereign rating actions; it is plausible that CRA signals produce reactions because the markets continue to believe that the CRAs' views reflect private or price-relevant information. However, there is ample evidence that prices were also falling prior to the negative rating news. Therefore, the view that the CRAs' actions worsened the crisis, which was expressed by many European politicians and commentators, is only partly justified by these findings.

Our investigation makes an important contribution toward understanding how equity markets perceive and evaluate the credibility of sovereign credit signals by each of the main three CRAs during the current sovereign debt crisis. Significant differences are identified in the impact of rating actions across the three CRAs. Fitch signals have lesser impact than those of the other two main global CRAs. Therefore, market participants, financial regulators and academic studies should consider whether it is valid to treat the ratings from major CRAs as equally important. We find that combined actions (downgrade plus outlook/watch action) tend to have the strongest impact on bank share prices for Moody's and Fitch, while downgrades (with no outlook/watch actions) have the strongest effect for S&P. Negative watch actions are found to have a stronger effect than downgrades for Moody's and Fitch, emphasising the importance of considering the full picture provided by CRAs (i.e. rating changes and outlook and watch signals). In general, negative sovereign credit actions for lower-rated European countries are found to have a large impact on bank share prices in richer countries. This finding resonates with the fact that during the recent financial crisis the exposure of EU banks to the sovereign debt of Spain and Italy are the largest and that the countries with big investment banks are those most exposed to Spain and Italy.

With the ongoing regulatory changes in the credit rating industry, our evidence will interest many market participants, such as regulators, financial institutions, issuers (corporates and sovereigns), credit risk managers and investment managers. Rating agencies will also be interested from a reputational perspective.

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Table 1

Country banking exposure to sovereign debt of France, Greece, Portugal, Spain, Ireland and Italy

Exposure to Greece	**Tier 1 Capital**	**Exposure to Portugal**	**Tier 1 Capital**
Greece	212%	Portugal	130%
Cyprus	129%	Belgium	10%
Belgium	21%	Luxemburg	10%
Portugal	6%	Germany	3%
Luxemburg	6%	Spain	3%
Germany	5%	France	2%
France	4%	Netherlands	1%
Italy	2%	United Kingdom	1%
Other	0%	Other	0%
Exposure to Spain	**Tier 1 Capital**	**Exposure to Ireland**	**Tier 1 Capital**
Spain	152%	Ireland	42%
Germany	14%	Cyprus	9%
Belgium	13%	Portugal	3%
Luxemburg	12%	Belgium	2%
Italy	4%	Finland	1%
France	3%	France	1%
Netherlands	2%	Germany	1%
United Kingdom	1%	Slovenia	1%
Other	0%	Other	0%
Exposure to Italy	**Tier 1 Capital**	**Exposure to France**	**Tier 1 Capital**
Italy	161%	France	49%
Luxemburg	94%	Netherlands	29%
Belgium	85%	Slovenia	19%
Germany	22%	Cyprus	13%
France	18%	Germany	13%
Portugal	6%	Belgium	11%
Austria	5%	United Kingdom	9%
Spain	5%	Spain	5%
Other	2%	Other	1%

NOTE: 2010 EU banking system stress test.
Source: Blundell-Wignall (2012).

Table 2

Descriptive statistics

		S&P	Moody's	Fitch
1	**No. of countries**	19	17	17
2	Upgrades (solo)	8	4	8
3	Downgrades (solo)	6	8	8
4	**Total rating changes (solo)**	14	12	16
5	Positive outlook signals (solo)	15	10	13
6	Negative outlook signals (solo)	21	17	18
7	**Total outlook signals (solo)**	36	27	31
8	Positive watch signals (solo)	0	3	2
9	Negative watch signals (solo)	18	17	4
10	**Total watch signals (solo)**	18	20	6
11	Upgrades and positive outlook signal	0	1	1
12	Downgrades and negative outlook signal	26	21	20
13	Downgrades and negative watch signal	8	3	6
14	**Total combined-signals for a given sovereign (actual rating change and watch/outlook signal simultaneously)**	34	25	27
15	**Total sovereign credit signals (Rows 4 + 7 + 10 + 14)**	102	84	80
16	**Number of single event days**	76	60	61
	Two events	8*2=16	7*2=14	3*2=6
	Three events	2*3=6	2*3=6	3*3=9
	Four events	1*4=4	1*4=4	1*4=4
17	**Total positive signals**	28	20	27
18	**Total negative signals**	74	64	53
19	**Independent negative events**	35	34	24
20	**Clustered negative events**	39	30	29

