The "Greatest" Carry Trade Ever? Understanding Eurozone Bank Risks

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November 18, 2012

Abstract

This paper argues that the European banking crisis can in part be explained by a "carry trade" behavior of banks. The factor loadings from cross-sectional tests relating bank stock returns to government bond returns suggest that banks have been long peripheral sovereign bonds funded in short-term wholesale markets. Large banks with low Tier 1 ratios and high risk-weighted assets had particularly large exposures. They raised more capital and were more dependent on central banks. The European Central Bank (ECB) has provided liquidity to fund these carry trades at the expense of real sector lending. We discuss alternative motives to hold sovereign debt such as home bias, suasion and redenomination risk.

Keywords: Sovereign debt crisis, bank risk, carry trades
JEL Classification: G01, G21, G28, G14, G15, F3

We thank Martin Brown, Paul Glaserman, Martin Hellwig, Marco Pagano, Hélène Rey and participants in the 12th annual FDIC / JFSR conference, 2012 C.R.E.D.I.T. and seminar participants at Leeds, the University of Osnabrueck and University of Mainz for valuable comments and suggestions.

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"And of course, the deterioration of the Euro zone situation and particularly the sovereign crisis in the peripheral economies hit very badly the group. And that's of course not a surprise for a group that still had very important short-term funding needs that was mainly present in strong exposures in peripheral countries. [...] Before 2008, it was the group's high rating granting easy access to wholesale funding that led to the situation of October 2008 with short-term funding need of €260 billion outstanding in October 2008, i.e. 43% of total balance sheet. [...] with very significant acceleration and buildup of the bond portfolio was amounting at €203 billion at the end of 2008. Mostly carry trades with marginal improvement of customer access [...] that led to a very significant gearing ratio because the portfolio size was, at that time, 25 times the group equity."

(Pierre Mariani, Chairman of the Management Board and CEO, Dexia SA, Earnings Call, February 23rd, 2012)

The ongoing sovereign debt crisis in Europe has cast doubt on the solvency of European banks that incurred substantial mark-to-market losses and impairments on their peripheral (Greece, Ireland, Portugal, Spain and Italy, or GIPSI) sovereign bond holdings. Since the beginning of 2008, government bond yield spreads between pairs of European countries, for example, between German bunds and GIPSI bonds, have widened considerably, mirroring the economic divergence between these countries (Figure 1).[1] This divergence has challenged even the survival of the Eurozone as a whole. Since then, banks have on average lost 70% of their market value and shed billions of euros of assets in an effort to increase regulatory capital ratios.

[Figure 1]

We show in this paper that banks' risks during this period can be understood as reflecting a "carry trade" behavior. With access to short-term unsecured funding in wholesale markets, banks appear to have undertaken long peripheral sovereign bond positions. On the upside, the trade would pocket the "carry", the spread between the long-term peripheral sovereign bonds and banks' short-term funding costs. On the downside, which has materialized, the spreads

[1] For almost a decade prior to this, the ten-year sovereign bond yields for these countries hovered around the four percent benchmark with a small yield spread difference between core and peripheral European countries.

between two legs of the trade diverged even further resulting in significant losses for banks and leading to questions in funding markets about their solvency and liquidity. In essence, this carry trade reflects a bet that Eurozone countries would converge economically resulting in a convergence of the spread between its two legs.

Dexia SA (Dexia), a Belgian financial group and one of the largest lenders to public sector entities, provides a quintessential example of such behavior as it invested heavily in these carry trades (see the introductory quote). Dexia built up a risky sovereign bond portfolio of almost a third of the bank's total balance sheet which was financed almost 50% with short-term funding. As the quality of the bond portfolio worsened, Dexia was unable to roll over the financing of its assets and was bailed out in October 2011.

In this paper, we show that Dexia-style behavior has in fact been pervasive among the Eurozone banks. More generally, we investigate the causes of the European banking crisis and argue that banks' substantial share price decline can in part be explained by banks placing a bet on the survival of the Eurozone, choosing to hold peripheral sovereign bonds and financing their investments in short-term wholesale markets. While correlations between bond yields of Germany (or France) and peripheral sovereign bond yields were above 95% in 2005, these correlations became negative in 2010 when markets started to demand a risk premium for holding risky sovereign debt and short-term funding markets froze causing a flight into longer-term core European government bonds. In other words, the banks lost on both sides of the carry trade. All publicly listed banks that took part in the stress tests by the European Banking Authority (EBA) are at the core of our analysis. We collect stock price data for these banks and daily ten-year sovereign bond yields over the January 2005 to March 2012 period and use the cross-sectional (across banks) and time-series (within bank) patterns in the correlations between banks' stock returns and sovereign bond returns to impute the effective exposure of banks to sovereign debt and show these patterns to be a major determinant in helping to explain the eventual stock price collapse of European banks.

We first perform a series of cross-sectional tests relating banks' daily stock returns to "risk factors" in the form of GIPSI bond returns and German bund returns. The factor loadings should inform us about the banks' exposure to these securities. We find a significant positive correlation between banks' stock returns and GIPSI bond returns and negative correlations with German bund returns. European banks are thus effectively, on average, long GIPSI government bonds and their stock returns decline when bond prices depreciate. The negative loadings on German government bonds (bunds) suggest that banks are "short" long-term German bunds. If long-term German bund prices appreciate whenever short-term funding dries up (due to a flight to safety or quality) and banks are exposed to short-term funding, then it would appear as if banks were "short" long-term German bunds. In other words, these results suggest that banks were financing long-term peripheral bonds with short-term debt in a carry trade.

We show a series of tests suggesting that banks were pursuing risks consistent with these carry trade exposures: (1) we control for home bias of peripheral banks[2]; (2) we use the Principal Component Analysis (PCA) to account for the collinearity of bond returns; (3) we use French bond returns as the funding leg of the carry trade instead of Germany; (4) we use two-year GIPSI bond yields instead of ten-year bonds as banks earn a higher carry when the investment is long-dated; (5) we use changes in bank credit default swap (CDS) spreads as dependent variables instead of stock returns.

In a next step, we show that these exposures relate to actual government bond holdings of banks and do not simply reflect some other underlying economic exposures and linkages. We use reported bond holdings by banks as well real sector exposure to firms, households and real estate and show that actual holdings do explain our factor loadings rather than non-sovereign holdings (both in the cross-section of banks and in time-series data for a given

[2] We find a positive factor loading on the banks' home country bond return indicating that banks are long in sovereign bonds of their home country. Banks are usually the largest domestic bond investors (see, for instance, the evidence in Acharya, Drechsler and Schnabl, 2010 and Gennaioli, Martin and Rossi, 2011).

bank). These results confirm that the factor loadings measured using market return data indeed proxy well for the underlying European banks' exposure to sovereign debt.

We then explore various motives for banks engaging in carry trades, namely: (1) implicit bailout guarantees, (2) regulatory capital arbitrage, (3) risk shifting, and (4) European Central Bank (ECB) funding, which might have made these trades more attractive for banks. We find that larger banks are significantly more exposed consistent with large banks exploiting an implicit bailout guarantee from their sovereign. Also, banks with a higher percentage of short-term leverage relative to total debt have somewhat higher exposure to GIPSI countries and lose significantly more in terms of market value when German bond prices appreciate.

Another motive we consider is regulatory capital arbitrage under the current Basel II regulations which assign a zero risk weight for investments in sovereign debt. The governments may themselves have had incentives to preserve the zero risk weight to be able to continue to borrow.[3] Undercapitalized banks, that is, banks with low Tier 1 capital ratios, now have an incentive to shift their portfolios into assets with lower risk weights in an attempt to increase their regulatory capital ratios (regulatory capital arbitrage). Moreover, riskier banks might shift into riskier government bonds placing a bet on their own survival (risk shifting) as this way they shift risk into the states of the world (government defaults) where they are likely to experience bank runs (as argued by Diamond and Rajan, 2011). We find that banks with lower core Tier 1 ratios or higher risk-weighted assets have greater exposure to GIPSI bonds. We find that the effects are usually stronger for Italian and Spanish exposure because of the impairments banks have already incurred with respect to Greek government debt.

[3] The more entangled the financial sector with the governments, the more costly the government default would be due to "collateral damage" in the form of bank runs and disruption of inter-bank and repo markets (Broner, Martin and Ventura, 2010; Bolton and Jeanne, 2011 and Acharya and Rajan, 2011).

We document that banks' current carry trades can predict their future capital offerings and dependence on funding from central banks. For example, we find that banks with more carry trade exposure to Greek government debt raise more capital relative to other banks thus reflecting the impairments they incurred following the private sector involvement and bailouts. We find that banks with more carry trade exposure depend more on the ECB relative to other financing sources in the following year. Banks with high exposure to short-term funding are particularly reliant on ECB financing. Large banks that benefit from implicit government guarantees are, on the other hand, less likely to obtain ECB funding.

In the final part of the paper, we analyze the time-series of carry trade exposures. Since the Lehman default, we observe a widening of the spreads between peripheral and German government bonds. The ECB started its "original" Long-Term Refinancing Operations (LTRO) in 2009 with three one-year tenders on June 6, 2009, September 30, 2009, and December 16, 2009.[4] We document a jump in the correlation of banks' stock and Italian bond returns when the money was injected into the markets, which is consistent with banks placing a bet on the temporary divergence of government bond yields.[5]

The ECB started another one-year LTRO on October 27, 2011 responding to increasing pressure on short-term funding markets. In the subsequent month, the estimated factor loadings suggest significantly higher exposure towards Italian sovereign debt, in particular of large and poorly capitalized banks, but in this case with a partial easing of funding pressure. Interestingly, our findings show that during the final months of our sample period, highly capitalized banks suffered more from tightening interbank markets suggesting that banks had very selectively been able to borrow short-term in the interbank or commercial

[4] Overall, the ECB lent EUR 614 billion at an interest rate of 1% to European banks at that time.

[5] The results from the quarterly regressions support this observation. For instance, the loading on Italian bond returns doubles in Q2 2009 when the first LTRO took place, which amounted to EUR 442 billion (that is, 72% of all three operations). Interestingly, the loading on German bunds became more negative suggesting that the ECB measure did not release existing tension in short-term funding markets for banks. Data on the quarterly flow of funds into public sector entities (loans and government bonds) obtained from the Deutsche Bundesbank shows that more than EUR 250 billion have been invested by European banks in the first three quarters of 2009 and about EUR 30 billion in the first quarter of 2010, after the third one-year LTRO.

paper markets. Two three-year LTROs were allotted on December 26, 2011 and February 29, 2012.[6] We document a further expansion of the carry trades of larger, poorly capitalized European banks. Again, particularly banks refinanced with more short-term debt increased their exposures. These results are particularly strong for non-GIPSI banks, less so for GIPSI banks emphasizing that moral hazard causes the former to pursue these risks.

In the last part of the paper we document that European banks did not use the funds provided by the ECB since 2009 to increase lending to firms but rather decreased their loan relative to their bond portfolio. Using bank balance sheet data we find that the cross-correlation of the time-series of loans to non-financial firms and government securities is -0.15 across all European banks over our sample period. Moreover, Italian and Spanish banks have substantially increased their government securities portfolios consistent with the analysis of our factor loadings above. At the same time, they have significantly reduced lending to the real sector.

The paper now proceeds as follows. The next section discusses a case study about the buildup and subsequent failure of Dexia. Section II describes the data and provides descriptive statistics. In Section III, we analyze various motives for banks to engage in carry trades. In Section IV, we analyze the effect of carry trades on future capital raisings and dependence on ECB funding. In Section V, we explore the role of the ECB in funding the carry trades. Section VI concludes.

I. Background and Methodology

A. Dexia SA – A Carry Trade Gone Awry

Dexia SA was formed in 1996 through a merger of Crédit Local (France) and Crédit Communal (Belgium). In October 2011, the Dexia Group was bailed out for a second time

[6] Even though there have been some redemptions of ECB funding (and some banks might have replaced short-term with long-term ECB funding), the lending to euro area credit institutions changed by EUR 335 billion in December 2011 and EUR 448 billion in the week of the respective LTRO operations according to data released by the ECB.

because of carry trades that went wrong (see the quote of Dexia's current CEO at the start of the paper). This section provides a brief overview how the situation unraveled.

Dexia built a proprietary portfolio of mainly bonds amounting to EUR 203 billion at the end of 2008 (about 32% of its balance sheet).[7] These investments were mainly carry-trades, financed in short term wholesale markets. The bond exposure was mainly to fixed rate bonds. Dexia hedged the interest rate risk using credit derivatives. Thus, afterwards, the interest rate risk was mainly floating rate risk and cash flows became sensitive to short term interest rates. The sovereign debt crisis started in November 2009 when Greece forecasted an annual budget deficit of 12.7% for 2009. During the following months, Greece, Portugal and Spain announced first austerity measures to reduce the indebtness of each respective country. Spain was downgraded by S&P losing its AAA rating in April 2010 and Greece was downgraded below investment grade. In May 2010, the Eurozone countries and the IMF agreed to the first EUR 110 billion bailout package for Greece. On May 5th, the ECB announced that it would have started to accept Greek sovereign bonds as collateral whatever the rating might be responding to the tensions in the funding market. The European Commission explicitly addressed its concerns with respect to the large amount of sovereign debt in Dexia's portfolio and the use of interest rate derivatives which "probably requires significant collateral for Dexia, which may reduce its eligible collateral base for financing from the central banks or in the interbank repo market" (EC (2010)). [8]

Even though Dexia made considerable progress in reducing its dependence on short-term wholesale funding and its overall balance sheet, it was poorly capitalized (given the huge impairments due to the deleveraging process) in summer 2011[9], i.e. when the crisis became worse, which contributed to the subsequent run on the bank. Moreover, both Moody's and

[7] Holding a large amount of securities given Dexia's funding imbalances was even encouraged by rating agencies: "Dexia's widely diversified funding base and the liquidity reserve provided by its large securities portfolio offset its reliance on wholesale capital markets." (S&P Ratings Direct, 22 May 2008).

[8] Dexia held a portfolio of GIPSI sovereign bonds amounting to EUR 26.1 billion as of March 31st, 2010 consisting mainly of Italian bonds (EUR 17.6 billion) and Greek government bonds (EUR 3.7 billion).

[9] Dexia's Tier 1 ratio fell to 7.56% at end of 2011 due to losses incurred while Dexia divested its assets.

S&P placed Dexia's ratings under review for possible downgrade. As reported by the group, EUR 22 billion in unsecured short-term funds have been withdrawn between April and June 2011 and their US Dollar position has been impacted first. Consequently, Dexia needed to rely increasingly on central bank funding which reduced the amount of available collateral for further repo transactions. Figure 2 shows the pairwise correlation of Dexia's stock return and Italian bond returns and its stock return and German bund returns from January 2011 onwards.

[Figure 2]

The graphic (Figure 2.A) shows strikingly how the two legs of the carry trade diverged when Italian yields surged and German bund yields continued to fall as investors continued their flight into long-term German government bonds. Dexia lost about EUR 40 billion short-term funding within 6 month in the second half of 2011. An additional EUR 6 billion unsecured short-term funding was withdrawn during the July - September period, and another EUR 6 billion after Moody's announcement of placing the group's long and short-term rating under review for possible downgrade on October 3rd, 2011. Moreover, the group lost commercial deposits of EUR 7 billion in the fourth quarter of 2011. Figure 2.B. shows the 1-year CDS spread of the banking subsidiary Dexia Crédit Local. The CDS spread increased within a few weeks after June 2011 from 200bps to 1,000bps reflecting its rise in short-term funding costs as well as the market expectation of Dexia's default probability over the next year. Dexia's derivative positions put even more pressure on short-term funding. Between June and September 2011, Dexia had to post EUR 15 billion cash collateral due the fall in interest rates. Figure 2.C shows the stock price decline and the market value loss Dexia incurred when the carry trade went under.

During the rest of this paper, we argue that Dexia's behavior has been widespread among European banks.

B. Methodology

Our approach is to infer European banks' sovereign risk exposure from asset prices as information about bond holdings is only sporadically available around stress tests. Our basic regression model is as follows:

$$Stock\ Return_{it} = \alpha + \beta_{GIPSI}\ x\ GIPSI_t + \beta_{Germany}\ x\ Germany_t + \gamma\ x\ Stock\ Index_t + \varepsilon_{it} \quad (1)$$

The factor loadings (β_{GIPSI}, $\beta_{Germany}$) provide us with an estimate of the size and direction of the exposure to each security. One obvious concern is that there are other (unobserved) factors that explain banks' stock returns. For example, changes in expectations about macroeconomic fundamentals such das employment, growth or productivity in the euro area that affect the profitability and risk profile of the banks will be reflected in stock prices. We use two strategies to address this concern. First, we include a proxy for each country's stock index ($Stock\ Index_t$) which is the residual from the regression of a country's home index return on the domestic sovereign and German bond returns.[10] The residuals are by definition orthogonal to the regressors, and more cleanly reflect the effect of changes in macroeconomic fundamentals in each country. Second, we cluster standard errors at two dimensions, bank and quarter, to account for (unobserved but time-variant) variation that is both bank specific in different quarters and that is common across all banks in the same quarter.

