

The “Greatest” Carry Trade Ever?

Understanding Eurozone Bank Risks

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Abstract

We investigate the causes of the European banking crisis and argue that banks’ share price decline can in substantial part be explained by banks placing a bet on the survival of the Eurozone in so-called “carry trades”. 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. This cannot be explained simply as “home bias” in sovereign bond holdings of banks. We document that the factor loadings are positively correlated with the actual bond holdings disclosed after the European Banking Authority (EBA) stress tests. We consider various motives for banks to participate in carry-trades such as implicit bailout guarantees, regulatory capital arbitrage, risk shifting, and cheap ECB financing that may have made these trades attractive for European banks. We find that large banks as well as banks with more short-term debt relative to total debt, low Tier-1 ratios and high risk-weighted assets have larger carry trade exposures. We also find evidence consistent with banks actively managing their sovereign portfolio around the stress tests, reducing their exposure before the reporting dates of their portfolio holding, and increasing their exposure after the results had been disclosed. Our time-series results suggest that banks built substantial carry trade portfolios following the ECB operations in 2009, 2010 and the recent 3-year LTROs in December 2011 and February 2012. Finally, banks with more carry trade exposure were more likely to need to, or be asked to, raise capital and they issued more capital, and also depended more on ECB funding in subsequent years.

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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-Management Board & CEO, Dexia SA, Earnings Call, February 23rd, 2012)

The ongoing sovereign debt crisis in Europe has cast doubt on the solvency of European banks which incurred substantial mark-to-market losses and impairments on their peripheral (Greece, Ireland, Portugal, Italy and Spain, or GIPSI) sovereign bond holdings. Since the beginning of 2010, 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 lost on average 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 bank risks during this period can be understood as reflecting a “carry trade” behavior: with access to short-term unsecured funding in wholesale

¹ For almost a decade prior to this, the 10-year sovereign bond yields for these countries hovered around a 4% benchmark with a small yield spread difference between core and peripheral European countries.

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 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 S.A. (Dexia), a Belgium 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). Having been bailed-out once in 2008 as a consequence of losses in the subprime mortgage market, Dexia needed a second bailout by the French, Belgium and Luxembourg governments in October 2011 when it lost access to both secured and unsecured funding. Dexia built-up a risky sovereign bond portfolio almost of a third of the bank’s total balance sheet which was financed almost 50% with short-term funding. As the quality of bond portfolio worsened further, Dexia was unable to roll over the financing of its assets. Regulators ring-fenced the important Belgium banking franchise of the group (Dexia Bank Belgium) while the rest of the group is going to be divested or unwound.

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, going long 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.

At the core of our analysis are all publicly listed banks that took part in the stress tests by the European Banking Authority (EBA). We collect stock price data for these banks and daily 10-year sovereign bond yields over the January 2005 to March 2012 period from Bloomberg and complement this data with financial information from SNL Financial. We 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 explain the eventual stock price collapse of 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 bank exposure to these securities. Each specification includes the home country bond return of each bank to discern a potential "home bias" effect. 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 suggest that banks are "short" long-term German bonds. If long-term German bond 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 bonds. 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. First, we include the home country bond return of each bank and

show that our results cannot be explained by a “home bias” in sovereign bond holdings.² Second, we use the principal component analysis (PCA) to account for the collinearity of bond returns. PCA provides us a linear combination of GIPSI bond returns (essentially an index) that explains the largest part of the variation in GIPSI bond returns. Substituting this index for the GIPSI returns we find results consistent with a carry trade behavior of banks. Third, we use French bond returns as funding leg of the carry trade instead of Germany. Until summer 2011, investors fled into French and German government bonds alike. Later in 2011, the exposure of French banks particularly to Greek surfaced increasing the likelihood that the country needs to bailout its banks. We observe a surge in yields of French government bonds at that time. While we also find negative loadings on French government bonds, they are somewhat smaller compared to the loadings on German bunds. Fourth, we use 2-year GIPSI bond yields and find considerably lower exposure compared to long-term bonds which is intuitive as banks earn higher carry the longer-dated the investment. Fifth, we use changes in bank CDS spreads as dependent variables instead of stock returns. We find that the increasing divergence in yields between GIPSI and German bonds is reflected in higher CDS spreads and funding costs of banks.

Do these exposures relate to actual government bond holdings of banks or simply reflect some other underlying economic exposures and linkages? To answer this important question, we exploit the fact that since July 2010, EBA has disclosed the results of three stress tests together with the portfolio holdings of banks in sovereign bonds. We use these sovereign bond holdings of banks and relate the factor loadings on peripheral bond returns to the actual portfolios. Our results show that larger bond holdings are positively related to the factor loadings (both in the cross-section of banks and in time-series for a given bank) supporting the argument that banks are long GIPSI government debt, confirming that the

² We do find a positive factor loading on the banks’ home country bond return indicates that banks are long 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).

factor loadings measured using market return data indeed proxy well the underlying European banks' exposure to sovereign debt.

In a next step, we explore various motives for banks to engage in carry trades. There are: (1) implicit bailout guarantees, (2) regulatory capital arbitrage, (3) risk shifting, and (4) ECB funding which might have made these trades more attractive for banks. We find that larger banks are significantly more exposed; their stock returns decline more when GIPSI bond prices fall and bunds appreciate in price. This is consistent with large banks exploiting an implicit bailout guarantee from their respective sovereign. Consistent with our arguments above, and after controlling for bank size effects, banks with 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 current Basel II regulation. The Capital Requirement Directive (CRD) assigns a zero risk weight a risk weight for "*exposures to Member States' central government [...] denominated and funded in the domestic currency of that central government*" (BIS (2011)).³ The governments may themselves have had incentives to preserve the zero risk weight to be able to continue to borrow.⁴ Under-capitalized 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 (gambling for resurrection) as this way they shift risk into the states of the world (government defaults) where they are likely to experience bank runs in any case (as argued by Diamond and Rajan,

³ Under the standardized approach, sovereign debt has zero risk weights. 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 chose to switch back to the standardized approach for assessing capital requirements for sovereign debt eventually holding no capital ("IRB permanent partial use").

⁴ The more entangled the financial sector with the governments, the more costly would government default 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).

2011). We find that banks with lower core Tier 1 ratios or higher risk weighted assets have greater exposure to GIPSI bonds. These findings suggest that banks with lower overall capitalization held riskier sovereign bonds (a “risk-shifting” motive), while continuing to meet regulatory capital requirements (a “regulatory arbitrage” motive since sovereign bonds in Europe had zero risk weights in regulatory capital assessments). 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.

We then analyze bank behavior around the three stress tests enforced by the EBA focusing on both the reporting dates as well as the disclosure dates of the stress test results. The different focus and designs of the tests make this an interestingly laboratory to analyze banks’ carry trade behavior. We find results consistent with the notion that banks actively “game” the stress tests. For example, we find that banks with higher Tier 1 ratios as revealed by the regulators in the adverse scenarios reduce their GIPSI exposure more before the reporting date of the second stress test compared to other banks. However, they significantly increase their exposure following the disclosure of the results.

Banks have lost a substantial amount of their capital, in part due to these carry trades having gone bad. We thus ask whether banks’ current carry trades can predict their future capital raisings. We collect all common and preferred equity issuance over the January 2007 – February 2012 period and document that 86% of our sample banks have raised capital during this time period. As proxy for carry trades, we use the predicted returns from the regressions of stock and bond returns as well as the factor loadings from these regressions. We find that banks with more carry trade exposure to Greek government debt are more likely to increase their capital and also raise more capital relative to other banks reflecting the impairments they incurred following the private sector involvement and bailouts. We then ask whether banks with carry trade exposure were also the banks that became particularly dependent on ECB financing. We collect all liabilities from repurchase agreements due to banks, customers and

the ECB from annual reports over the 2008 to 2010 period. We find that banks with more carry trade exposure depend more on 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 which benefit from implicit government guarantees are, on the other hand, less likely to obtain ECB funding.

We then explore the time-series of stock returns both graphically and using quarterly as well as monthly regressions starting in Q1 2009 focusing on 3 key events: (1) the “original” 1 year LTRO in 2009; (ii) the fourth 1-year LTRO in October 2011; and (iii) the 3-year LTROs in December 2011 and February 2012. The ECB started its “original” Long Term Refinancing Operations in 2009 with three 1-year tender in June 6, 2009, September 30, 2009, and December 16, 2009. Overall, the ECB lent EUR 614 billion at an interest rate of 1% to European banks at that time. Since the Lehman default, we observe a widening of the spreads between peripheral and German government bonds. We document a jump in the correlation of banks stock and Italian bond returns around the times the money was injected into the markets which is consistent with banks placing a bet on the temporary divergence of government bond yields. 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 that amounted to EUR 442 billion (that is, 72% of all three operations). Interestingly, the loading on German bunds is becoming more negative suggesting that the ECB measure did not release existing tension in short-term funding markets for banks.⁵

The ECB started another 1-year LTRO on October 27th 2011 responding to increasing pressure on short-term funding markets (in fact, the coefficient of the German bond return is most negative since beginning of that year). In the subsequent month, the estimated factor

⁵ Data on 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 1-year LTRO.

loadings suggest significantly higher exposure towards Italian sovereign debt, but in this case with a partial easing of funding pressure.

Finally, on December 7, 2012, the ECB announced two 3-year LTROs to be allotted on December 26th 2011 and February 29th 2012. Even though there have been some redemptions of ECB funding (and some banks might have replaced short-term with long-term ECB funding) the change in lending to euro area credit institutions has 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. One objective of both operations was to preserve lending to the real sector. The second objective was to resource banks to purchase sovereign debt, in particular Italian and Spanish debt, whose credit spread had risen substantially in the weeks before the LTROs, in ECB funded carry trades. Our results are consistent with a further expansion of the carry trades for some banks. The factor loading on Italian bond returns increases substantially in the months following the December LTRO.⁶

The rest of the paper proceeds as follow. The next section discusses a case study about the build-up 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.

⁶ 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.

I. Dexia S.A. – A Carry Trade Gone Awry

Dexia SA was formed in 1996 through a merger of Credit Local (France) and Crédit Communal (Belgium). In October 2011, the Dexia group needed to be bailed-out for a second time because of carry trades that went wrong (see the quote of Dexia's current CEO above). This chapter explores Dexia's demise in more detail.

A. A period of leverage and portfolio growth

Dexia is organized as parent holding company under Belgium law with three main banking subsidiaries, Dexia Crédit Local (DCL, France), Dexia Bank Belgium (DBB, Belgium) and Dexia Banque Internationale à Luxembourg (DBL, Luxembourg). Dexia is focussed on four major segments (EC (2010)):

1. Public and wholesale banking (PWB), which comprises loans to public sector entities, project finance, the credit enhancement activities of DCL's US subsidiary Financial Security Assurance Inc. (FSA) and the Financial Products (FP) portfolio of FSA which includes a portfolio of bonds and asset-backed-securities mainly directed by DCL and its subsidiaries.
2. Retail and commercial banking (RCB), which comprises business with retail customers in Belgium and Luxembourg directed by DBB and DBL. It also covers the retail activities in Turkey directed by DenizBank, a Dexia subsidiary.
3. Treasury, Funding and Markets (TFM) which comprises the treasury, asset-liability-management and proprietary trading activities of Dexia.
4. Asset Management & Services (AMS), investor services and insurance activities of the group in Belgium, France, Turkey and Ireland.

While Dexia's core lending activities to public sector entities is a low margin business, most of its profitability until summer 2008 was coming from maturity transformation and non-core investment activities. As of October 2008, Dexia was funded with EUR 260 billion short term debt (40% of its balance sheet). The maturity of its assets, on the other hand, including both loans as well as bond portfolio, was beyond 11 years, on average. A major part of short term funding was obtained in the interbank market and money markets against long term assets. Moreover, Dexia's funding structure made DCL highly dependent on intra-group financing (from DBB and DBL).

Dexia was also diversifying into various non-core investment activities. It was strongly exposed to the U.S. market through FSA that led not only to a strong exposure to the municipal bond and municipal debt market but also to more than €120 billion exposure due to credit enhancement activities in U.S. property markets. FSA also provided asset management activities for local authorities guaranteeing the amount of capital invested plus interest which it invested mainly in the U.S. mortgage market and particularly in subprime mortgages (USD 7.6 billion out of USD 17.3 billion as of June 2008 (EC (2009))). FSA also had a sizable off-balance sheet commitment with EUR 55 billion in standby bond purchase agreements (SBPA).

Dexia also 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, as emphasized by Dexia's CEO (see quote above), mainly carry-trades, i.e. 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.

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).

B. The post-Lehman period

During the two weeks following the Lehman Brothers bankruptcy, interbank markets and secured bond markets froze and market participants lost confidence in the business model and viability of Dexia (EC (2009)). It incurred significant losses due to its heavy exposure to bank counterparties.⁸ The stock market decline led to deterioration of Dexia's securities portfolio and Dexia transferred EUR 7 billion into AFS reserve which could heavily impact its capital position once realized. The sub-portfolio of FSA lost in value creating a divergence between money invested from local authorities and portfolio value of USD 4.3 billion as of June 30th, 2008. Dexia set aside USD 5 billion to cover impairments in order to avoid a sale and even higher losses of impaired assets. Dexia lost its ability to issue bonds guaranteed by loans to public sector entities. Even private customers started withdrawing money on September 29th, 2008.