This table presents summary statistics for the dataset, which consists of long-term foreign-currency ratings, outlooks and watch for sovereigns rated by Standard and Poor's, Moody's and Fitch during the period 1st January 2007 to 19th September 2011.

Note: Actions which involve moving to negative outlook from negative watch (with no rating change) are regarded as a positive signal in Row 17. There are five such cases for S&P, two for Moody's and three for Fitch. This explains why adding up the negative credit signals in Rows 3 + 6 + 9 + 12 + 13 ≠ Row 18, and adding up the positive credit signals in Rows 2 + 5 + 8 + 11 ≠ Row 17. See Section 3.1 for definition of independent and clustered events.

Table 3

List of banks

	Bank Name	Country
1	Erste Group Bank AG	Austria
2	Raiffeisen Bank International AG	Austria
3	Dexia	Belgium
4	KBC Groep NV	Belgium
5	Bank of Cyprus Public Company Limited	Cyprus
6	Marfin Popular Bank Public Company Limited	Cyprus
7	Danske Bank A/S	Denmark
8	Jyske Bank AS	Denmark
9	Nordjyske Bank A/S	Denmark
10	Sydbank A/S	Denmark
11	Pohjola Pankki A	Finland
12	BNP Paribas	France
13	Credit Agricole SA	France
14	Societe Generale	France
15	Commerzbank AG	Germany
16	Deutsche Bank AG	Germany
17	Landesbank Berlin Holding AG	Germany
18	Agricultural Bank of Greece SA	Greece
19	Alpha Bank SA	Greece
20	Bank Of Piraeus SA	Greece
21	EFG Eurobank Ergasias SA	Greece
22	National Bank of Greece SA	Greece
23	TT Hellenic Postbank SA	Greece
24	Allied Irish Banks PLC	Ireland
25	Bank of Ireland	Ireland
26	Irish Life & Permanent Group Holdings PLC	Ireland
27	Banca Monte dei Paschi	Italy
28	Banco Popolare	Italy
29	Intesa Sanpaolo	Italy
30	UBI Banca	Italy
31	Unicredit	Italy
32	DNB Nor ASA	Norway
33	PKO Bank SA	Poland
34	Banco BPI SA	Portugal
35	Banco Comercial Portugues	Portugal
36	Banco Bilbao Vizcaya Argentaria SA	Spain
37	Banco de Sabadell SA	Spain
38	Banco Pastor SA	Spain
39	Banco Popular Espanol SA	Spain
40	Banco Santander SA	Spain
41	Bankinter SA	Spain
42	Caixabank SA	Spain
43	Caja Ahorros Del Mediterraneo	Spain
44	Nordea Bank AB	Sweden
45	SE Banken	Sweden
46	Svenska Handelsbanken AB	Sweden
47	Swedbank AB	Sweden
48	Barclays PLC	United Kingdom
49	HSBC Holdings PLC	United Kingdom
50	Lloyds Banking Group PLC	United Kingdom
51	Royal Bank of Scotland Group PLC	United Kingdom

This table presents the banks and their country of origin which are included in our sample to determine the market impact. The 51 banks were part of the 2011 EU stress test which actually consisted of 91 banks. 40 banks were excluded either due to: (a) bank is not listed, hence no share price information; or (b) thinly traded shares.

We gathered share prices for these banks for the period 2nd January 2006 to 6th October 2011. The share price time window is larger than that for the credit signals in order to calculate the abnormal returns. Three of the 51 banks did not have share prices available for this whole period: (a) TT Hellenic Postbank SA (Row 23) from 5th June 2006; (b) Caixabank SA (Row 42) from 10th October 2007; (c) Caja Ahorros Del Mediterraneo (Row 43) from 28th July 2008.

