Do Central Bank Interventions Limit the Market Discipline from Short-Term Debt? preliminary draft

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This version: June 25, 2015

Abstract: In this paper, we investigate the impact of European Central Bank (ECB) interventions on the private short-term funding of European banks and asset prices of sovereign bonds and bank stocks during the sovereign debt crisis. We show that consistent with a market discipline role of wholesale funding "runs," the U.S. money market funds reduced unsecured funding for risky banks exposed to Eurozone peripheral debt during summer 2011, while maintaining unsecured funding and increasing repo funding to low risk non-Eurozone banks. This market discipline effect of risk on funding liquidity is reversed with ECB interventions; Eurozone risky banks gain access to U.S. repos, and recover part of their unsecured funding after the intervention period. Short-term funding flowing back to risky banks coincides with increasing sovereign bond prices of peripheral countries. Event studies around ECB intervention dates support this: We find that banks with large holdings of risky sovereign debt experience abnormal stock returns and get increased access to U.S. MMF following ECB interventions.

Keywords: Money market funds, repos, bank risk, sovereign debt, ECB.

JEL Classification: G01, G21, G28.

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The authors thank Eric Jondeau, Loriano Mancini, Ralf Meisenzahl (discussant), Ouarda Merrouche, Erwan Morellec, Thomas Mosk, Artem Neklyudov, Kleopatra Nikolaou, Guillaume Rousselet, Batchimeg Sambalaibat, Oren Sussman (discussant), seminar participants at CREST, ESMT, HEC Lausanne, and participants at the IBEFA 2015, IAES 2015, and the SAFE-Deutsche Bundesbank-ESMT-CEPR conference on Regulating Financial Markets for valuable comments and suggestions. The authors are grateful to Matthias Warnke for excellent research assistance. Financial support from Inquire Europe and the Volatility Institute at NYU Stern is gratefully acknowledged.

1 Introduction

The dependence of European banks on short-term wholesale funding poses a threat to their funding liquidity. When the financial sector is undercapitalized, funding liquidity can rapidly evaporate reflecting investors concerns on banks solvency risk.[1] Short-term wholesale investors withdrawing their liquidity from banks can have severe consequences when banks are forced to sell illiquid assets and to cut lending to the real economy. Similarly, the dependence of European banks on U.S. money market funds (MMF) for US-Dollar funding potentially poses a threat to their liquidity, and can be transmitted to other financial institutions and to the real economy (Chernenko and Sunderam (2014); Ivashina et al. (2012)).

Short-term financing of otherwise highly leveraged banks has been an important catalyst of stress in the banking sector during the recent sovereign debt crisis. Acharya and Steffen (2014) show that U.S. MMFs decreased their holdings of weak banks substantially in 2011, withdrawing about USD 160 billion from the European banking sector contributing to severe stress in wholesale funding markets during that time.

The European Central Bank (ECB) intervened substantially using non-standard measures to specifically address funding liquidity risk in the financial sector and avoid the negative consequences on lending. Since the start of the European sovereign debt crisis, ECB interventions include the 3-year Long-Term Refinancing Operations (LTRO) in December 2011 and February 2012, the announcement of the Outright Monetary Transaction (OMT) program in September 2012, as well as its forward guidance since 2013. At the same time, it has reduced interest rates to almost 0%.

While central bank interventions help reduce the cost of bank runs, there are potential unintended consequences of such unconventional measures. In particular, central bank interventions can limit discipline in wholesale short-term funding markets. Unlike insured depositors, wholesale investors (like MMFs) can discipline the banks by making sure they pay the actual cost of their risk taking (Freixas and Rochet (2008)). Market discipline therefore reduces the moral hazard problem of banks and complements banking regulation in setting prudential requirements.[2]

Market discipline is inherent to the observation that fragility (i.e. being subject to bank runs) is a desirable characteristic of banks (Diamond and Rajan (2001)). Indeed, market

[1] This interaction between solvency risk and liquidity risk of banks has been well studied theoretically in the literature (Allen and Gale (1998); Gorton (1988); Rochet and Vives (2004); Diamond and Rajan (2005)) and empirically (Das and Sy (2012); Pierret (2015)).

[2] Market discipline is actually the third Pillar of Basel II international standards.

discipline disappears if banks cannot fail (Bliss and Flannery (2002)). In this paper, we investigate the consequences of ECB interventions on the market discipline of short-term creditors investing at European banks. We start the analysis of ECB interventions by an event study showing the effect of interventions on sovereign bond prices and bank performance.[3] Then, we study the evolution of U.S. MMF investments at European banks exploring cross-sectional variation in bank risk. Did MMF decrease investments in risky financial institutions while increasing their holdings of low risk banks? Banks issue various types of securities, for example, unsecured commercial paper as well as secured repos. As funds withdrew from banks in 2011, did they differentiate between secured and unsecured investments? And most importantly, how did ECB interventions affect MMF flows?

The impact of ECB interventions on banks balance sheets can be classified into two broad categories: injecting liquidity (liability side) by reducing collateral requirements or interest rates, and improving bank asset returns (asset side) by purchasing assets that banks hold. To measure these effects on bank's performance, we conduct an event study on sovereign bond prices and bank equity prices around intervention dates. We find significant negative cumulative abnormal returns (CAR) of German bonds around the first LTRO, suggesting that the flight-to-quality is mitigated and there is less funding pressure on banks. We do not find effects on Greece, Italy, Ireland, Portugal and Spain (GIIPS) bonds, which suggests that there is not much demand for these bonds, probably also not as collateral in private European repo markets. There is a positive CAR on bank equity but not more for banks with large GIIPS holdings. During this time, GIIPS banks were fully relying on ECB short-term funding.

In July 2012, Draghi declared he will do whatever it takes to preserve the euro and the ECB announced the OMT in September 2012. The OMT gave the ECB the possibility to purchase unlimited amounts of sovereign debt in secondary markets if specific conditions were met. We see significant CAR on German and GIIPS bonds following the speech and the OMT announcements. Sovereign yields of the Eurozone periphery were decreasing substantially which stabilized their domestic banking sectors. This suggests a higher demand for GIIPS bonds and better access to private repo markets and eventually less reliance on ECB funding. This is also reflected in higher CAR on bank equity for banks with large GIIPS holdings.

[3]The analysis is linked to the recent literature that investigates the effects of ECB interventions on yields. Krishnamurthy et al. (2014) identify default risk and sovereign bond segmentation effects as dominant channels through which interventions affect bond yields. Trebesch and Zettelmeyer (2014) also find evidence for market segmentation analyzing Greek sovereign bonds around the SMP. Eser and Schwaab (2013) document large changes in bond yields upon purchases by the ECB under the SMP.

The analysis of U.S. MMF investments at European banks starts in November 2010, when the regulatory requirement of U.S. MMFs to report their portfolio composition started. U.S. MMFs were the first group of investors to withdraw from banks in the euro area in summer 2011; U.S. prime MMFs holdings of Eurozone banks fell from 30 percent of their assets in May 2011 to 11 percent by December 2011 (ICI).[4] The run of U.S. MMFs from European banks is a run on unsecured funding (see Figure 1). In contrast, repo funding via U.S. MMFs increases indicating a flight-to-quality towards U.S. collateral.[5] We observe the reverse trend in late 2012: unsecured funding increases again while repo funding decreases.

The run on US-Dollar unsecured funding before ECB interventions is non negligeable. European banks, however, also rely on euro-denominated short-term debt. Mancini et al. (2015) show that the central counterparty-based euro interbank repo market stabilized funding markets during the crisis because of its market design and high-quality collateral. In other words, there was no run on euro repo markets as there was in the U.S. in summer 2007 (Gorton and Metrick (2012)). Repo rates were however higher for GIIPS counterparties at the peak of the European sovereign debt crisis in 2011 (Boissel et al. (2015)). Garcia de Andoain et al. (2014) also find that rates dropped on unsecured interbank markets with ECB excess liquidity only in stressed countries like Italy and Spain. We further show that unsecured funding outflows in U.S. MMFs predict other short-term funding outflows and the demand for public funding. Unsecured MMF outflows Granger-cause outflows in the short-term debt of EU-28 banks with residual maturity of maximum one year. U.S. MMF outflows also trigger ECB LTRO; banks that experienced higher US dollar outflows during the crisis become more reliant on ECB secured funding through long-term refinancing operations.

In the analysis of U.S. MMFs investments at European banks, we show (i) some evidence of market discipline before ECB interventions, and (ii) how market discipline is impaired following ECB interventions. Banks are classified as high risk (or low risk) according to their CDS spreads in November 2010. This helps us to address possible endogeneity concerns that funding problems due to MMF withdrawals feed back into bank solvency problems, which increases CDS spreads.

We find that U.S. MMFs reduced unsecured funding for risky banks during summer 2011 (i), while maintaining unsecured funding and increasing repo funding to low risk non-Eurozone banks. During this period, risky banks are penalized for their excessive risk taking

[4]ICI Research Perspective, January 2013.

[5]Note that the eligible collateral in U.S. MMF repos are U.S. treasuries and U.S. government bonds. In other words, banks that do not invest in these securities (probably banks without a network of subsidiaries in the U.S.) do not receive U.S. MMF repo funding.

by losing access to unsecured funding (extensive margin). The number of securities lost is significantly higher for risky banks before ECB interventions. In a Probit analysis, we also show that risky banks have a higher probability of completely losing access to U.S. MMF unsecured funding, and a higher probability of losing access to one fund. The results suggest that the "run" on unsecured funding at risky banks is mainly an extensive margin effect. In addition, the risky banks that are able to maintain access are penalized with shorter maturities and larger yield spreads.