September 29th, 2008. Dexia was close to collapsing on September 29th, 2008. Unsecured funding markets were unavailable, unguaranteed interbank markets (repo markets) as well. Dexia turned to the ECB, the Bank Nationale de Belgique and Banque de France to subscribe to a collateralized line of liquidity amounting to EUR 10-25 billion. Private customers in Belgium and Luxembourg started to withdraw money and S&P announced that it will downgrade Dexia's long term credit rating. Dexia's share fell by 30% on this day and needed an urgent recapitalization to restore confidence in the markets which was finally taken place on October 3rd, 2008.

During the next five days, the stock price declined by 27%. Dexia was shut out of short and long term funding markets and experienced additional pressure on its liquidity when

⁸ Dexia lost EUR 350 million alone because of the Lehman default and had significant exposures to banks in the US, Iceland, Ireland and Turkey.

US municipalities drew from FSA's credit commitments. Belgium, France and Luxembourg announced a guarantee scheme on October 9th, 2008.⁹

The first bailout had three elements: (1) a EUR 6 billion capital injection where Belgium and France became majority shareholders; (2) a EUR 150 billion debt guarantee scheme by Belgium (60.5%), France (36.5%) and Luxembourg (3%). The guarantee covers all financing obtained by Dexia, DBB, DBL and DCL from credit institutions and institutional investors if the maturity of these instruments is before October 31st, 2011; (3) the Belgian and French state provide a guarantee for FSA's securities portfolio up to an amount of USD 16.98 billion, but will be reimbursed by Dexia for a loss up to USD 4.5 billion. The guarantee is supposed to facilitate the sale of FSA. Panel A of Table I shows Dexia's liquidity situation during the 2007 to 2011 period.

[Table I]

Dexia became heavily dependent on bank financing in 2008, its ECB liabilities increase more than 10 times to EUR 121 billion representing 73% of financing in repo markets. At the end of 2008, its loan-to-deposit ratio almost doubled relative to the year because Dexia increased its loan book by 50% but lost about 18% in customer deposits during this year.

Restructuring of Dexia as a consequence of state aid measures. The European Commission approved a restructuring plan containing several actions to be taken by Dexia in order to minimize competitive distortions among European banks and to avoid prolonging excessive risk taking, for example, building up a EUR 203 billion securities portfolio. The

⁹ Dexia also obtained USD funding from the Federal Reserve Bank in the U.S. Fed data show that Dexia borrowed as much as USD 37 billion with an average daily amount of USD 12.3 billion in the 18 months following the Lehman default.

plan has to ensure that the costs of the restructuring process are shared between the bank and the States. These measures should restore Dexia's long-term viability by improving Dexia's capitalization and autonomous access to funding markets.

The restructuring plan allows for a reduction of Dexia's balance sheet by 35% by focusing on its core activities. FSA and related securities will be sold, non-core PWB activities and certain bonds amounting to EUR 161.7 billion will be ringfenced in a Legacy Portfolio Management Division (LPMD) which is separated from the traditional banking activities and placed in run-off under certain funding rules. The off-balance sheet commitment towards certain U.S. municipalities (SBPO) were also placed in the LPMD. Proprietary trading activities were stopped and value-at-risk limits were reduced by 44% relative to 2008.

The European Commission agreed to the restructuring plan. Nevertheless, in its decision, the 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)). 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). Panel B of Table I contains the portfolio holdings in GISPI bonds at 4 points in time from March 2010 to December 2011.

C. The sovereign debt crisis

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 indebtedness 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 will accept Greek sovereign bonds as collateral whatever the rating might be responding to the tensions in the funding market.

Access to wholesale markets. Dexia issues covered bonds through Dexia Municipal Agency (DMA) or Dexia Kommunalbank Deutschland AG (DKD) packaging public finance loans into covered bonds. Access to covered bond markets is crucial for Dexia to mitigate funding imbalances.

In the last quarter of 2008, this market froze and Dexia was only able to issue EUR 1.5 billion covered bonds in the first 4 months of 2009 through private placements. DMA issued EUR 1.5 billion, 12 year covered bonds with a spread of 123 basis points over the midswap curve signaling the reopening of the market at higher costs. Until the wholesale market opens up completely for Dexia, it has to rely on the guarantees extended by France, Belgium and Luxembourg on November 9th, 2008 to issue debt. As of May 25, 2009, the amount of guaranteed debt outstanding was at EUR 92.2 billion.

Dexia has issued EUR 13 billion covered bonds and, overall, €46 billion medium and long term funds in 2009, of which €22.4 billion were state-guaranteed, €13 billion covered bonds, €10.3 billion senior unsecured funds. That is, over 50% of these funds were not state guaranteed.

Until June 2011, Dexia made considerable progress in restructuring the company. Short-term funding has been reduced to EUR 96 billion (-63%) and contingent liquidity risk through SBPA has been reduced by EUR 44 billion since October 2008.¹⁰ The balance sheet has been reduced by 20% to EUR 518 billion, EUR 70.3 billion through disposal of assets. Dexia also cut their costs by 15% due to efficiency gains and refocus on core franchises since 2008. Its Tier 1 ratio increased by 280bps to 13.4% by end of March 2011 but

¹⁰ EUR 44 billion reduction is number as of February 2008 due to missing June 2011 data.

fell to 7.56% at end of 2011 due to losses incurred while Dexia divested its assets.¹¹ However, there was still an obvious asymmetry between the Tier 1 and equity-asset ratio which is - 0.08% on December 31st, 2011. Impairments on assets in Dexia's available-for-sale (AFS) portfolio have been charged against common equity but did not go through the income statement challenging the solvency of the Dexia group.¹²

The carry trade went wrong. Dexia's liquidity has been under pressure since March 2011, when both Moody's and 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. They have been shut-out of short-term funding markets despite the confirmation of their short-term debt rating. Correspondingly, Dexia needed to rely increasingly on central bank funding which reduced the amount of available collateral for further repo transactions. Panel A of Table I suggests that central bank funding (relative to total repo transactions) doubled between 2010 and 2011.

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 its flight into long-term German government bonds. Dexia lost about EUR 40

¹¹ The disposal of Dexia Bank S.A., for example, translated into a EUR 4.1 billion loss. Dexia Bank S.A. was taken over by the Belgium government in October 2011 and is to be renamed "Belfius Banque & Assurances". The impairment of Greek sovereign bonds by 75% led to an additional loss of EUR 3.4 billion over and above the holdings in the Dexia Bank Belgium portfolio.

¹² This is consistent with repeated comments by the Governor of the Belgian Central Bank in April and May 2012 that Dexia needed an additional capital injection.

billion short-term funding within 6 month as the situation got worse 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 1,000bp 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. Dexia was long fixed rate assets and hedged its positions using interest rate swaps. 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

II. Data and Descriptive Statistics

A. Data

To identify the effects of banks' carry trades on stock returns, we construct a dataset using 3 major data sources. We collect market information (bank stock prices, bank and sovereigns CDS spreads, and sovereign bond yields) from Bloomberg, information about bond portfolio holdings from the European Banking Authority (EBA) and the 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 (ECB) and Bank of International Settlement (BIS).

We start with the universe of public banks included in the EBA stress tests. A list of these banks is included in Appendix I.¹³ We collect financial information such as size, leverage and capitalization as well as information about capital raising activity from SNL Financial. In addition to that, we compute stock returns from daily stock prices. We use 10-year government bond yields which are observed on a daily frequency during the 1 January 2005 to 5 March 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 (EBA). The EBA took over the responsibilities from the Committee of European Banking Supervisors (CEBS) on January 1st, 2011. They have been responsible for 3 stress tests that have been conducted in the European banking market since 2010 to “to ensure the orderly functioning and integrity of financial markets and the stability of the financial system in the EU”.¹⁴ In each of these tests, the EBA calculated the Tier 1 capital ratio after considering an adverse scenario of the economy. The results of the tests were published on (1) July 23rd, 2010, (2) July 15th, 2011, and (3) December 8th, 2011. The last test is called a “capital exercise” rather than a stress test because the EBA required banks to raise capital if they fall short of a core Tier-1 capital ratio of 9%.¹⁵

Finally, we collect the Euro amount of funding obtained from the European Central Bank (ECB) from the quarterly and annual reports from each bank.

¹³ We exclude 6 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).

¹⁴ There has been a stress test already in 2009, but neither the names nor details about the results were disclosed except the information that all institutions were adequately capitalized.

¹⁵ The data are publicly available on the website of the EBA (<http://www.eba.europa.eu/Home.aspx>).

B. Descriptive Statistics

We provide descriptive statistics about the returns of GIPSI sovereign bonds as well as German and France 10-year government bonds in Table II. Panel A of Table II shows mean daily bond returns. 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 small variance.

[Table II]

Table II 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 including. 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, correlation between GIPSI and German or French bond returns became negative showing the divergence within the Eurozone. Interestingly, the correlation dropped between France and Germany significantly in 2011. Figure 1 in Appendix III plots the time series of German, French and UK government bond yields. Starting in 2011, there is a sharp increase in French bond yields and an obvious divergence in yields between France and the other two countries. French banks, in particular Credit Agricole and Societe Generale through their Greek subsidiaries, had a particular high exposure to European's periphery. Higher expected bailout costs for these banks most likely explain the rise in government bond yields.

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

[Table III]

Panel A of Table III 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. Tier1 is the Tier 1 capital divided by risk weighted assets. On average, 33% of total debt is short-term debt and banks have a Tier1 ratio of 9.3%. The EBA discloses “stressed” Tier1 ratios under the adverse stress-test scenarios (Tier1_{07/2010}, Tier1_{07/2011} and Tier1_{12/2011}). Appendix II shows these on an individual bank basis. The mean Tier1 ratio under the adverse scenarios is between 8% and 10% at the date of these tests. 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. 86% of them issued capital during that time period. Moreover, 6% of total assets is, on average, funding obtained from the ECB.¹⁶ Panel B provides time-series characteristics of banks’ stock returns and CDS prices which we observe on daily basis. The average daily (quarterly) realized return is -0.14% (-6%) and the average 5-year CDS spread about 183 basis points (bp). We also show average factor loadings estimated quarterly for each bank which are positive for both Italy and Greece and negative for Germany suggesting significant exposure of European banks to peripheral sovereigns. Panel C of Table III finally provides average GIPSI sovereign bond holdings of banks as disclosed by the EBA after all 3 stress tests. Not surprisingly, banks have the largest exposure to Italy as Italy is the world’s

¹⁶ The difference as to the dependence on ECB funding between bank 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 which further speaks to the divergence between the European core and periphery.

third largest bond issuer, followed by Spain and Greece. The Greek exposure drops by 75% in December 2011 reflecting the private sector impairments.

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 variation in bank characteristics to analyze differences in the factor loadings to investigate the various motives banks have to invest in carry trades.

A. "Carry trade" behavior of European banks

In our first set of tests, we regress banks' daily stock return on the return of 10-year peripheral government bonds and German bunds. The factor loadings should provide us with an estimate of the size and direction of the exposure to each security. We first run these test for all GIPSI countries individually, and then jointly using all GIPSI countries. The results are reported in Table IV.

[Table IV]

Model (1) estimates the correlation between stock and Greek government bonds returns. Standard errors are clustered two ways, at the bank and the quarter level to account for autocorrelation of the residuals at the firm and time dimension. 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 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 which 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. 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. Particularly model (6) suggests that carry-trade investments were undertaken mostly in Greece and Italian long-term government bonds.

In Panel B of Table IV, we report a series of tests that support the notion of “carry trade” behavior of European banks.

Home Bias. 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 of each bank in model (1).¹⁷ The positive factor loading on the banks’ home country bond return indicates that banks are long sovereign bonds of their home country. The factor loadings of Greek, Italian and German bonds do not materially change.

Principal component analysis. Bond markets, particularly the sovereign debt market, are characterized by a high degree of collinearity. Principal component analysis (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

¹⁷ The number of observations is somewhat smaller because we were unable to obtain 10-year government bond yields for Malta and Cyprus.

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 carry trade behavior of banks.

Funding Leg. We observe a co-movement of French and German government bond yields for a large part of the previous years. Most recently, however, German and French yields diverged remarkably as depicted in Figure A-1 of Appendix III. In model (3), we substitute French for German government bonds and find, as expected, a negative and significant coefficient, which is smaller in magnitude compared to the factor loadings of German bunds. The coefficients of Greece and Italy are even stronger.

Maturity. 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, 2-year GIPSI sovereign bonds. Model (4) substitutes 2-year GIPSI government bonds for 10-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 a half consistent with the carry trade behavior of banks.

Bank CDS Spreads. 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 bond yields either through an increase in peripheral bond yields or through worsening funding conditions. We test this in models (5) and (6) and use $\Delta \text{Log}(\text{Bank CDS})$ as 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, that is, if Greek bond prices fall,

banks experience, on average, an increase in their CDS spreads. Moreover, if German bond prices appreciate, banks' funding costs also rise, *ceteris paribus* pointing to their exposure to short-term wholesale markets. The principal component analysis 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 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.

B. Factor loadings and bank's 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 each stress test. We know at 3 points in time the banks' exposure to sovereign debt.¹⁸

[Table V]

To analyze whether bank holdings of sovereign bond explain the factor loading from the return regressions, we repeat the analysis from Table IV but restrict our regressions to 60 days before and after the reporting dates on which banks hold the bonds and extract the factor loadings. Table V contains the results regressing the factor loadings (Beta) on some measure for portfolio holdings. We use two measures for portfolio holdings. There are:

$\text{Log}(\text{Holdings}_{\text{GIPSI}})$ is the natural logarithm of GIPSI bond holdings. $\text{Log}(\text{Holdings}_{\text{GIPSI}}/\text{Total Assets})$ is the natural logarithm of GIPSI bond holdings divided by contemporaneous book

¹⁸ As not all banks were included in all 3 stress test, we might have only 2 observations for some banks in our sample.

assets. Models (1) to (4) relate Greek factor loadings to banks' Greek sovereign bond holdings, models (5) to (8) focus on Italy and models (9) – (12) on Spain. The dependent variable is the natural logarithm of the factor loadings of the respective GIPSI country. To visualize the relationship of factor loadings on bond holdings, we plot $\text{Log}(\text{Beta}_{\text{Greece}})$ on $\text{Log}(\text{Holding}_{\text{Greece}}/\text{Assets})$ in Figure 4.