Table 4

Bank CARs around S&P credit signals

			Mean-adjusted returns		
	No. of obs.		*Pre-event*	*Event*	*Post-event*
Panel A: Positive rating events					
All events	1313	*coefficient*	-0.0052**	-0.0005	-0.0015*
		t-stat	-4.41	-0.87	-2.40
2007	97	*coefficient*	0.0178**	0.0073**	0.0039*
		t-stat	11.26	7.34	2.17
2008	197	*coefficient*	-0.0056	0.0025	-0.0060
		t-stat	-0.84	-0.46	-1.69
2009	254	*coefficient*	0.0131**	0.0053**	0.0242**
		t-stat	3.12	4.56	5.43
2010	510	*coefficient*	-0.0023	-0.0048**	-0.0084
		t-stat	-0.47	-4.01	-6.32
2011	255	*coefficient*	-0.0378**	-0.0032	-0.0117**
		t-stat	-13.67	-1.95	-2.94
Panel B: Negative rating events					
All events	3065	*coefficient*	-0.0061**	-0.0077**	-0.0024**
		t-stat	-10.20	-12.81	-5.43
2007	341	*coefficient*	-0.0072**	-0.0014*	-0.0081**
		t-stat	-6.31	-2.32	-6.14
2008	695	*coefficient*	-0.0315**	-0.0147**	-0.0026
		t-stat	-13.63	-9.11	-0.02
2009	754	*coefficient*	0.0192**	-0.0139**	0.0126**
		t-stat	5.21	-10.48	3.97
2010	612	*coefficient*	-0.0047**	0.0005	0.0034*
		t-stat	-4.13	0.33	2.17
2011	663	*coefficient*	-0.0090**	-0.0041**	-0.0217**
		t-stat	-6.11	-4.66	-11.81
Panel C: Independent negative rating events					
All events	1304	*coefficient*	-0.0055**	-0.0022**	0.0015
		t-stat	-8.25	-4.86	0.14
2007	341	*coefficient*	-0.0072**	-0.0014*	-0.0081**
		t-stat	-6.31	-2.32	-6.14
2008	98	*coefficient*	-0.0154**	-0.0049*	0.0433**
		t-stat	-6.07	-2.24	11.70
2009	151	*coefficient*	0.0064	-0.0015	-0.0050*
		t-stat	0.30	-1.18	-2.43
2010	459	*coefficient*	-0.0070**	0.0009	0.0057**
		t-stat	-4.68	1.50	2.90
2011	255	*coefficient*	-0.0038	-0.0081**	-0.0058*
		t-stat	-1.32	-8.37	-2.47

Table 4 continued

	No. of obs.		*Mean-adjusted returns*		
			Pre-event	*Event*	*Post-event*
Panel D: Clustered negative rating events					
All events	1458	*coefficient*	-0.0157**	-0.0120**	-0.0090**
		t-stat	-10.29	-10.48	-8.29
2007	0	*coefficient*			
		t-stat			
2008	547	*coefficient*	-0.0318**	-0.0155**	-0.0160**
		t-stat	-10.88	-7.95	-5.83
2009	401	*coefficient*	-0.0024	-0.0224**	0.0225**
		t-stat	-0.37	-10.28	5.12
2010	153	*coefficient*	0.0024	-0.0005	-0.0037
		t-stat	0.23	-1.50	-0.58
2011	357	*coefficient*	-0.0137**	0.0004	-0.0360**
		t-stat	-6.30	0.79	-13.25
Panel E: Negative rating events to specific countries					
All events	1318	*coefficient*	-0.0022**	-0.0099**	-0.0044**
		t-stat	-3.94	-11.50	-4.81
2007	0	*coefficient*			
		t-stat			
2008	0	*coefficient*			
		t-stat			
2009	553	*coefficient*	0.0104**	-0.0180**	0.0025
		t-stat	2.87	-11.12	0.63
2010	306	*coefficient*	-0.0232**	-0.0031*	0.0064*
		t-stat	-13.91	-2.40	2.28
2011	459	*coefficient*	-0.0035**	-0.0047**	-0.0198**
		t-stat	-3.09	-5.27	-9.43
Panel F: Negative outlook and watch signals					
All events	1351	*coefficient*	-0.0084**	-0.0046**	-0.0046*
		t-stat	-8.00	-6.08	-2.54
2007	292	*coefficient*	-0.0081**	-0.0021**	-0.0078**
		t-stat	-6.37	-3.46	-5.34
2008	247	*coefficient*	-0.0285**	-0.0216**	0.0183**
		t-stat	-8.37	-8.14	5.80
2009	302	*coefficient*	0.0020	-0.0114**	-0.0237**
		t-stat	0.99	-8.13	-5.44
2010	357	*coefficient*	0.0071**	0.0086**	0.0052**
		t-stat	3.25	10.82	3.16
2011	153	*coefficient*	-0.0330**	0.0004	-0.0203**
		t-stat	-7.46	0.68	-5.00