Our hypothesis is that carry trades reflect moral hazard of riskier banks. To identify this, we augment (1) with risk factors (*RISK*) obtained from bank balance sheets, such as asset

[10] We additionally perform several robustness tests using a variety of macroeconomic state variables that directly measures changes in fundamentals.

size, loan-asset ratios, short-term leverage, Tier 1 ratio and risk-weighted assets and estimate the following cross-sectional regression.

$$Stock\ Return_{it} = \alpha + \beta_{GIPSI}\ x\ GIPSI_t + \beta_{Germany}\ x\ Germany_t + \sum \beta_{GIPSIxRISK}\ x\ GIPSI_t\ x\ RISK_{i,t-1}$$
$$+\sum \beta_{GermanyxRISK}\ x\ Germany_t\ x\ RISK_{i,t-1} + \sum \beta_{RISK}\ x\ RISK_{i,t-1} + \gamma\ x\ Stock\ Index_t + \varepsilon_{it} \qquad (2)$$

$\beta_{GIPSIxRISK}$ provides us with an estimate of the additional exposure of riskier banks.

Our methodological approach accommodates various alternative explanations as to why banks hold sovereign debt. For example, our factor loadings could measure exposure of GIPSI banks to GIPSI sovereign debt ("home bias"). Estimating (2) separately for non-GIPSI and GIPSI banks helps to address this. Moreover, it is unlikely that there is a feedback effect from banks to the non-domestic sovereign. Peripheral banks have other incentives to hold domestic sovereign debt. The government might have asked them to buy their own sovereign debt in an attempt to lower yields ("(im-) moral suasion hypothesis"). Peripheral banks also have an advantage to hold debt of their own country in the case of a break-up of the Eurozone ("redenomination hypothesis"). While it is difficult to distinguish between the suasion and redenomination hypotheses, our estimates from (2) clearly distinguishe the moral hazard (carry trade) hypothesis from the alternatives which is the focus of this paper.

II. Data and Descriptive Statistics

A. Data

To identify the effects of banks' carry trades on stock returns, we construct a dataset using three major data sources. We collect market information (bank stock prices, bank and sovereign CDS spreads, and sovereign bond yields) from Bloomberg, information about bond portfolio holdings from the European Banking Authority (EBA) and annual and quarterly reports from the banks, and financial information from SNL Financial as well as company

reports. We augment the data with information from S&P Credit Portal, investor presentations and the European Central Bank and Bank of International Settlement (BIS).

We start with all public European banks included in the EBA stress tests. A list of these banks is included in Appendix II.[11] We collect financial information such as size, leverage and capitalization as well as information about capital offerings from SNL Financial. In addition, we compute stock returns from daily stock prices. We use ten-year government bond yields, which are observed on a daily basis during the January, 1 2005 to March 5, 2012 period. Stock and bond prices are collected from Bloomberg.

Information about banks' actual portfolio holdings of sovereign bonds is obtained from the European Banking Authority. The EBA took over the responsibilities from the Committee of European Banking Supervisors (CEBS) on January 1, 2011. They have been responsible for five stress tests and capitalization exercises that have been conducted in the European banking market since 2010 to "ensure the orderly functioning and integrity of financial markets and the stability of the financial system in the EU."[12] The results of the tests together with detailed information about banks sovereign bond portfolios were published for the following reporting dates: (1) March 2010, (2) December 2010, (3) September 2011, (4) December 2011 and (5) June 2012.[13] Finally, we collect the euro amount of funding obtained from the ECB from the quarterly and annual reports from each bank.

B. Descriptive statistics

We provide descriptive statistics for the returns of GIPSI sovereign bonds as well as German ten-year government bonds in Table I. Panel A of Table I shows the mean daily bond returns.

[11] We exclude six banks from our analysis either because of data availability or because the bank is part of a banking group where the parent owns the vast majority of stocks. There are: Bankia (BKIA), Raiffeisenbank International AG (RBI), Österreichische Volksbanken AG (VBPS), Caja de Ahorros del Mediterraneo (CAM), Hypo Real Estate (HRX) and Irish Life and Permanent (IPM).

[12] A stress test was already done in 2009, but neither the names nor details about the results were disclosed except for the information that all institutions were adequately capitalized.

[13] The data is publicly available on the website of the EBA (http://www.eba.europa.eu/Home.aspx).

Greek government bonds have the highest negative return as well as the highest variance followed by Portugal and Ireland. All three countries have already been bailed out by the European Union. Germany and France both have positive daily returns with a small variance.

[Table I]

Table I also contains correlations between the returns in 2005 (Panel B) and 2011/2012 (Panel C). In 2005, bond returns were almost perfectly correlated, usually above 0.9 both between the GIPSI countries, but also between GIPSI and core European countries. This demonstrates that these countries were perceived by investors as being almost identical despite the major economic differences between them. Greece and German government bond returns, for example, had a correlation of 0.96. This changed significantly as the sovereign debt crisis unfolded. In 2011/2012, the correlation between GIPSI and German bond returns became negative showing the divergence within the Eurozone.

Table II contains descriptive statistics on bank characteristics and stock and bond returns.

[Table II]

Panel A of Table II reports summary statistics on bank characteristics calculated at the bank level. Log-Assets is the natural logarithm of total book assets. Book-LVG is measured as total book assets divided by book value of equity. ST-LVG is short-term debt divided by total debt. Assets/RWA is book assets divided by risk-weighted assets. Tier 1 is the Tier 1 capital divided by risk-weighted assets. On average, 33% of the total debt is short-term debt and banks have a Tier 1 ratio of 9.3%. Capital (Yes/No) is an indicator variable that is 1 if the sample banks raised common or preferred capital during the January 2007 and February 2012

period. Eighty-six percent (86%) of them issued capital during that time period. Moreover, 7% of total assets is, on average, funding obtained from the ECB.[14] Panel B provides time-series characteristics of banks' stock returns and CDS prices observed on a daily basis. The average daily (quarterly) realized return is -0.14% (-6%) and the average five-year CDS spread is about 183 basis points. We also show that average factor loadings estimated quarterly for each bank are positive for both Italy and Greece and negative for Germany suggesting significant exposure of European banks to peripheral sovereigns. Panel C of Table II provides descriptive statistics of the estimated factor loadings, for the full sample of banks and separately for GIPSI and non-GIPSI banks. The mean factor loadings for peripheral bond exposure (Italy, Spain and Greece) are positive and suggest, on average, more exposure of banks to Italian sovereign debt. A large negative loading of German bunds indicate the funding pressure on banks during our sample period due to a flight to quality of investors. Interestingly, the factor loadings for Italian and Spanish bonds are larger for the non-Italian and non-Spanish banks, respectively. This shows that non-domestic banks had large exposures to the periphery. Panel D of Table II finally shows European banks' total bond holdings of GIPSI government debt at five reporting dates. Again, we provide these statistics for the full sample and for GIPSI and non-GIPSI banks separately.[15] We document that the total exposure of banks towards Italian government debt did not decrease substantially during the March 2010 and June 2012 period; we only observe a decrease from EUR 264.5 billion to EUR 258.9 billion. In the subsample of non-Italian banks, this exposure declines from EUR 115 billion to EUR 69 billion in the same period which is still substantial. This exposure is

[14] The difference as to the dependence on ECB funding between banks is appalling. While mostly peripheral banks (such as Greek banks) are entirely dependent on the ECB to obtain liquidity, other banks (for example, in Germany or France) can refinance themselves in other ways, further highlighting the divergence between the European core and periphery. There is a huge divergence as to each bank's dependence on ECB funds, from almost zero dependence to fully dependent. The top five ECB-dependent firms are Bankinter, ATEbank, Banco Commerciale Portuguese, Piraeus Bank and Alpha Bank. The five least ECB-dependent firms are RBS, Société Générale, BNP Paribas, Banco Sabadell and Crédit Agricole. Apparently, the peripheral banks especially struggled to obtain financing from interbank markets or any source other than the ECB, while large core European banks barely relied on ECB financing.

[15] GIPSI banks means that we report only the exposures of Greek banks, Italian banks, etc. to their domestic sovereign.

also somewhat increasing after December 2011, most likely through additional purchases from banks financed with (cheap) ECB liquidity. GIPSI banks increased their exposure over this period.[16] For example, Italian banks invested about EUR 37 billion in domestic sovereign debt between December 2011 and June 2012; Spanish banks increased their exposure to the Spanish government debt by about EUR 13 billion.

III. Cross-Sectional Analysis of Stock and Bond Returns

To investigate whether the use of carry trades can explain Eurozone bank risks, we estimate the factor loadings in regressions of banks' stock returns on government bond returns. The lack of micro level changes in portfolio holdings of banks gives these tests more power. We relate the loadings to actual bond portfolio holdings that we can observe once they have been disclosed in the European stress tests. Moreover, we exploit cross-sectional variations in bank characteristics to analyze differences in the factor loadings to investigate the moral hazard (carry trade) motive vis-à-vis the alternatives.

A. "Carry trade" behavior of European banks

In our first set of tests, we regress banks' daily stock return on the return of ten-year peripheral government bonds and German bunds. The results are reported in Table III.

[Table III]

Model (1) estimates the correlation between stock and Greek government bond returns. We find a significant positive correlation between banks' stock returns and Greek bond returns, which suggests that banks have, on average, exposure to Greece and stock prices decline when bond prices decline. The factor loading on German bond returns is negative suggesting

[16] Note that Greek banks did not participate in the stress tests or capitalization exercises since September 2011.

that banks are "short" long-term German bonds. This is consistent with a "carry trade" behavior of European banks: they appear to have invested in long-term government bonds financed in the short-term wholesale market to maximize the carry between both legs of the trade. The negative factor loading on German bunds reflects a "flight to quality" of investors who purchase long-term safe (German) government bonds, at the same time reducing the supply of short-term capital. If long-term bond prices appreciate whenever short-term funding dries up and banks are exposed to short-term funding, then it appears as if banks were short long-term bonds. The positive and significant coefficient of Stock Index suggests that macroeconomic fundamentals are important in explaining bank stock returns. We replace Greek government bonds with Italian, Spanish, Portuguese and Irish bonds in models (2) to (5) and include all GIPSI bond returns together in model (6). All results extend to these models as well. Model (6) in particular suggests that carry trade investments were mostly undertaken in Greek and Italian long-term government bonds. The factor loadings are both economically and statistically significant and the R^2 of the models show that a substantial proportion of the variation in stock returns is explained by these covariates. In Panel B of Table III, we report a series of tests that supports the notion of "carry trade" behavior of European banks.

Banks are usually the largest domestic bond investors. To ensure that our factor loadings do not reflect a "home bias" in sovereign bond holdings of banks, we include the home country bond return (Home) of each bank in model (1). Home, as an example, reflects the amount of Italian government debt that is held by Italian banks. The positive factor loading on the banks' home country bond return indicates that banks are long in sovereign bonds of their home country. The factor loadings of Italian and German bonds do not change materially suggesting Italian bonds as primary asset class for carry trades. Interestingly, the factor loadings of Greek bond returns are insignificant. Thus, it is important to differentiate between the motives of non-peripheral banks to hold peripheral sovereign debt and of

peripheral banks to hold domestic debt and explore the dynamics of this relationship. Our empirical approach carefully accounts for these dynamics both in the cross-section and in the time-series.

We include a variety of other macroeconomic state variables to control for changes in macroeconomic fundamentals that could drive both stock and sovereign bond prices, namely: (i) We follow the empirical literature and use the VSTOXX index, the European counterpart to the VIX index for the S&P 500, VSTOXX is the change in the VSTOXX Index for the European stock market; (ii) Term Structure is the slope of the term structure of interest rates measured as the difference between the yield on a ten-year euro area government bond and the one-month Euribor; (iii) Bond Default Spread is the difference between the yield on ten-year German BBB bonds and yields on ten-year German government debt; (iv) 1 month EURIBOR is the level of the short-term risk-free interest rate measured as the one-month Euribor; (v) ΔEuropean Economic Sentiment is the monthly change in the economic sentiment indicator obtained from opinion surveys conducted by the European Central Bank; (vi) ΔLevel of Industrial Production is the monthly change in the level of industrial production; (vii) ΔEuropean Consumer Price Index is the change in inflation measured as the monthly change in the European Consumer Price Index. Model (2) reports the results. Most importantly, the factor loadings do not change including these variables.

Bond markets, particularly the sovereign debt market, are characterized by a high degree of collinearity. PCA offers a way to construct different linear combinations of the factor returns that are uncorrelated with each other using the covariance matrix of the returns. As the covariance matrix is symmetric, it has linearly independent eigenvectors corresponding to the number of positive eigenvalues. The eigenvectors are called principal components and are ranked according to the eigenvalue. The first principal component (PC1) is thus the linear combination of GIPSI bond returns with the highest eigenvalue. It is the component that explains the largest part of the variation in GIPSI bond returns. Instead of using the GIPSI

returns as independent variables, we regress the banks' stock return on PC1 and Germany. We find a positive and significant relationship between PC1 and stock returns, which is consistent with the carry trade behavior of banks.

In model (3), we substitute French for German government bonds and find a negative and significant coefficient, which is smaller in magnitude compared to the factor loadings of German bunds. This is reflecting the increasing divergence of yields between French and German government debt that started in 2011. The coefficients of Greece and Italy are even stronger.

If banks undertake carry trades, these are most profitable if investments are as long-dated and funding as short-term as possible. We would thus expect lower exposures of banks to, say, two-year GIPSI sovereign bonds. Model (4) substitutes two-year GIPSI government bonds for ten-year bonds used in all previous models. The coefficient of Greece is reduced by a factor of 6 and the coefficient of Italy is reduced by at least half, consistent with the carry trade behavior of banks. Note that lower factor loadings on the two-year GIPSI government bonds do not reflect a shorter duration of two-year vis-à-vis ten-year bonds. In fact, factor loadings should be larger if caused by differences in duration. To see this, suppose that the following simple relationships of banks' stock returns (R) and government bond returns (IR) hold: $R_{it} = \beta \times IR_t$, $IR_t^{10} = 10 \times IR_t$ and $IR_t^2 = 2 \times IR_t$. Substituting these relationships shows that betas should actually be higher in the case of two-year sovereign bonds.

Carry trade exposure should also be reflected in CDS spreads as an important proxy for bank risk and bank funding costs. We would expect to see that CDS spreads reflect a widening of the gap between GIPSI bond and German bund yields, either through an increase in peripheral bond yields or through worsening funding conditions. We test this in models (5) and (6) and use Δ Log (Bank CDS) as a dependent variable, which is the change in the natural logarithm of daily bank CDS spreads. As reported in column (5), the coefficient of Greek bond returns is negative and significant, whereby, if Greek bond prices fall, banks experience,

on average, an increase in their CDS spreads. Moreover, if German bund prices appreciate, banks' funding costs also rise, *ceteris paribus*, pointing to their exposure to short-term wholesale markets. The PCA in model (6) shows a similar result.

Overall, and across our various tests, we find strong evidence indicating that European banks were betting on the convergence of yields in the Eurozone in the form of carry trades. Yields, however, have diverged even further since the beginning of 2010, which is reflected in lower stock prices and higher CDS spreads.

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B. Factor loadings and banks' direct exposures

Do these exposures relate to actual government bond holdings of banks or simply reflect some other underlying economic exposures and linkages? To address this important question, we exploit the data disclosed by the EBA after stress tests and capitalization exercises. Since June 2010, the EBA has disclosed bank level sovereign bond holdings at five reporting days.[17] Moreover, we know each banks' real and financial sector holdings as of 31 Dec 2010. Our analysis proceeds in two steps: first, we show that our measure of sovereign exposure explains a significant proportion of the variation of sovereign bond holdings both in the cross-section of banks as well within banks. Second, we analyze the relative importance of sovereign relative to real sector exposure in explaining our factors loadings estimated around the 31 Dec 2010 reporting date. In a first step, we relate the factor loadings estimated for each bank in the time period 60 days before and 60 days after each reporting date on the sovereign bond holdings scaled by total assets. To visualize this relationship, we plot the factor loadings on the sovereign bond holdings for each reporting date and country separately in Figure 3. We use logs for illustration purposes.

[Figure 3]

[17] Note that not all banks participated in all stress tests or the capitalization exercise.

The scatterplot shows a positive relationship between factor loadings and portfolio holdings. We perform cross-sectional (across banks) and time-series (within bank) regressions of loadings on bond holdings and find a consistent pattern. We report the results in Table IV.