[Figure 4]

The scatterplot shows a positive relationship between factor loadings and bond holdings. We perform cross-sectional (across banks) and time-series (within bank) regressions of loadings on bond holdings and find a consistent pattern. For example, models (1) and (2) show cross-sectional tests of $\text{Log}(\text{Beta}_{\text{Greece}})$ on $\text{Log}(\text{Holding}_{\text{Greece}})$ and $\text{Log}(\text{Holding}_{\text{Greece}} / \text{Assets})$ and reports a positive and significant relationship. That is, banks with larger exposures to Greek sovereign debt also have higher factor loadings (estimated from regressions of stock on sovereign bond returns). Similarly, in time-series tests, if a bank increases (decreases) its exposure to Greece during our sample period, its factor loadings also increase (decrease). These results extend to exposure to other GIPSI countries such as Italy and Spain.

Overall, all tests suggest that an increase in sovereign bond holdings in a bank's portfolio increases the correlation of its stock return with the bond return of the respective sovereign. These results are important and provide strong support for the methodology employed in our paper to identify banks' carry trade behavior using stock and bond returns.

C. Bank risk and leverage

In a variety of cross-sectional tests, we investigate different motives for banks to invest in carry trades. One motivation for banks to invest in carry trades is high risk of banks which might make this behavior more attractive. We investigate this hypothesis in Table VI.

[Table VI]

As Greece, Italy and Spain are the largest exposures in the portfolios of European banks, these countries are also the focus of our analysis. That is, we report tests for each country separately, Greece in columns (1) to (4), Italy in columns (5) to (8) and Spain in columns (9) to (12). We use three proxies for bank risk. There are: 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 1-year lagged bank characteristics to identify the effect of bank risk on their carry trade behavior.¹⁹ As in previous tests, standard errors are clustered at the bank and quarter level.

We start with bank size. It is reasonable to assume that larger banks have a somewhat more international focus and are thus most likely also engage to a larger extent in cross-border investments within the euro area. They can be expected to also diversify their funding sources such that they have a larger exposure also to wholesale funding. More importantly, they benefit from an implicit bailout guarantee. Larger banks are more systemically important and are most likely to be rescued when they are in distress. Focusing on Greece, we include Log-Assets and interaction terms with GIPSI sovereign bonds and German bunds in column (1) and (4). We find that larger banks do more carry trades, they have higher exposure to Greek sovereign debt which they finance with short-term debt, that

¹⁹ 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 control variable in all models.

is, the interaction term with German bunds is highly significant and negative. In the next step, we introduce a direct measure of short-term leverage and bank funding risk in models (2) and (4). The latter model jointly tests the effect of all risk proxies which is important because balance sheet items are usually at least to some extent collinear. In other words, our risk proxies which might pick up other effects when used individually. Based on our discussion above we would expect significantly more negative stock returns for banks that engage in carry trades and have more short-term leverage. And our results support this hypothesis: the interaction term of ST-LVG with German government bonds returns is negative and significant. Moreover, we find that riskier banks are also more exposed to Greek (and also Italian and Spanish) sovereign debt. As a third measure of risk we introduce the amount of loans to customers divided by total assets. While not significant in the individual regression, we find a strong effect in the joint regression on the investment leg of the carry trade. Banks that are riskier as measured by larger loan portfolios relative to total assets are more exposed to peripheral sovereign debt.²⁰ For all three measures, the effects are somewhat smaller for Greece than for Italy and Spain, which is not surprising given the impairments that have already taken place.

Taken together, bank risk is important in explaining bank behavior in the cross-section. Particularly large banks and banks with short-term leverage are undertaking more carry trades.

D. Capital Adequacy

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

²⁰ One possible interpretation is that banks with large loan portfolios try to shift into low risk-weighted assets. We analyze regulatory capital arbitrage as motivation for carry trade behavior in the next section.

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)). That is, despite (even little) differences in country ratings, banks were allowed to reduce their capital they hold against these positions to zero. Consequently, particularly under-capitalized banks, that is, banks with low Tier-1 capital ratios, 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). We test this hypothesis using Tier1, which is defined as Tier1 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 Greece (columns (1) to (3)), Italy (columns (4) to (6)) and Spain (columns (7) to (9)). In models (3), (6) and (9), we jointly estimate the effect of Tier1 capital ratio and RWA / Assets, and include ST-LVG. Bank funding risk is not considered in the regulatory framework but we have shown that it is an important determinant of bank behavior in the previous section. Our proxies for regulatory should not pick up a bank’s exposure to short-term funding including the respective controls. Moreover, in all regressions, we include Log-Assets as well as interaction terms with GIPSI and Germany to control for bank size.

[Table VII]

We observe throughout all models that size is an important determinant of bank carry trade behavior as we have also seen in the previous section. More importantly, we find evidence consistent with regulatory capital arbitrage and risk shifting as further important motives to engage in carry trades. For example, in models (4) and (5) we study the effects for banks’ investment in Italian sovereign bonds using Tier1 (model (4)) and RWA / Assets

(model (5)) as proxies for regulatory capital.²¹ We find that banks with higher Tier1 capital ratios have lower exposure to Italian sovereign debt. Tier1 increases if 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. Including both variables in the same model (column (6)) shows that the coefficient of Tier1 is even more negative. 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 (4). We find similar effects analyzing investments into Spanish government bonds. As we have seen above, the effects on Greek government bond holdings are (not surprisingly) somewhat muted.

D. Carry trade behavior around the EBA stress tests

Since the beginning of the sovereign debt crisis in early 2010, the EBA has performed 2 stress tests to assess the soundness of the European banking system.²²

The first stress test was designed to assess the resilience of the banking sector in the EU to absorb shocks on credit and market risk (EBA (2010)). Liquidity risk was not stress tested. 91 banks were included in the test that at least comprises 50% of total assets of the

²¹ We include Tier1 and RWA / Assets (without interactions) but do not report the coefficients for brevity. However, we find that banks with high Tier1 ratios as well as low RWA / Assets have higher stock returns. The constant term as well as Log-Assets are also not reported. Standard errors are clustered at bank and quarter.

²² The tests have been widely criticized for being too lax because hardly any bank failed them. For example, all Irish banks passed the July 2010 stress test but needed to be bailed out soon after. However, the EBA disclosed an amount of data that has not been available about bank portfolio holdings to that date. For example, they disclosed Tier 1 ratios after projecting losses in the adverse scenarios based on which they calculate whether or not the sample banks have passed the stress test. Appendix II shows a table that contains the Tier 1 ratios of our sample banks as of December 31, 2009 and December 31, 2010. It also reports the Tier 1 ratio calculated by the EBA under the adverse scenarios in all tests. The table is sorted by the December 31, 2009 Tier 1 ratio in descending order. Interestingly, the bank with the highest Tier 1 ratio at that time was TT Hellenic Postbank, a Greek bank that is now insolvent.

banking sector and 65% of total assets of the EU banking sector. Sovereign risk was stress tested only in the trading book. The EBA explicitly excluded an impact on the held-to-maturity (HTM) banking book not considering a sovereign default. The stress test was carried out under a constant balance sheet assumption using end of 2009 data over a 2 year period. Regulatory imposed decisions as well as management actions until 1st July 2010 were taken into consideration. Around EUR 169 billion of government capital contribution were included corresponding to 1.2 percentage points of aggregate Tier 1 capital. A bank failed the stress test if its Tier 1 capital ratio falls short of the hurdle set by the EBA which is 6% of RWA. 7 banks eventually failed the stress test with an overall shortfall of EUR 3.5 billion.²³

The second stress test was designed to assess the resilience of banks against an adverse scenario such as deterioration in GDP, unemployment and housing prices (EBA (2011 a)). Only sovereign debt held in the trading book was subject to haircuts. However, banks were required to hold provisions against a deteriorating credit quality of sovereign debt in the banking book with a floor established by PDs estimated from external ratings and LGDs based on the most conservative estimate used by the banks. The stress test considered an increase in funding costs due to rising interest rates and sovereign yield spreads. The stress tests were based on a static balance sheet assumption at end of December 2010 and conducted over 2 years. Banks were required to hold highest quality core Tier 1 capital that exceed the hurdle set by the EBA of 5% of RWA. Capital at end of 2010 already included about EUR 160 billion government support. If only capital had been considered at end of 2010, 20 banks (that is 22% of all banks) would have failed the stress test. However, the EBA included specific capital measures during the first 4 months of 2011 in the calculation of capital and thus gave banks incentives to strengthen their capital positions. About EUR 50 billion in

²³ For example, the EBA reported a stressed-Tier 1 ratio for Dexia of 10.9% in the adverse scenario end of 2011. Dexia's actual Tier 1 ratio was 7.5% and it still has a substantial reserve account with impairments on sovereign debt that did not go through income statement yet.

capital has been raised until April 2011 on a net basis. Consequently, only 8 banks fell below the 5% core Tier 1 hurdle. The results have been disclosed on July 15th, 2011.

The third test was a “capital exercise” and designed to address market concerns about sovereign risk by creating an “exceptional and temporary” capital buffer such that banks are able to withstand a shock to their sovereign portfolio (EBA (2011 b)).²⁴ Contrary to the stress tests, banks’ balance sheet were not stressed as to the resilience against adverse scenarios but they were required to hold a capital buffer that reflected the difference between the book value of their sovereign portfolio in the held-to-maturity (HTM) portfolio and the revalued amount based on end of September 2011 market prices and the impact on the available-for-sale (AFS) portfolio after removing potential filters that prevented the valuation of assets to be directly reflected in capital. Overall, the capital shortfall (as of end of Sept. 2011) was calculated as the difference between 9% of RWA and the core Tier 1 capital (both measured at end of Sept. 2011) plus the sovereign capital buffer.²⁵

We analyze banks behavior around the reporting and disclosure dates of the tests in Table VIII.

[Table VIII]

Panel A of Table VIII reports the results from the analysis around the reporting dates of each stress test. To focus on the events, we include observations in the quarter before and after the reporting dates. Tier 1_{*i*}, where subscript *i* represent the stress test dates, are the stressed Tier 1 ratios from these tests. Before_{*i*} is an indicator variable that is 1 if we observe banks before the reporting date. Results for Greece are reported in columns (1) to (3), for Italy

²⁴ 71 of the bank from the 2011 stress test were included in the capital exercise; smaller non-cross border banks were excluded. Also, data for Greek banks were not disclosed because the EU/IMF assistance programs already defined targets with respect to backstop measures that exceed the EBA exercise.

²⁵ Core Tier 1 capital was defined as in the 2011 stress test. Banks had to incorporate the CDR 3 requirements when calculating the core Tier1 capital ratios (that is, Basel 2.5 requirements with respect to changes in trading book and securitization treatment).

in columns (4) to (6) and Spain in columns (7) to (9) each around the reporting dates of the first, second and third stress test. We find weak evidence that banks reduce exposure to Italy and Spain before the reporting date of the first stress test. Overall, there is very little evidence that banks reacted to this test with respect to their sovereign exposure, probably because sovereign risk was not focus of this test and many banks had already transferred their exposure from the trading to the banking book.

During the second stress test and consistent with risk shifting behavior of banks, we find that banks with high stressed Tier 1 ratios have lower exposure to GIPSI sovereign bonds and also have lower exposure to short-term funding around the reporting dates. Regulators explicitly consider possible increases in funding costs of banks in this test. In unreported tests, we split the Tier 1 ratios into terciles and find evidence that particularly medium quality borrowers reduce their GIPSI exposure before the reporting dates which is consistent with window dressing behavior of banks that are closer to the Tier 1 hurdle set by the EBA.

The capital exercise explicitly evaluated the GIPSI portfolio of banks without stressing the remaining portfolio. We find that banks reacted to this test: particularly banks with higher Tier 1 ratios are reducing their GIPSI exposure more in the time before the reporting date of the test. Interestingly, we find that they have substantially higher exposure to short term funding markets before the reporting date relative to after which consistent with notion that banks game the tests designed by the EBA.

Panel B of Table VIII reports the results from the analysis around the disclosure dates of each stress test. Again, we do not find that banks reacted to the first stress test. More importantly, analyzing the behavior after the disclosure of the second stress test, we find that the higher Tier1 banks that reduced the exposure more strongly before the reporting date of the tests are no significantly increasing their exposure to GIPSI sovereigns.

Overall, these results suggest that banks actively game the stress tests.

IV. Capital Issuance Activities of European Banks and ECB Funding

A. Predicting capital raisings with carry trades

In the previous sections we argued that carry trade behavior was pervasive among Eurozone banks. However, as the sovereign debt crisis unfolded, sovereign yields continued to climb and investors fled into high quality assets such as German bunds, and banks' equity value dropped substantially. It is thus a natural question to ask whether banks' current carry trades can predict its future capital raising activities.

To answer this important question, we collect all common and preferred stock issuances of our sample banks over the January 2007 to February 2012 period on a quarterly basis. Capital (Yes / No) is an indicator variable that is 1 if the bank raises capital in the current quarter. As we have seen earlier, 86% of them have raised capital during this period.²⁶ Log-Capital is the natural logarithm of the amount of common and preferred capital raised. 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 based on the estimated factor loadings and the constant term. 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. In a next step, we relate capital raisings to the 1 quarter lagged carry trade behavior of banks. The results are reported in Table IX.