This table presents the results of the bank cumulative abnormal returns (CARs) around the time of sovereign credit signals by S&P in the period 1st January 2007 to 19th September 2011. We report the 10-day pre-event (-10, -1), the two-day event (0, +1) and the 10-day post-event (+2, +11) window mean-adjusted and raw CARs. Mean-adjusted returns calculations are specified in Section 3.1. *t*-statistics are the Boehmer at al. (1991) standardized cross-sectional *t*-statistics.

** Significant at the 1% level; * significant at 5% level.

Table 5

Bank CARs around Moody's credit signals

	No. of obs.		*Mean-adjusted returns*		
			Pre-event	*Event*	*Post-event*
Panel A: Positive rating events					
All events	647	*coefficient*	-0.0005	-0.0005*	-0.0228**
		t-stat	-0.10	-2.57	-16.87
2007	194	*coefficient*	0.0000	0.0007	-0.0096**
		t-stat	0.15	0.20	-7.08
2008	147	*coefficient*	0.0031	-0.0036**	-0.0178**
		t-stat	0.51	-3.86	-7.76
2009	0	*coefficient*			
		t-stat			
2010	204	*coefficient*	0.0000	0.0024**	-0.0247**
		t-stat	0.50	3.24	-11.17
2011	102	*coefficient*	-0.0075*	-0.0042**	-0.0513**
		t-stat	-1.98	-5.36	-10.48
Panel B: Negative rating events					
All events	2785	*coefficient*	0.0038	-0.0017**	-0.0108**
		t-stat	0.93	-6.37	-11.22
2007	49	*coefficient*	-0.0094**	0.0022	-0.0003
		t-stat	-4.15	1.70	-0.09
2008	398	*coefficient*	-0.0065**	-0.0012*	-0.0530**
		t-stat	-3.72	-2.01	-13.83
2009	706	*coefficient*	0.0226**	-0.0014	0.0047
		t-stat	7.70	-1.67	1.06
2010	765	*coefficient*	0.0025	0.0004	0.0024
		t-stat	1.36	0.24	1.23
2011	867	*coefficient*	-0.0049*	-0.0043**	-0.0165**
		t-stat	-2.42	-9.38	-9.88
Panel C: Independent negative rating events					
All events	1416	*coefficient*	0.0051*	-0.0011**	-0.0019
		t-stat	2.13	-2.58	-1.62
2007	49	*coefficient*	-0.0094**	0.0022	-0.0003
		t-stat	-4.15	1.70	-0.09
2008	148	*coefficient*	0.0018	0.0062	-0.0103*
		t-stat	-1.31	0.86	-2.03
2009	454	*coefficient*	0.0117**	-0.0060**	-0.0054
		t-stat	3.36	-4.81	-1.54
2010	408	*coefficient*	0.0107**	0.0018*	0.0146*
		t-stat	6.32	2.35	7.35
2011	357	*coefficient*	-0.0064*	-0.0018*	-0.0131*
		t-stat	-2.45	-3.04	-6.70