[Table IV]

Models (1) to (4) relate β_{Italy} to banks' Italian sovereign bond holdings (Italy-Sov/Assets) while models (5) to (8) focus on Spain (β_{Spain}) and models (9) to (12) on Greece (β_{Greece}). Models (1), (5) and (9) analyze the full sample of banks, all other models exclude the banks headquartered in the country that we analyze, for example, Italy in models (2) to (4). Standard errors are clustered at the bank level. We find that banks with larger reported Italian bond holdings also have larger factor loadings both in the full sample and in the sample of non-Italian banks. Model (3) adds indicator variables for each reporting date (omitted group is March 2010). The negative coefficients suggest that non-Italian banks have reduced their exposure to Italy since March 2010. Smaller coefficients in December 2011 and June 2012, however, suggest that they have added Italian sovereign exposure since September 2011. Our conjecture is that non-Italian banks used funds from the two 3-year LTROs to finance additional sovereign bond purchases in further carry trades. Model (4) adds bank fixed effects showing that, also within banks, higher reported Italian sovereign holdings are associated with larger factor loadings. These results extend to Spain and Greece as well.

In a second step, we use the data on banks' real sector exposure in each country. One could argue that our factor loadings reflect cross-border investments of internationally active banks rather than exposure to sovereign debt. We construct a new variable Italy-Real/Assets which is the sum of each bank's exposure to firms, the retail sector (including retail real estate) and commercial real estate scaled by total assets. Real sector exposures to Spain and

Greece are constructed accordingly. Table V reports the results of regressions of our factor loadings estimated 60 days before and after 31 Dec 2010 on real sector and sovereign exposure.

[Table V]

Using Italy as an example, models (1) and (2) shows that our factor loadings are positively related to reported sovereign and real sector exposure in separate regressions. Model (3) includes both types of exposures and model (4) excludes Italian banks. Particularly in our sample of non-Italian banks, we find that sovereign holdings explain our factor loadings while real sector exposures are not significantly related to the latter. Interestingly, around this reporting date, we do not find a significant relationship between factor loadings and sovereign holdings among the sample of non-Spanish banks. Moreover, Greek factor loadings are associated with real-sector exposure of non-Greek banks which is intuitive given, for example, the exposure of Greek banks to retail and corporate clients through their Greek subsidiaries. These findings point to interesting differences and dynamics between countries and over time. They also suggest that Italian sovereign debt is the primary asset class for banks' investment in carry trades.

C. Bank risk and leverage

In the next step, we investigate various characteristics of banks with significant sovereign debt exposure. Particularly risky banks should be more likely to invest in carry trades ("gambling"). We investigate this hypothesis in Table VI separately for exposure to Italy (models (1) to (3)), Spain (models (4) to (6)) and to Greece (models (7) to (9)).

[Table VI]

We use three proxies for bank risk, namely bank size (Log-Assets), short-term leverage (ST-LVG) as proxy for risk on the liability side and the size of the loan portfolio (Loans/Assets) as proxy for risk on the asset side of the balance sheet. In all tests, we use the one-year lagged bank characteristics to identify the effect of banks' risk on their carry trade behavior.[18] As in previous tests, standard errors are clustered at the bank and quarter level. We include all risk proxies collectively and run regressions on the full sample of banks, non-domestic banks and domestic banks only.

We document in the full sample that larger banks (i.e. banks with more international focus, more wholesale funding and that are more systemically important) have larger sovereign exposures to Italy. Also, riskier banks, i.e. banks with more short-term leverage and loan to asset ratios have more exposure. On the funding side, we find that banks with more short-term funding have significantly more short-term funding exposure. More importantly, we find that these results are particularly strong for the sample on non-Italian banks. These results provide strong support for the carry trade hypothesis but are not consistent with alternative hypotheses such as home bias or suasion. Larger Italian banks have more exposure to their own domestic sovereign debt. Interestingly, riskier Italian banks have lower sovereign exposure suggesting that moral hazard (even though there is some evidence) is not the only motive of these banks to hold domestic sovereign debt. We document similar results as to European banks' exposure to Spanish sovereign debt. Interestingly, we find strong evidence consistent with carry trade behavior also among the sample of Spanish banks. The results are a bit muted with respect to exposures to Greek sovereign debt.

D. Capital adequacy

[18] ST Debt and Loans/Assets are included in addition to the interaction terms in the respective models as well as a constant term, but all remain unreported for brevity. Log-Assets is added as a control variable in all models.

A second motive as to why banks are heavily invested in government debt is regulatory capital arbitrage because of how banks' balance sheet exposure to sovereign debt is treated under existing capital rules. Basel II encourages banks to hold sovereign debt and to build up cross-border holdings as well. The Capital Requirement Directive (CRD) assigns a zero risk weight for "exposures to Member States' central government […] denominated and funded in the domestic currency of that central government" (BIS, 2011).[19] That is, despite (even little) differences in country ratings, banks are allowed to reduce the capital they hold against these positions to zero. Consequently, particularly undercapitalized banks, that is, banks with low Tier 1 capital ratios, have an incentive to shift their portfolios into assets with lower risk weights (regulatory capital arbitrage). We test this hypothesis using Tier 1, which is defined as Tier 1 capital divided by risk-weighted assets, and RWA/Assets as proxies for capital adequacy. Table VII contains the results of the cross-sectional regressions. We report the results again separately for Italy (columns (1) to (3)), Spain (columns (4) to (6)) and Greece (columns (7) to (9)). Similar to above, we include all risk proxies collectively and run regressions on the full sample of banks, non-domestic banks and domestic banks only. In all regressions, we include Log-Assets as well as interaction terms with GIPSI and Germany to control for bank size.

[Table VII]

Again, we focus on banks' exposure to Italy first. Consistent with above, we find that larger banks have larger exposure to Italian sovereign debt. We find that banks with higher Tier1 capital ratios have lower exposure to Italian sovereign debt. Tier1 increases if

[19] Under the standardized approach, sovereign debt has a zero risk weight. Even under the Internal Ratings Based (IRB) approach there is a loophole. Usually, banks have to hold capital based on an assessment of the default likelihood estimated with their own internal models. However, they can choose to switch back to the standardized approach for assessing capital requirements for sovereign debt eventually holding no capital ("IRB permanent partial use").

banks have higher RWA or if they decide to hold more economic capital. For a given amount of RWA, the negative coefficient implies higher risk-shifting incentives. Moreover, the positive coefficient on RWA/Assets (unlike the sign on Tier1) suggests that there is a regulatory arbitrage motive. Only including one of these variables might result in biased estimates of the coefficients due to confounding effects.[20] Moreover, we find that banks high exposure to short-term funding have significantly more exposure to Italy. Additionally, European banks with more short-term debt are also more exposed to funding shocks. These results hold both in the full sample as well as in the subsample of non-Italian banks and provide strong support for carry trade (moral hazard) behavior of European banks. Interestingly, we do not find statistically significant evidence that Italian banks are investing more in domestic sovereign debt if they are more risky (that is, have lower capital ratios or higher RWA or short-term debt), which is in line with our earlier result from Table VI. Domestic banks most likely have different motives to invest in own sovereign debt (over and above the carry trade motive).

The results extend to European banks' exposure to Spanish government debt. However, we find strong evidence that even Spanish banks with low Tier 1 capital ratios and high RWA / Assets invested more in domestic sovereign debt compared to better capitalized Spanish banks and they also were more exposed to short term funding. In other words, these results are consistent with carry trade (moral hazard) behavior among Spanish banks. As seen above, the effects on Greek government bond holdings are (not surprisingly) somewhat muted.

Overall, our results show that particularly risky and undercapitalized (non domestic) banks are purchasing more Italian and Spanish (and to a lesser degree) Greece government debt consistent with carry trade behavior of these banks.

[20] In unreported results, we include either Tier 1 or RWA / Assets and find that the coefficient of Tier 1 is less negative when we do not control for RWA / Assets. This result suggests that the discretionary part of Tier1 capital is more strongly related to the risk-shifting motive. In other words, not controlling for RWA understates the risk-shifting effect in model.

IV. Capital Offerings of European Banks and ECB Funding

As the sovereign debt crisis unfolded, sovereign yields continued to climb and investors fled to high-quality assets such as German bunds. Interbank market froze and banks' equity value dropped substantially. Do banks' carry trades predict future capital offerings? Did they become particularly dependent on ECB funds? These is an important question for regulators in Europe as the carry trade behavior of banks could have led to massive disruptions in the interbank markets and required regulators to step in with emergency funding. To answer them, we collect all common and preferred stock issuances of our sample banks over the January 2007 to February 2012 period on a quarterly basis. 86% of them raised capital during this period.[21] We also collect information about each bank's liabilities from repurchase agreements to banks, customers and the ECB from their annual reports over the 2008 – 2010 period.[22] We construct two dependent variables. Log-Capital is the natural logarithm of the amount of common and preferred capital raised. ECB /Assets is the percentage of each bank's funding obtained from the ECB in each year divided by total assets of the banks. Both variables are our main dependent variables. To construct proxies for banks' carry trade behavior, we run the quarterly regressions for each bank and calculate the predicted return in each quarter. The predicted return can be interpreted as the part of the returns that is induced by carry trades. As additional proxies, we use the estimated vector of factor loadings for Greece, Italy and Germany. The results are reported in Table VIII.

[Table VIII]

[21] We do not differentiate economically between common and preferred stock and add both volumes on a quarterly basis.

[22] We use annual reports as, even though these are stock exchange listed banks, many of the mostly peripheral banks do not provide quarterly reports (or semi-annual reports) and the few that do are usually not in English and with very limited information.

In models (1) and (2), we first relate Log-Capital and ECB / Assets to the realized return in the previous quarter. All regressions include Log-Assets as the additional control variable. Standard errors are clustered at the bank and quarter level. The results suggest that banks with lower realized returns as well as larger banks raise more capital in the subsequent quarter.[23] While realized returns do not (at least statistically) significantly predict ECB dependence, we find that larger banks depend less on funding from central banks. We find that the lower the banks' stock return from carry trades, the higher the capital offering in the following quarter (model (3)). Predicted returns do not predict ECB dependence. As a third test, we use the estimated factor loadings, β_{Greece} in columns (5) and (6) and β_{Italy} in columns (7) and (8). Banks with larger exposure to Greece raised more capital in the next quarter. We do not find that this result extends to the exposure to Italian bonds suggesting that it is not the exposure in and of itself, but the impairments and capital loss incurred that consequently prompted banks to raise capital. During our sample period, banks only impaired their Greek bond holdings because of the private sector involvement (PSI) when negotiating the bailouts. However, we find some evidence that banks with larger carry trade exposure to Italy needed to rely more on ECB funds (model (8)). Consistent with increased funding pressure on banks with larger carry trade exposures as measured by more negative $\beta_{Germany}$, we find that these banks needed to raise more capital and were more dependent on ECB funding as well.

V. Time-Series of Carry Trade Exposures

A. Building up a portfolio of "cheap" sovereign debt

In the "original" one-year Long-Term Refinancing Operations (LTRO) in 2009, the ECB lent about EUR 614 billion to European banks at an interest rate of one percent.

[23] In unreported tests, we use an indicator variable Capital (Yes/No) which is one if a bank raises capital in a given quarter and find, consistent with the reported results, that banks that have higher realized and predicted returns are less likely to raise capital in the subsequent quarter.

"The original LTROs, for instance, allowed some banks to go on a buying spree – using inexpensive ECB funds to snap up higher-yielding assets in a classic 'carry trade'. Unfortunately many of those investments appear to have taken the form of government debt from the region's weaker nations, strengthening the link between troubled sovereigns and banks which Europe is trying to desperately break" (Tracy Alloway, FT, October 2011).

Moreover, *"the banks pretty much used the last opportunity of getting cheap money to invest in sovereign debt they thought was even cheaper"* (Gary Jenkins, Head of Fixed Income at Evolution Securities). In other words, banks thought that the divergence in yield spreads between, for example, German bunds and peripheral bonds at that time compared to the year preceding the financial crisis was temporary and yields would ultimately converge, which is the motivation behind the carry trade.

[Figure 4]

Figure 4 shows the average 30-day rolling correlations between the stock return of our sample banks and Italian bond returns as well as German bunds as two time-series for the January 2005 to February 2012 period (Figure 4.A) and since January 2011 (Figure 4.B). The red lines indicate the four one-year LTROs of the ECB on June 6, 2009, September 30, 2009, December 16, 2009 and October 27, 2011 as well as the first three-year LTRO on December 20, 2011. We find a strong increase in correlation between stock and Italian government bond returns following the capital injections by the ECB in 2009 consistent with banks substantially building up their Italian bond holdings.[24]

Figure 4.b strikingly shows how the spread between two legs of the carry trade diverged resulting in significant losses for banks. In the first half of 2010 and particularly

[24] There are some estimates reporting that from the first one-year LTRO in June 2009, which amounted to EUR 442 billion, half was invested in peripheral government debt. Interestingly, German banks are supposed to have taken up most of this money (about EUR 126 billion) followed by French banks (EUR 85 billion) and Spanish banks (EUR 53 billion).

since April 2011, correlations between stock and peripheral bond returns on the one hand and core European bonds on the other hand diverged: the correlation between Italian bond and stock returns kept rising while the correlation between German bond and stock returns decreased. On average, the banks' market value decreased because Italian (more generally, GIPSI) bond yields were rising and because German long-term bond yields were falling.[25]

On December 7, 2011, the ECB announced two three-year LTROs to be allotted on December 26, 2011 and February 29, 2012. After accounting for redemptions of existing ECB funds, the LTROs increased lending to credit institutions in the euro area by EUR 783 billion according to data released by the ECB. The correlations displayed in Figure 4 suggest that banks increased their exposure to sovereign debt substantially following the LTROs.[26] We perform monthly regressions of banks' stock returns on our risk factors and stock index returns around the most recent LTRO events starting in January 2011. We focus on Italian sovereign debt exposure and exclude all Italian banks. The results are reported in Table IX.

[Table IX]

Consistent with above, we find evidence of increased exposure to Italian sovereign debt following the fourth one-year LTRO in October 2011 among banks with high RWA / Assets and financed with more short-term debt. The exposure of large banks increased after the three-year LTRO in January and February 2012. Particularly poorly capitalized banks, banks

[25] We then perform quarterly cross-sectional tests of stock returns on Italian, German and home country bond returns. We find that during 2009, banks' stock returns and Italian bond returns were highly positively correlated. For instance, the loading on Italian bond returns doubles in Q2 2009 when the first LTRO took place, which amounted to EUR 442 billion (that is, 72% of all three operations). Interestingly, the loading on German bunds became more negative suggesting that the ECB measures did not release existing tensions in short-term funding markets for banks. We do not report these findings for reasons of space.

[26] A Bundesbank report (Bundesbank (2012)) also shows that banks were increasing their exposure after ECB liquidity injections by more than EUR 100 billion. While banks were the net seller of sovereign debt in Q1 and Q3 2011, they purchased again in Q4 2011 after the fourth one-year LTRO. About EUR 130 billion of cash flow in Q3 and Q4 2011 came from the Eurosystem.

with high RWA and banks financed with short-term debt increased their exposure. Note that these are non-Italian banks increasing their exposure to Italian government debt.[27] Interestingly, highly capitalized banks suffered more from tightening interbank markets suggesting that banks had very selectively been able to borrow short-term in the interbank or commercial paper market. Overall, our results are consistent with a further expansion of the carry trades with ECB as funding leg of the carry trade.[28]

B. Did sovereign debt purchases crowd out lending?

The ECB's liquidity injections were earmarked to increase lending to the real sector. Two interesting questions emerge: was the ECB successful in giving banks incentives to lend and did banks increase lending relative to their investments in sovereign debt?

We collect monthly data from the ECB about banks' investments in government securities and lending to non-financial corporations since January 2007. The ECB publishes data aggregated at the country level for activities within the euro area.[29]

[Figure 5]

[27] Banks may shift into riskier assets to earn carry and boost the remuneration of their employees. Regulators are concerned with this in the recent LTRO. "Profit from carry trades, where investors borrow money at a low interest rate to buy higher yielding securities, 'should not count toward computation of remuneration and bonus pools' at banks, under plans being weighed by European Union lawmakers, according to a document obtained by Bloomberg News" (Bloomberg, May 3rd, 2012). Members of the EU parliament understand they likely funded carry trades with LTROs. To that end, they are proposing to amend the legislation to implement global capital and liquidity rules for European banks requiring them to disclose profits from their carry trades to avoid excessive risk-taking due to remuneration incentives.

[28] The German regulator BaFin is investigating how domestic banking institutions are using the loans they acquired through the ECB's longer-term refinancing operation, Bloomberg News reported May 11. The regulator is concerned that an inappropriate use of these loans could potentially lead to the formation of a new bubble. More than half of the 800 banks that took LTRO money in February were German banks. However, since, for example, also minimum reserve requirements have been cut from 2% to 1% by the ECB, the demand for liquidity has reduced and regulators are worried about how banks will invest the excess liquidity from the LTROs.

[29] The countries in our analysis include Austria, Belgium, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain. Non-EU countries, Sweden and the UK, and Norway, which are officially outside of the EU, are excluded from the analysis as they only provide information about their banks' investments within their home country.