[Table IX]

In models (1) and (2), we first relate capital raisings to the *realized* return in the previous quarter. All regressions include Log-Assets as additional control variable. The

²⁶ We do not differentiate economically between common and preferred stock and add both volumes on a quarterly basis.

results suggest that banks with lower realized returns as well as larger banks are both more likely to raise capital in the subsequent quarter (column (1)) and they raise more capital (column (2)). We then regress our dependent variables on the predicted returns and find that the lower the banks' stock return from carry trades the higher the likelihood that they raise capital and the more capital they raise (columns (3) and (4)). As a third test, we use the estimated factor loadings, $\text{Beta}_{\text{Greece}}$ in columns (5) and (6) and $\text{Beta}_{\text{Italy}}$ in columns (7) and (8). Banks with larger exposures to Greece are more likely to raise capital in the following quarter and also raise more capital. 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 prompt banks to raise capital. During our sample period, banks only impaired their Greek bond holdings because of the "private sector involvement" when negotiating the bailouts.

B. Carry trades and ECB dependence

Were the banks which did carry trades also the ones that became particularly dependent on ECB funds? This is an important question for regulators in Europe as a positive answer would imply that carry trade behavior of banks led to massive disruptions in the interbank markets and required regulators to step in with emergency funding. We 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.²⁷ As we have seen earlier, there is a huge divergence as to each bank's dependence on ECB funds, from almost zero dependence to fully dependent. The top 5 ECB dependent firms are Bankinter, ATEbank, Banco Commerciale Portugese, Piraeus Bank, and Alpha Bank. The least 5 bank dependent firms are RBS, Société Générale, BNP Paribas, Banco Sabadell and Crédit Agricole.

²⁷ 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 usually not in English and with very limited information.

Apparently, particularly the peripheral banks struggle to obtain financing from interbank markets or any other source than the ECB, while large core European banks do hardly depend on ECB financing.

We test this in a multivariate regression model, trying to explain ECB Funding / Repo with banks' past carry trade behavior. ECB Funding / Repo is the percentage of each banks funding obtained from the ECB in each year divided by total repos with banks, customers and the ECB. Our independent variables, Realized Return, Predicted Return, and the factor loadings ($\text{Beta}_{\text{Greece}}$, $\text{Beta}_{\text{Italy}}$, and $\text{Beta}_{\text{Germany}}$) are measured annually and are lagged by 1 year. We always include Log-Assets as bank size seems to be an important determinant. For example, implicit bailout guarantees of large banks from their governments help them obtaining financing in secured or unsecured interbank markets. The results are reported in Panel B of Table IX. Standard errors are clustered at the bank level. We do not find evidence that past realized returns predict future ECB dependence. However, Predicted Return is negative and significant suggesting that the part of the return that due to carry trade behavior is an important determinant of future ECB funding, or, in other words, banks that do more carry trades need to turn more to the ECB for funding in the subsequent year relative to other banks. Using the vectors of factor loadings shows consistent results. Again, the private sector involvement associated with the Greece bailouts seems to explain a large part of the variation in ECB dependence among banks exposed to this country. Moreover, it is the banks that are heavily exposed to short-term wholesale markets (that is, with more negative $\text{Beta}_{\text{Germany}}$) are more reliant on ECB funding as well.

V. The Role of the ECB in Funding Carry Trades

This section explores the role of the ECB in funding the carry trades both graphically and using monthly regressions starting in Q1 2009 focusing on 3 key events: (1)

the “original” 1 year LTRO in 2009; (ii) the fourth 1-year LTRO in October 2011; and (iii) the 3-year LTROs in December 2011 and February 2012.

A. Building-up a portfolio of “cheap” sovereign debt

In the “original” 1-year Long Term Refinancing Operations (LTRO) in 2009, the ECB lent about EUR 614 billion to European banks at an interest rate of 1 percent.

“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.

We analyze the time-series characteristics of the pairwise correlation between peripheral government bonds and banks’ stock returns using Italian government debt as an example.

[Figure 4]

Figure 4 shows the average 30-day rolling correlation 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 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, 2012. 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 building up their Italian bond holdings substantially.²⁸

Figure 4 strikingly shows how the spreads between two legs of the carry trade diverged resulting in significant losses for banks. In the first half of 2010 and particularly 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 decreases because Italian (more generally, GIPSI) bond yields are rising and because German long-term bond yields are falling.²⁹

[Figure 5]

Figure 5 shows quarterly inflows into the public sector by European banks and the central banks for the Q1 2008 to Q1 2012 period. The numbers are reported in the March banking and financial stability report by the Deutsche Bundesbank. More than EUR 280 billion have been invested by banks in the first three quarters of 2009 and in the first quarter of 2010, after the third 1-year LTRO. While banks have been net seller of sovereign debt in Q1 and Q3 2011,

²⁸ There are some estimates reporting that from the first 1-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).

²⁹ We then perform quarterly cross-sectional tests of stock returns on Italian, German and home country bond returns. Appendix III - Table II contains the results. We find that already 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 that amounted to EUR 442 billion (that is, 72% of all three operations). Interestingly, the loading on German bunds is becoming more negative suggesting that the ECB measure did not release existing tensions in short-term funding markets for banks.

they purchased again in Q4 2011 after the fourth 1-year LTRO. About EUR 130 billion of flows in Q3 and Q4 2011 were coming from the Eurosystem.

Overall, this discussion suggests that the ECB played a major role in the build-up of European banks' sovereign bond portfolios through since 2009.

B. The effect of ECB's 3-year LTRO

On December 7, 2012, the ECB announced two 3-year LTROs to be allotted on December 26th 2011 and February 29th 2012. After accounting for redemptions of existing ECB fund, the LTROs increased lending to credit institutions in the euro area by EUR 783 billion according to data released by the ECB. One objective of both operations was to preserve lending to the real sector. The second objective was to resource banks to purchase sovereign debt, in particular Italian and Spanish debt, whose credit spread had risen substantially in the weeks before the LTROs, in ECB funded carry trades.

Both the quarterly flow data in Figure 5 as well as the correlation displayed in Figure 4 suggests that banks increased their exposure to sovereign debt by more than EUR 100 billion. Figure 3 shows more specifically the rise in the exposure to Italian government bonds. We perform monthly regressions of stock returns on our risk factors around the most recent LTRO events. The results are reported in Table X.

[Table X]

Starting in November, i.e. immediately after the fourth 1-year LTRO, the coefficient of Italian bond returns even tripled from November 2011 to February 2012. Before the LTROs in Q3 and Q4 2011, interbank market froze and investors flew into German government bonds causing bond prices to rise. This increased the divergence between the two legs of the carry trade and banks that were placing these bets were incurring losses. The

correlation between stock returns and bunds suggest that the LTROs somewhat relieved the tension in the funding markets.

Overall, our results are consistent with a further expansion of the carry trades.³⁰

V. Conclusion

During the past 2 years, increasing economic imbalances between core 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 into German bunds.

In this paper, we argue 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 and the situation materialized as it is, 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 investigate differences in the behavior of banks exploiting variation among banks with regard to size, leverage or capitalization and find that larger and less capitalized banks are more exposed to carry trades. There are various motives for banks to participate in carry-trades such as regulatory capital arbitrage, gambling for resurrection, remuneration incentives, and cheap ECB financing. In future work, we aim to investigate these motives and differentiate between them.

³⁰ 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 gone down and regulators are worried how banks invest the excess liquidity from the LTROs.

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Table I. Dexia S.A. Liquidity and Sovereign Debt Holdings

This table reports Dexia's bond holdings at four different points in time: (1) 31.3.2010, (2) 31.12.2010, (3) 30.9.2011 and (4) 31.12.2011. Numbers are in million Euros if not differently reported.

Panel A. Dexia's liquidity profile

Item	2007	2008	2009	2010	2011
Central bank funds/ liabilities due to central banks	12,414	120,559	54,502	25,520	27,315
Repurchase agreements due to banks	35,755	35,331	31,512	34,873	17,423
Repurchase agreements due to customers	2,994	9,314	20,180	19,161	38
Central bank dependence	0.24	0.73	0.51	0.32	0.61
Deposits due to Banks	178,681	213,192	123,724	98,490	106,384
Deposits due to customers	120,493	102,340	97,739	105,001	16,870
Total Loans	243,635	368,961	354,079	352,606	173,566
Total Loans (% Deposits due to Customers)	2.02	3.61	3.62	3.36	10.29

Panel B. Dexia's bond portfolio holdings

As of	Greece	Ireland	Italy	Portugal	Spain	Total (GIPSI)
31.03.2010	3,747	147	17,553	2,817	1,823	26,087
31.12.2010	3,462	0	15,009	1,927	1,443	21,842
30.09.2011	4,034	0	14,343	1,926	1,399	21,703
31.12.2011	747	0	9,779	1,575	481	12,582

Table II. Descriptive Statistics on Return Correlations

This table contains descriptive statistics (**Panel A**) and correlations (**Panel B**) of 10-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%
France	0.00%	0.37%	0.00%	-2.58%	2.77%

Panel B. Sovereign bond return correlations (2005)

	Greece	Italy	Portugal	Spain	Ireland	Germany	France
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	
France	0.96	0.98	0.66	0.98	0.94	0.98	1.00

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

	Greece	Italy	Portugal	Spain	Ireland	Germany	France
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	
France	-0.02	0.22	0.00	0.23	-0.03	0.51	1.00

Table III. 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. **Tier1-Ratio** is Tier 1 capital divided by risk weighted assets. **Tier1_{07/2010}** the Tier 1 capital ratio in the adverse scenario of the July 2010 stress test; **Tier1_{07/2011}** the Tier 1 capital ratio in the adverse scenario of the July 2011 stress test; **Tier1_{12/2011}** is the Tier 1 capital ratio in the adverse scenario of the December 2011 stress test. **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 5-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. β_{Greece} , β_{Italy} , and β_{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 Ireland** government bonds at the time of the 3 stress test.

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
<i>"Stressed" Tier 1 Ratios</i>						
Tier1_{07/2010}	49	0.10	0.02	0.07	0.10	0.17
Tier1_{07/2011}	50	0.08	0.03	-0.01	0.08	0.14
Tier1_{12/2011}	41	0.10	0.03	0.06	0.09	0.20
<i>Capital Issuance Activity & ECB Funding</i>						
<i>Jan 2007 - Feb 2012</i>						
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-Funding / Repo	32	0.47	0.29	0.01	0.50	1.00

Panel B. Time-series

	Obs	Mean	Std-Dev	Min	P50	Max
<i>Daily returns Jan 2006 - Feb 2012</i>						
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
<i>Quarterly returns Q1 2008 - Q1 2012</i>						
Realized Return (%)	833	-6%	26%	-87%	-7%	161%
Predicted Return (%)	833	-8%	38%	-275%	-8%	186%
β_{Italy}	833	1.55	2.89	-7.94	0.87	25.87
β_{Greece}	833	0.09	2.02	-18.23	0.14	11.08
β_{Germany}	833	-2.96	2.35	-20.05	-2.68	8.39

Panel C. Sovereign bond holdings

	Greece	Italy	Spain	Portugal	Ireland
July 2010	2,073	5,934	3,065	639	533
July 2011	1,500	4,882	2,975	544	282
December 2011	569	5,142	3,007	646	380

Table IV. Stock and Bond Return Correlations

This table contains the results of the cross-sectional analysis of individual banks stock returns on sovereign bond returns over the January 2006 – 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 10 year German bond returns (**Germany**) as “funding leg” of the carry trade. **Panel B** contains results of various model specifications: (1) reports factor loadings of home country bond returns (**Home**); (2) reports the results of a principal component analysis (**PC1**); (3) uses French bond returns as funding leg of the carry trade; (4) uses 2-year government bond returns; (5) and (6) report the results of the cross-sectional analysis of bank CDS spread changes on GIPSI bond returns. Dependent variable in (5) and (6) is $\Delta \text{Log}(\text{Bank CDS})$. 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	0.193*** (6.98)					0.150*** (8.19)
Italy		0.649*** (3.47)				0.526*** (2.63)
Spain			0.578*** (4.14)			-0.065 (-0.32)
Portugal				0.182** (2.11)		-0.009 (-0.52)
Ireland					0.347*** (3.15)	0.097 (1.29)
Germany	-2.299*** (-12.74)	-2.469*** (-11.73)	-2.522*** (-12.58)	-2.370*** (-12.05)	-2.393*** (-12.23)	-2.401*** (-13.37)
Constant	-0.001 (-1.00)	-0.001 (-1.43)	-0.001 (-1.36)	-0.001 (-1.34)	-0.001 (-1.30)	-0.001 (-1.05)
Observations	63,105	63,105	63,105	63,105	63,105	63,105
R-squared	0.12	0.12	0.12	0.11	0.12	0.13

Panel B. Robustness tests

	(1) Home Bias	(2) PC1	(3) Funding Leg	(4) Maturity	(5) $\Delta \text{Log}(\text{Bank CDS})$	(6) $\Delta \text{Log}(\text{Bank CDS})$
Greece	0.129*** (6.35)		0.175*** (8.58)	0.021*** (2.58)	-0.213*** (-4.60)	
Portugal	-0.018 (-0.92)		-0.023 (-0.42)	-0.015 (-1.38)	-0.098* (-1.72)	
Italy	0.518** (2.54)		0.968*** (5.50)	0.212** (2.48)	-0.296 (-1.23)	
Spain	-0.073 (-0.35)		-0.147 (-0.48)	0.004 (0.03)	-0.204 (-0.90)	
Ireland	0.091 (1.17)		0.102 (1.25)	0.077** (2.29)	-0.181 (-1.58)	
Germany	-2.598*** (-14.69)	-2.483*** (-12.76)		-2.305*** (-13.08)	2.939*** (5.68)	3.049*** (5.42)
Home	0.180*** (3.02)					
PC1		0.003*** (6.22)				-0.005*** (-4.05)
France			-2.133*** (-6.42)			
Constant	-0.001 (-0.93)	-0.001 (-1.53)	-0.001 (-1.19)	-0.001 (-1.29)	0.002 (1.47)	0.002** (1.99)
Observations	56,234	63,105	63,105	63,105	31,109	31,109
R-squared	0.14	0.13	0.09	0.12	0.09	0.09

Table V. Bond Holdings and Factor Loadings

This table contains the cross-sectional regressions of factor loadings on sovereign bond holdings. $\text{Log}(\text{Holdings}_{\text{GIPSI}})$ is the natural logarithm of GIPSI bond holdings. $\text{Log}(\text{Holdings}_{\text{GIPSI}}/\text{Total Assets})$ is the natural logarithm of GIPSI bond holdings divided by total book assets. $\text{Log}(\text{Beta})$ is the natural logarithm of factor loadings. Results for **Greece** are reported in models (1) to (4), for **Italy** in models (5) to (8) and **Spain** in models (9) to (12). Factor loadings are estimated using the cross-sectional regressions from models (1), (2) and (3) in Panel A of Table IV, estimated 60 days before and after the reporting date. Standard errors are clustered at bank level. t-statistics are given in parentheses. ***,** and * indicate significance at 1, 5 and 10% levels, respectively.