Table 5 continued

	No. of obs.		*Mean-adjusted returns*		
			Pre-event	*Event*	*Post-event*
Panel D: Clustered negative rating events					
All events	1219	*coefficient*	0.0000*	-0.0044**	-0.0181**
		t-stat	-2.05	-8.76	-11.48
2007	0	*coefficient*			
		t-stat			
2008	150	*coefficient*	-0.0206**	-0.0106**	-0.0527**
		t-stat	-4.41	-4.02	-9.00
2009	202	*coefficient*	0.0370**	-0.0015	-0.0023
		t-stat	6.40	-0.88	-0.78
2010	357	*coefficient*	-0.0068**	-0.0011	-0.0114**
		t-stat	-4.91	-1.42	-5.34
2011	510	*coefficient*	-0.0039	-0.0061**	-0.0188**
		t-stat	-1.01	-10.41	-7.66
Panel E: Negative rating events to specific countries					
All events	1477	*coefficient*	-0.0028*	-0.0024**	-0.0006**
		t-stat	-2.00	-7.53	-3.62
2007	0	*coefficient*			
		t-stat			
2008	0	*coefficient*			
		t-stat			
2009	304	*coefficient*	-0.0046	0.0049*	0.0186**
		t-stat	-1.38	3.92	5.52
2010	561	*coefficient*	-0.0008	-0.0014	0.0018
		t-stat	-0.93	-1.77	0.41
2011	612	*coefficient*	-0.0037	-0.0069**	-0.0124**
		t-stat	-1.22	-12.03	-7.56
Panel F: Negative outlook and watch signals					
All events	1364	*coefficient*	0.0067	-0.0012	-0.0064**
		t-stat	1.13	-1.86	-4.56
2007	49	*coefficient*	-0.0094**	0.0022	-0.0003
		t-stat	-4.15	1.70	-0.09
2008	199	*coefficient*	-0.0063**	0.0124**	-0.0612**
		t-stat	-2.87	5.22	-9.89
2009	402	*coefficient*	0.0274**	-0.0093**	0.0107**
		t-stat	7.46	-2.83	5.17
2010	408	*coefficient*	0.0004	-0.0007	0.0040**
		t-stat	-0.61	-1.35	3.08
2011	306	*coefficient*	-0.0013*	-0.0005**	-0.0080**
		t-stat	-2.19	-3.34	-3.79

This table presents the results of the bank cumulative abnormal returns (CARs) around the time of sovereign credit signals by Moody's in the period 1st January 2007 to 19th September 2011. We report the 10-day pre-event (-10, -1), the two-day event (0, +1) and the 10-day post-event (+2, +11) window mean-adjusted and raw CARs. Mean-adjusted returns calculations are specified in Section 3.1. *t*-statistics are the Boehmer at al. (1991) standardized cross-sectional *t*-statistics.

** Significant at the 1% level; * significant at 5% level.

Table 6

Bank CARs around Fitch credit signals

	No. of obs.		*Mean-adjusted returns*		
			Pre-event	*Event*	*Post-event*
Panel A: Positive rating events					
All events	1304	*coefficient*	-0.0073**	-0.0040**	-0.0036**
		t-stat	-7.35	-9.93	-4.87
2007	291	*coefficient*	-0.0089**	0.0002	-0.0103**
		t-stat	-8.04	0.30	-8.21
2008	197	*coefficient*	-0.0122**	0.0037*	0.0134**
		t-stat	-3.13	2.31	3.28
2009	51	*coefficient*	-0.0200**	-0.0007	0.0104*
		t-stat	-4.88	-0.55	2.28
2010	357	*coefficient*	-0.0039	-0.0079**	0.0125**
		t-stat	-0.71	-9.29	7.13
2011	408	*coefficient*	-0.0052*	-0.0078**	-0.0230**
		t-stat	-2.33	-11.75	-9.47
Panel B: Negative rating events					
All events	2113	*coefficient*	-0.0077**	-0.0021**	-0.0009**
		t-stat	-7.77	-3.34	-4.51
2007	194	*coefficient*	-0.0033*	0.0074**	0.0001
		t-stat	-2.14	12.38	0.58
2008	547	*coefficient*	-0.0134**	-0.0094**	-0.0296**
		t-stat	-4.28	-6.25	-11.83
2009	454	*coefficient*	0.0012	-0.0005	0.0455**
		t-stat	-0.53	-1.38	13.02
2010	408	*coefficient*	-0.0007	0.0045**	-0.0110**
		t-stat	-1.12	6.25	-6.67
2011	510	*coefficient*	-0.0167**	-0.0045**	-0.0036*
		t-stat	-7.83	-6.02	-2.22
Panel C: Independent negative rating events					
All events	949	*coefficient*	-0.0162**	0.0020**	0.0198**
		t-stat	-8.90	3.97	6.26
2007	194	*coefficient*	-0.0033*	0.0074**	0.0001
		t-stat	-2.14	12.38	0.58
2008	198	*coefficient*	-0.0422**	0.0031	0.0074
		t-stat	-7.93	0.66	0.74
2009	302	*coefficient*	-0.0074*	-0.0001	0.0649**
		t-stat	-2.39	-1.10	14.48
2010	153	*coefficient*	-0.0115**	0.0025*	-0.0072**
		t-stat	-5.08	2.43	-2.83
2011	102	*coefficient*	-0.0239**	-0.0053**	-0.0120**
		t-stat	-2.98	-4.34	-2.74