Figure 5.A displays the time-series of lending and government securities holdings relative to banks' total assets across European banks since January 2007. The horizontal lines indicate the ECB interventions.[30] Since 2009, we observe that sovereign debt holdings increased relative to total assets while lending declined by about 2 percentage points. The cross-correlation between both time-series is -0.15. There is also a noticeable increase in sovereign debt holdings following ECB interventions both in 2009 and particularly after the October 2011 capital injection. Figures 5.B and 5.C show these developments for Italy (Figure 5.B) and Spain (Figure 5.C). The pattern is similar but much more pronounced. Sovereign debt holdings of the domestic banks have almost doubled since 2009 with the largest increase after October 2011. At the same time, however, lending declined by 3% (Italy) and 6% (Spain). The cross-correlation between lending and government securities holdings is -0.6 and -0.9 for Italian and Spanish banks respectively.

[Table X]

We test this more formally and report the results in Table XI using ECB country-level data (Panel A) and bank balance sheet data (Panel B). The ECB country-level data is on a monthly basis and we include the January 2007 to June 2012 period in our analysis. The 2009 LTRO is an indicator variable equal to 1 for the months June 2009 until February 2010 assuming that the effects of the ECB interventions materialize within two months following the interventions. The Oct 2011/Dec 2011 LTRO is an indicator variable that is 1 for the months October 2011 to February 2012 and March 2012 LTRO is 1 for the months March to May 2012. In models (1) to (4), our dependent variable is Loans/Government Securities, that is, negative signs of the coefficients of our explanatory variables indicate that banks use the

[30] The four one-year LTROs of the ECB on June 6, 2009, September 30, 2009, December 16, 2009 and October 27, 2011 as well as the two three-year LTROs on December 20, 2011 and March 1, 2012.

ECB liquidity to purchase sovereign debt rather than increase lending to firms. We also include other control variables. Log-TA is the natural logarithm of the total sum of total assets across all banks and Log-Banks is the natural logarithm of the number of banks within each country. Deposits/Assets is total deposits of all banks over total assets. Repos/Assets is the sum of (secured) repo funding over total assets for all banks. We also include ΔEuropean Economic Sentiment to control for loan demand by firms. All regressions include time-controls and country-fixed effects. We find that banks purchased more sovereign debt relative to their investments in lending after the 2009 LTROs, but we do not find statistically significant evidence for this following the most recent LTROs across all European banks. Large banks increase their sovereign holdings relative to lending vis-à-vis small banks. Banks also do not increase lending following capital offerings (model (2)). Analyzing Italy and Spain separately as well as the remaining euro countries suggests that this effect extends to all banks. In models (5) to (7) and (8) to (10) we relate the banks' investments in Government Securities (% Total Assets) and Loans (% Total Assets) to the ECB measures, for the full sample and separately for Italy and Spain as well as the remaining euro countries. The increase in government securities holdings after the 2009 liquidity injections was pervasive across European banks. However, Italian and Spanish banks increased their sovereign debt holdings by 1.1 percentage points following the March 2012 LTRO. Only Italian and Spanish banks significantly reduced their lending to non-financial corporations following the March 2012 LTRO.

In Panel B of Table XI, we use quarterly balance sheet data and run the same tests. Note that we cannot distinguish between the 2011 and 2012 LTROs because of the closeness of the ECB interventions which results in overlapping quarters. The results show similar patterns as observed using monthly country-level data.

Overall, our results suggest that the success of the ECB to channel liquidity into the real sector was rather limited. Instead, banks used the liquidity to increase their portfolios of sovereign debt, crowding out lending to the real sector.

VI. Conclusion

During the past two years, increasing economic imbalances between the core of Europe and the periphery have caused a surge in the yield spread of peripheral countries (such as Greece, Italy, Ireland, Portugal and Spain) and a flight to German bunds.

Our article argues that European banks have placed bets on the opposite economic development within the euro area expecting yield spreads between, for example, Italy and Germany or Spain and Germany to converge. These bets or "carry trades" were designed as investments in GIPSI government bonds financed with short-term debt. As the sovereign debt crisis deepened, European banks lost a substantial portion of their market value. In a series of cross-sectional and time-series tests, we find evidence that these trades have been widespread among European banks. We carefully discuss alternative explanations of our results. These are: home bias of domestic banks, (im-) moral suasion or redenomination of assets and liabilities if the euro area breaks up. While all channels are potentially important, we find convincing evidence for bank moral hazard. We show that large banks, banks with more short-term debt as well as undercapitalized banks are more likely to engage in carry trades, particularly among non-GIPSI banks. These results are most pronounced for banks' exposure to Italian sovereign debt. Italian debt is important probably because it is quantitatively huge. Our paper further documents that these banks were more likely to raise capital and depend on ECB funding as the crisis unfolded. Moreover, we provide evidence that the ECB's liquidity injections were encouraging banks to load up on sovereign debt at the expense of private sector lending.

Our paper has important policy implications. It speaks to the treatment of sovereign debt in the calculation of regulatory capital that a bank is required to hold. Zero risk weights imposed by the regulator increase the benefits of carry trades vis-à-vis private sector lending. More broadly, it questions the role of banks in financing government debt.

References (TO BE COMPLETED)

Acharya, V. and Yorulmazer, T. (2007) 'Too Many to Fail: An Analysis of Time-Inconsistencies in Bank Closure Policies', *Journal of Financial Intermediation* 16, pp. 1–31.

Acharya, V. and Rajan, R.G. (2011) 'Sovereign Debt, Government Myopia and the Financial Sector', working paper, NYU-Stern.

Acharya, V., Afonso, G. and Kovner, A. (2012) 'How Do Global Banks Scramble For Liquidity? Evidence from the Asset-Backed-Commercial Paper Freeze in 2007.' working paper, NYU-Stern.

Acharya, V., Drechsler, I. and Schnabl, P. (2010) 'A Pyrrhic Victory? – Bank Bailouts and Sovereign Credit Risk', working paper, NYU-Stern.

Bolton, P. and Jeanne, O. (2011) 'Sovereign default and bank fragility in financially integrated economies', NBER working paper, 16899.

Broner, F., Martin, A. and Ventura, J. (2010) 'Sovereign risk and secondary markets', *American Economic Review* 100, pp. 1523–1555.

Diamond, D. and Rajan, R.G. (2011) 'Fear of Fire Sales and the Credit Freeze', *Quarterly Journal of Economics*, 126(2), pp. 557–591.

EBA, (2010) 'Aggregate outcome of the 2010 EU wide stress test exercise coordinated by CEBS in cooperation with the ECB', available at: http://stress-test.c-ebs.org/documents/Summaryreport.pdf.

EBA, (2011 a) 'European Banking Authority: 2011 EU Wide Stress Test Aggregate Report', available at: http://stress-test.eba.europa.eu/pdf/EBA_ST_2011_Summary_Report_v6.pdf.

EBA, (2011 b) 'Capital buffers for addressing market concerns over sovereign exposures', available at: http://stress-test.eba.europa.eu/capitalexercise/Methodology%20FINAL.pdf.

Gennaioli, N., Martin, A. and Rossi, S. (2011) *Sovereign Defaults, Domestic Banks, and Financial Institutions*, available at: http://crei.cat/people/gennaioli.

Gorton, G. (2009) *Slapped in the Face by the Invisible Hand: Banking and the Panic of 2007*. Mimeo.

Gozzi, J.C. and Goetz, M. (2010). *Liquidity Shocks, Local Banks, and Economic Activity: Evidence from the 2007–2009 Crisis*. Mimeo.

Huang, R. and Ratnovski, L. (2011) 'The Dark Side of Bank Wholesale Funding', *Journal of Financial Intermediation* 20, pp. 248–263.

Figure 1.A. Pairwise Comparison of Government Bond Yield Spreads: Italy versus Germany

This graphic shows the time series of 10-year government bond yields comparing Italian and German 10-year government bond yields since January 2005.

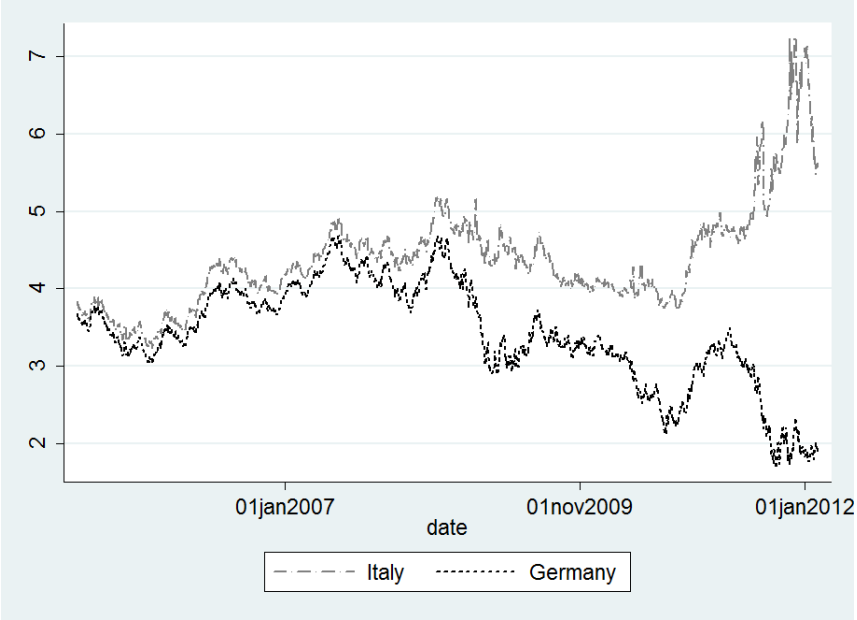

Figure 1.B. Pairwise Comparison of Government Bond Yield Spreads: Greece versus Germany

This graphic shows the time series of 10-year government bond yields comparing Greek and German 10-year government bond yields since January 2005.

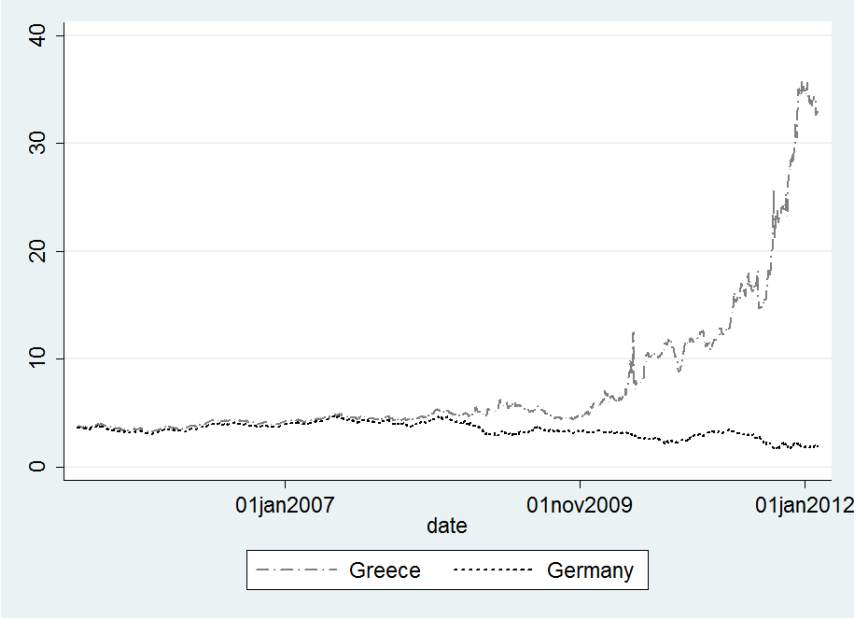

Figure 1.C. Pairwise Comparison of Government Bond Yield Spreads: Spain versus Germany

This graphic shows the time series of 10-year government bond yields comparing Spanish and German 10-year government bond yields since January 2005.

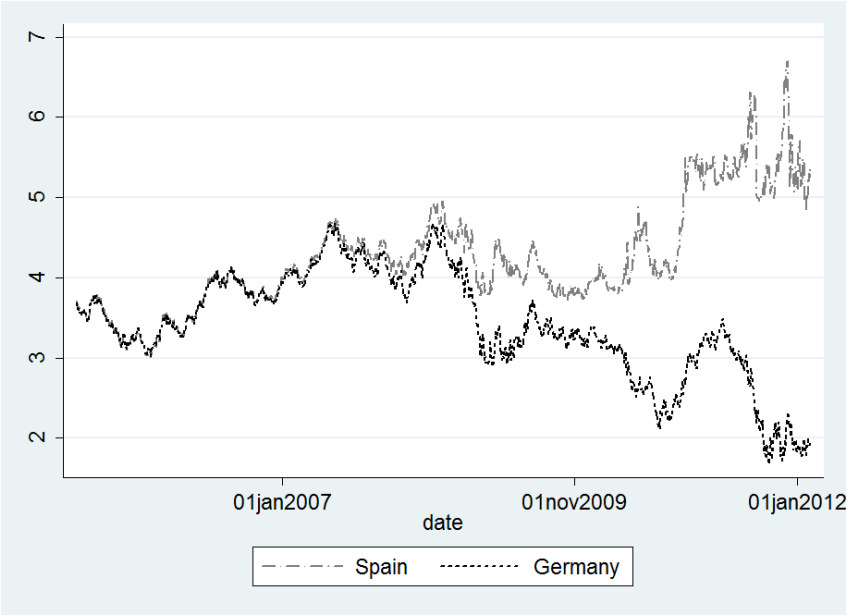

Figure 2.A. Dexia Return Correlations

This graphic shows the time-series of 30-day rolling correlations of Dexia's stock returns with 10-year Italian and 10-year German government bond returns since January 2011. The vertical red lines indicate the two 3-year Long-Term-Refinancing-Operations (LTRO) of the European Central Bank (ECB) in December 2011 and February 2012.

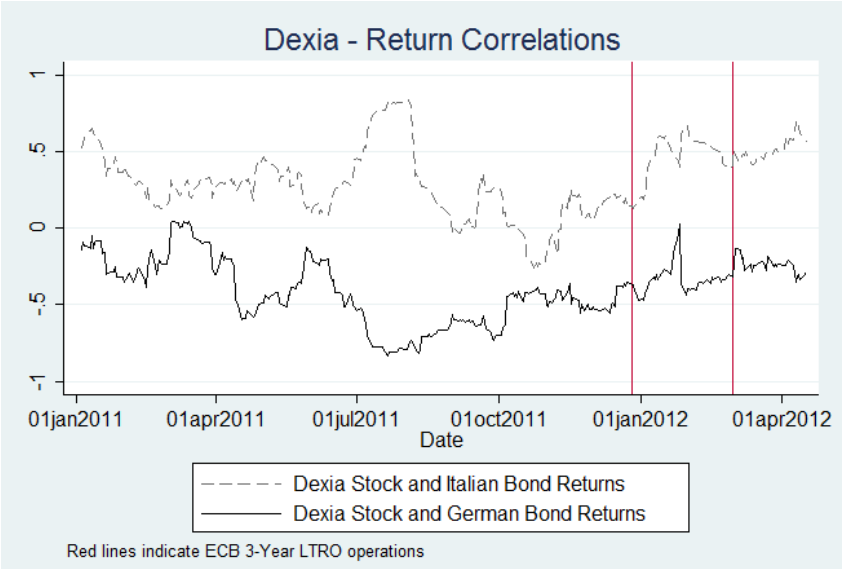

Figure 2.B. Dexia 1 Year CDS Prices

This graphic shows the 1-year CDS spreads of Dexia's bank subsidiary in France, Dexia Crédit Local starting in July 2008.

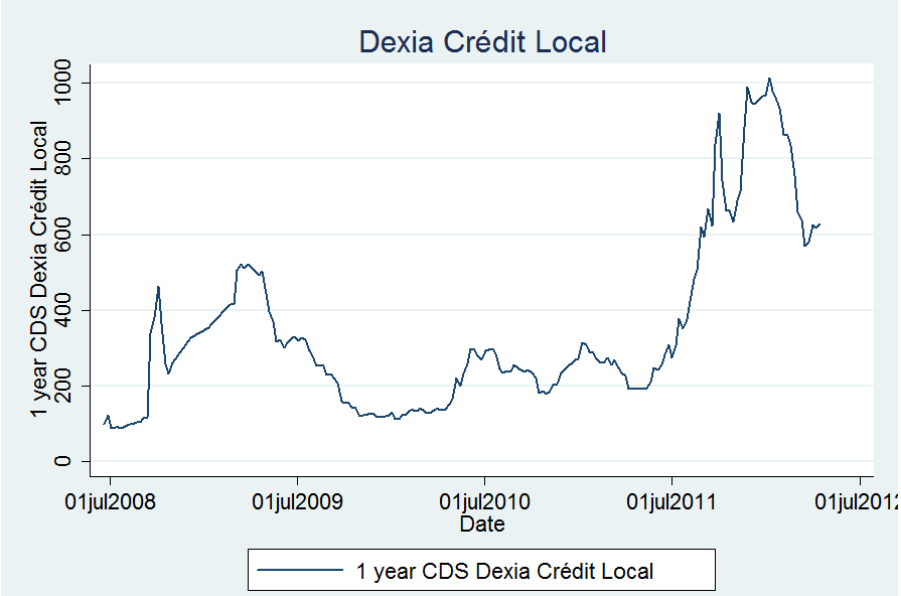

Figure 2.C. Dexia Stock Price Decline since Janurary 2011
This graphic shows Dexia's stock price performance since January 2011.