Dependent Variables	$\text{Log}(\text{Beta}_{\text{Greece}})$				$\text{Log}(\text{Beta}_{\text{Italy}})$				$\text{Log}(\text{Beta}_{\text{Spain}})$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\text{Log}(\text{Holding}_{\text{GIPSI}})$	0.171*** (4.00)		0.236** (2.08)		0.104** (2.23)		0.609** (2.38)		0.157*** (3.02)		0.285 (0.73)	
$\text{Log}(\text{Holding}_{\text{GIPSI}} / \text{Assets})$		0.126*** (4.14)		0.228** (2.11)		0.110** (2.48)		0.636** (2.45)		0.127*** (3.18)		0.286 (0.77)
Constant	-2.717*** (-8.85)	-0.854*** (-4.14)	-3.128*** (-4.33)	-0.234 (-0.36)	-0.903** (-2.30)	0.456* (1.94)	-4.452** (-2.48)	3.483** (2.34)	-1.492*** (-3.40)	0.354 (1.52)	-2.351 (-0.90)	1.350 (0.58)
Bank Fixed Effects	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
Observations	93	93	93	93	83	83	83	83	76	76	76	76
R-squared	0.13	0.11	0.03	0.03	0.05	0.04	0.12	0.13	0.08	0.05	0.01	0.01

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 10 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 10-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. 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 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.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Greece	Greece	Greece	Greece	Italy	Italy	Italy	Italy	Spain	Spain	Spain	Spain
GIPSI_t	0.062 (0.68)	0.115** (2.53)	0.186*** (3.85)	-0.271** (-2.38)	0.079 (0.31)	0.339** (2.33)	0.441** (2.21)	-1.923*** (-4.17)	0.084 (0.21)	0.404** (2.48)	0.293 (1.62)	-1.866*** (-3.79)
GIPSI x Log-Assets_{t-1}	0.011 (1.59)			0.018*** (2.91)	0.046** (2.39)			0.108*** (4.15)	0.040 (1.41)			0.106*** (3.82)
GIPSI x ST-LVG_{t-1}		0.234** (2.16)		0.283** (2.25)		0.980** (2.24)		1.212*** (2.94)		0.578* (1.67)		0.850** (2.32)
GIPSI x Loans / Assets_{t-1}			0.011 (0.11)	0.265*** (2.65)			0.338 (1.48)	1.527*** (5.26)			0.480 (1.63)	1.543*** (5.21)
Germany_t	1.038 (1.36)	-1.816*** (-7.30)	-2.931*** (-6.67)	1.779 (1.18)	0.958 (1.16)	-1.828*** (-6.82)	-3.062*** (-6.63)	2.331 (1.53)	0.968 (1.11)	-1.918*** (-7.13)	-3.058*** (-6.44)	2.469 (1.56)
Germany x Log-Assets_{t-1}	-0.278*** (-4.29)			-0.285*** (-3.38)	-0.285*** (-4.19)			-0.304*** (-3.61)	-0.290*** (-4.03)			-0.315*** (-3.55)
Germany x ST-LVG_{t-1}		-1.477*** (-2.64)		-0.653 (-1.58)		-1.971*** (-2.88)		-1.361** (-2.27)		-1.859*** (-2.73)		-1.296** (-2.18)
Germany x Loans / Assets_{t-1}			1.131* (1.87)	-0.769 (-0.83)			1.068 (1.59)	-1.221 (-1.28)			0.971 (1.39)	-1.368 (-1.43)
Constant	-0.003** (-2.04)	-0.001 (-1.08)	-0.001 (-1.12)	-0.001 (-1.01)	-0.003** (-2.07)	-0.001 (-1.21)	-0.001 (-1.10)	-0.001 (-0.91)	-0.003** (-2.11)	-0.001 (-1.16)	-0.001 (-1.15)	-0.001 (-0.90)
Observations	62,862	46,767	61,554	45,459	62,862	46,767	61,554	45,459	62,862	46,767	61,554	45,459
R-squared	0.13	0.13	0.12	0.13	0.13	0.13	0.12	0.13	0.12	0.13	0.12	0.13

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 10 year peripheral government bond returns which is **Greece** in models (1) to (3), **Italy** in models (4) to (6) and **Spain** in models (7) to (9). **Germany** is the 10-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. **Tier1-Ratio** is Tier 1 capital divided by risk weighted assets. **RWA/Assets** is book assets divided by risk weighted assets. **ST-LVG** is short term debt divided by total debt. All regression specifications include bank size (Log-Assets) and a constant term that are omitted. 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.

	(1) Greece	(2) Greece	(3) Greece	(4) Italy	(5) Italy	(6) Italy	(7) Spain	(8) Spain	(9) Spain
GIPSI_t	0.083 (0.73)	-0.071 (-0.63)	-0.244 (-1.32)	0.703* (1.85)	-0.891* (-1.82)	-0.108 (-0.24)	0.443 (0.92)	-0.941* (-1.94)	-0.901* (-1.69)
GIPSI x Log-Assets_{t-1}	0.012* (1.73)	0.017** (2.21)	0.022*** (2.71)	0.054** (2.10)	0.094*** (2.64)	0.088*** (4.05)	0.050* (1.77)	0.091*** (2.79)	0.110*** (4.40)
GIPSI_t x Tier 1_{t-1}	-0.003 (-0.59)		-0.002 (-0.24)	-0.070** (-2.42)		-0.096*** (-4.32)	-0.046* (-1.95)		-0.056*** (-2.63)
GIPSI_t x RWA / Assets_{t-1}		0.113 (1.42)	0.185* (1.76)		0.778*** (2.67)	0.395 (1.35)		0.806*** (2.63)	0.765** (2.43)
GIPSI_t x ST-LVG_{t-1}			0.300** (2.31)			1.566*** (3.88)			1.080*** (3.33)
Germany_t	1.237 (1.26)	0.449 (0.44)	1.797 (0.91)	0.808 (0.72)	0.774 (0.69)	1.415 (0.64)	0.821 (0.72)	0.861 (0.74)	1.523 (0.71)
Germany x Log-Assets_{t-1}	-0.268*** (-4.15)	-0.241*** (-3.46)	-0.281*** (-3.02)	-0.283*** (-4.00)	-0.268*** (-3.48)	-0.293*** (-2.98)	-0.287*** (-3.85)	-0.277*** (-3.49)	-0.301*** (-3.05)
Germany x Tier 1_{t-1}	-0.032 (-0.75)		-0.040 (-0.62)	0.009 (0.17)		0.020 (0.26)	0.008 (0.16)		0.019 (0.27)
Germany_t x RWA / Assets_{t-1}		0.287 (0.49)	-0.346 (-0.38)		-0.037 (-0.06)	-0.296 (-0.29)		-0.096 (-0.14)	-0.408 (-0.40)
Germany x ST-LVG_{t-1}			-0.598 (-1.38)			-1.567** (-2.51)			-1.455** (-2.49)
Observations	60,700	60,747	44,785	60,700	60,747	44,785	60,700	60,747	44,785
R-squared	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.13

Table VIII. EBA Stress Tests

Panel A of Table VIII contains the results of the cross-sectional analysis of banks' carry trade behavior around the *reporting dates* of the 3 EBA stress tests. The dependent variable is the banks' daily stock return.: (1) **Tier1_{07/2010}** the Tier 1 capital ratio in the adverse scenario of the July 2010 stress test; (2) **Tier1_{07/2011}** the Tier 1 capital ratio in the adverse scenario of the July 2011 stress test; (3) **Tier1_{12/2011}** is the Tier 1 capital ratio in the adverse scenario of the December 2011 stress test. **GIPSI** proxies for 10 year peripheral government bond returns which is **Greece** in models (1) to (3), **Italy** in models (4) to (6) and **Spain** in models (7) to (9). **Germany** is the 10-year German government bond return. All regression specifications control for bank size (Log-Assets), the respective stressed Tier 1 ratio, and a constant term. Regressions are performed during the quarter before and after the reporting date. **Panel B** of Table VIII contains the results of the cross-sectional analysis of banks' carry trade behavior around the *disclosure dates* of the 3 EBA stress tests. The dependent variable is the banks' daily stock return. All regressions are performed during the quarter before and after the disclosure date. **After** is an indicator variable that is 1 for all observations after the disclosure date. All regressions control for bank size (Log-Assets), the respective stressed Tier 1 ratio, After and a constant term. Standard errors are clustered at the bank level. t-statistics are given in parentheses. ***,** and * indicate significance at 1, 5 and 10% levels, respectively.

(Continued on next page)

Panel A. Carry trade behavior around the reporting dates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Greece	Greece	Greece	Italy	Italy	Italy	Spain	Spain	Spain
GIPSI	0.515*** (3.70)	0.900*** (5.00)	0.027 (1.16)	3.486*** (3.60)	1.892*** (5.64)	0.269*** (2.91)	1.907*** (3.17)	1.661*** (5.63)	0.396*** (3.96)
GIPSI x Tier1_{07/2010}	-0.670 (-0.51)			-0.133 (-0.01)			1.141 (0.20)		
GIPSI x Before_{07/2010}	-0.165 (-1.32)			-1.644** (-2.27)			-1.068* (-1.98)		
GIPSI x Tier1_{07/2010} x Before_{07/2010}	3.634*** (2.90)			9.062 (1.20)			5.520 (1.16)		
GIPSI x Tier1_{07/2011}		-8.607*** (-4.53)			-11.399*** (-2.91)			-12.190*** (-3.62)	
GIPSI x Before_{07/2011}		-0.324** (-2.51)			-0.523 (-1.09)			-0.476 (-1.09)	
GIPSI x Tier1_{07/2011} x Before_{07/2011}		5.264*** (3.00)			6.672 (1.23)			6.765 (1.37)	
GIPSI x Tier1_{12/2011}			0.507** (2.19)			0.889 (0.92)			1.151 (1.00)
GIPSI x Before_{12/2011}			0.141*** (3.84)			0.065 (0.53)			-0.208** (-2.07)
GIPSI x Tier1_{12/2011} x Before_{12/2011}			-0.560 (-1.42)			-3.364** (-2.45)			-2.632** (-2.21)
Germany	-2.086** (-2.68)	-1.722*** (-6.34)	-2.973*** (-8.18)	-3.525*** (-3.20)	-3.063*** (-8.08)	-2.818*** (-7.59)	-3.158*** (-3.19)	-2.598*** (-7.79)	-2.864*** (-7.66)
Germany x Tier1_{07/2010}	-3.075 (-0.42)			-2.624 (-0.25)			-3.035 (-0.32)		
Germany x Before_{07/2010}	0.310 (0.71)			0.676 (1.40)			0.855* (1.91)		
Germany x Tier1_{07/2010} x Before_{07/2010}	-1.783 (-0.42)			-7.565 (-1.63)			-6.235 (-1.44)		
Germany x Tier1_{07/2011}		4.572 (1.35)			15.250*** (3.53)			12.614*** (3.34)	
Germany x Before_{07/2011}		-0.158 (-0.52)			1.040*** (3.14)			0.821** (2.60)	
Germany x Tier1_{07/2011} x Before_{07/2011}		4.765 (1.26)			-5.533 (-1.37)			-3.919 (-1.02)	
Germany x Tier1_{12/2011}			6.999* (1.84)			7.469* (1.96)			7.351* (1.90)
Germany x Before_{12/2011}			0.517 (1.28)			0.408 (1.02)			0.334 (0.87)
Germany x Tier1_{12/2011} x Before_{12/2011}			-12.531*** (-3.07)			-14.574*** (-3.55)			-13.614*** (-3.44)
Observations	5,969	6,021	6,037	5,969	6,021	6,037	5,969	6,021	6,037
R-squared	0.14	0.09	0.23	0.15	0.09	0.21	0.13	0.09	0.21