Table 6 continued

	No. of obs.		*Mean-adjusted returns*		
			Pre-event	*Event*	*Post-event*
Panel D: Clustered negative rating events					
All events	1063	*coefficient*	-0.0016*	-0.0044**	-0.0149**
		t-stat	-2.50	-4.99	-9.35
2007	0	*coefficient*			
		t-stat			
2008	299	*coefficient*	-0.0006	-0.0153**	-0.0449**
		t-stat	0.09	-6.15	-13.99
2009	152	*coefficient*	0.0184**	-0.0011	0.0070*
		t-stat	3.88	-0.84	2.15
2010	204	*coefficient*	0.0088**	0.0090**	-0.0139**
		t-stat	3.89	9.88	-5.64
2011	408	*coefficient*	-0.0149**	-0.0044**	-0.0015
		t-stat	-7.73	-4.75	-0.74
Panel E: Negative rating events to specific countries					
All events	1067	*coefficient*	-0.0085**	-0.0001	0.0107**
		t-stat	-6.68	-0.19	4.89
2007	0	*coefficient*			
		t-stat			
2008	50	*coefficient*	-0.1404**	0.0150**	0.0055
		t-stat	-12.46	4.00	1.08
2009	354	*coefficient*	0.0037	-0.0015	0.0392**
		t-stat	0.11	-1.42	9.48
2010	357	*coefficient*	-0.0018	0.0034**	-0.0076**
		t-stat	-1.45	4.77	-4.65
2011	306	*coefficient*	-0.0088**	-0.0051**	-0.0001
		t-stat	-5.69	-4.50	0.07
Panel F: Negative outlook and watch					
All events	799	*coefficient*	-0.0093**	-0.0017	0.0208**
		t-stat	-4.14	-1.13	4.90
2007	97	*coefficient*	0.0216**	0.0055**	-0.0076**
		t-stat	8.79	7.87	-3.66
2008	247	*coefficient*	-0.0392**	-0.0029	-0.0103**
		t-stat	-7.68	-0.99	-4.47
2009	251	*coefficient*	0.0049	-0.0031*	0.0802**
		t-stat	0.24	-2.39	16.86
2010	51	*coefficient*	-0.0002	0.0036**	-0.0164**
		t-stat	-0.43	2.83	-4.88
2011	153	*coefficient*	-0.0067**	-0.0039**	0.0038
		t-stat	-3.11	-3.74	0.79

This table presents the results of the bank cumulative abnormal returns (CARs) around the time of sovereign credit signals by Fitch in the period 1st January 2007 to 19th September 2011. We report the 10-day pre-event (-10, -1), the two-day event (0, +1) and the 10-day post-event (+2, +11) window mean-adjusted and raw CARs. Mean-adjusted returns calculations are specified in Section 3.1. *t*-statistics are the Boehmer at al. (1991) standardized cross-sectional *t*-statistics.