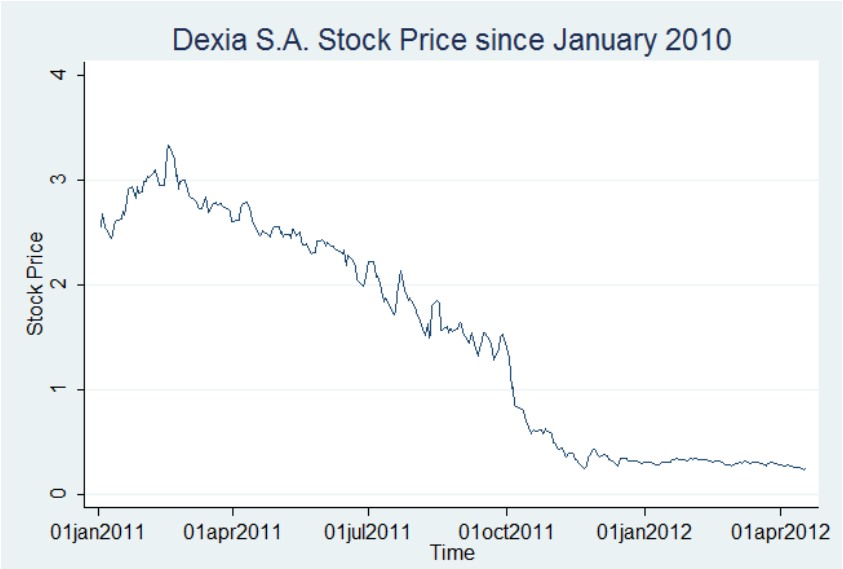

Figure 3. Factor Loadings and Bond Portfolio Holdings

The graph depicts a scatter plot of Log(Beta) estimated from a cross-sectional regression of stock on 10-year Greek and German government bond returns on Log(Holdings / Assets). Factor loadings are estimated within 60 days before and after the reporting date of the portfolio holdings.

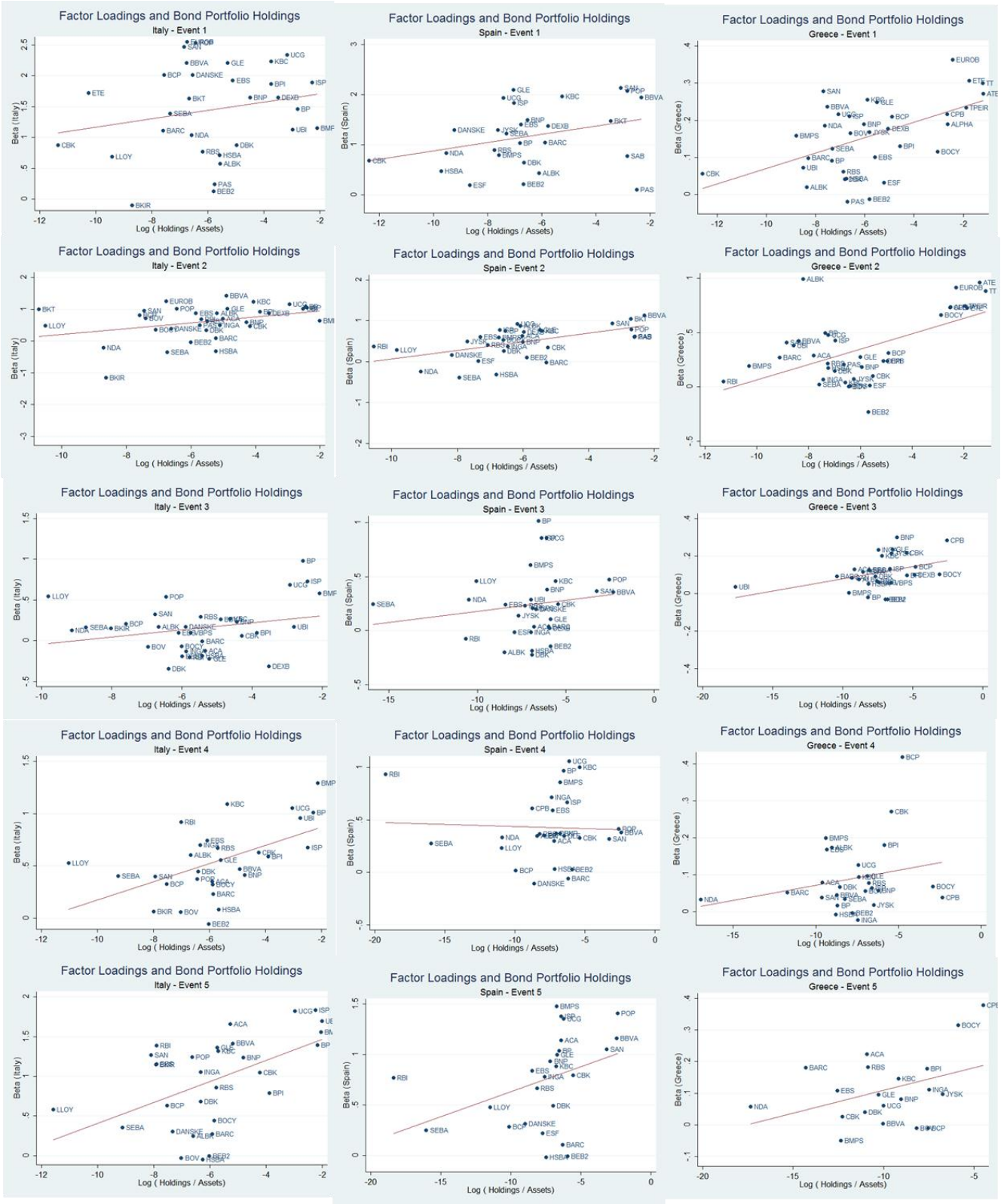

Figure 4.A. Time-Series of Stock and Bond Return Correlations

This graphic shows the 30-day rolling correlations between (1) stock returns and 10-year Italian bond returns and (2) stock returns and 10-year German bond returns for all European banks included in the sample. The red lines indicate the four 1-year LTROs of the ECB on June 6, 2009, September 30, 2009, December 16, 2009 and October 27, 2011 as well as the first 3-year LTRO on December 20, 2011.

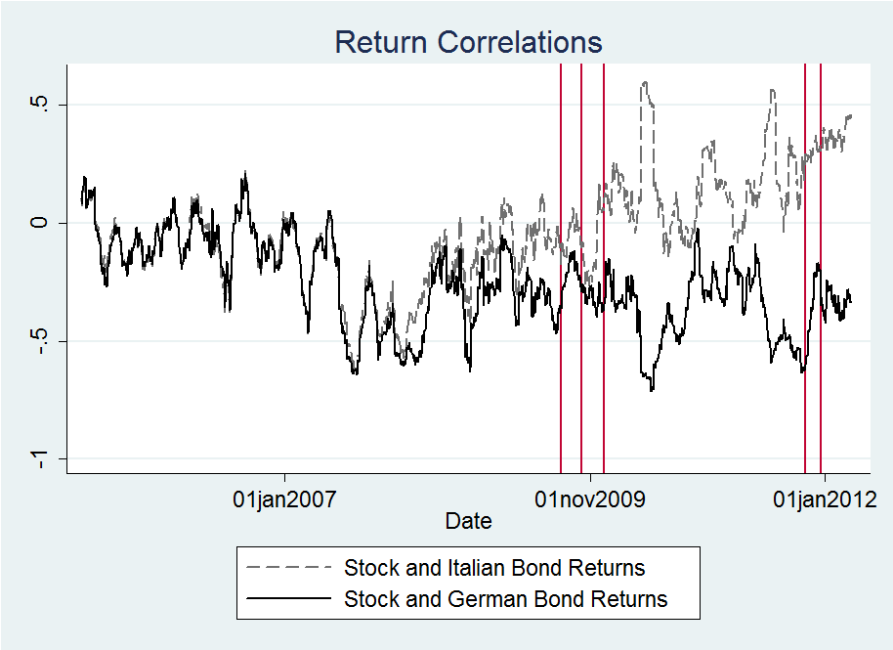

Figure 4.B. Time-Series of Stock and Bond Return Correlations (since January 1, 2011)

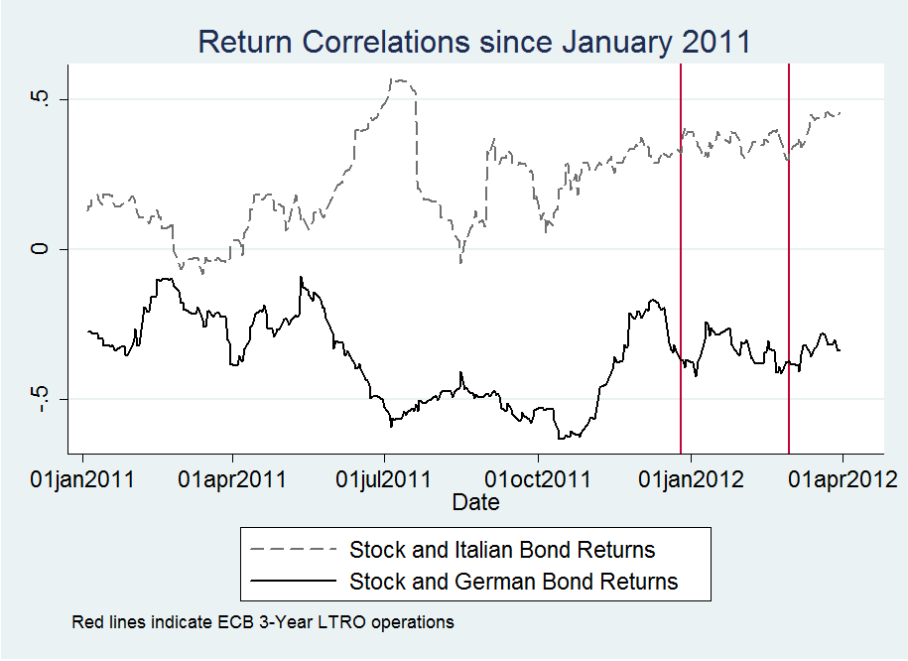

Figure 5.A Lending to Non-Financial Corporates vs. Government Securities Holding by European Banks

This graphic shows lending versus government securities holdings by banks in 12 Euro countries using data provided by the ECB. All data are aggregated to the country level. The countries include: Austria, Belgium, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. The red lines indicate the four 1-year LTROs of the ECB on June 6, 2009, September 30, 2009, December 16, 2009 and October 27, 2011 as well as the two 3-year LTRO on December 20, 2011 and March 1, 2012.

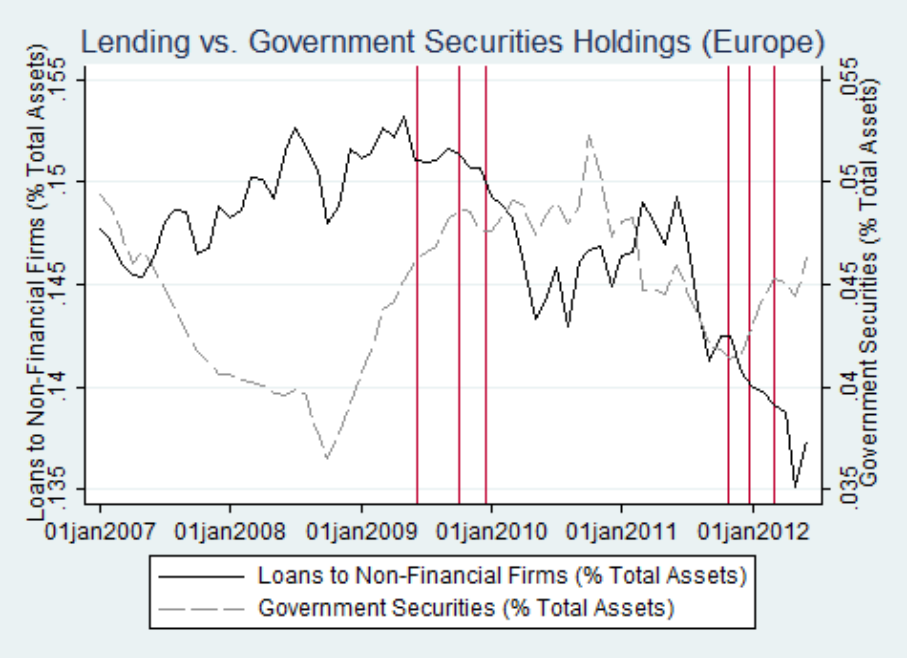

Figure 5.B. Lending to Non-Financial Corporates vs. Government Securities Holding by Italian Banks

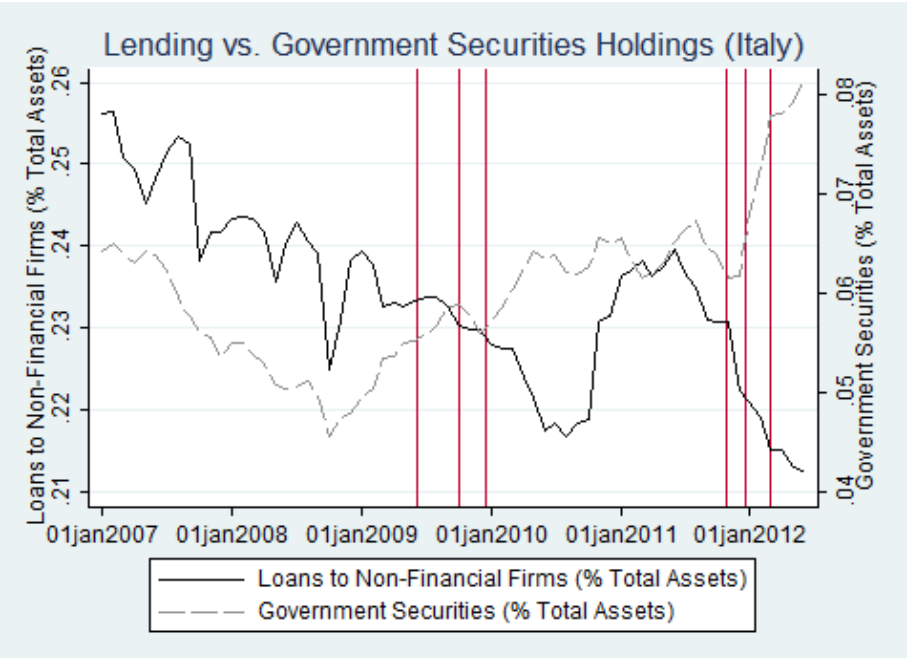

Figure 5.C. Lending to Non-Financial Corporates vs. Government Securities Holding by Spanish Banks

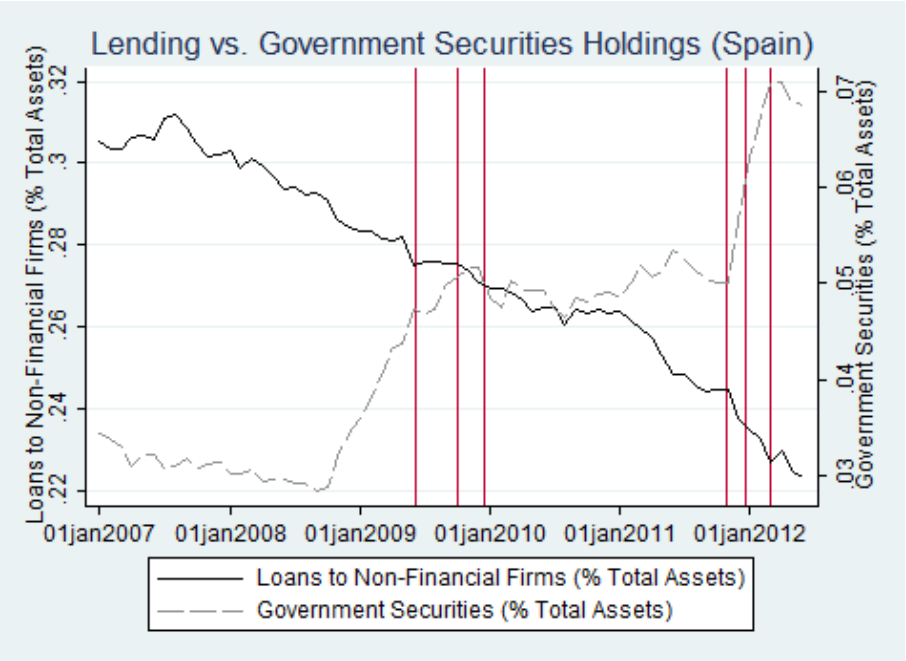

Table I
Descriptive Statistics on Return Correlations

This table contains descriptive statistics (**Panel A**) and correlations (**Panel B**) of ten-year sovereign bond returns of **Greece, Italy, Portugal, Spain, Ireland, Germany and France**.