U.S. MMFs return to high-risk banks following ECB interventions (ii), as these interventions provided implicit insurance for private investors. To identify the impact of risk on MMF flows, we use risk measures (e.g. CDS prices) updated before each intervention. We find that MMF funding flows back to banks with larger CDS spreads following the OMT announcement. Consistent with the OMT increasing the equity value of banks that invested in GIIPS bonds, we find larger *unsecured* inflows at banks exposed to GIIPS sovereign debt following the OMT. Bank performance also improves with the LTRO that acted as a "haircut subsidy" for bad quality collateral (Nyborg (2015)). Following the reduction of funding pressure with the LTRO, we also find larger *secured* inflows at banks exposed to GIIPS sovereign debt. The results hold when we exclude GIIPS banks from the sample and focus on non-GIIPS euro area banks. In other words, MMF did not focus exclusively on GIIPS banks but they did differentiate between high and low-risk banks.

Funds flowing back to risky banks do not seem to be coming from better access to MMFs. The probability of (re-)gaining access to U.S. MMFs is not significantly increasing with risk. Inflows are rather due to larger amounts (intensive margin) lent with new securities by funds where a bank-fund relationship already exists. Then, risky banks are still penalized by shorter maturities, but the difference in yield spreads compared to low risk banks is reduced.

Overall, our results are consistent with a market discipline role of wholesale funding "runs" of U.S. MMF on high-risk banks at the beginning of the sovereign debt crisis. This market disciplining effect was reversed with a series of ECB interventions when MMF flew back to high-risk banks in secured as well as unsecured funds. The paper highlights this reduction of market discipline in short-term funding markets as a potential unintended consequence of ECB interventions. While necessary measures to stabilize national financial sectors, these interventions limit market discipline for short-term debt. Moreover, Acharya et al. (2015) show that the transmission of monetary policy to the real economy is impaired: central bank liquidity does not transalte into lower loan spreads for the borrowers of high risk banks. The lack of disciplining effect reduces the incentives for banks to clean their balance sheet and

recapitalize. Banks holding risky sovereign debt are rewarded by more short-term funding inflows, while their fundamentals remain weak. This lack of market discipline, in turn, makes the financial system and the real economy even more vulnerable to liquidity shocks.

The paper proceeds as follows. In Section 2, we briefly describe different ECB policy programs and the data sources we use in the paper. Section 3 describes the event study on sovereign bond and bank equity prices. Section 4 presents the results on U.S. money market funds investments at European banks. Section 5 concludes.

2 Institutional background and data

2.1 ECB interventions

Since 2010, the ECB conducted a series of unconventional policy measures to support a "dysfunctional market" and repair the monetary policy transmission mechanism. Our sample period starts in November 2010 with the disclosure regulation for U.S. MMF, and, therefore, we consider ECB interventions during this period.

Securities Markets Programme (SMP)

The ECB announced the SMP on 10 May 2010 and purchased about EUR 75 billion Greek, Irish and Portuguese government bonds until July 2011. In August 2011, the ECB expanded the SMP and started purchasing Italian and Spanish government bonds in secondary markets. Given the larger size of these bonds markets, the purchases increased to EUR 220 billion in February 2012.

The SMP terminated in September 2012 with the introduction of the Outright Monetary Transaction (OMT) program.

Long-Term Refinancing Operations (LTRO)

The ECB conducted two 3-year LTROs on 22 December 2011 and 1 March 2012. In the first LTRO (LTRO 1), the ECB allotted EUR 489 billion to 523 banks; in the second LTRO (LTRO 2), she allotted EUR 530 billion to 800 banks. The banks had to post collateral in exchange for funding under the LTRO programs and the interest on the funds was tied to the ECB policy rate.

The ECB already switched to full allotment in its regular main refinancing operations (MRO) in October 2008 for which banks pay the same interest rate as for LTROs. Rolling

over weekly MROs is thus similar to borrowing under the LTRO. The latter, however, removes the uncertainty that the ECB switches back to fixed quantity allotment in its MROs.

Acharya and Steffen (2014) document a substantial increase in home bias that was accelerated through the LTROs: in particular, Italian and Spanish banks purchased substantial amounts of domestic sovereign bonds while core European banks were reducing their exposure to GIIPS countries contributing to a further monetary and financial fragmentation of the euro area. Moreover, LTRO funding contributed to a further crowding out of real-sector lending through government bond purchases.

Outright Monetary Transactions (OMT)

ECB president Mario Draghi announced during a conference on 26 July 2012 that the ECB (within their mandate) "is ready to do whatever it takes to preserve the euro. And believe me, it will be enough".

On 6 September 2012, the ECB introduced and announced the key parameters of the Outright Monetary Transaction Program (OMT). Under the OMT, the ECB can purchase unlimited amounts of government bonds with a maturity of 1 to 3 years. However, the country, whose bonds the ECB is planning to purchase, has to officially apply for a program under the European Stability Mechanism (ESM), which is necessarily associated with conditionalities. Compared to previous bond purchase programs, the ECB also does not make itself a senior claimant under the OMT program.

Forward Guidance

During the press conference on 4 July 2013, the ECB changed its monetary policy communication strategy to include a form of forward guidance.

"The Governing Council expects the key ECB interest rates to remain at present or lower levels for an extended period of time. This expectation is based on the overall subdued outlook for inflation extending into the medium term, given the broad-based weakness in the real economy and subdued monetary dynamics."

The rationale of the ECB is to have an impact on decisions of market participants by influencing expectations about the development of short-term interest rates for the predictable future rather than by changing interest rates.

2.2 Data sources

The analysis of the consequences of ECB interventions on the funding liquidity of European banks starts with an event study in Section 3, linking those interventions with sovereign bond prices and equity prices of European banks. The asset prices are collected from Bloomberg. We describe how abnormal returns around ECB intervention dates are derived in the next section.

In Section 4, we study the access of European banks to U.S. money market funds. We start with a sample of 63 European banks that receive funding from U.S. MMF (see Appendix A). The 63 banks cover 15 European countries; 10 are Eurozone countries (including 3 GIIPS countries).

Monthly information on U.S. MMF investments at European banks is collected from the regulatory reports of U.S. MMFs available from the iMoneyNet database. As a consequence of the 2008-2009 financial crisis, the Securities and Exchange Commission (SEC) approved changes to Rule 2a-7 of the Investment Company Act of 1940 in 2010 and took other actions to strengthen the regulatory framework that governs MMFs. Following the SEC regulation, U.S. MMFs have to report monthly mark-to-market net asset value (NAV) per share of their portfolios on Form N-MFP, which is then published by the SEC.

From the N-MFP forms downloaded from iMoneyNet, we collect data on principal amounts, maturities, and yields of 15 different types of MMF securities (including CDs, repos, financial CPs) from November 2010 until August 2014 (46 months). The MMF data are collected for approximately 13,000 issuer names in the European banking industry and aggregated at the bank holding company level (63 banks).

We also collect financial information (assets, capitalization, etc.) from SNL for the 63 European banks, market data (stock prices, market cap) from Bloomberg for the 31 banks that are publicly traded, and 5-year CDS prices for 34 banks (see Appendix A). The amount of LTRO funding a bank received is hand collected from press articles.[6] Finally, we use data on sovereign bond holdings available for 32 banks and disclosed by the European Banking Authority (EBA) in its stress tests and capitalization exercises at six different dates from December 2010 until June 2013.

[6]The LTRO numbers collected are consistent with results of Morgan Stanley LTRO survey of March 1, 2012.

3 Sovereign bond prices and bank performance: an event study

Before turning to the analysis of short-term funding flows at European banks, we investigate the impact of ECB interventions on government bond and equity prices in an event study. We start with a test of abnormal returns in sovereign bond prices around ECB interventions in Section 3.1. We repeat the test for abnormal equity returns of European banks in Section 3.2, and explain banks' abnormal returns using bank characteristics (including information on sovereign exposures) in Section 3.3. The results of this section suggest that an increase in bank performance comes from a reduction of overall funding pressure (liability side) following the LTRO, while increased bank performance is due to a reduction of sovereign yields (asset side) following the OMT.

3.1 Cumulative abnormal returns of sovereign bonds

We calculate cumulative abnormal returns (CAR) of 10-year sovereign bonds around 5 events which are reported in Table 1: (1) LTRO 1, (2) LTRO 2, (3) the EU summit, (4) the "Draghi speech", and (5) the OMT announcement. Interestingly, the EUR 1 trillion injected into the financial system in both LTRO transactions did not have a major effect on sovereign bond yields despite some effect on Italian sovereign bond prices in the second LTRO tranche. However, the first LTRO had a significant negative effect on German bund returns consistent with the interpretation that it substantially reduced the funding pressure of European banks. The EU summit in June 2012 was again largely without an impact. We find significant positive CAR following the Draghi speech and, in particular, after the OMT announcement. For example, the 2-day CAR of Spanish bonds around the OMT announcement is 4.8% and increases to 10.8% using the 5-day CAR. Italian sovereign bonds show similar CAR. German bund returns, on the other hand, exhibit significant negative CAR suggesting that both ECB actions helped to reduce the flight-to-quality in German bunds. Overall, these results highlight the importance of ECB interventions to reduce bond yields of the peripheral countries.