Panel B. Carry trade behavior around the disclosure dates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Greece	Greece	Greece	Italy	Italy	Italy	Spain	Spain	Spain
GIPSI	0.148*** (3.12)	0.389*** (4.06)	0.144*** (3.33)	1.704*** (4.57)	1.514*** (6.30)	0.590*** (3.53)	1.023*** (3.49)	1.957*** (7.34)	1.141*** (6.35)
GIPSI x Tier-1_{07/2010}	0.215 (0.49)			-6.540* (-1.81)			-2.564 (-0.93)		
GIPSI x Tier-1_{07/2010} x After_{07/2010}	0.411 (0.33)			8.434 (1.25)			8.019 (1.63)		
GIPSI x After_{07/2010}	0.090 (0.70)			-0.341 (-0.49)			-0.509 (-1.00)		
GIPSI x Tier-1_{07/2011}		-2.683*** (-2.84)			-8.831*** (-3.51)			-10.016*** (-3.64)	
GIPSI x Tier-1_{07/2011} x After		3.072*** (3.45)			6.865*** (2.77)			9.459*** (3.54)	
GIPSI x After_{07/2011}		-0.249*** (-2.99)			-1.204*** (-4.84)			-1.839*** (-6.66)	
GIPSI x Tier-1_{12/2011}			-0.182 (-0.49)			-2.455 (-1.56)			-5.153*** (-3.26)
GIPSI x Tier-1_{12/2011} x After			0.107 (0.07)			-7.283*** (-2.92)			-2.578 (-1.26)
GIPSI x After_{12/2011}			0.070 (0.45)			1.146*** (3.97)			0.091 (0.40)
Germany	-3.717*** (-4.94)	-1.732*** (-4.14)	-3.543*** (-6.47)	-3.845*** (-4.51)	-1.248*** (-2.78)	-3.404*** (-5.96)	-3.908*** (-4.76)	-0.457 (-1.05)	-3.369*** (-6.08)
Germany x Tier-1_{07/2010}	1.391 (0.20)			-2.492 (-0.32)			-1.304 (-0.17)		
Germany x Tier-1_{07/2010} x After_{07/2010}	4.409 (0.68)			7.796 (1.18)			5.783 (0.94)		
Germany x After_{07/2010}	1.391* (1.98)			1.209* (1.69)			1.438** (2.11)		
Germany x Tier-1_{07/2011}		-0.033 (-0.01)			-2.348 (-0.45)			-5.780 (-1.15)	
Germany x Tier-1_{07/2011} x After_{07/2011}		-4.718 (-0.88)			-3.259 (-0.54)			0.621 (0.10)	
Germany x After_{07/2011}		-0.938* (-1.93)			-1.440** (-2.55)			-2.296*** (-4.03)	
Germany x Tier-1_{12/2011}			10.548** (2.34)			9.498** (2.05)			9.278* (2.01)
Germany x Tier-1_{12/2011} x After_{12/2011}			-9.161 (-1.40)			-18.820** (-2.50)			-9.608 (-1.42)
Germany x After_{12/2011}			0.746 (1.03)			2.517*** (2.95)			0.838 (1.10)
Observations	6,025	5,916	4,371	6,025	5,916	4,371	6,025	5,916	4,371
R-squared	0.36	0.24	0.24	0.34	0.21	0.25	0.35	0.22	0.24

Table IX. Capital Issuances and ECB Funding

Panel A of Table IX contains the results of the time-series analysis as to whether banks' carry trade behavior predicts their capital raising activity over the time period January 2008 through April 2012. The dependent variable is: **Capital (Yes/No)**, an indicator variable that is 1 if the bank has raised capital in the current quarter, in models (1), (3), (5) and (7) and **Log-Capital** is the natural logarithm of amount raised in that quarter. **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 Greece, Italian and German government bond returns. Predicted returns and factor loadings are computed based on the following quarterly regression for each bank *i*:

$$Realized\ Return_{i,t} = \alpha_{i,t} + Beta_{Greece,i,t} \times Greece_t + Beta_{Italy,i,t} \times Italy_t + Beta_{Germany,i,t} \times Germany_t + \varepsilon_{i,t}$$

Log-Assets is the natural logarithm of the 1 year lagged total assets. **Panel B** of Table IX contains the results of the time-series analysis as to whether banks' carry trade behavior predicts their dependence on ECB funds. The dependent variable is the amount of ECB funding divided by total repos (**ECB Funding / Repo**) at the annual reporting date. The independent variables are lagged by 1 year. 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. Capital issuances of European banks during January 2008 and April 2012

	(1) Capital (Yes/No) Logit	(2) Log-Capital OLS	(3) Capital (Yes/No) Logit	(4) Log-Capital OLS	(5) Capital (Yes/No) Logit	(6) Log-Capital OLS	(7) Capital (Yes/No) Logit	(8) Log-Capital OLS
Realized Return_{t-1}	-1.584*** (-2.81)	-2.036*** (-3.60)			-1.540*** (-2.73)	-2.188*** (-3.64)	-1.430** (-2.47)	-1.913*** (-3.22)
Predicted Return_{t-1}			-0.742** (-1.97)	-1.138** (-2.20)				
Beta_{Greece,t-1}					0.186** (2.20)	0.271*** (3.37)		
Beta_{Italy,t-1}							-0.068 (-1.57)	-0.117** (-2.07)
Beta_{Germany,t-1}					-0.064 (-0.86)	-0.134 (-1.17)	-0.113 (-1.32)	-0.192 (-1.41)
Log-Assets_{t-1}	0.156** (2.43)	0.243*** (3.01)	0.154** (2.39)	0.240*** (2.97)	0.131** (2.23)	0.203*** (2.73)	0.124** (2.02)	0.193** (2.51)
Constant	-4.210*** (-5.14)	-1.622* (-1.72)	-4.132*** (-5.02)	-1.572 (-1.66)	-4.162*** (-5.41)	-1.581* (-1.80)	-4.066*** (-5.12)	-1.417 (-1.57)
Observations	750	750	750	750	750	750	750	750
R-squared		0.02		0.01		0.04		0.03
Pseudo R-squared	0.03		0.02		0.04		0.03	

Panel B. ECB funding

	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Realized Return_{t-1}	-0.226 (-1.68)		-0.170 (-0.86)	-0.053 (-0.27)
Predicted Return_{t-1}		-0.254** (-2.15)		
Beta_{Greece,t-1}			0.049*** (3.20)	
Beta_{Italy,t-1}				-0.018 (-1.02)
Beta_{Germany,t-1}			-0.039** (-2.05)	-0.051** (-2.05)
Log-Assets_{t-1}	-0.131*** (-4.12)	-0.131*** (-4.17)	-0.149*** (-4.81)	-0.147*** (-4.50)
Constant	2.041*** (4.86)	2.028*** (4.85)	2.125*** (5.17)	2.109*** (4.93)
Observations	80	80	80	80
R-squared	0.37	0.38	0.41	0.39

Table X. ECB LTRO Operations – Monthly Regressions

This table contains the monthly analysis of banks' stock returns on Italian, German and home country government bond returns for the January 2011 to February 2012 period. Standard errors are clustered at the bank level. t-statistics are given in parentheses. ***,** and * indicate significance at 1, 5 and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	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 2011	Feb 2011
Italy_t	1.635*** (9.50)	0.281 (1.47)	1.281*** (4.53)	0.173 (0.39)	0.646*** (4.11)	1.701*** (8.27)	0.820*** (5.81)	-0.090 (-1.42)	0.766*** (5.91)	0.059 (0.22)	0.425*** (7.10)	0.288*** (4.97)	1.440*** (8.90)	1.378*** (4.42)
Germany_t	-2.997*** (-12.23)	-1.419*** (-4.07)	-1.778*** (-8.97)	-1.385*** (-5.48)	-0.865*** (-4.40)	-1.906*** (-7.37)	-1.345*** (-7.31)	-2.733*** (-13.46)	-3.190*** (-12.06)	-3.515*** (-17.54)	-1.545*** (-8.03)	-2.055*** (-10.35)	-0.131 (-0.26)	-1.719*** (-3.58)
Constant	-0.001 (-0.86)	0.001** (2.10)	-0.006*** (-6.68)	-0.001 (-0.76)	-0.002** (-2.34)	-0.004** (-2.67)	0.002** (2.34)	-0.007*** (-6.12)	0.000 (0.19)	-0.005** (-2.62)	-0.006*** (-3.71)	0.004*** (4.18)	0.003* (1.85)	0.000 (0.09)
Observations	973	944	1,058	885	1,022	986	988	1,052	1,028	981	1,043	974	1,008	522
R-squared	0.25	0.04	0.04	0.02	0.03	0.12	0.22	0.17	0.28	0.26	0.14	0.16	0.12	0.12

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.

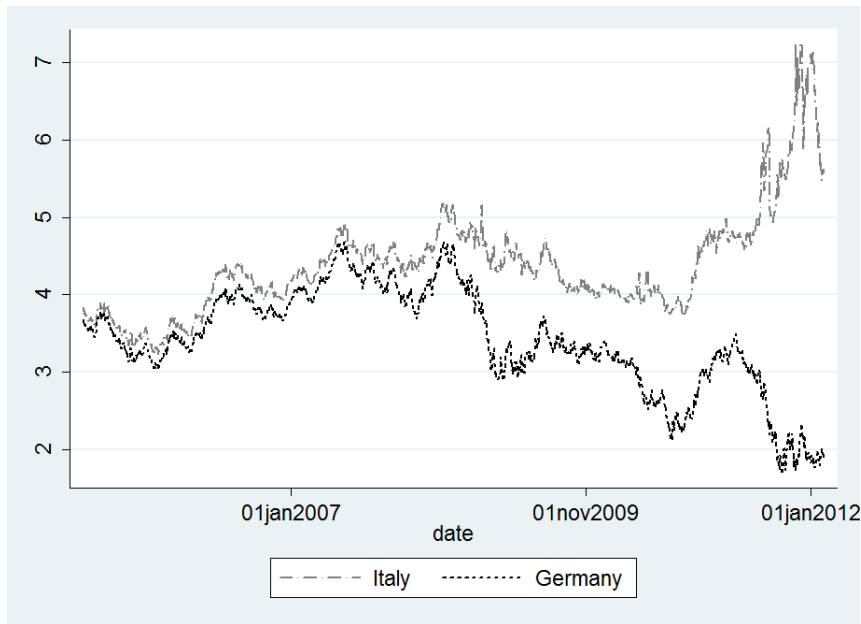


Figure 1.B. Pairwise Comparison of Government Bond Yield Spreads: Greece versus Germany

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

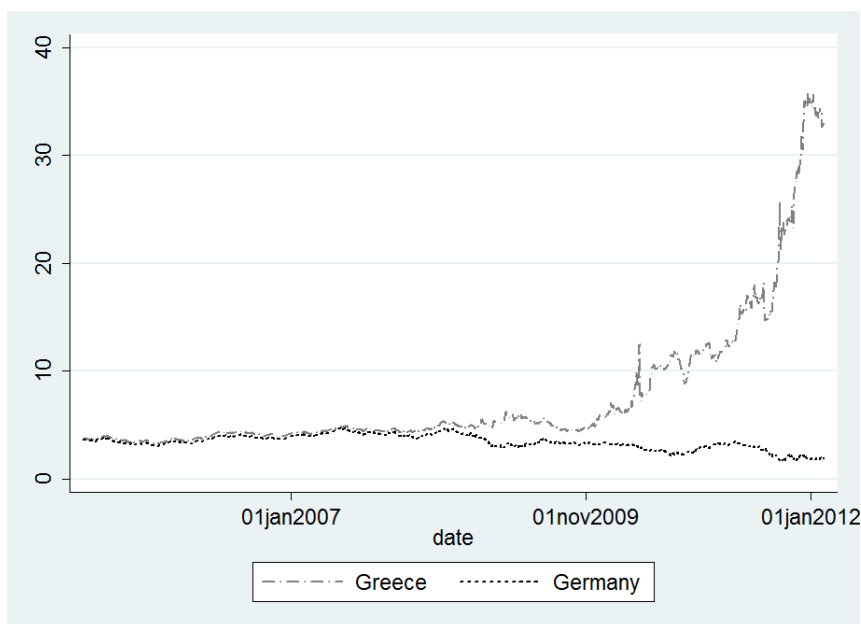


Figure 1.C. Pairwise Comparison of Government Bond Yield Spreads: Spain versus Germany

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

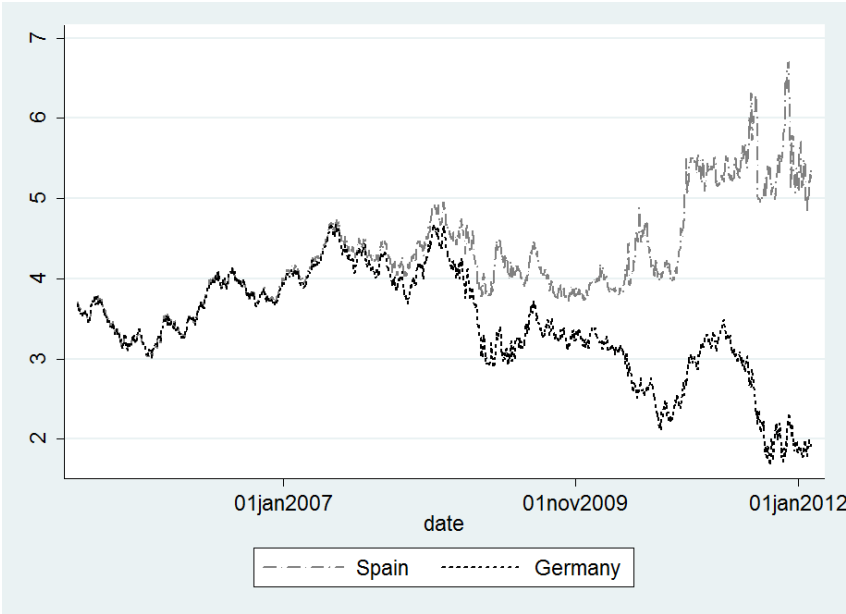


Figure 2.A. Dexia Return Correlations

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.