Panel A. Descriptive statistics of sovereign bond returns

Country	Mean	Std. Dev.	Variance	Min	Max
Greece	-0.10%	1.76%	0.03%	-24.49%	42.54%
Italy	-0.01%	0.50%	0.00%	-4.46%	7.55%
Portugal	-0.03%	1.08%	0.01%	-18.68%	15.49%
Spain	-0.01%	0.51%	0.00%	-3.63%	8.37%
Ireland	-0.02%	0.72%	0.01%	-7.91%	10.76%
Germany	0.01%	0.39%	0.00%	-2.24%	2.52%

Panel B. Sovereign bond return correlations (2005)

	Greece	Italy	Portugal	Spain	Ireland	Germany
Greece	1.00					
Italy	0.97	1.00				
Portugal	0.65	0.67	1.00			
Spain	0.96	0.98	0.65	1.00		
Ireland	0.92	0.93	0.64	0.93	1.00	
Germany	0.96	0.98	0.66	0.98	0.94	1.00

Panel C. Sovereign bond return correlations (2011/2012)

	Greece	Italy	Portugal	Spain	Ireland	Germany
Greece	1.00					
Italy	0.12	1.00				
Portugal	0.19	0.22	1.00			
Spain	0.13	0.77	0.17	1.00		
Ireland	0.26	0.17	0.33	0.23	1.00	
Germany	-0.13	-0.27	-0.10	-0.19	-0.17	1.00

Table II
Descriptive Statistics on Bank Characteristics

Panel A descriptive statistics on bank characteristics. **Log-Assets** is the natural logarithm of total book assets. **ST-LVG** is short-term debt divided by total debt. **RWA/Assets** is book assets divided by risk-weighted assets. **Book-LVG** is measured as total book assets divided by book value of equity. **Tier 1** is Tier 1 capital divided by risk-weighted assets. **Capital (Yes/No)** is a dummy variable equal to 1 if the bank raised common or preferred capital during the January 2007 to February 2012 period. **Log-Capital** is the natural logarithm of the amount of common or preferred capital raised. **ECB Funding/Repo** is the euro amount of ECB financing divided by total repos from banks, customers and the ECB. All bank characteristics are collapsed to the bank level. **Panel B** of Table III reports time-series characteristics of stock and bond returns and factor loadings. **Realized return** is the banks' equity return. **Bank CDS** is the five-year CDS spread of European banks. **Δ Log (Bank CDS)** is the change in the log of daily CDS spreads. **Predicted return** is the predicted banks' equity return. $\textbf{Beta}_{\textbf{Greece}}$, $\textbf{Beta}_{\textbf{Italy}}$, and $\textbf{Beta}_{\textbf{Germany}}$ are factor loadings for Greece, Italian and German government bond returns. **Panel C** of Table III reports average bond portfolio holdings in **Greek, Italian, Spanish, Portuguese** and **Irish** government bonds at the time of the three stress tests.

Panel A. Cross-section

	Obs	Mean	Std-Dev	Min	P50	Max
Log-Assets	51	11.88	1.65	7.82	11.99	14.38
ST-LVG	43	0.33	0.14	0.00	0.31	0.71
RWA / Assets	50	0.52	0.17	0.18	0.55	0.84
Book-LVG	51	21.61	10.09	2.02	18.68	59.22
Tier-1 Ratio	50	9.30	1.65	6.66	9.05	13.97
Capital Issuance Actvity & ECB Funding Jan 2007 - Feb 2012						
Capital (Yes/No)	51	0.86	0.35	0.00	1.00	1.00
Log-Capital	44	14.18	1.64	7.77	14.39	16.81
ECB / Assets	32	0.07	0.07	0.00	0.05	0.22

Panel B. Time-series

	Obs	Mean	Std-Dev	Min	P50	Max
Daily returns Jan 2006 – Feb 2012						
Realized Return (%)	63,105	-0. 14%	4%	-100%	0%	55%
Bank CDS (bps)	31,116	183	275	4	104	3,183
Δ Log (Bank CDS)	31,109	0.00	0.06	-0.82	0.00	1.34
Quarterly returns Q1 2008 – Q1 2012						
Realized Return (%)	833	-6%	26%	-87%	-7%	161%
Predicted Return (%)	833	-8%	38%	-275%	-8%	186%

Panel C. Factor loadings

	Obs	Mean	Std-Dev	Min	P50	Max
Factor loadings						
β_{Italy}	833	1.84	2.00	-3.17	1.40	16.42
β_{Spain}	833	1.42	2.13	-9.45	0.95	18.64
β_{Greece}	833	0.98	1.60	-1.89	0.36	15.36
$\beta_{Germany}$	833	-2.76	2.13	-20.81	-2.44	5.97
No GIPSI banks						
β_{Italy}	765	1.85	2.05	-3.17	1.39	16.42
β_{Spain}	731	1.47	2.24	-9.45	0.97	18.64
β_{Greece}	731	0.94	1.64	-1.89	0.32	15.36
GIPSI banks						
β_{Italy}	68	1.75	1.14	-0.11	1.52	4.98
β_{Spain}	102	1.02	0.84	-0.90	0.81	3.56
β_{Greece}	102	1.25	1.32	-0.43	0.81	5.61

Panel D. Sovereign bond holdings

	Greece	Italy	Portugal	Spain	Ireland
March 2010	94,912	264,500	27,154	174,833	24,878
December 2010	85,558	303,999	30,799	200,283	18,221
September 2011	24,579	267,218	28,723	177,466	17,016
December 2011	19,939	223,208	22,267	137,874	16,327
June 2012	1,818	258,894	25,600	148,422	17,494

	Greece	Italy	Portugal	Spain	Ireland
No GIPSI banks					
March 2010	34,814	115,472	14,776	29,190	18,677
December 2010	28,208	132,803	14,636	41,923	5,017
September 2011	21,832	103,137	13,975	30,039	3,845
December 2011	17,355	69,243	10,390	22,311	3,528
June 2012	1,672	69,344	10,169	20,615	2,961
GIPSI banks					
March 2010	56,148	144,856	5,176	143,869	5,322
December 2010	54,447	164,011	10,351	154,793	12,466
September 2011[1)]	NA	156,043	10,972	143,629	12,455
December 2011[1)]	NA	147,746	8,180	111,774	12,109
June 2012[1)]	NA	184,171	10,657	124,385	13,848

1) Greek banks were excluded from stress tests

Table III
Banks' Stock and Sovereign Bond Returns

This table contains the results of the cross-sectional analysis of individual banks' stock returns on sovereign bond returns over the January 2007 to February 2012 period. Columns (1) to (5) of **Panel A** show factor loadings on GIPSI sovereign bond returns individually for **Greece, Italy, Spain, Portugal and Ireland** and jointly in column (6). All regressions include ten-year German bond returns (**Germany**) as the "funding leg" of the carry trade. **Stock Index** is the residual from the regression of the domestic stock market's daily log returns on daily domestic sovereign bond and German bund returns. **Panel B** contains results of various model specifications: Model 1 reports factor loadings of home country bond returns (**Home**). Model 2 reports the results controlling for a wide array of state variables: (1) : **ΔVSTOXX** is the change in the VSTOXX Index for the European stock market; (2) **Term Structure** is the slope of the term structure of interest rates measured as the difference between the yield on a ten-year euro area government bond and the one-month Euribor; (3) **Bond Default Spread** is the difference between the yield on ten-year German BBB bonds and yields on ten-year German government debt; (4) **1 month EURIBOR** is the level of the short-term risk-free interest rate measured as the one-month Euribor; (5) Δ**European Economic Sentiment** is the monthly change in the economic sentiment indicator obtained from opinion surveys conducted by the European Central Bank; (6) Δ**Level of Industrial Production** is the monthly change in the level of industrial production; (7) Δ**European Consumer Price Index** is the change in inflation measured as the monthly change in the European Consumer Price Index. Model 3 reports the results of a principal component analysis (**PC1**); Model 4 uses French bond returns as the funding leg of the carry trade; Model 5 uses two-year GIPSI government bond returns. Models 6 and 7 report the results of the cross-sectional analyses of bank CDS spread changes on GIPSI bond returns. The dependent variable is **Δ Log (Bank CDS)**. Standard errors are clustered at bank and quarter level. t-statistics are given in parentheses. ***,** and * indicate significance at 1, 5 and 10% levels respectively.

Panel A. Stock and bond return correlations

	(1) Greece	(2) Italy	(3) Spain	(4) Portugal	(5) Ireland	(6) GIPSI
Greece	0.095***					0.048***
	(5.73)					(2.73)
Italy		0.432***				0.261***
		(5.12)				(2.93)
Spain			0.427***			0.077
			(8.78)			(1.46)
Portugal				0.130***		0.007
				(3.05)		(0.57)
Ireland					0.267***	0.132**
					(5.32)	(2.49)
Germany	-2.460***	-2.563***	-2.611***	-2.500***	-2.517***	-2.558***
	(-19.09)	(-23.64)	(-23.07)	(-19.40)	(-19.78)	(-22.70)
Stock Index	1.359***	1.363***	1.367***	1.373***	1.371***	1.354***
	(14.98)	(15.17)	(15.27)	(15.02)	(15.30)	(15.25)
Constant	-0.001**	-0.001***	-0.001***	-0.001***	-0.001**	-0.001***
	(-2.56)	(-2.94)	(-2.64)	(-2.75)	(-2.58)	(-2.73)
Observations	55,206	55,206	55,206	55,206	55,206	55,206
R-squared	0.46	0.46	0.46	0.46	0.46	0.46

Panel B. Robustness tests

	(1) Home	(2) Macro	(3) PCA	(4) Funding Leg	(5) Maturity	(6) Δ Log(Bank CDS)	(7)
Greece	0.008	0.052***		0.073***	0.014***	-0.150***	
	(0.49)	(3.07)		(4.50)	(3.82)	(-4.77)	
Italy	0.217**	0.256***		0.735***	0.014	-0.161	
	(2.39)	(2.84)		(6.68)	(0.29)	(-0.93)	
Spain	0.029	0.095*		-0.009	-0.043	-0.270*	
	(0.55)	(1.80)		(-0.06)	(-0.46)	(-1.67)	
Portugal	-0.005	0.007		-0.007	0.006	-0.117*	
	(-0.46)	(0.62)		(-0.13)	(0.41)	(-1.94)	
Ireland	0.119**	0.135**		0.143**	0.046**	-0.203*	
	(2.42)	(2.57)		(1.99)	(2.49)	(-1.90)	
Germany	-2.662***	-2.717***	-2.570***		-1.819***	2.913***	2.983***
	(-23.74)	(-21.47)	(-21.77)		(-12.97)	(6.39)	(6.15)
Stock Index	1.365***	1.419***	1.357***	1.355***	1.270***	-0.745***	-0.755***
	(14.94)	(16.29)	(15.29)	(15.22)	(19.61)	(-7.61)	(-7.62)
Home	0.295***						
	(8.34)						
ΔVSTOXX		0.088***					
		(3.91)					
Term Structure		0.024					
		(0.24)					
Bond Default Spread		0.014					
		(0.51)					
1 month EURIBOR		0.043					
		(0.64)					
ΔEuropean Economic Sentiment		0.037**					
		(2.38)					
ΔLevel of Industrial Production		0.044*					
		(1.84)					
ΔEuropean Consumer Price Index		-0.084					
		(-0.75)					
PC1			0.002***				-0.004***
			(8.60)				(-4.70)
France				-2.294***			
				(-8.21)			
Constant	-0.001***	-0.002	-0.001***	-0.001***	-0.001**	0.002*	0.003**
	(-2.80)	(-0.87)	(-3.11)	(-2.77)	(-2.03)	(1.80)	(2.27)
Observations	55,206	55,005	55,206	55,206	55,086	29,832	29,832
R-squared	0.47	0.46	0.46	0.42	0.43	0.13	0.13

Table IV
Factor Loadings and Bank Portfolio Holdings

This table contains the results regressing factor loadings (β_{Italy}, β_{Spain}, β_{Greece}) on sovereign bond holdings. **Italy-Sov/Assets, Spain-Sov/Assets, Greece-Sov** are the ratios of Italian, Spanish and Greek sovereign debt holdings by European banks over total assets. December 2010, September 2011, December 2011 and June 2012 are indicator variables for the reporting date of the banks' sovereign debt holdings. March 2010 is the omitted group. Results for **Italy** are reported in models (1) to (4), for **Spain** in models (5) to (8) and **Greece** in models (9) to (12). Models (1), (5) and (9) include the full sample of banks, all other models exclude always the banks of the particular country, i.e. Italian banks (models (2) – (4)), Spanish banks (models (6) – (8)) and Greek banks (models (10) – (12)). Models (4), (8) and (12) further include bank fixed effects. Factor loadings are estimated 60 days before and 60 days after the reporting date for each bank. Standard errors are clustered at the bank level. t-statistics are given in parentheses. ***,** and * indicate significance at 1, 5 and 10% levels respectively.

	β_{Italy}				β_{Spain}				β_{Greece}			
	All	**Non-Italian**	**Non-Italian**	**Non-Italian**	**All**	**Non-Spanish**	**Non-Spanish**	**Non-Spanish**	**All**	**Non-Greek**	**Non-Greek**	**Non-Greek**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Italy-Sov / Assets	6.881***	20.769**	17.732***	37.858***								
	(5.97)	(2.20)	(3.15)	(2.79)								
Spain-Sov / Assets					5.763***	68.506**	73.182***	112.711***				
					(3.12)	(2.06)	(2.85)	(3.12)				
Greece-Sov / Assets									2.006***	2.701*	2.588**	-0.693
									(4.15)	(1.88)	(2.21)	(-1.64)
December 2010			-0.817***	-1.074***			-0.711***	-0.928***			0.103**	0.039
			(-4.72)	(-8.22)			(-5.28)	(-9.81)			(2.58)	(0.91)
September 2011			-1.253***	-1.819***			-0.952***	-1.461***			-0.016	-0.043**
			(-7.97)	(-9.78)			(-7.65)	(-12.64)			(-0.82)	(-2.41)
December 2011			-0.871***	-1.356***			-0.753***	-0.997***			-0.043*	-0.077***
			(-5.46)	(-7.73)			(-5.86)	(-8.82)			(-1.95)	(-3.60)
June 2012			-0.641***	-1.087***			-0.561***	-0.841***			-0.019	-0.065***
			(-3.66)	(-6.84)			(-4.09)	(-7.72)			(-0.89)	(-2.95)
Constant	0.535***	0.483***	1.249***	1.746***	0.485***	0.425***	1.057***	1.431***	0.121***	0.114***	0.108***	0.194***
	(11.11)	(8.83)	(7.81)	(11.81)	(12.61)	(9.19)	(8.77)	(14.10)	(11.34)	(10.86)	(6.51)	(11.45)
Bank FE	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Observations	205	180	180	181	205	184	184	185	211	199	199	200
R-squared	0.10	0.04	0.40	0.62	0.05	0.03	0.35	0.70	0.26	0.06	0.18	0.12

Table V
Non-Sovereign Cross-Border Exposure of Banks

This table reports the results from cross-sectional regressions of factor loadings (β_{Italy}, β_{Spain}, β_{Greece}) on sovereign bond and real sector holdings of European banks. **Italy-Sov/Assets, Spain-Sov/Assets, Greece-Sov** are the ratios of Italian, Spanish and Greek sovereign debt holdings by European banks over total assets. **Italy-Real/Assets, Spain-Real/Assets, Greece-Real** are the ratios of Italian, Spanish and Greek real sector exposures by European banks over total assets. Real sector exposure is the sum of each banks' exposure to the corporate sector, retail sector and commercial real estate sector. All data are from December 2010 (reporting date) and disclosed in the July 2011 stress tests. Results for **Italy** are reported in models (1) to (4), for **Spain** in models (5) to (8) and **Greece** in models (9) to (12). Three models exclude always the banks of the particular country, i.e. Italian banks (model (4)), Spanish banks (model (8)) and Greek banks (model (12)). Standard errors are clustered at the bank level. t-statistics are given in parentheses. ***,** and * indicate significance at 1, 5 and 10% levels respectively.