3.2 Cumulative abnormal equity returns

We perform a related analysis in Table 2, investigating average cumulative abnormal equity returns (ACAR) of European public banks around the same events. We also find that banks have significant abnormal returns around the 1st tranche of the LTROs and the OMT

announcement. For example, the 2-day CAR around LTRO is about 1.4%. The results are consistent with banks benefiting from less funding pressure and suppressed sovereign bond yields following the OMT.

3.3 Understanding CARs

To understand the drivers behind the abnormal returns, we regress the 2-day CAR of each bank around all 5 events on sovereign bond portfolio holdings (as reported in the most recent stress test of each event) and bank characteristics (Log-Assets, Tier 1 ratio, RWA/Assets). [7] We report the results in Table 3. The results suggest that banks with higher German bond holdings have somewhat lower CARs around the 1st LTRO tranche consistent with the interpretation that the LTRO funds reduced funding pressure for some banks but did not help in decreasing peripheral sovereign yields. However, we find that banks that have large holdings of Spanish and Italian sovereign debt have substantially higher CARs around Draghi's speech in July 2012 and the OMT announcement which is consistent with the CARs we reported for Italian and Spanish sovereign bonds. Our results suggest that these measures taken by the ECB increased the equity value (and decreased leverage) of those banks that invested in these bonds, which eventually helped them to regain access to private funding market as we will see in Section 4.4.

4 U.S. MMF investments at European banks

Banks benefited from ECB interventions through increased access to funding liquidity (LTRO) and higher prices of their sovereign bond holdings (OMT). In this section, we study the reaction of private short-term investors to central bank interventions. We start with descriptive statistics of secured and unsecured investments of U.S. MMFs at European banks in Section 4.1. We show how MMFs play a discipling role on banks before ECB interventions in Section 4.2. We investigate the consequences of U.S. MMF run on other private and public short-term funding flows in Section 4.3. Finally, Section 4.4 shows how market discipline in U.S. MMFs is impaired following ECB interventions.

[7] The number of observations corresponds to the number of banks participating in the European Banking Authority (EBA) stress tests for which data is available.

4.1 Descriptive statistics of U.S. MMF investments at European banks

In Table 4, we report some descriptive statistics of the principal amounts, maturities, and yields of MMF securities invested at European banks. The four most important securities in terms of invested amounts include certificates of deposits (CD), financial company commercial papers (Fin CP), government agency repurchase agreements (Gvt Repo), and Treasury repurchase agreements (Treasury Repo). These four securities amount for between 75% and 86% of all securities invested at 63 European banks through U.S. MMFs between 2010 and 2014. U.S. MMFs constitute the largest source of US-Dollar lending for European banks and their subsidiaries. U.S. MMF repos are secured by U.S. collateral, in particular U.S. government agency collateral for government agency repos, and U.S. treasuries for Treasury repos. In the rest of the paper, we will refer to unsecured funding for CDs and financial CPs, and secured funding for government repos, treasury repos and other repos.

From Table 4 (Panel A), we also observe some variation in maturities and yields across securities. As expected, the relationship between maturity and yield is such that longer-maturity securities are also more expensive sources of funding (higher yields) for banks. Highest yields and maturities are attached to unsecured funding (CDs and CPs), in contrast to repos that are the largest source of cheap short-term funding.

MMF investments at European banks decreased from 993 USD billion to 686 USD billion over the sample period, with a minimum of 529 USD billion in June 2014 (see Figure 1a). A strong end-of-quarter seasonality is driven by repo funding. Collins and Gallagher (2014) explain that this seasonality usually appears around corporate tax payment dates for the fund, which occur on the 15th of March, June, September, and December. Munyan (2014) however shows that the seasonality in repo investments is driven by the broker-dealer subsidiaries of non-US banks rather than their repo lenders as banks practice "window dressing" to appear safer at regulatory reporting dates.

In Figure 1b, we show the evolution of unsecured and secured funding invested at European banks from November 2010 until August 2014. A "run" appears on unsecured funding starting in April 2011, then CDs and financial CPs start flowing back to European banks in summer 2012. The trend in secured funding (repos) is reversed; some banks are able to increase their secured funding from April 2011 until June 2012, then repo investments decrease when banks regain access to unsecured funding.

4.2 Market discipline in U.S. MMFs before ECB interventions

4.2.1 MMF flows at non-Eurozone, Eurozone and GIIPS banks

To understand MMF behavior during the crisis and the effect of ECB interventions, we investigate the evolution of MMF investments in GIIPS banks, Eurozone (but non GIIPS) banks, and non-Eurozone banks, and plot the total principal amount invested in each region in Figure 2. In the summer of 2011, we observe that (i) Eurozone banks lose access to unsecured funding, (ii) secured funding flows to non-Eurozone banks. In particular, GIIPS banks completely lose access to unsecured funding in 2011, and do not have access to repos (even before 2011) in U.S. MMFs.

The panel regressions on MMF flows confirm these observations. In Table 5 (Panel A), we report the estimation results of the regression

$$dF_{it} = \varphi dF_{it-1} + \sum_{k} \left[\alpha_k + \alpha_{k,pre-interv.} d_{pre-interv.}\right] d_k + \epsilon_{it} \tag{1}$$

where $dF_{it} = (MMF_{it} - MMF_{it-1})/MMF_{it-1}$ and MMF_{it} is the average MMF principal amount invested at bank i over a 3-month window $[t-1, t+1]$; d_k is a dummy variable where k refers to GIIPS, Eurozone non-GIIPS, and non-Eurozone regions; and $d_{pre-interv.}$ is a dummy variable that refers to the period preceding the first LTRO allotment (November 2010 – December 2011).

Table 5 (Panel A) provides some first signs of market discipline before ECB interventions where U.S. MMFs reduce their investments at risky Eurozone (particularly GIIPS) banks, while maintaining their investments at non-Eurozone banks. The average monthly outflow is -26% for GIIPS banks ($\alpha_{GIIPS} + \alpha_{GIIPS,pre-interv.}$) between November 2010 and December 2011, and -10% for Eurozone non-GIIPS banks ($\alpha_{Euro} + \alpha_{Euro,pre-interv.}$). In contrast, U.S. MMF funding at non-Eurozone banks is stable as the average monthly outflow (-2%) is not significant at the 10% level.

Consistent with what we observe in Figure 2, the "run" of U.S. MMFs in summer 2011 is a run on *unsecured* funding. GIIPS and core Eurozone banks lose access to unsecured funding (-30% and -14% monthly outflows respectively), but do not have significant *secured* funding outflows. The trend at non-Eurozone banks is quite different: non-Eurozone banks do not lose access to unsecured funding, and start relying more on secured funding via U.S. MMF repos (2% monthly inflow) reflecting a flight-to-quality towards U.S. collateral.

In addition to showing the presence of market discipline before ECB interventions, Table 5 also shows that there is more discipline during this period. The flows we describe for the

period before ECB interventions are significantly different from the post-intervention flows, as parameter $\alpha_{k,pre-interv.}$ of eq. (1) measures the relative magnitude of pre-intervention flows compared to post-intervention flows.

4.2.2 MMF flows at high risk and low risk banks

To further analyze the impact of risk on funding, Figure 3 shows the evolution of MMF funding at high risk versus low risk banks. A bank is classified as "high risk" (resp. "low risk") if its 5-year CDS price in November 2010 was above (resp. below) the median of all banks 5-year CDS prices in November 2010. In Figure 6, we can see that (i) high risk banks always have average CDS prices above the average CDS prices of low risk banks throughout the sample (Figure 5a), and (ii) the ranking of risk according to CDS prices does not change much over time when CDS prices are updated. The rank correlation of current CDS prices with November 2010 CDS prices is alway above 0.7 until April 2014, as shown in Figure 5b.[8]

In Figure 3a, we observe that unsecured funding flows out of European banks, and particularly high risk banks during the crisis. With a similar regression as in eq. (1), we find additional evidence of increased market discipline before ECB interventions; risky banks outflows are significantly larger ($\alpha_{high.risk,pre-interv.} = -8\%$) before ECB interventions, and this effect comes from unsecured funding. The results are reported in Table 5 (Panel B), and are robust to country and time fixed effects. We show in Section 4.4.1 that the result of higher market discipline also holds when we reproduce this regression for Eurozone non-GIIPS banks only, showing that the results are not only driven by market segmentation.

4.2.3 Losing access to U.S. MMFs

In Table 6, we investigate access to U.S. money market funds using three different variables: (i) the difference in the number of securities invested at a bank, (ii) the probability of completely losing access to U.S. MMF unsecured funding, and (iii) the probability of losing access to one fund. In Panel A, access to U.S. MMF is explained by the region where the bank is located (GIIPS, Eurozone, and non-Eurozone). In Panel B, banks are classified according to their CDS prices in November 2010 (low risk vs. high risk banks, according to the definition of Section 4.2.2).

The results of the first three columns of Table 6 are obtained with a similar regression as eq. (1), where dF_{it} is replaced by the change in the number of securities invested at

[8] After this date most single-name CDS price series of European banks become "flat", reflecting a lack of market liquity for those CDS names.

bank i over month t. Eurozone non-GIIPS banks are the banks that lose the most securities before ECB interventions; core Eurozone banks lose an average of 5 U.S. MMF securities per month (4 in unsecured funding), compared to 3.7 securities lost in average at GIIPS banks. In contrast, non-Eurozone banks gain 2.5 security contracts in average per month (1.4 in secured funding) before ECB interventions. U.S. MMFs penalize banks for their risk taking before ECB interventions by not renewing their short-term funding contracts; high risk banks lose 6.4 securities (4.7 in unsecured funding) in average over a month, while low risk banks only lose 2 security contracts.