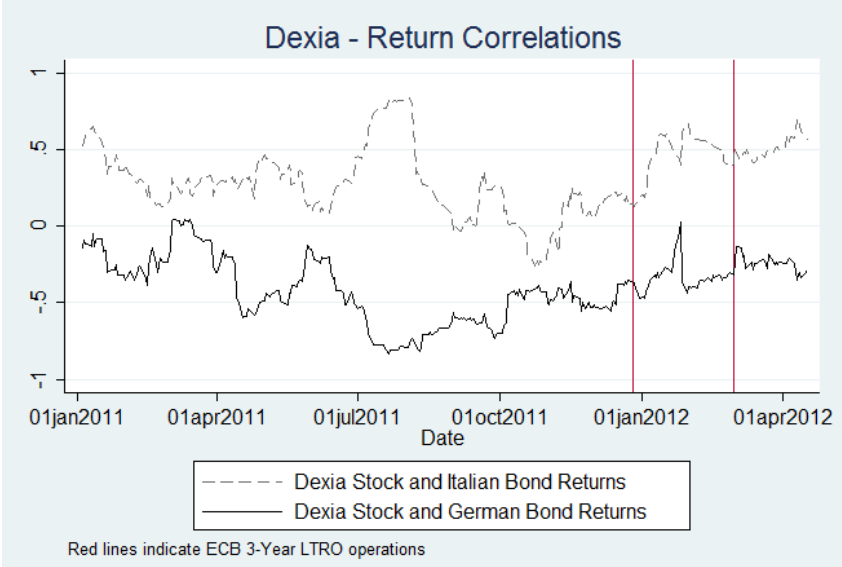


Figure 2.B. Dexia 1 Year CDS Prices

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

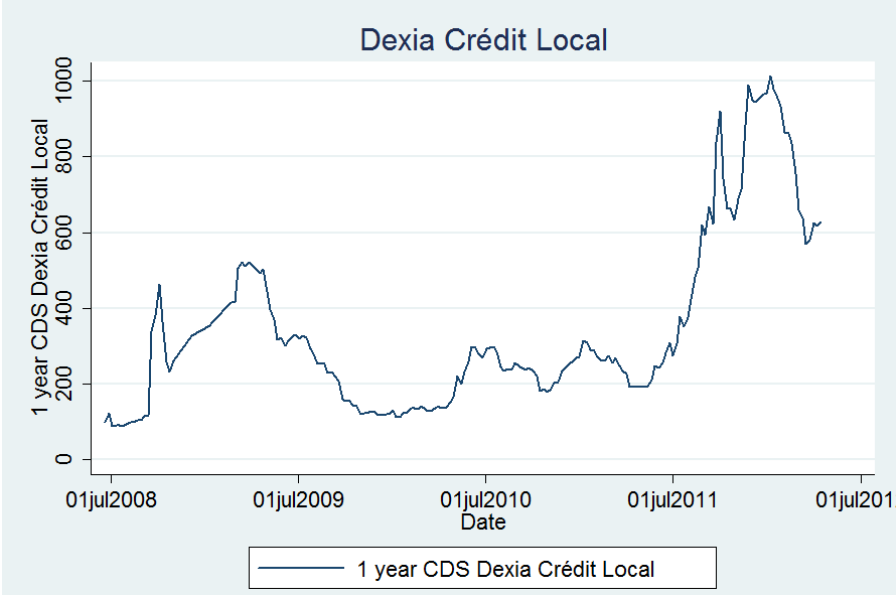


Figure 2.C. Dexia Stock Price Decline since January 2011

This graphic shows Dexia's stock price performance since January 2011.

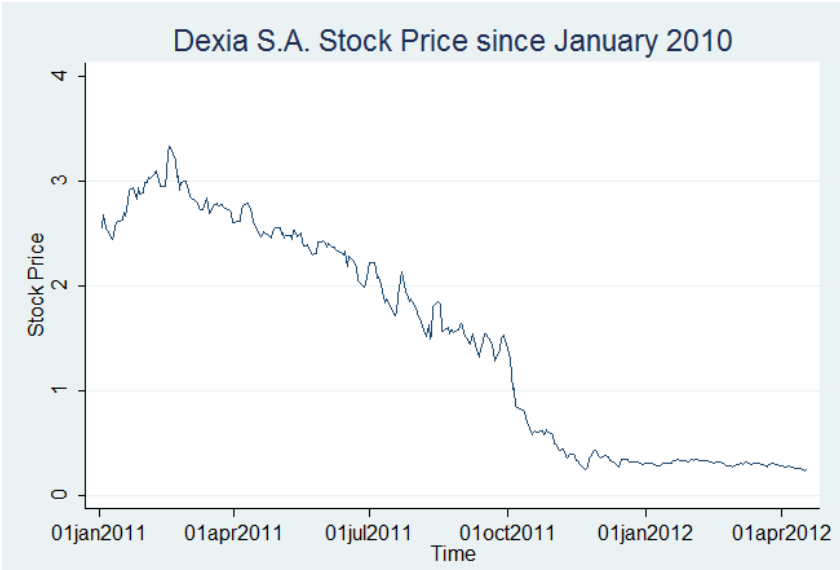


Figure 4. Factor Loadings and Bond Portfolio Holdings

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.

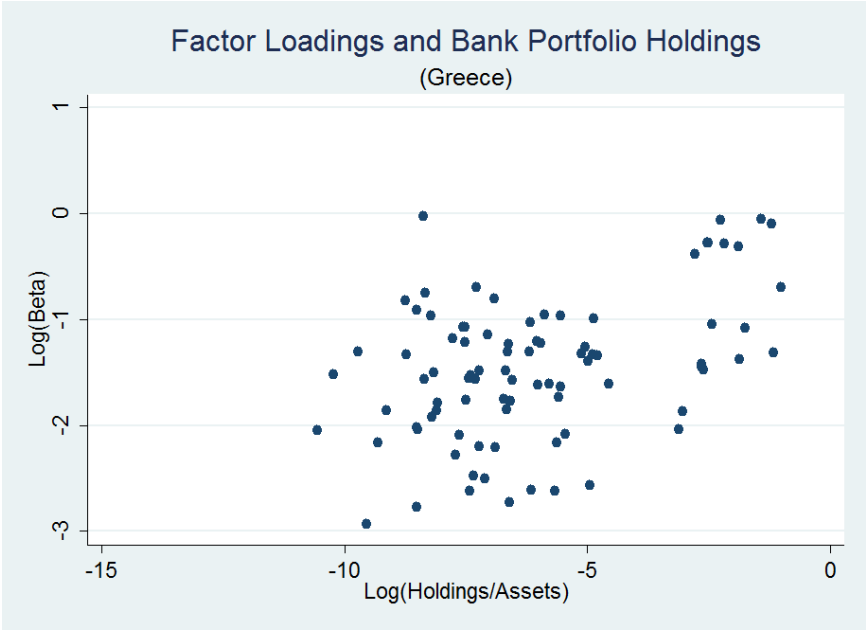


Figure 3.A. Time-Series of Stock and Bond Return Correlations

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, 2012.

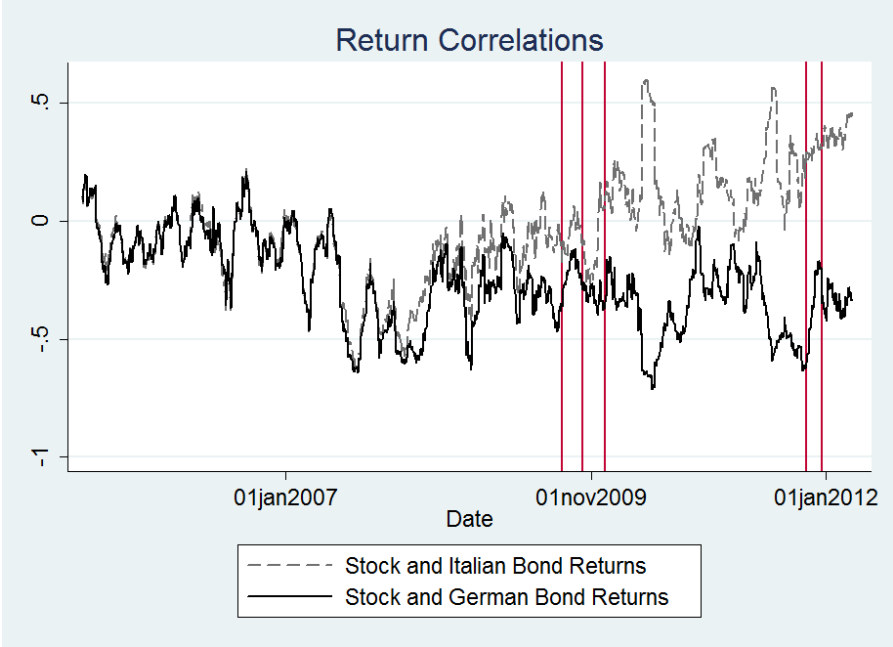


Figure 3.B. Time-Series of Stock and Bond Return Correlations (since January 1, 2011)

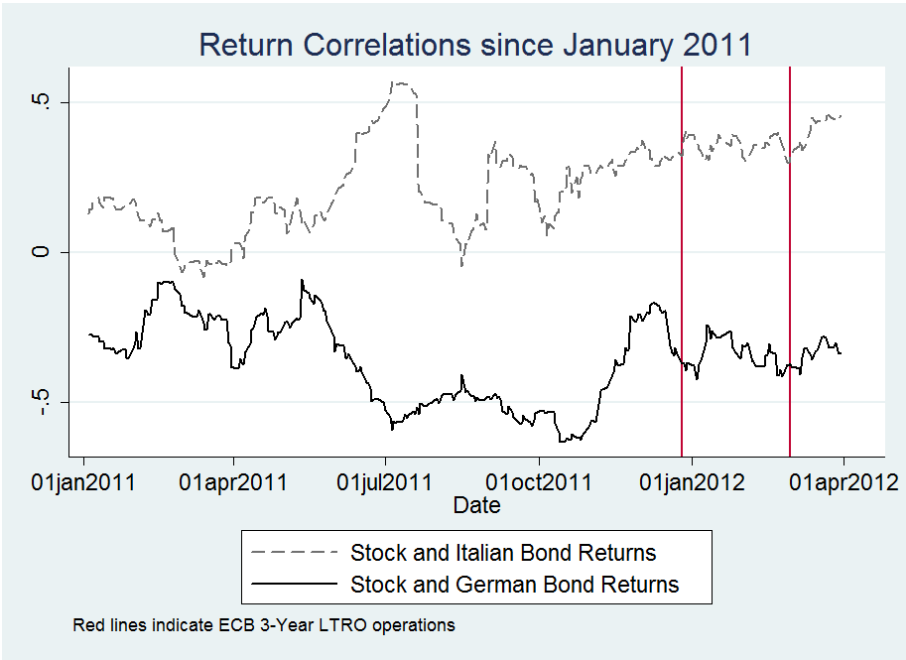
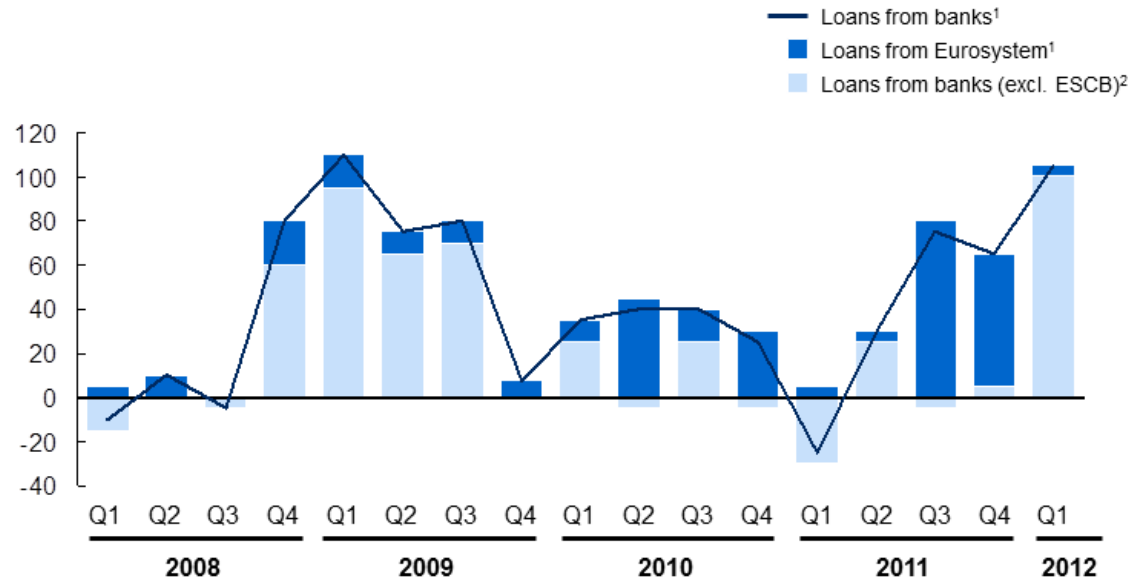


Figure 4. Loans and sovereign bond flows into public sector

This graphic depicts quarterly flows, seasonally adjusted, into public sector debt. Volumes are in billion Euro. Graphic reproduced based on Bundesbank report (published in German).