	β_{Italy}				β_{Spain}				β_{Greece}			
	All	**All**	**All**	**Non-Italian**	**All**	**All**	**All**	**Non-Spanish**	**All**	**All**	**All**	**Non-Greek**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Italy-Real / Assets	1.148***		-0.602	4.990								
	(4.09)		(-0.63)	(0.73)								
Italy- Sov / Assets		8.565***	12.091	36.248***								
		(2.95)	(1.52)	(2.81)								
Spain-Real / Assets					0.657**		-0.808	-3.556				
					(2.66)		(-1.41)	(-0.81)				
Spain-Sov / Assets						6.847***	13.158***	71.094				
						(3.53)	(3.37)	(1.39)				
Greece-Real / Assets									1.527***		1.305***	6.846**
									(9.66)		(4.55)	(2.40)
Greece-Sov / Assets										3.095***	0.578	-17.989
										(5.78)	(1.11)	(-1.67)
Constant	0.845***	0.807***	0.799***	0.685***	0.691***	0.676***	0.676***	0.625***	0.209***	0.227***	0.209***	0.219***
	(6.84)	(6.38)	(6.20)	(5.14)	(9.53)	(9.36)	(9.32)	(6.56)	(5.69)	(6.14)	(5.62)	(5.54)
Observations	51	51	51	46	51	51	51	45	51	51	51	45
R-squared	0.06	0.08	0.09	0.08	0.07	0.11	0.12	0.05	0.49	0.40	0.49	0.20

Table VI
Risk and Leverage

This table contains the cross-sectional analysis of banks' carry trade behavior conditioning on bank characteristics such as bank size and leverage. The dependent variable is the banks' daily stock return. **GIPSI** proxies for ten-year peripheral government bond returns which is **Greece** in models (1) to (4), **Italy** in models (5) to (8) and **Spain** in models (9) to (12). **Germany** is the ten-year German government bond return. The results of the analysis of bank size are reported in models (1), (5) and (9), short-term debt in models (2), (6) and (10), loans to total assets in models (3), (7) and (11). Columns (4), (8) and (12) show the results of the analysis of all three factors jointly. **ST-LVG** is short-term debt divided by total debt. **Log-Assets** is the natural logarithm of total book assets. **Loans/Assets** is customers' loans divided by total assets. **Stock Index** is the residual from the regression of the domestic stock market's daily log returns on daily domestic sovereign bond and German bund returns. ST Debt and Loans/Assets are included in addition to the interaction terms in the respective models as well as a constant term but all remain unreported for brevity. Log-Assets is added as a control variable in all models. Bank characteristics are from t-1. Standard errors are clustered at bank and quarter level. t-statistics are given in parentheses. ***,** and * indicate significance at 1, 5 and 10% levels respectively.

	Italy			Spain			Greece		
	All	**Non-Italian**	**Italian**	**All**	**Non-Spanish**	**Spanish**	**All**	**Non-Greek**	**Greek**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
$GIPSI_t$	-1.567***	-1.378***	-0.028	-1.364***	-1.173***	-4.201***	-0.18	-0.359***	-2.214
	(-3.80)	(-2.87)	(-0.04)	(-3.72)	(-3.32)	(-7.10)	(-1.09)	(-3.26)	(-1.92)
GIPSI x Log-$Assets_{t-1}$	0.083***	0.066**	0.132**	0.076***	0.069***	0.205***	0.008	0.021***	0.181
	-3.43	-2.5	-2.86	-3.81	-3.38	-6.8	-1.02	-4.12	-2.05
GIPSI x ST-LVG_{t-1}	0.828**	0.922**	-1.595**	0.610*	0.374	0.298	0.182	0.309***	-0.567
	-2.31	-2.31	(-3.29)	-1.81	-1.13	-0.59	-1.24	-4.08	(-1.77)
GIPSI x Loans / $Assets_{t-1}$	1.229***	1.172***	-0.615	1.152***	1.114***	3.028**	0.192*	0.112	0.991*
	-6.01	-4.19	(-1.44)	-5.66	-5.36	-4.06	-1.78	-1.47	-2.48
$Germany_t$	-0.734	-0.423	3.396	-0.676	-0.727	8.564**	-1.149	-0.91	4.951***
	(-0.47)	(-0.25)	-1.17	(-0.43)	(-0.45)	-3.6	(-0.75)	(-0.55)	-7.2
Germany x Log-$Assets_{t-1}$	-0.091	-0.102	-0.454*	-0.096	-0.087	-0.562***	-0.08	-0.094	-0.735***
	(-1.21)	(-1.21)	(-2.67)	(-1.25)	(-1.16)	(-4.81)	(-1.06)	(-1.11)	(-6.25)
Germany x ST-LVG_{t-1}	-1.257**	-1.231**	-1.663	-1.243**	-0.942	-0.291	-0.745	-0.925	0.722*
	(-2.08)	(-1.99)	(-1.18)	(-2.06)	(-1.32)	(-0.38)	(-1.46)	(-1.47)	-2.85
Germany x Loans / $Assets_{t-1}$	-0.507	-0.937	0.755	-0.595	-1.026	-5.441**	-0.146	-0.091	0.306
	(-0.46)	(-0.81)	-0.49	(-0.54)	(-0.87)	(-3.22)	(-0.14)	(-0.08)	-0.26
Stock Index	1.322***	1.343***	1.199***	1.326***	1.364***	1.102***	1.320***	1.273***	1.583***
	-16.04	-15.6	-8.8	-16.15	-16.25	-6.43	-15.85	-14.29	-17.5
Constant	-0.001	0	0.003	0	0	0.004	-0.001	-0.001	0
	(-0.44)	(-0.03)	-0.44	(-0.35)	-0.34	-1.9	(-0.46)	(-0.53)	(-0.13)
Observations	39,925	34,148	5,777	39,925	34,234	5,691	39,925	35,310	4,615
R-squared	0.46	0.44	0.62	0.46	0.45	0.68	0.46	0.44	0.57

Table VII
Regulatory Capital Ratios

This table contains the cross-sectional analysis of banks' carry trade behavior conditioning on bank capital adequacy. The dependent variable is the banks' daily stock return. **GIPSI** proxies for ten-year peripheral government bond returns which is **Italy** in models (1) to (3), **Spain** in models (4) to (6) and **Greece** in models (7) to (9). **Germany** is the ten-year German government bond return. We use the Tier1 ratio in models (1), (4) and (7) and RWA/Assets in models (2), (5) and (8). Models (3), (6) and (9) include both variables jointly and further include ST Debt. **Log-Assets** is the natural logarithm of total book assets. **Tier1-Ratio** is Tier 1 capital divided by risk-weighted assets. **RWA/Assets** is risk-weighted assets divided by total assets. **ST-LVG** is short-term debt divided by total debt. **Stock Index** is the residual from the regression of the domestic stock market's daily log returns on daily domestic sovereign bond and German bund returns. Log-Assets, Tier 1, RWA/Assets and ST Debt are included in addition to the interaction terms in the respective models as well as a constant term but all remain unreported for brevity. Bank characteristics are from t-1. Standard errors are clustered at the bank and quarter level. t-statistics are given in parentheses. ***,** and * indicate significance at 1, 5 and 10% levels respectively.

	Italy			Spain			Greece		
	All	**Non-Italian**	**Italian**	**All**	**Non-Spanish**	**Spanish**	**All**	**Non-Greek**	**Greek**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
$GIPSI_t$	-0.576	-0.513	-0.986	-0.849*	-0.811*	-1.646**	-0.260	-0.349**	0.123
	(-1.19)	(-1.06)	(-0.87)	(-1.72)	(-1.65)	(-3.52)	(-1.05)	(-2.01)	(0.08)
GIPSI x Log-$Assets_{t-1}$	0.073***	0.065**	0.079	0.081***	0.081***	0.180***	0.014	0.022***	-0.011
	(3.05)	(2.57)	(0.65)	(4.06)	(4.10)	(9.14)	(1.47)	(3.51)	(-0.08)
$GIPSI_t$ x Tier 1_{t-1}	-0.053***	-0.057***	0.117	-0.038	-0.035	-0.104*	0.001	-0.001	0.027
	(-3.47)	(-3.48)	(1.34)	(-1.55)	(-1.35)	(-2.61)	(0.15)	(-0.11)	(1.46)
$GIPSI_t$ x RWA / $Assets_{t-1}$	0.726***	0.776***	0.270	0.870***	0.934***	1.525**	0.201	0.109	0.353
	(3.02)	(3.02)	(0.42)	(4.27)	(4.61)	(3.21)	(1.44)	(1.28)	(1.19)
$GIPSI_t$ x ST-LVG_{t-1}	0.917***	1.073***	-1.353	0.730**	0.475	-0.142	0.197*	0.290***	-0.565
	(2.84)	(2.98)	(-1.51)	(2.15)	(1.23)	(-0.29)	(1.74)	(3.16)	(-1.28)
$Germany_t$	0.150	0.078	7.306	0.139	0.392	1.598	0.391	0.624	1.453
	(0.09)	(0.04)	(1.92)	(0.08)	(0.22)	(1.21)	(0.25)	(0.31)	(0.38)
Germany x Log-$Assets_{t-1}$	-0.129*	-0.129	-0.545*	-0.132*	-0.141*	-0.414***	-0.123*	-0.141	-0.418
	(-1.68)	(-1.59)	(-2.45)	(-1.73)	(-1.80)	(-5.04)	(-1.70)	(-1.52)	(-0.88)
Germany x Tier 1_{t-1}	-0.053	-0.037	-0.194	-0.047	-0.058	0.228**	-0.095**	-0.089*	-0.132
	(-1.10)	(-0.73)	(-1.94)	(-1.03)	(-1.28)	(3.44)	(-2.19)	(-1.71)	(-1.91)
$Germany_t$ x RWA / $Assets_{t-1}$	-0.528	-0.778	-1.511	-0.598	-1.101	-0.932	-0.441	-0.427	2.673
	(-0.53)	(-0.78)	(-0.79)	(-0.61)	(-1.08)	(-1.81)	(-0.48)	(-0.39)	(1.73)
Germany x ST-LVG_{t-1}	-1.249**	-1.277**	-1.119	-1.271**	-0.884	-0.496	-0.629	-0.772	0.025
	(-2.06)	(-2.03)	(-0.76)	(-2.10)	(-1.15)	(-0.98)	(-1.24)	(-1.32)	(0.08)
Stock Index	1.321***	1.342***	1.204***	1.326***	1.364***	1.097***	1.322***	1.276***	1.586***
	(15.90)	(15.44)	(8.94)	(16.03)	(16.13)	(6.37)	(15.77)	(14.35)	(18.76)
Constant	-0.002	-0.002	-0.017**	-0.002	-0.000	0.001	-0.003	-0.005***	-0.013
	(-1.08)	(-0.77)	(-2.82)	(-0.55)	(-0.12)	(0.70)	(-1.02)	(-2.78)	(-1.30)
Observations	39,711	33,934	5,777	39,711	34,020	5,691	39,711	35,310	4,401
R-squared	0.46	0.44	0.63	0.46	0.45	0.68	0.46	0.44	0.58

Table VIII
Capital Issuances and ECB Funding

Table IX contains the results of the analysis whether banks' carry trade behavior predicts their capital-raising activity and dependence on ECB funds over the time period from January 2008 to April 2012. The dependent variables are: **Log-Capital,** the natural logarithm of the amount raised in each quarter, and ECB funding divided by total assets (**ECB /Assets**) at the annual reporting date. **Realized Return$_{t-1}$** is the bank's equity return, **Predicted Return$_{t-1}$** is the bank's predicted return; **$\beta_{Greece,t-1}$** , **$\beta_{Italy,t-1}$** , and **$\beta_{Germany,t-1}$** are factor loadings for Greek, Italian and German government bond returns measured over the previous quarter. **Log-Assets** is the natural logarithm of the one-year lagged total assets. Standard errors are clustered at bank and quarter level. t-statistics are given in parentheses. ***,** and * indicate significance at 1, 5 and 10% levels respectively.

	(1) Log-Capital	(2) ECB/Assets	(3) Log-Capital	(4) ECB/Assets	(5) Log-Capital	(6) ECB/Assets	(7) Log-Capital	(8) ECB/Assets
Realized Return$_{t-1}$	-2.036***	-0.001			-2.284***	0.011	-2.232***	0.031
	(-3.60)	(-0.02)			(-3.92)	(0.19)	(-3.70)	(0.50)
Predicted Return$_{t-1}$			-1.217**	-0.047				
			(-2.57)	(-0.95)				
$\beta_{Greece,t-1}$					0.881***	0.021		
					(2.73)	(1.12)		
$\beta_{Italy,t-1}$							0.169	0.029*
							(1.11)	(1.82)
$\beta_{Germany,t-1}$					0.023	-0.023***	-0.307**	-0.024***
					(0.14)	(-2.89)	(-2.07)	(-2.97)
Log-Assets$_{t-1}$	0.243***	-0.022***	0.202**	-0.022***	0.182**	-0.030***	0.155	-0.031***
	-3.01	(-3.49)	(2.21)	(-3.46)	(2.10)	(-4.28)	(1.64)	(-4.38)
Constant	-1.622*	0.338***	-1.086	0.326***	-1.051	0.374***	-1.379	0.382***
	(-1.72)	(4.02)	(-0.98)	(3.83)	(-1.03)	(4.07)	(-1.22)	(4.25)
Observations	750	80	699	76	699	76	699	76
R-squared	0.02	0.18	0.01	0.18	0.06	0.28	0.04	0.31

Table IX
Time Series of Carry Trades Exposures

This table contains the analysis regressing banks' daily stock returns on Italian and German government bond returns for the January 2011 to February 2012 period. Italian banks are excluded. **Log-Assets** is the natural logarithm of total book assets. **Tier 1** is Tier 1 capital divided by risk-weighted assets. **RWA/Assets** is risk-weighted assets divided by total assets. **ST-LVG** is short-term debt divided by total debt **Stock Index** is the residual from the regression of the domestic stock market's daily log returns on daily domestic sovereign bond and German bund returns. Log-Assets, Tier 1, RWA/Assets and ST Debt are included in addition to the interaction terms in the respective models as well as a constant term but all remain unreported for brevity. Standard errors are clustered at the bank level. t-statistics are given in parentheses. ***,** and * indicate significance at 1, 5 and 10% levels respectively.

Dependent Variable:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**
	Stock Returns													
	Jan 2011	**Feb 2011**	**March 2011**	**April 2011**	**May 2011**	**June 2011**	**July 2011**	**Aug 2011**	**Sept 2011**	**Oct 2011**	**Nov 2011**	**Dec 2011**	**Jan 2012**	**Feb 2012**
GIPSI$_t$	-4.584***	-5.964***	-1.032	-4.832	-2.275	-4.953	-1.206	0.238	-2.295	0.148	-1.010	-0.597	0.573	-4.810**
	(-2.86)	(-4.06)	(-0.34)	(-0.72)	(-1.23)	(-1.27)	(-1.43)	(0.53)	(-0.82)	(0.03)	(-1.05)	(-0.62)	(0.45)	(-2.32)
GIPSI x Log-Assets$_{t-1}$	0.362***	0.318***	0.068	0.168	0.141**	0.297*	0.072	0.046**	0.096	0.043	0.046	0.010	0.057	0.273**
	(5.33)	(4.32)	(0.45)	(0.71)	(2.20)	(2.02)	(1.67)	(2.35)	(0.66)	(0.19)	(1.11)	(0.21)	(0.79)	(2.60)
GIPSI$_t$ x Tier 1$_{t-1}$	-0.026	0.147	0.102	0.319	-0.003	0.035	0.099*	-0.091**	-0.011	-0.088	-0.030	0.064	-0.098***	-0.076**
	(-0.30)	(1.48)	(0.71)	(0.74)	(-0.03)	(0.28)	(1.90)	(-2.53)	(-0.15)	(-0.36)	(-0.71)	(1.58)	(-5.58)	(-2.44)
GIPSI$_t$ x RWA / Assets$_{t-1}$	2.560**	2.301***	0.875	2.567	1.209	2.240	-0.277	0.837***	2.449*	0.798	0.869*	0.210	0.319	1.492
	(2.15)	(3.01)	(0.47)	(0.75)	(1.00)	(1.30)	(-0.53)	(3.84)	(1.89)	(0.34)	(1.83)	(0.42)	(0.45)	(1.49)
GIPSI$_t$ x ST-LVG$_{t-1}$	0.799	-0.744	-1.863	-5.345	1.157	2.749	-0.732	0.322	1.389	-0.427	1.244*	-0.475	0.661	5.258***
	(0.47)	(-0.44)	(-0.73)	(-1.24)	(0.89)	(1.40)	(-1.20)	(0.99)	(1.18)	(-0.12)	(1.95)	(-0.77)	(0.98)	(3.46)
Germany$_t$	-1.313	-10.041***	-0.056	-2.047	-1.879	5.379*	0.189	0.622	0.682	-1.695	-5.419	0.057	-2.117	-3.570
	(-0.56)	(-4.56)	(-0.02)	(-0.59)	(-0.43)	(1.76)	(0.08)	(0.13)	(0.15)	(-0.57)	(-1.56)	(0.02)	(-0.70)	(-0.63)
Germany x Log-Assets$_{t-1}$	-0.324***	0.404***	-0.076	-0.010	0.128	-0.263	-0.140	-0.103	-0.209	-0.033	0.076	-0.126	0.093	0.039
	(-2.91)	(3.70)	(-0.49)	(-0.08)	(0.74)	(-1.56)	(-1.18)	(-0.51)	(-0.88)	(-0.24)	(0.46)	(-0.99)	(0.61)	(0.12)
Germany x Tier 1$_{t-1}$	0.300**	0.216	-0.051	0.099	-0.064	-0.169*	0.053	-0.097	-0.060	0.110	0.017	0.133	-0.365***	-0.114**
	(2.64)	(1.47)	(-0.48)	(0.39)	(-0.35)	(-1.95)	(0.36)	(-0.76)	(-0.54)	(0.97)	(0.11)	(0.98)	(-5.20)	(-2.08)
Germany$_t$ x RWA / Assets$_{t-1}$	-2.222	0.647	-1.883	-2.131	-1.228	-4.501***	-2.369*	-0.294	-0.348	-1.691	0.840	-2.946	2.280	-2.118
	(-1.68)	(0.39)	(-0.97)	(-1.58)	(-0.77)	(-3.09)	(-1.97)	(-0.13)	(-0.15)	(-0.99)	(0.40)	(-1.56)	(1.51)	(-0.85)
Germany x ST-LVG$_{t-1}$	-0.973	1.713	1.309	-1.402	-1.258	-1.642	-2.654	-0.098	0.124	-3.038	2.976	-4.235**	3.319*	4.495
	(-0.36)	(0.51)	(0.81)	(-0.65)	(-0.78)	(-0.95)	(-1.17)	(-0.04)	(0.05)	(-1.57)	(1.01)	(-2.16)	(1.80)	(1.59)
Stock Index	1.082***	1.528***	1.209***	1.419***	1.293***	1.071***	1.513***	1.244***	1.263***	2.018***	1.460***	1.234***	1.739***	2.445***
	(10.95)	(11.84)	(10.63)	(7.45)	(9.39)	(4.58)	(3.88)	(12.34)	(14.00)	(7.45)	(10.75)	(7.22)	(8.79)	(6.02)
Constant	-0.020**	-0.011	-0.006	-0.016	-0.016	-0.025*	-0.044**	-0.003	-0.042**	-0.026*	0.020	-0.009	-0.028	-0.006
	(-2.57)	(-1.65)	(-0.58)	(-0.62)	(-1.15)	(-1.95)	(-2.25)	(-0.16)	(-2.67)	(-1.77)	(1.01)	(-0.74)	(-1.47)	(-0.43)
Observations	561	565	601	483	584	552	585	620	610	548	561	541	512	252
R-squared	0.50	0.36	0.42	0.22	0.23	0.34	0.36	0.46	0.60	0.49	0.43	0.35	0.60	0.65

Table X
Do Investments in Government Bonds Crowd Out Lending?