Some banks completely lose access to U.S. money market funds during the crisis. In Table 6, we show the results of a Probit regression that explains the probability for a bank to lose access to U.S. MMFs. Since only 13 banks have access to secured funding and since these banks never completely lose access to repos, we concentrate on banks losing access to unsecured funding via U.S. MMFs. The dependent variable is equal to one at date t if the bank had access to unsecured funding in month $t-1$ and lost its access to unsecured funding during month t. The results in Table 6 show that the probability of completely losing access to U.S. MMF unsecured funding is the highest for GIIPS banks (10%) before ECB interventions, compared to core Eurozone banks (5%) or non-Eurozone banks (1.5%). Indeed, all GIIPS banks lose access to unsecured funding before the first LTRO. The probability of high risk banks to lose access to unsecured funding is 6%, and this probability is significantly higher before ECB interventions. In contrast, the probability of low risk banks to lose access to unsecured funding (1%) is not significantly higher before interventions.

The probability of losing access to a particular fund in month t when the bank had access to this fund in month $t-1$ is always larger than the probability of completely losing access to U.S. MMFs. The Probit regression describing access to a fund is

$$\mathrm{P}\left(Y_{ijt}=1|X\right)=\Phi\left(\sum_{k}\left[\alpha_{k}+\alpha_{k,pre-interv.}d_{pre-interv.}\right]d_{k}\right)$$

where Y_{ijt} is a binary variable equal to one if fund j invested unsecured in bank i in month $t-1$ and ceased investing unsecured in that bank in month t, X comprises all explaining variables included in the regression, and $\Phi\left(\cdot\right)$ is the standard normal c.d.f. Before ECB interventions, the probability $\mathrm{P}\left(Y_{ijt}=1|X\right)$ is the highest for GIIPS banks (26%), compared to core Eurozone and non-Eurozone banks (15% and 12% respectively). Similarly, the probability of high risk banks of losing access to a fund for its unsecured funding (17%) is larger than the probability of low risk banks (12%). These probabilities are significantly higher than

the post-intervention probabilities, reflecting the run on unsecured funding during summer 2011. We obtain similar results for secured funding.

Overall, the results of this section show the disciplining role of U.S. MMF investors: they set prudential incentives for banks since banks are penalized for their excess risk taking through their access to short-term funding.

4.2.4 Market discipline through the characteristics of new securities

We have shown in the previous sections that market discipline operates through funding flows and access to U.S. MMFs; risky banks lose MMF funding compared to low risk banks. In this section, we analyze the effect of market discipline through the characteristics of new MMF securities once a bank has access to MMF funding. In the presence of market discipline, maturities should be shorter and yield spreads should be larger for risky banks. The principal amount of funding received with new securities could also be smaller for high risk banks compared to low risk banks.

To measure the effect of market discipline on the characteristics of MMF funding contracts, we run regressions on the maturities, yield spreads, and principal amounts of new securities invested by one fund at one bank according to

$$Mat_{ijt} = \alpha_1 d_{qend} + \alpha_2 d_{qstart} + \sum_k \left[\alpha_k + \alpha_{k,pre-interv.} d_{pre-interv.}\right] d_k + \epsilon_{ijt} \tag{2}$$

$$Yieldsp_{ijt} = \alpha_1 d_{qend} + \alpha_2 d_{qstart} + \beta_1 Mat_{ijt} + \sum_k \left[\alpha_k + \alpha_{k,pre-interv.} d_{pre-interv.}\right] d_k + \epsilon_{ijt} \tag{3}$$

$$\log(Amount_{ijt}) = \alpha_1 d_{qend} + \alpha_2 d_{qstart} + \sum_k \left[\alpha_k + \alpha_{k,pre-interv.} d_{pre-interv.}\right] d_k + \epsilon_{ijt} \tag{4}$$

where $Mat_{ijt}, Yieldsp_{ijt}, Amount_{ijt}$ are the average maturity, average yield spread (relative to Euribor 1 month), and total principal amount of new funding contracts invested by U.S. MMF fund j in European bank i at time t, d_{qend} and d_{qstart} are dummies for the 3rd month of quarter (quarter end) and 1st month of quarter (quarter start) respectively. The results are reported in Table 7 where d_k refers to the bank's region (GIIPS, Euro non-GIIPS, or non-Euro) in Panel A, and to the riskiness of the bank (high risk or low risk) in Panel B.

The Table shows additional market discipline evidence for a bank that already has access to U.S. MMFs; however this type of market discipline is less specific to the period before ECB interventions. Maturities are shorter for (i) GIIPS compared to non-GIIPS banks, and (ii) high risk banks compared to low risk banks. The average unsecured funding contract

maturity is 53 days for risky banks compared to 71 days for low risk banks, and the maturity of repo contracts is almost 2 days for risky banks compared to 2.5 days for low risk banks.

The yield spread to the Euribor 1 month rate is wider for risky banks than low risk banks for unsecured funding only. Before interventions, yield spreads of unsecured funding are larger for (i) GIIPS compared to non-GIIPS banks, (ii) Eurozone compared to non-Eurozone banks, and (iii) high risk banks compared to low risk banks. Market discipline in *secured* funding does not operate through yields (yield spreads are not larger for risky banks), but possibly through collateral requirements. Higher collateral requirement can translate into higher haircut,[9] or simply a restriction on the type and quality of eligible collateral in U.S. MMF repo transactions (e.g. U.S. government agency collateral).

Finally, the average principal amount received by a bank when it gets access to new securities is smaller for low risk banks compared to high risk banks. Before ECB interventions, the average amount received with new unsecured funding contracts is USD 59 millions ($\exp(\alpha_{high.risk} + \alpha_{high.risk,pre-interv.})$) for a high risk bank compared to USD 51 millions ($\exp(\alpha_{low.risk} + \alpha_{low.risk,pre-interv.})$) for low risk banks. The average amount of secured funding received with a new repo contract is USD 135 millions for high risk banks compared to USD 122 millions for low risk banks. This result and the results of Section 4.2.3 suggest that market discipline of U.S. MMFs before interventions is rather an extensive margin (banks losing access to U.S. MMF funding) than an intensive margin effect.

4.3 Unsecured funding run triggers other runs and ECB interventions

U.S. money market funds were the first group of investors to withdraw funding from European banks in 2011.[10] The results of Table 8 (Panel A) indicate that the U.S. MMF flows at European banks are correlated with other short-term funding flows. In particular, we show that one-month lagged U.S. MMF unsecured funding flows are correlated with the flows in debt securities invested at EU-28 banks with residual maturity of one year.[11] In contrast, secured funding flows are not significant to predict the evolution of other debt securities flows. The results of this Table suggest that the run of unsecured funding and the recovery following ECB interventions is somewhat also present in other sources of funding at European

[9] We only observe a positive trend in the average haircut of other repos throughout the sample. The average haircuts of government repos and treasury repos remain stable (around 2.3% for government repos, and 2% for treasury repos).

[10] "US money market funds warm to eurozone" (FT, February 28, 2013)

[11] Banks' short-term debt includes commercial papers, certificates of deposits and short-term notes with a maximum maturity of 12 months. Source: ESRB.

banks. The Granger-causal relationship of MMF unsecured funding on 1-year debt securities is robust to controlling for 2-year maturity debt flows at EU-28 banks (since 2-year residual maturity debt can become 1-year debt the next month).

Focusing on the crisis period, we also show that unsecured funding outflows in U.S. MMFs predict the demand for public funding; banks that experienced U.S. dollar outflows through MMFs during the crisis become more reliant on ECB secured funding though long-term refinancing operations. The negative correlation between the six-month U.S. MMF unsecured funding flows during the crisis (from June 2011 until December 2011) and the LTRO amount (including the two LTRO tranches) a bank received is illustrated in Figure 6b.

In Table 8 (Panel B), we show that unsecured MMF outflows during the crisis predict the probability of receiving LTRO funding (Probit analysis), as well as the amount of LTRO funding received (OLS analysis). Unsecured U.S. dollar outflows at a bank during the crisis increase the probability of the bank to receive LTRO funding. We measure this effect with the following Probit regression

$$\mathrm{P}\left(LTRO_i = 1|X\right) = \Phi\left(\alpha + \beta_F dF_{i,crisis}\right)$$

where $LTRO_i$ is a binary variable equal to one if bank i received LTRO funding (2 tranches of LTRO combined), X comprises all explaining variables included in the regression, and $\Phi\left(\cdot\right)$ is the standard normal c.d.f. The marginal effect of unsecured funding outflows on the probability of receiving LTRO funding is given by $-\phi\left(\beta_F * dF_{i,crisis} + \alpha\right) * \beta_F$, where $\phi\left(\cdot\right)$ denotes the standard normal p.d.f., and $dF_{i,crisis}$ is the 6-month unsecured funding flow at bank i before the LTRO.