** Significant at the 1% level; * significant at 5% level.

Table 7

Regression analysis of bank share price reactions to negative sovereign credit signals

		Mean-adjusted returns	
		Coefficient	*t*-Val
S&P	Constant	0.0322	1.78
	Δ*LCCR*	-0.0076**	-2.65
	Lag Δ*LCCR*	0.0025	0.40
	BC CCR	0.0004	1.83
	EC CCR	-0.001**	-4.80
	Y/Co/Ba	Yes	
	R^2	9.43%	
	Obs.	3646	
Moody's	Constant	-0.0319**	-3.26
	Δ*LCCR*	-0.0087**	-7.55
	Lag Δ*LCCR*	0.0000	0.01
	BC CCR	-0.0001	-0.60
	EC CCR	-0.0001	-0.67
	Y/Co/Ba	Yes	
	R^2	25.18%	
	Obs.	3171	
Fitch	Constant	-0.1456**	-5.33
	Δ*LCCR*	-0.0041	-1.30
	Lag Δ*LCCR*	-0.0267*	-1.97
	BC CCR	0.0008*	2.29
	EC CCR	0.0011**	5.42
	Y/Co/Ba	Yes	
	R^2	17.75%	
	Obs.	2610	

This table presents the coefficient estimates of Model (2) using data samples of European countries rated by S&P, Moody's and Fitch during January 2007 to September 2011. CAR_{it} ($CARR_{it}$): the dependent variable, is the mean-adjusted (raw) cumulative abnormal return of bank *i* in the event window (0, +1) around a negative European sovereign credit signal at time *t*. $\Delta LCCR_{st}$ is the 1-day change in the logit-type transformation of the 58-point rating scale of sovereign *s* at time *t*. *Lag ΔLCCR* is the cumulative change in the LCCR of the bank's country's sovereign rating during the ten days (-10 to -1) preceding the event. *BC CCR* is the level of the bank's country's comprehensive credit rating. *EC CCR* is the level of the event country comprehensive credit rating. Full sets of year/event country/bank dummy variables included. We apply Huber-White robust standard errors.

** Significant at 1% level; * significant at 5% level.

Table 8

Regression analysis with categories for negative credit signals

		Mean-adjusted returns	
		Coefficient	*t*-Val
S&P	Constant	0.0298*	1.99
	NOD	-0.0054**	-3.13
	NWD	-0.0079**	-3.09
	NW	-0.0032	-1.62
	DN	-0.0194**	-4.51
	Lag ΔLCCR	-0.0043	-0.69
	BC CCR	0.0004*	2.05
	EC CCR	-0.0010**	-5.81
	Y/Co/Ba	Yes	
	R^2	10.38%	
	Obs.	3646	
Moody's	Constant	-0.0661**	-6.60
	NOD	-0.0110**	-6.89
	NWD	-0.0139**	-5.32
	NW	-0.0104**	-6.02
	DN	-0.0064**	-4.43
	Lag ΔLCCR	-0.0004	-0.18
	BC CCR	-0.0001	-0.53
	EC CCR	0.0003**	3.40
	Y/Co/Ba	Yes	
	R^2	25.63%	
	Obs.	3171	
Fitch	Constant	-0.2014**	-6.81
	NOD	-0.0112**	-6.27
	NWD	-0.0175**	-6.24
	NW	-0.0106**	-2.96
	DN	0.0008	0.43
	Lag ΔLCCR	-0.0275*	-2.01
	BC CCR	0.0008*	2.30
	EC CCR	0.0016**	7.24
	Y/Co/Ba	Yes	
	R^2	19.68%	
	Obs.	2610	

This table presents the coefficient estimates of Model (3) where the $\Delta LCCR_{st}$ variable in Table 7 has been split into its constituent credit signals: NOD_{st} is the combined-signal of a downgrade and negative outlook action to sovereign *s* at time *t*; NWD_{st} is the combined-signal of a downgrade and negative watch action to sovereign *s* at time *t*; NW_{st} is when sovereign *s* is put on negative watch at time *t*; DN_{st} is when sovereign *s* is downgraded at time *t*. CAR_{it} ($CARR_{it}$), *Lag ΔLCCR*, *BC CCR* are *EC CCR* are included as in Model (2), (see Table 7). Full sets of year/event country/bank dummy variables included. We apply Huber-White robust standard errors.

** Significant at 1% level; * significant at 5% level.