1 ECB
2 Bundesbank calculation based on ECB data

SOURCE: ECB, Deutsche Bundesbank

Appendix I – List of Banks

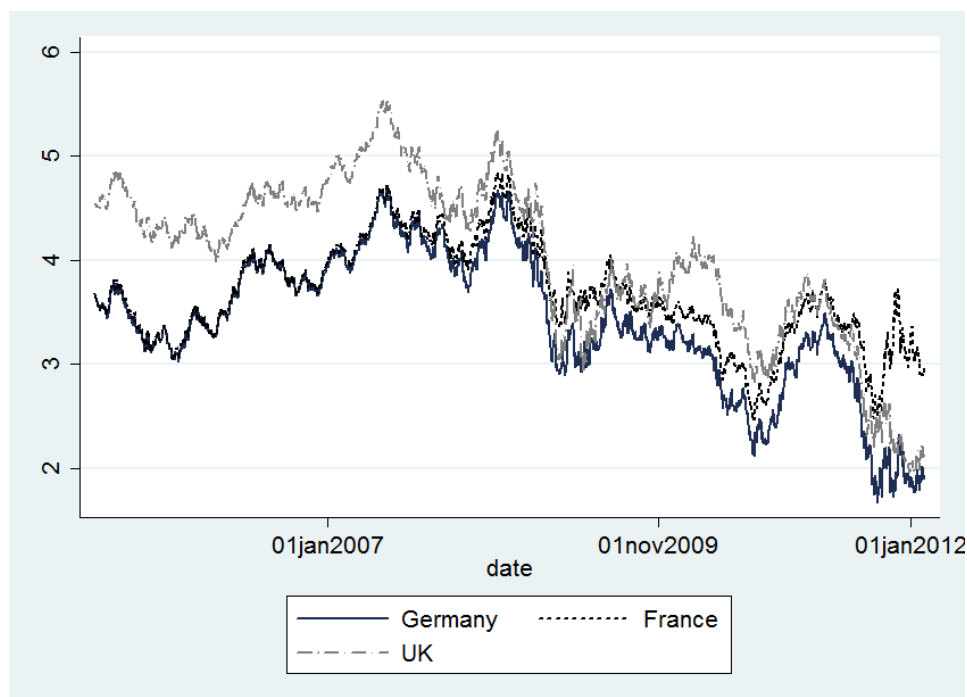
This table provides a list of all public banks included in the EBA stress tests sorted by asset size as of December 31st, 2011. We provide the identifier used to match the banks to SNL Financial, Bloomberg and the EBA stress test data.

Bank	SNL ID	Bloomberg Ticker	EBA ID	Country	Total Assets (EUR Million) (31Dec2011)
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 NV	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

Appendix II – EBA Stress Test Results

Bank	July 2010		July 2011		December 2011	
	Tier 1 ratio at 31.12.2009	Tier 1 ratio - adverse scenario	Tier 1 ratio at 31.12.2010	Tier 1 ratio – adverse scenario	Tier 1 incl. existing govt support	Tier 1 excl. existing government support
TT Hellenic Postbank SA	17.1%	15.0%	18.5%	5.5%		
Royal Bank of Scotland Group Plc	14.4%	11.7%	9.7%	6.3%	10.5%	10.5%
OTP Bank Nyrt.	13.8%	16.8%	12.3%	13.6%	12.5%	12.5%
Jyske Bank A/S	13.5%	12.8%	12.1%	12.8%	12.5%	12.5%
Landesbank Berlin Holding AG	13.3%	11.3%	14.6%	10.4%	13.8%	13.8%
Powszechna Kasa Oszczędności Bank Polski SA	13.3%	15.7%	11.8%	12.2%	11.2%	11.2%
Sydbank A/S	13.1%	13.4%	12.4%	13.6%	12.8%	12.8%
Barclays Plc	13.0%	13.9%	10.0%	7.3%	9.8%	9.8%
Deutsche Bank AG	12.6%	10.3%	8.8%	6.5%	8.3%	8.3%
Skandinaviska Enskilda Banken AB	12.4%	10.7%	11.1%	10.5%	13.6%	13.6%
Dexia SA	12.3%	11.2%	12.1%	10.4%	7.8%	7.8%
Danske Bank A/S	11.7%	10.8%	10.0%	13.0%	13.8%	11.0%
Alpha Bank AE	11.6%	10.9%	10.8%	7.4%		
National Bank of Greece SA	11.3%	9.6%	11.9%	7.7%		
EFG Eurobank Ergasias SA	11.2%	10.2%	9.0%	4.9%		
KBC Group NV	10.9%	9.8%	10.5%	10.0%	10.1%	9.6%
HSBC Holdings Plc	10.8%	10.4%	10.5%	8.5%	10.0%	10.0%
Société Générale SA	10.7%	10.2%	8.1%	6.6%	8.4%	8.4%
SNS Reaal NV	10.7%	10.8%	8.4%	7.0%	9.1%	8.3%
Bank of Cyprus Public Company Limited	10.5%	9.4%	8.1%	6.2%	8.1%	8.1%
Commerzbank AG	10.5%	9.3%	10.0%	6.4%	8.8%	8.1%
Bank of Valletta Plc	10.5%	11.0%	10.5%	10.4%	10.5%	10.5%
Banco Pastor SA	10.5%	6.8%	7.6%	3.3%		
Swedbank AB	10.4%	10.5%	8.7%	9.4%	13.3%	13.3%
ING Groep N.V.	10.2%	9.1%	9.6%	8.7%	9.2%	9.2%
Nordea Bank AB	10.2%	10.2%	8.9%	9.5%	10.9%	10.9%
BNP Paribas SA	10.1%	9.7%	9.2%	7.9%	9.2%	9.2%
Banco Santander SA	10.0%	10.2%	7.1%	8.4%	6.8%	6.8%
Crédit Agricole SA	9.7%	9.2%	8.2%	8.5%	9.2%	9.2%
Lloyds Banking Group Plc	9.6%	9.4%	10.2%	7.7%	10.1%	10.1%
Cyprus Popular Bank Public Co. Ltd.	9.4%	8.5%	7.3%	5.3%	5.8%	5.8%
Hypo Real Estate Holding AG, München	9.4%	5.3%	28.4%	10.0%	27.9%	26.2%
Banco Bilbao Vizcaya Argentaria, SA	9.4%	9.6%	8.0%	9.2%	7.8%	7.8%
Raiffeisen Zentralbank Österreich AG	9.3%	7.9%	8.1%	7.8%	7.0%	5.4%
Banco Comercial Português SA	9.3%	8.4%	5.9%	5.4%	7.3%	7.3%
Caja de Ahorros del Mediterráneo	9.3%	8.4%	3.8%	3.0%		
Erste Group Bank AG	9.2%	8.1%	8.7%	8.1%	8.4%	7.4%
Bank of Ireland	9.2%	7.6%	8.4%	7.1%	12.8%	10.3%
Banco Popular Español SA	9.1%	7.5%	7.1%	5.3%	7.1%	7.1%
Piraeus Bank SA	9.1%	8.3%	8.0%	5.3%		
Svenska Handelsbanken AB	9.1%	9.1%	7.7%	8.6%	14.7%	14.7%
Banco Sabadell SA	9.0%	7.7%	6.2%	5.7%		
Bankia, SA	8.6%	6.8%	6.9%	5.4%	8.6%	6.3%
UniCredit SpA	8.6%	8.1%	7.8%	6.7%	7.8%	7.8%
FHB Jelzalogbank Nyrt	8.6%	10.8%				
Banco BPI SA	8.5%	10.3%	8.2%	6.7%	8.9%	8.9%
ATEbank SA	8.4%	8.9%	6.3%	-0.8%		
Intesa Sanpaolo SpA	8.3%	8.8%	7.9%	8.9%	10.0%	10.0%
Unione di Banche Italiane SCpA	8.0%	7.1%	7.0%	7.4%	8.4%	8.4%
Banco Popolare Società Cooperativa	7.7%	7.4%	5.8%	5.7%	6.5%	6.5%
Espirito Santo Financial Group SA	7.7%	7.4%	6.4%	5.1%	6.8%	6.8%
Banca Monte dei Paschi di Siena SpA	7.5%	6.8%	5.8%	6.3%	9.2%	7.4%
Bankinter SA	7.5%	7.6%	6.2%	5.3%		
Allied Irish Banks, Plc	7.0%	7.2%	3.7%	10.0%	20.1%	13.3%
Österreichische Volksbanken AG			6.4%	4.5%	5.5%	1.7%
Irish Life and Permanent			10.6%	20.4%	23.9%	23.9%
DNB ASA			8.3%	9.0%	7.8%	7.8%
Nova Kreditna banka Maribor d.d.			7.4%	8.0%	9.4%	9.4%

Appendix III – French Government Bond Yields as “Funding Leg”



Appendix III – Table 1

This table contains the results of the cross-sectional analysis of individual banks stock returns on sovereign bond returns. Columns (1) to (5) show factor loadings on GIPSI sovereign bond returns individually for Greece, Italy, Spain, Portugal and Ireland and collectively in column (6). All regressions include French bond returns as “funding leg” of the carry trade. All regressions further report factor loadings of home country bond returns (**Home**). 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)	(2)	(3)	(4)	(5)	(6)
	Greece	Italy	Spain	Portugal	Ireland	GIPSI
Greece	0.212*** (6.18)					0.162*** (8.83)
Italy		1.041*** (5.16)				1.032*** (5.27)
Spain			0.776*** (4.15)			-0.191 (-0.60)
Portugal				0.187** (2.02)		-0.023 (-0.44)
Ireland					0.367*** (3.32)	0.112 (1.24)
France	-1.703*** (-4.74)	-2.351*** (-5.93)	-2.217*** (-6.50)	-1.790*** (-4.63)	-1.857*** (-4.90)	-2.225*** (-6.79)
Constant	-0.000 (-0.64)	-0.001 (-0.93)	-0.001 (-0.91)	-0.001 (-0.92)	-0.001 (-0.87)	-0.000 (-0.61)
Observations	78,828	78,828	78,828	78,828	78,828	78,828
R-squared	0.06	0.07	0.06	0.05	0.05	0.08

Appendix III – Table 2

This table contains the quarterly analysis of banks' stock returns on Italian, French and home country government bond returns for the Q1/2009 to Q1/2012 period. Standard errors are clustered at the bank level. t-statistics are given in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels, respectively.

Panel A.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Q1/2009	Q2/2009	Q3/2009	Q4/2009	Q1/2010	Q2/2010	Q3/2010	Q4/2010	Q1/2011	Q2/2011	Q3/2011	Q4/2011	Q1/2012
Italy	1.574*** (7.50)	2.904*** (10.76)	1.881*** (9.10)	1.614*** (7.37)	2.808*** (10.01)	1.333*** (13.80)	0.661*** (4.07)	0.976*** (8.33)	1.042*** (8.24)	1.105*** (6.55)	0.123*** (2.77)	0.318*** (7.41)	1.414*** (7.50)
Germany	-2.505*** (-11.74)	-3.744*** (-14.42)	-2.544*** (-11.36)	-3.203*** (-12.59)	-3.632*** (-13.15)	-3.979*** (-18.96)	-2.346*** (-16.96)	-1.295*** (-9.14)	-1.885*** (-13.73)	-1.466*** (-7.38)	-3.012*** (-15.92)	-2.269*** (-14.70)	-0.767 (-1.61)
Constant	-0.004*** (-7.53)	0.005*** (7.88)	0.005*** (10.64)	-0.003*** (-5.25)	0.001*** (3.66)	-0.000 (-0.80)	0.002*** (5.94)	-0.002*** (-3.02)	-0.002*** (-3.09)	-0.002** (-2.30)	-0.002** (-2.30)	-0.002*** (-2.72)	0.002** (2.31)
Observations	3,009	2,947	3,175	3,025	2,980	2,955	3,117	3,026	2,975	2,893	3,068	2,998	1,530
R-squared	0.03	0.14	0.08	0.12	0.15	0.42	0.17	0.06	0.08	0.05	0.21	0.17	0.11

Panel B.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Q1/2009	Q2/2009	Q3/2009	Q4/2009	Q1/2010	Q2/2010	Q3/2010	Q4/2010	Q1/2011	Q2/2011	Q3/2011	Q4/2011	Q1/2012
Italy _t	1.273*** (5.32)	3.795*** (12.21)	2.328*** (9.03)	2.917*** (9.57)	2.830*** (9.77)	2.357*** (19.01)	1.209*** (6.79)	1.171*** (9.94)	1.307*** (9.81)	1.492*** (7.21)	0.482*** (9.70)	0.801*** (13.76)	1.545*** (10.48)
France _t	-1.951*** (-6.94)	-4.864*** (-14.68)	-2.742*** (-10.66)	-4.449*** (-13.40)	-2.975*** (-12.16)	-4.230*** (-18.16)	-2.645*** (-17.34)	-1.478*** (-9.34)	-2.076*** (-14.96)	-1.297*** (-7.07)	-2.378*** (-12.40)	-0.789*** (-9.86)	-0.145 (-0.94)
Constant	-0.005*** (-8.20)	0.006*** (9.19)	0.004*** (10.42)	-0.002*** (-4.32)	0.000 (0.82)	-0.001** (-2.32)	0.002*** (6.88)	-0.002*** (-2.97)	-0.002*** (-3.05)	-0.003** (-2.42)	-0.004*** (-4.62)	-0.002** (-2.48)	0.002* (1.97)
Observations	3,009	2,947	3,175	3,025	2,980	2,955	3,117	3,026	2,975	2,893	3,068	2,998	1,530
R-squared	0.01	0.14	0.05	0.11	0.09	0.36	0.15	0.06	0.07	0.04	0.10	0.07	0.11