For the median bank (i.e. the bank with $dF_{i,crisis}$ equal to the median of all banks unsecured crisis flows), the results in the first column of Table 8 (Panel B) indicate that the probability of receiving LTRO funding increases by 0.7% with an additional 1% outflow in the six month preceding the first LTRO. This effect does not appear to be large but it is conditional on the value of median unsecured funding outflows during the crisis that are already 73%. Therefore, the probability of a bank to get access to LTRO funding increases by 0.7% with one additional percent outflow when the bank already lost 73% of its unsecured funding. The marginal effect of unsecured funding outflows is still significant and of similar magnitude (0.6%) when we control for the change in non-deposit liabilities of the bank in the regression. Finally, LTRO funding is also explained by the risk of the bank through its CDS spread and its exposure to GIIPS sovereign debt; the LTRO probability of the median

bank increases by 26% with a 100 bps CDS spread increase, and by 16% with an increase of 0.01% of the ratio of GIIPS exposure to total assets.[12]

Ultimately, ECB liquidity injected through the LTRO helped stopping the run in U.S. MMFs: in Figure 6a, we observe that the aggregate unsecured funding outflow at European banks stops when the ECB started injecting liquidity through its LTRO in December 2011.

4.4 The impact of ECB interventions on U.S. MMF market discipline

In Table 5, the market discipline of U.S. MMFs on European banks that we observe during the crisis tends to disappear when the ECB starts its interventions in December 2011. Unsecured funding starts flowing back to Eurozone banks in the second half of 2012, and in 2013 for GIIPS banks (Figure 2a). At the same time, MMFs secured invesments at non-Eurozone banks decrease, indicating a possible reduction of the flight-to-quality in U.S. collateral (Figure 2b).

In this Section, we further show that the disciplining effect of bank risk on funding is reversed as risky banks get increased access to MMF funding. To differentiate between the impact of the two main ECB interventions (LTRO and OMT), we focus the following analysis on four different periods: the pre-crisis period from November 2010 until May 2011, the crisis period from June 2011 until December 2011, the intervention period (following the LTRO) from January 2012 until September 2012, and the post-intervention period (following the OMT) from October 2012 until August 2014.

4.4.1 MMF flows according to bank risk

With ECB interventions, funding flows back to high risk banks; the average monthly inflow is 1.3% during the intervention period for secured funding, and 4% the year following the OMT announcement for unsecured funding. In contrast, MMF investments at low risk banks are stable (flows are not significantly different from zero).

To measure the incremental effect of risk on funding flows, we use the cross-sectional information from CDS prices

$$dF_{it} = \varphi dF_{it-1} + \sum_{\tau} \left[\beta_\tau CDS_{i,\tau} + \alpha_\tau\right] d_\tau + \epsilon_{it} \tag{5}$$

[12]These variables are however not jointly significant to predict LTRO funding as they are highly correlated (e.g. the correlation between unsecured outflows and GIIPS exposure is 0.87).

where $CDS_{i,\tau}$ is the last available 5-year CDS price of bank i before the period τ starts. We report the results of eq. (5) in Table 10. The impact of risk is negative and significant for unsecured funding before and during the crisis, while secured funding is not sensitive to risk during these periods as U.S. MMF repos are secured by U.S. collateral (see Table 10). Banks with higher CDS prices experience higher outflows on their unsecured funding during the crisis; a widening of 100 bps of the CDS spread produces an incremental monthly outflow of -17%. Following the period of ECB interventions, the impact of risk on funding is reversed as risky banks recover part of their secured and unsecured funding. Banks with higher CDS prices obtain larger inflows; the incremental inflow is 2% (for both secured and unsecured funding) for a 100 bps CDS spread increase.

Most of the results we find in this section hold when we reproduce the results on Eurozone non-GIIPS banks only (see Figure 4 and Table 11). This allows us to highlight the impact of the risk channel in determining access to U.S. MMFs. In Table 11, the post-intervention impact of risk on unsecured funding flows (0.1%) is not significant during the post-intervention period. Breaking the rather long post-intervention period (from October 2012 to August 2014) into two subperiods of one year, we can show that this effect is positive (3.8%) and significant at 10% the year following the OMT announcement (from October 2012 to September 2013), but disappears after a year for Eurozone core banks. Similarly, we can show that this positive impact of bank risk on unsecured funding following the OMT announcement is robust to country fixed effects, common factors (Table 17 in Appendix B), and the interaction between country and period fixed effects, supporting again the effect of market discipline over market segmentation.

4.4.2 MMF flows according to bank GIIPS bond holdings

The EBA disclosed sovereign bond portfolio holdings of European banks at six different dates (from December 2010 until June 2013). To investigate how banks' portfolio composition affect the supply of U.S. MMF funds, we replace CDS prices by GIIPS holdings as a percentage of bank's total assets in equation (5), where this information is updated with the last available disclosure before period τ starts. The results are reported in Table 10.

Results are similar to the results of the previous section: MMF funding flows out of banks with high exposure to risky debt during the crisis, and flows back to the banks with high peripheral country debt exposure after the intervention period. We also see that the positive post-intervention impact of CDS spreads on unsecured funding (the impact following the

OMT announcement) is mainly driven by banks exposure to GIIPS sovereign debt.[13] We also note larger secured inflows at banks with large GIIPS exposure following the LTRO. Therefore, both interventions channel private liquidity to banks with large exposure to GIIPS sovereign debt; these banks get larger repo inflows following the LTRO, and larger unsecured inflows with the OMT.

The findings linking GIIPS exposure to USD funding are confirmed by cross-sectional regressions of banks' bond portfolio exposures against their MMF flows 3 months and 6 months after each EBA measurement date. We find that the exposure of banks to GIIPS debt has a significant impact on their future MMF flows (see Table 15 in Appendix B). In early exercises (December 2010 and September 2011), the exposure to risky sovereign debt has a negative impact on MMF investments. But in the last two exercises (December 2012 and June 2013), this parameter has the opposite sign such that banks with higher exposure to GIIPS debt also experience higher MMF inflows in the next months.

Overall, the results of this section tends to confirm that risky bank – in particular, banks with large exposures to GIIPS sovereign debt – are rewarded by positive MMF inflows following ECB interventions.

4.4.3 Gaining access to U.S. MMFs

We repeat the analysis of Section 4.2.3 to understand which banks regain access to U.S. MMFs following ECB interventions. In Panel A, we find that the number of securities increases significantly at Eurozone non-GIIPS banks following the first LTRO and following the OMT; the number of securities invested at a bank increases by one in average per month (1.3 after the LTRO, and 1.2 after the OMT), and this increase mainly comes from unsecured funding. The increase in securities post-intervention is also higher at risky banks (Panel B), but the impact of risk is not significant.

Some banks regain access to MMFs following ECB interventions and after they completely lost access as we described in Section 4.2.3. The probability of (re-)gaining access to unsecured funding in month t when a bank did not have access in month $t-1$ is also reported in Table 12. This probability is the highest before the crisis, and it is not significantly increasing with risk (Panel C).

The probability of gaining access to fund j in month t when the bank does not have access to the fund in month $t-1$ is quite small for all periods (Panels A and B). The probability of

[13] We explore other risk measures like market leverage (Lvg), or the Tier 1 capital ratio (T1CR) in Table 16 (Appendix B).

gaining access to a fund is always larger before the crisis; it is reduced with the crisis, and does never really increase after ECB interventions. For example, the probability of a high risk bank to gain access to a new fund for unsecured funding is 30.43% before the crisis, 7.69% during the crisis, and is reduced even further following the LTRO (3.61%) and the OMT (3.74%).

The impact of risk on access to new funds is derived from the Probit regression

$$\mathrm{P}\left(Y_{ijt}=1|X\right)=\Phi\left(\sum_{\tau}\left[\beta_{\tau}CDS_{i,\tau}+\alpha_{\tau}\right]d_{\tau}\right)$$

where Y_{ijt} is a binary variable equal to one if fund j did not invest unsecured in bank i in month $t-1$ and started investing unsecured in that bank in month t, X comprises all explaining variables included in the regression, and $\Phi\left(\cdot\right)$ is the standard normal c.d.f. The marginal effect of risk on access to new fund j in period τ is given by $\phi\left(\beta_{\tau}*CDS_{i,\tau}+\alpha_{\tau}\right)*\beta_{\tau}$. If we take a bank such that its CDS price is the median of CDS prices the month before period τ starts, its probability of gaining access to a new fund for unsecured funding decreases by -1.43% before the crisis, and by -0.44% during the crisis with a 100 bps CDS spread increase (Panel C). Then, the impact of risk on access to new funds becomes zero in the intervention and post-intervention periods. In other words, there is no effect of risk on the probability of gaining access to new funds following ECB interventions. We obtain similar results for secured funding.

4.4.4 Maturities, yield spreads, and principal amounts of new MMF securities

From Table 4 (Panel B), we observe that the post-intervention period is characterized by longer maturities and lower yields for all securities indicating that funding pressure has been reduced due to ECB interventions. We also test the impact of risk on maturities, yield spreads, and principal amounts of new securities invested by one fund at one bank according

to

$$Mat_{ijt} = \alpha_1 d_{qend} + \alpha_2 d_{qstart} + \beta_2 Size_{j,2010} + \beta_3 Risk_{j,2010} + \sum_{\tau} \left[\beta_{4,\tau} CDS_{i,\tau} + \alpha_\tau\right] d_\tau + \epsilon_{ijt} \quad (6)$$

$$Yieldsp_{ijt} = \alpha_1 d_{qend} + \alpha_2 d_{qstart} + \beta_1 Mat_{ijt} + \beta_2 Size_{j,2010} + \beta_3 Risk_{j,2010} + \sum_{\tau} \left[\beta_{4,\tau} CDS_{i,\tau} + \alpha_\tau\right] d_\tau + \epsilon_{ijt} \quad (7)$$

$$\log(Amount_{ijt}) = \alpha_1 d_{qend} + \alpha_2 d_{qstart} + \beta_2 Size_{j,2010} + \beta_3 Risk_{j,2010} + \sum_{\tau} \left[\beta_{4,\tau} CDS_{i,\tau} + \alpha_\tau\right] d_\tau + \epsilon_{ijt} \quad (8)$$

where $Size_{j,2010}$ is the logarithm of fund j net assets in November 2010, and $Risk_{j,2010}$ is fund j exposure to Eurozone banks as a percentage of its net assets in November 2010. The results are reported in Table 13 for unsecured (Panel A) and secured funding (Panel B), with and without fund fixed effects $Size_{j,2010}$ and $Risk_{j,2010}$. We also report in this table the results of regressions (6)-(8) where we replace CDS prices by a dummy variable equal to one when the bank is classified as "high risk" according to the definition of Section 4.2.2.