Table XI contains the results of the analysis regarding how lending by banks changes relative to sovereign debt holdings after the ECB interventions over the time period Q1 2008 to Q1 2012. We use monthly ECB data aggregated to the country level (Panel A) and quarterly bank balance sheet data (Panel B). The dependent variables are: **Loans/Government Securities** in models (1) to (4), Government Securities (% Total Assets) in models (5) to (7) and Loans (% Total Assets) in models (8) to (10). The independent variables in Panel A are: **2009 LTROs** is an indicator variable equal to 1 for the months June 2009 until February 2010. **Oct 2011/Dec 2011 LTRO** is an indicator variable that is 1 for the months October 2011 to February 2012 and **March 2012 LTRO** is 1 for the months March to May 2012. **Log-TA** is the natural logarithm of the total sum of total assets across all banks, **Log-Banks** is the natural logarithms of the number of banks within each country. **Deposits/Assets** is the ratio of the sum of total deposits over total assets. **Repos/Assets** is total repos over total assets. All variables are lagged by one quarter. **Capital (Yes/No)** is an indicator variable that is 1 if the bank has raised capital in the previous quarter. Δ**European Economic Sentiment** is the 12-month change in the European Economic Sentiment Index. Country and year-quarter fixed effects are included. We use quarterly bank balance sheet characteristics in Panel B, **2011/2012 LTROs** is an indicator variable equal to 1 in the fourth quarter of 2011 and first quarter of 2012. Bank fixed effects and time effects are included in all regressions. Standard errors are robust to heteroscedasticity. t-statistics are given in parentheses. ***,** and * indicate significance at 1, 5 and 10% levels respectively.

Panel A: ECB country-level data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Loans/Government Securities			Government Securities (% Total Assets)			Loans (% Total Assets)		
			Not Italy and Spain	Only Italy and Spain		Not Italy and Spain	Only Italy and Spain		Not Italy and Spain	Only Italy and Spain
2009 LTROs	-0.8080***	-0.8077***	-0.7378***	-0.6911**	0.005***	0.0049***	0.0041**	-0.0006	-0.0005	0.0008
	(-5.39)	(-5.39)	(-4.22)	(-2.16)	(5.85)	(5.44)	(2.58)	(-0.48)	(-0.32)	(0.42)
Oct 2011/Dec 2011 LTRO	-0.0720	-0.0856	-0.0793	0.2006	-0.0004	-0.0012	-0.0009	-0.0028	-0.0027	-0.0039
	(-0.22)	(-0.26)	(-0.20)	(0.47)	(-0.22)	(-0.60)	(-0.33)	(-1.24)	(-1.32)	(-0.71)
March 2012 LTRO	-0.2457	-0.2800	-0.1687	-0.3936	-0.0000	-0.0038	0.0105***	-0.0043	-0.0032	-0.0125**
	(-0.52)	(-0.59)	(-0.30)	(-0.73)	(-0.01)	(-1.28)	(4.10)	(-1.23)	(-1.00)	(-2.11)
Log-TA	-8.4690***	-8.3727***	-9.1027***	4.8975	0.0145***	0.0133**	-0.0454**	-0.0440***	-0.0353***	-0.0072
	(-7.44)	(-7.29)	(-7.06)	(1.27)	(2.67)	(2.19)	(-2.27)	(-5.80)	(-4.55)	(-0.20)
Log-Banks	-0.6535***	-0.6217***	-0.7434***	-8.9936	-0.0007	-0.0003	-0.0176	-0.0140***	-0.0150***	-0.2520***
	(-4.06)	(-3.81)	(-4.44)	(-0.82)	(-0.61)	(-0.23)	(-0.33)	(-8.06)	(-8.70)	(-2.77)
Deposits/Assets	3.1245***	3.1286***	3.0145***	3.8664***	-0.0063**	-0.0029	-0.0228***	0.0210***	0.0171***	0.0304***
	(6.05)	(6.05)	(5.25)	(3.10)	(-2.16)	(-0.95)	(-4.48)	(7.41)	(7.16)	(2.87)
Repos/Assets	-29.1993*	-28.7485*	-55.8495**	38.6281	0.0137	-0.0126	-0.1302	0.5372***	0.1089	0.2958
	(-1.96)	(-1.92)	(-2.43)	(1.61)	(0.12)	(-0.06)	(-1.10)	(3.90)	(0.72)	(1.30)
Capital (Yes/No)		-0.1191			0.0021**			-0.0002		
		(-0.77)			(2.46)			(-0.18)		
ΔEuropean Economic Sentiment	-0.0378***	-0.0383***	-0.0405***	-0.0141**	0.0002***	0.0002***	0.0001	-0.0001***	-0.0001***	-0.0001**
	(-6.72)	(-6.79)	(-6.10)	(-2.26)	(9.93)	(9.47)	(1.57)	(-4.05)	(-3.68)	(-2.13)
Constant	66.8017***	65.9581***	71.6824***	23.1532	-0.0681*	-0.0636	0.5527**	0.5392***	0.4854***	1.9810***
	(8.16)	(7.96)	(7.77)	(0.42)	(-1.65)	(-1.38)	(2.00)	(9.25)	(8.15)	(4.43)
Country-Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	725	725	593	132	725	593	132	725	593	132
R-squared	0.72	0.72	0.71	0.78	0.84	0.85	0.84	0.98	0.97	0.89

Panel B: Bank balance data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Loans / Government Securities				Government Securities (% Total Assets)			Loans (% Total Assets)		
			Not Italy and Spain	Only Italy and Spain		Not Italy and Spain	Only Italy and Spain		Not Italy and Spain	Only Italy and Spain
2009 LTROs	-0.685**	-0.623**	-0.811***	-0.182	0.013***	0.015***	0.005	-0.002	-0.002	-0.005
	(-2.47)	(-2.24)	(-2.80)	(-0.26)	(3.86)	(3.92)	(0.76)	(-0.96)	(-0.64)	(-0.89)
2011 / 2012 LTROs	0.305	0.325	0.282	-2.382*	-0.006	-0.007	0.019*	-0.004	-0.001	-0.013**
	(0.62)	(0.65)	(0.72)	(-1.97)	(-0.81)	(-0.89)	(1.88)	(-0.67)	(-0.15)	(-2.01)
Log-TA	-0.934	-0.979	0.404	-12.659**	0.014	0.007	0.076**	-0.053***	-0.041**	-0.137***
	(-0.85)	(-0.89)	(0.49)	(-2.27)	(0.89)	(0.40)	(2.05)	(-2.81)	(-2.06)	(-3.02)
Capital (Yes / No)		-0.432			-0.002			-0.000		
		(-1.53)			(-0.48)			(-0.10)		
Constant	17.226	17.779	0.418	162.037**	-0.025	0.081	-0.839*	1.218***	1.046***	2.352***
	(1.32)	(1.36)	(0.04)	(2.41)	(-0.13)	(0.43)	(-1.86)	(5.51)	(4.50)	(4.31)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	362	362	291	71	373	292	81	559	439	120
R-squared	0.73	0.73	0.72	0.71	0.90	0.89	0.84	0.98	0.97	0.94

Appendix I
Variable Definitions

Variable	Definition
Greece, Italy, Spain, Portugal, Ireland	Daily returns on 10-year government bonds issued by Greece, Italy, Spain, Portugal and Ireland
GIPSI	Daily returns on 10-year government bonds issued by either Greece, Italy, Spain, Portugal or Ireland
Home	Home is the return from the 10-year government bond of the home country the bank is domiciled in.
PC1	The first principal component (PC1) is the linear combination of GIPSI bond returns with the highest eigenvalue.
Germany	Daily returns on ten-year government bonds issued by Germany.
France	Daily returns on ten-year government bonds issued by France.
Log-Assets	Log-Assets is the natural logarithm of total book assets.
ST-LVG	ST-LVG is short-term debt divided by total debt.
RWA/Assets	RWA/Assets is risk-weighted assets divided by total assets.
Book-LVG	Book-LVG is measured as total book assets divided by book value of equity.
Loans/Assets	Loans/Assets is customers' loans divided by total assets.
Tier 1	Tier1 is Tier 1 capital divided by risk-weighted assets.
Capital (Yes/No)	Capital (Yes/No) is an indicator variable that is 1 if the bank has raised capital in the current quarter.
Log-Capital	Log-Capital is the natural logarithm of the amount raised in that quarter.
ECB Funding/Repo	ECB Funding/Repo is the euro amount of ECB financing divided by total repos from banks, customers and the ECB.
Realized Return (%)	Realized Return is the bank's equity return.
Bank CDS (bps)	Bank CDS is the five-year CDS spread of European banks.
ΔLog(Bank CDS)	Δ Log (Bank CDS) is the change in the log of daily CDS spreads.
Predicted Return	Predicted return is the predicted banks' equity return.
β_{Greece}, β_{Italy}, β_{Spain}	Estimated factor loadings from cross-sectional regressions from banks' stock returns on ten-year government bond returns from Greece, Italy and Spain.
Macro-State Variables	
Stock Index	Stock Index is the residual from the regression of the domestic stock market's daily log returns on daily domestic sovereign bond and German bund returns.
ΔVSTOXX	ΔVSTOXX is change in the VSTOXX Index for the European stock market.
Term Structure	Term Structure is the slope of the term structure of interest rates measured as the difference between the yield on a ten-year euro area government bond and the one-month Euribor.
Bond Default Spread	Bond Default Spread is the difference between the yield on ten-year German BBB bonds and yields on ten-year German government debt.
1 month EURIBOR	One-month EURIBOR is level of the short-term risk-free interest rate measured as the one-month Euribor.
ΔEuropean Economic Sentiment	ΔEuropean Economic Sentiment is the monthly change in the economic sentiment indicator obtained from opinion surveys conducted by the European Central Bank.
ΔLevel of Production	ΔLevel of Industrial Production is the monthly change in the level of industrial production.
ΔEuropean Consumer Price Index	European Consumer Price Index is the change in inflation measured as the monthly change in the European Consumer Price Index.

Appendix II
List of Banks

This table provides a list of all public banks included in the EBA stress tests sorted by asset size as of December 31, 2011. We provide the identifier used to match the banks to SNL Financial, Bloomberg and the EBA stress test data.

Bank	SNL ID	Bloomberg Ticker	EBA ID	Country	Total Assets (EUR Million)
Deutsche Bank AG	113830	DBK	DE017	Germany	2,164,103
HSBC Holdings Plc	113876	HSBA	GB089	United Kingdom	1,967,796
BNP Paribas SA	3001689	BNP	FR013	France	1,965,283
Barclays Plc	114508	BARC	GB090	United Kingdom	1,871,469
Royal Bank of Scotland Group Plc	3001937	RBS	GB088	United Kingdom	1,803,649
Crédit Agricole SA	4085960	ACA	FR014	France	1,723,608
ING Groep N.V.	113837	INGA	NL047	Netherlands	1,273,580
Banco Santander SA	113983	SAN	ES059	Spain	1,251,525
Société Générale SA	113818	GLE	FR016	France	1,181,372
Lloyds Banking Group Plc	4041848	LLO	GB091	United Kingdom	1,161,698
UniCredit SpA	4055762	UCG	IT041	Italy	926,769
Nordea Bank AB	4108919	NDA	SE084	Sweden	716,204
Commerzbank AG	113985	CBK	DE018	Germany	661,763
Intesa Sanpaolo SpA	4100801	ISP	IT040	Italy	639,221
Banco Bilbao Vizcaya Argentaria, SA	113904	BBVA	ES060	Spain	597,688
Danske Bank A/S	4080954	DANSKE	DK008	Denmark	460,832
Dexia SA	4024522	DEXB	BE004	Belgium	412,759
Bankia	4280116	BKIA	ES061	Spain	318,119
KBC Group N.V.	4145062	KBC	BE005	Belgium	285,382
Svenska Handelsbanken AB	4144846	SHBA	SE086	Sweden	275,514
DNB ASA	4142645	DNB	NO051	Norway	274,216
Skandinaviska Enskilda Banken AB	4144847	SEBA	SE085	Sweden	265,219
Banca Monte dei Paschi di Siena SpA	4182766	BMPS	IT042	Italy	240,702
Erste Group Bank AG	4089743	EBS	AT001	Austria	210,006
Swedbank AB	4153551	SWEDA	SE087	Sweden	208,464
Bank of Ireland	4041921	BKIR	IE038	Ireland	154,880
Raiffeisen Bank International AG	4145042	RBI	AT002	Austria	146,985
Allied Irish Banks, Plc	4002079	ALBK	IE037	Ireland	136,651
Banco Popolare Società Cooperativa	4183874	BP	IT043	Italy	134,127
Landesbank Berlin Holding AG	4087940	BEB2	DE027	Germany	131,175
Banco Popular Español SA	4144838	POP	ES064	Spain	130,926
Unione di Banche Italiane SCpA	4238420	UBI	IT044	Italy	129,804
National Bank of Greece SA	4048999	ETE	GR031	Greece	106,732
Banco Sabadell SA	4151699	SAB	ES065	Spain	100,437
Banco Comercial Português SA	4150602	BCP	PT054	Portugal	93,482
Espirito Santo Financial Group SA	4050944	ESF	PT055	Luxembourg	84,020
EFG Eurobank Ergasias SA	4145113	EUROB	GR030	Greece	76,822
Bankinter SA	4144839	BKT	ES069	Spain	59,491
Alpha Bank AE	4080963	ALPHA	GR032	Greece	59,148
Piraeus Bank SA	4145110	TPEIR	GR033	Greece	49,352
Banco BPI SA	4182795	BPI	PT056	Portugal	42,956
PKO Bank Polski SA	4182794	PKO	PL052	Poland	42,735
Österreichische Volksbanken AG	4155879	VBPS	AT003	Austria	41,135
Bank of Cyprus Public Company Limited	4055628	BOCY	CY007	Cyprus	37,474
Jyske Bank A/S	4145097	JYSK	DK009	Denmark	36,364
Cyprus Popular Bank Public Co. Ltd.	4238370	CPB	CY006	Cyprus	33,762
OTP Bank Nyrt	4145030	OTP	HU036	Hungary	32,413
Banco Pastor SA	4182796	PAS	ES074	Spain	30,376
ATEbank SA	4145105	ATE	GR034	Greece	28,818
Sydbank A/S	4145111	SYDN	DK010	Denmark	20,649
TT Hellenic Postbank SA	4185792	TT	GR035	Greece	16,396
Bank of Valletta Plc	4186075	BOV	MT046	Malta	6,623
Nova Kreditna Banka Maribor d.d.	4238383	KBMR	SI058	Slovenia	5,816
FHB Jelzalogbank Nyrt	4186091	FHB	HU111	Hungary	2,593
Caja de Ahorros del Mediterráneo	4120096	CAM	ES083	Spain	NA
Hypo Real Estate	4145051	HRX	DE023	Germany	NA
Irish Life and Permanent	4022210	IPM	IE039	Ireland	NA