The estimated parameters in Table 13 are consistent with the observation of longer maturities and smaller yield spreads during the post-intervention period for both secured and unsecured funding. The results also reveal a smaller average principal amount invested by a fund at a bank through new securities in the post-intervention period. The results we describe in this Section are robust to fund fixed effects. Fund fixed effects are significant for yield spreads and principal amounts but not for maturities. Larger funds and funds with a larger exposure to Eurozone banks are able to charge higher yields and to lend larger amounts. Fund size and Eurozone exposure are actually the main determinants of the principal amount lent with a new security.[14]

The maturity of *unsecured* funding (Panel A) shortens with the risk of the bank in all periods, but the impact of risk is significantly higher in the post-intervention period. The increased impact of risk on maturities in the post-intervention period comes from an increase of maturities at low risk banks, while maturities of high risk banks remain stable. Maturity is shortened by 58 days with a 100 bps increase in the bank's CDS spread in the post-

[14]However, the results with fund fixed effects are based on the funds that had exposure to Eurozone in November 2010 and exclude funds that invested later in Eurozone banks. The difference approximatively represents 40 funds that only invest in non-Eurozone banks or started investing in Eurozone banks after 2010.

intervention period, compared to a reduction of 26 days for the same CDS spread increase in the pre-crisis period.

Unsecured funding is more expensive for risky banks in the post-intervention period, but the impact of risk on yield spreads is significantly reduced compared to the pre-crisis period. While we expect maturities and yield spreads to be positively correlated, we find that maturities diverge between high and low risk banks and that yield spreads converge after the period of interventions. Indeed, the maturity of low risk banks increases significantly without a corresponding increase im yield spreads (yield spreads actually decrease for low risk banks post-intervention).

The impact of risk on *secured* funding maturity (Panel B) is not significant, but bank risk has a negative impact on yield spreads in the post-intervention period. Therefore, higher risk taking helps a bank lowering its cost of repo funding (when the bank holds U.S. collateral). Given the results on yields spreads, the positive impact of risk on repo inflows post-intervention looks more like a demand effect (risky banks' demand for cheaper funding), while the impact of risk on unsecured inflows is coming from U.S. MMFs (as they find more profitable investing unsecured in risky banks).

The average principal amount received with new (secured or unsecured) funding contracts increases with risk in the post-intervention period. This result and the results of Section 4.4.3 indicate that the post-intervention inflows to risky banks can be due to both intensive and extensive margin effects. In contrast, we have shown in Section 4.4.4 that the crisis outflows are mainly an extensive margin effect (banks losing access to U.S. MMFs).

5 Conclusion

We study investments of U.S. MMF in European banks during the sovereign debt crisis. Our data strikingly shows a run of short-term investors on high-risk banks, in particular on unsecured funding such as commercial paper or certificate of deposits, in the second half of 2011, when the crisis deepened. At the same time, we observe an increase of repo funding of European banks that is collateralized with U.S. treasury securities. We find a reversal in fund flows following a series of interventions by the ECB: U.S. MMF return to high-risk banks and provide increasing amounts of unsecured funding after the ECB announced its OMT program.

Our results are consistent with a weakening of market discipline of short-term debt during the sovereign debt crisis. Wholesale funding returns to those high-risk banks that were

initially experiencing runs. The ECB thus provided support for a troubled financial system, making it possible for national regulators to delay dealing with troubled banks. Moreover, repeatedly lowering its collateral standard, the ECB was effectively providing assistance to banks that likely had solvency issues. In other words, the interventions by the ECB facilitated forbearance by national regulators rather than curtailing these incentives.

Our results therefore have important implications for regulators and policy makers in Europe. As a first step to a banking union in Europe, the ECB took over as single supervisor of the largest banks in the euro area in November 2014. Before that, they conducted a comprehensive assessment to ensure that they supervise a healthy financial sector. There are considerable concerns that the comprehensive assessment did not reach its objective to identify problem assets and cleanup the balance sheet of European banks leaving the financial system vulnerable to shocks and questioning the stability of the banking union. The ECB might thus need to continue providing assistance to banks about whose solvency one can have considerable doubts.

Importantly, a sustainable growth path still eludes the Eurozone countries. Not having dealt with troubled financial institutions in a decisive way endangers the Eurozone and increases the risk that they can escape the low-growth environment in the near future.

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Table 1: **Cumulative abnormal returns of sovereign bonds surrounding various ECB interventions**

This table reports the cumulative abnormal sovereign bond returns for all 10-year GIIPS bonds and German bunds surrounding various interventions from the European Central Bank (ECB). These are: LTRO 1 (December 21, 2011), LTRO 2 (February 28, 2012), the EU Summit (June 2012), the Draghi speech (July 2012), and the announcements of the OMT details (September 6, 2012). The evidence in this table is based on market model adjusted abnormal bond returns. We use the Lehman Brothers EU Sovereign Bond Index as the benchmark bond market index in computing these abnormal returns. T-statistics are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

		CAR of Sovereign Bond Portfolio					
		Spain	**Italy**	**Ireland**	**Portugal**	**Greece**	**Germany**
LTRO 1	[-2;+2]	0.007	0.019	0.009	-0.008	-0.033	-0.015***
		(.468)	(1.343)	(.605)	(-.891)	(-0.633)	(-2.916)
	[-1;+1]	-0.008	0.006	0.006	0.002	0.010	-0.015***
		(-0.552)	(.329)	(.566)	(.189)	(.36)	(-3.211)
	[-1;0]	0.002	0.010	<0.001	-0.007	-0.016***	-0.013***
		(.151)	(.398)	(.012)	(-1.521)	(-7.208)	(-7.585)
LTRO 2	[-2;+2]	0.002	0.038***	-0.010	-0.108***	0.069	-0.003
		(.413)	(3.799)	(-0.821)	(-4.662)	(1.092)	(-0.556)
	[-1;+1]	-0.005	0.016*	-0.006	-0.059*	-0.017	0.002
		(-0.974)	(1.684)	(-0.371)	(-1.84)	(-0.428)	(.68)
	[-1;0]	-0.006	0.003*	0.009	-0.014	-0.043***	0.004
		(-1.129)	(1.691)	(1.136)	(-1.220)	(-3.972)	(1.599)
EU Summit	[-2;+2]	0.032	0.012	0.068	-0.045	0.058*	-0.0036
		(.905)	(.351)	(1.238)	(-1.313)	(1.718)	(-0.413)
	[-1;+1]	0.034	0.009	0.066	-0.02	0.054*	0.001
		(.899)	(.207)	(1.068)	(-.571)	(1.853)	(.083)
	[-1;0]	0.035	0.027	0.063	-0.023	0.056***	-0.005
		(.891)	(1.016)	(1.04)	(-.585)	(3.204)	(-0.375)
Draghi speech	[-2;+2]	0.08***	0.022	0.014	-0.044	0.152	-0.024***
		(6.171)	(.905)	(1.031)	(-.853)	(1.248)	(-6.449)
	[-1;+1]	0.055***	0.033***	-0.002	-0.031	0.101*	-0.016***
		(4.943)	(2.4)	(-.226)	(-.596)	(1.683)	(-7.370)
	[-1;0]	0.035***	0.026***	-0.004	-0.04	0.043	-0.009***
		(3.314)	(2.625)	(-.571)	(-.779)	(1.305)	(-8.129)
OMT	[-2;+2]	0.108***	0.047***	0.018	0.079	0.111	-0.018***
		(4.413)	(2.474)	(1.487)	(1.504)	(1.371)	(-2.490)
	[-1;+1]	0.075***	0.044***	0.018*	0.071*	0.018	-0.014***
		(3.298)	(6.88)	(1.796)	(1.885)	(.9)	(-2.777)
	[-1;0]	0.048*	0.031***	0.008	0.027	0.014	-0.012***
		(1.842)	(4.714)	(.861)	(1.043)	(.588)	(-2.096)

Table 2: **Cumulative abnormal equity returns surrounding various ECB interventions**

This table reports average cumulative abnormal equity returns (ACAR) for all publicly traded European banks that participated in the EBA stress tests surrounding various ECB interventions. These are: LTRO 1 (December 21, 2011), LTRO 2 (February 28, 2012), the EU Summit (June 2012), the Draghi speech (July 2012), and the announcements of the OMT details (September 6, 2012). The evidence in this table is based on market model adjusted abnormal bond returns. We use the MSCI Europe Index as the benchmark stock market index in computing these abnormal returns. T-statistics are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Event Window		**ACAR**
LTRO 1	[-2;+2]	0.025***
		(3.45)
	[-1;+1]	0.021***
		(3.58)
	[-1;0]	0.014***
		(3.56)
LTRO 2	[-2;+2]	0.025***
		(3.45)
	[-1;+1]	0.013
		(1.65)
	[-1;0]	-0.009
		(-1.16)
EU Summit	[-2;+2]	-0.001
		-(0.07)
	[-1;+1]	0.006
		(.73)
	[-1;0]	0.002
		(.2)
Draghi speech	[-2;+2]	0.014
		(1.64)
	[-1;+1]	-0.003
		(.35)
	[-1;0]	-0.003
		(-0.36)
OMT	[-2;+2]	0.049***
		(3.55)
	[-1;+1]	0.027***
		(4.34)
	[-1;0]	0.013***
		(2.69)

Table 3: **Regression analysis of determinants of Cumulative Abnormal Returns surrounding various ECB interventions**

This table presents estimates from a linear regression analysis of the determinants of cumulative abnormal banks' stock returns (CARs) surrounding the different ECB interventions. The dependent variable is the two-day [-1;0] CAR. Independent variables are each banks' GIIPS sovereign bond holdings scaled by total assets. Bank characteristics and sovereign bond holdings are from the period prior to the intervention. T-statistics are in parentheses. Standard errors are heteroscedasticity robust. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Tier1 is Tier 1 capital divided by risk-weighted assets; RWA/TA is risk-weighted assets divided by total assets.

	LTRO 1		**LTRO 2**		**Draghi speech**		**OMT**	
	CAR [-1;0]	**CAR** [-1;0]	**CAR** [-1;0]	**CAR** [-1;0]	**CAR** [-1;0]	**CAR** [-1;0]	**CAR** [-1;0]	**CAR** [-1;0]
Italy/Assets	-0.144		0.034		0.385***		0.329**	
	(-1.13)		(0.25)		(3.02)		(2.23)	
Spain/Assets	-0.095		0.303		0.561***		0.174*	
	(-0.77)		(1.00)		(3.01)		(1.71)	
Ireland/Assets	0.460		-0.151		0.903*		0.350	
	(0.32)		(-0.21)		(1.87)		(0.88)	
Portugal/Assets	-0.307**		0.789		-0.029		0.328	
	(-2.29)		(1.58)		(-0.21)		(0.99)	
GIIPS/Assets		0.018		-0.011		0.322***		0.304**
		(0.30)		(-0.04)		(2.78)		(2.31)
Germany/Assets	-0.209*	-0.201*	0.012	-0.011	0.127	0.122	-0.188	-0.193
	(-1.87)	(-1.74)	(0.07)	(-0.07)	(1.08)	(0.93)	(-1.54)	(-1.65)
Log-Assets	-0.001	-0.001	0.002	0.002	0.003	0.005	0.005	0.005
	(-0.20)	(-0.36)	(0.35)	(0.28)	(0.66)	(1.17)	(1.08)	(1.04)
Tier 1	0.001	0.001	0.002*	0.002	-0.000	0.000	-0.002	-0.002*
	(0.58)	(0.57)	(1.68)	(1.10)	(-0.33)	(0.47)	(-1.63)	(-1.86)
RWA/Assets	0.000	0.000	-0.000	-0.000	0.000*	0.001**	-0.001	-0.001
	(0.34)	(0.16)	(-1.03)	(-0.85)	(1.70)	(2.17)	(-1.51)	(-1.67)
Constant	0.015	0.019	-0.047	-0.039	-0.061	-0.107	-0.008	0.000
	(0.23)	(0.32)	(-0.56)	(-0.40)	(-0.87)	(-1.52)	(-0.10)	(0.00)
N	54	54	51	51	42	42	42	42
R^2	8.77%	3.72%	12.00%	6.77%	39.8%	31.23%	32.74%	32.07%

Table 4: **Descriptive statistics of Money Market Funds investments at European Banks**

This table reports descriptive statistics of unsecured and secured MMF invested at European banks: total principal amount ($m), average maturity (days), and average annual yield. Total principal amount is the sum of principal amounts at 63 banks. Average maturities and yields are cross-sectional weighted averages (over 63 banks), weights given by principal amounts. Panel A: Avg. and Std. Dev. are time-series averages and standard deviations (over 46 months). Panel B: Avg. and Std. Dev. are time-series averages and standard deviations by period. Pre crisis period: Nov 2010 – May 2011; Crisis period: June 2011 – Dec 2011; Intervention period: Jan 2012 – Sept 2012; Post intervention period: Oct 2012 – Aug 2014.

Panel A

	Total principal amount ($m)		Average maturity (days)		Average yield	
Security type	Avg.	Std. Dev.	Avg.	Std. Dev.	Avg.	Std. Dev.
Unsecured Funding						
Certificate of Deposit	211,990	79,179	71.02	10.33	0.314	0.094
Financial Company Commercial Paper	116,390	20,709	57.24	10.08	0.286	0.084
Secured Funding						
Government Agency Repurchase Agreement	131,870	37,519	5.31	1.85	0.139	0.060
Other Repurchase Agreement	40,180	10,479	20.93	7.23	0.431	0.079
Treasury Repurchase Agreement	119,710	25,783	3.07	2.31	0.101	0.059

Panel B

	Total principal amount ($m)				Average maturity (days)				Average yield			
Security type	pre-crisis	crisis	interv.	post-int.	pre-crisis	crisis	interv.	post-int.	pre-crisis	crisis	interv.	post-int.
Unsecured Funding												
Certificate of Deposit	365,140	235,850	137,530	187,270	83.287	66.890	58.616	73.393	0.407	0.364	0.412	0.232
	(19,908)	(68,674)	(15,560)	(28,202)	(7.949)	(9.893)	(5.037)	(6.141)	(0.020)	(0.024)	(0.016)	(0.057)
Financial Company												
Commercial Paper	142,880	108,770	87,011	122,150	52.499	47.501	50.839	64.150	0.338	0.309	0.397	0.219
	(9,788)	(11,370)	(8,200)	(12,680)	(6.236)	(10.042)	(6.881)	(6.545)	(0.021)	(0.043)	(0.030)	(0.053)
Secured Funding												
Government Agency												
Repurchase Agreement	143,330	155,870	166,740	107,430	3.587	3.463	4.729	6.621	0.183	0.110	0.185	0.116
	(24,307)	(14,604)	(14,335)	(34,667)	(1.026)	(1.164)	(1.337)	(1.260)	(0.056)	(0.036)	(0.017)	(0.060)
Other Repurchase												
Agreement	59,638	41,513	38,033	34,692	10.757	14.447	19.144	26.707	0.377	0.432	0.538	0.404
	(13,722)	(2,273)	(3,623)	(2,813)	(3.018)	(3.136)	(3.054)	(4.021)	(0.021)	(0.038)	(0.018)	(0.074)
Treasury Repurchase												
Agreement	113,280	133,820	143,420	108,090	3.445	2.300	2.337	3.479	0.151	0.066	0.141	0.081
	(18,965)	(17,288)	(16,778)	(24,310)	(3.116)	(0.832)	(0.913)	(2.567)	(0.064)	(0.040)	(0.028)	(0.052)

Table 5: **Market discipline in MMF investments before ECB interventions**

This table presents estimates from a linear regression analysis of the determinants of MMF flows at European banks. The regression is a pooled OLS regression where the dependent variable is the percentage change in principal amount at date t. Panel A: GIIPS is a dummy variable equal to one if the bank is in a GIIPS country, Euro non-GIIPS is a dummy for a bank in the Eurozone (but not GIIPS), non-Eurozone is a dummy for European banks outside the Eurozone. Panel B: high (low) risk is a dummy variable equal to one if the CDS price of a bank in November 2010 was above (below) the median of November 2010 CDS prices. The regression is augmented by deterministic interaction terms to account for changing parameters before ECB LTRO ("pre interv."). AR: autoregressive parameter. ***, **, and * indicate significance (based on panel robust standard errors) at the 1%, 5%, and 10% levels, respectively.

Panel A

	All securities	Unsecured	Secured
GIIPS, pre interv.	-0.253***	-0.453***	
Euro nonGIIPS, pre interv.	-0.133***	-0.166***	-0.009
non-Euro, pre interv.	-0.072	-0.005	0.056***
GIIPS	-0.004	0.149***	
Euro nonGIIPS	0.031	0.022	-0.003
non-Euro	0.052	0.001	-0.032***
AR	0.105***	0.042	0.399***
R^2 (%)	1.84	6.90	15.75
Adj. R^2 (%)	1.54	6.57	15.10
Observations	1944	1667	531
Banks	61	56	13

Panel B

	All securities	Unsecured	Secured
high risk, pre interv.	-0.075***	-0.125***	0.019*
low risk, pre interv.	-0.013	-0.027*	-0.029
high risk	-0.014	0.015	0.008***
low risk	0.005	0.002	-0.005
AR	0.668***	0.586***	0.418***
R^2 (%)	36.51	40.92	20.38
Adj. R^2 (%)	36.24	40.6	19.35
Observations	924	846	316
Banks	29	29	9

Table 6: **Banks losing access to U.S. MMFs before ECB interventions**

This table presents estimates from a linear regression analysis of the determinants of access to MMF. The regression is a pooled OLS regression where the dependent variable is the change in number of securities at date t (Number of securities change). The regression is a pooled Probit regression where the dependent variable is the probability of losing access to MMF when the bank has access at time t-1 (P(Losing access to MMF)), or the probability of losing access to one fund when the bank has access to the fund at time t-1 (P(Losing access to one fund)). Panel A: GIIPS, Euro non-GIIPS, or non-Eurozone banks. Panel B: high or low risk banks according to November 2010 CDS prices. "pre interv.": time dummy before ECB LTRO. AR: autoregressive parameter. ***, **, and * indicate significance (based on panel robust standard errors) at the 1%, 5%, and 10% levels, respectively. R^2 is adjusted R^2 for OLS regressions, and Pseudo R^2 of McFadden for Probit regressions.

Panel A

	Number of securities change			P(Losing access to MMF)		P(Losing access to one fund)			
	All securities	Unsecured	Secured	Unsecured		Unsecured		Secured	
					Prob.		Prob.		Prob.
GIIPS, pre interv.	-3.995***	-2.796**		0.537	10.00	0.759***	26.42		
Euro nonGIIPS, pre interv.	-6.267***	-4.741***	-0.838*	0.287*	5.31	0.145***	14.77	0.137***	12.77
non-Euro, pre interv.	3.214*	1.472*	2.038*	0.231	1.52	0.078***	12.03	-0.024	12.97
GIIPS	0.236	0.195		-1.819***	3.45	-1.390***	8.23		
Euro nonGIIPS	1.214***	0.803***	0.326*	-1.902***	2.86	-1.191***	11.68	-1.274***	10.13
non-Euro	-0.705	-0.197	-0.637*	-2.395***	0.83	-1.252***	10.53	-1.104***	13.48
AR	-0.028	0.133**	-0.324***						
Unconditional probability					2.84		12.09		12.09
R^2 (%)	1.33	3.42	10.91	5.04		0.61		0.29	
Observations	2,651	2,651	2,651	1,761		63,092		36,194	
Banks	61	61	61	56		58		13	

Panel B

	Number of securities change			P(Losing access to MMF)		P(Losing access to one fund)			
	All securities	Unsecured	Secured	Unsecured		Unsecured		Secured	
					Prob.		Prob.		Prob.
high risk, pre interv.	-8.313***	-5.812***	-0.814	0.597**	6.25	0.077***	16.86	0.235***	17.51
low risk, pre interv.	-2.336	-1.336	-0.646	0.133	1.01	0.117***	11.10	0.104***	12.34
high risk	1.893**	1.088***	0.668	-2.131***	1.65	-1.036***	15.00	-1.170***	12.10
low risk	0.385	0.202	0.060	-2.458***	0.70	-1.338***	9.04	-1.263***	10.34
AR	-0.018	0.177***	-0.340***						
Unconditional probability					0.39		11.38		11.52
R^2 (%)	0.78	4.59	11.72	8.44		1.13		0.36	
Observations	982	982	982	1,026		46,035		26,659	
Banks	29	29	29	34		30		9	

Table 7: **Market discipline through the characteristics of new securities**

This table presents estimates from a linear regression analysis of the determinants of characteristics of new MMF securities invested by one fund at a European bank. The regression is a pooled OLS regression where the dependent variable is the maturity (days), the yield spread (%), and log principal amount at date t. Panel A: GIIPS is a dummy variable equal to one if the bank is in a GIIPS country, Euro non-GIIPS is a dummy for a bank in the Eurozone (but not GIIPS), non-Eurozone is a dummy for European banks outside the Eurozone. Panel B: high (low) risk is a dummy variable equal to one if the CDS price of a bank in November 2010 was above (below) the median of November 2010 CDS prices. Yield spread is the difference between MMF yield and Euribor 1 month. The regression is augmented by deterministic interaction terms to account for changing parameters before ECB LTRO ("pre interv."). AR: autoregressive parameter. ***, **, and * indicate significance (based on panel robust standard errors) at the 1%, 5%, and 10% levels, respectively.

Panel A

	Unsecured			Secured		
	Maturity	Yield spread	Amount	Maturity	Yield spread	Amount
GIIPS, pre interv.	-0.841	0.621***	0.067			
Euro nonGIIPS, pre interv.	7.073	-0.125	0.374***	-0.984	-0.596***	0.342***
non-Euro, pre interv.	-10.042	-0.256**	0.286**	0.229	-0.663***	0.425***
GIIPS	38.777***	1.722***	18.070***			
Euro nonGIIPS	59.878***	1.534***	17.459***	3.255***	1.262***	18.311***
non-Euro	75.482***	1.432***	17.385***	4.161***	1.301***	18.117***
Maturity		0.009***			0.013*	
R^2 (%)	1.93	23.05	2.07	0.65	14.69	2.25
Adj. R^2 (%)	1.86	22.98	2.00	0.56	14.58	2.15
Observations	8989	8458	8991	5060	4712	5062
Banks	56	56	56	13	13	13
Funds	185	183	185	267	265	267

Panel B

	Unsecured			Secured		
	Maturity	Yield spread	Amount	Maturity	Yield spread	Amount
high risk, pre interv.	13.618	0.212	0.175	0.005	-0.792***	0.160
low risk, pre interv.	-14.997	-0.302***	0.458***	-1.544*	-0.560***	0.494***
high risk	39.601***	1.603***	17.724***	1.751***	1.182***	18.564***
low risk	86.273***	1.409***	17.302***	4.205***	1.271***	18.125***
Maturity		0.009***			0.008	
R^2 (%)	7.69	25.02	2.85	0.92	14.40	3.59
Adj. R^2 (%)	7.61	24.94	2.77	0.79	14.24	3.45
Observations	6108	5792	6110	3643	3358	3645
Banks	30	30	30	9	9	9
Funds	183	182	183	264	260	264

Table 8: **MMF flows and other sources of funding**

Panel A presents estimates from a time-series regression that explain aggregate flows of debt securities of residual maturity of one year at EU-28 banks (Source: ESRB). Banks' short-term debt includes commercial papers, certificates of deposits and short-term notes with a maximum maturity of 12 months. Panel B presents estimates from cross-sectional regressions that explain demand for public funding through Long-Term Refinancing Operations (LTRO). Probit: the dependent variable is a dummy variable equal to one if bank received LTRO funding (LTRO 1 and 2 combined). OLS: the dependent variable is the logarithm of LTRO funding received, if LTRO amount is positive. GIIPS(2011): GIIPS gross direct exposure (in hundredth of percentage of total assets) as of end September 2011, CDS(2011): CDS price as of end November 2011. Standard errors in parentheses (Newey-West standard errors in Panel A). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: U.S. MMF flows and short-term debt securities flows

	1-year debt flow at EU-28 banks			
MMF unsecured flow (t-1)	0.081*			0.107**
	(0.046)			(0.050)
MMF secured flow (t-1)		0.039		0.089
		(0.090)		(0.091)
2-year debt flow (t-1)			-0.835**	-0.824**
			(0.321)	(0.315)
AR	0.002	0.030	0.356*	0.292
	(0.102)	(0.131)	(0.209)	(0.202)
Constant	-0.264	-0.285	-0.517	-0.365
	(0.321)	(0.344)	(0.329)	(0.293)
R^2 (%)	4.133	0.572	12.411	16.549
Adj. R^2 (%)	-0.544	-4.277	8.138	10.290
Estimation sample	2011(2) - 2014(9)			

Panel B: MMF flows during the crisis and the demand for LTRO funding

	Probit				OLS			
MMF unsecured flow (crisis)	-1.790**	-1.447*			-5.279***	-4.437**		
	(0.639)	(0.720)			(1.292)	(1.756)		
Debt flow (2011)		-1.408				-5.233		
		(3.423)				(8.756)		
CDS(2011)			0.660**				0.265*	
			(0.296)				(0.128)	
GIIPS(2011)				0.402*				1.056***
				(0.219)				(0.262)
Constant	-0.972*	-0.818	-2.094**	-0.419	1.778**	2.243**	3.430***	3.321***
	(0.473)	(0.536)	(0.906)	(0.313)	(0.753)	(1.024)	(1.081)	(0.957)
Number of banks	28	24	28	31	28	24	28	31

Table 9: **U.S. MMF investments at Eurozone, non-Eurozone, and GIIPS banks**

This table presents estimates from a linear regression analysis of the determinants of MMF flows at a bank surrounding the different ECB interventions. The regression is a pooled OLS regression where the dependent variable is the percentage change in principal amount at date t. The regression is augmented by deterministic interaction terms to account for changing parameters before the Sovereign debt crisis ("pre crisis"), during the crisis ("crisis"), during the intervention period ("interv."), and post intervention ("post interv."). Pre crisis period: Nov 2010 – May 2011; Crisis period: June 2011 – Dec 2011; Intervention period: Jan 2012 – Sept 2012; Post intervention period: Oct 2012 – Aug 2014. AR: autoregressive parameter. ***, **, and * indicate significance (based on panel robust standard errors) at the 1%, 5%, and 10% levels, respectively.

	Unsecured		Secured	
	avg. flow	marg. effect	avg. flow	marg. effect
GIIPS, pre-crisis	-0.102***	-0.142***		
GIIPS, crisis	-0.453***	-0.426***		
GIIPS, interv.	-0.213***	-0.196***		
GIIPS, post interv.	0.272***	0.258***		
Euro nonGIIPS, pre-crisis	-0.016	-0.057	0.005	-0.017
Euro nonGIIPS, crisis	-0.267***	-0.240***	-0.023	-0.049
Euro nonGIIPS, interv.	0.061	0.078	0.009**	0.017**
Euro nonGIIPS, post interv.	0.007	-0.007	-0.008	0.034*
non-Euro, pre-crisis	0.041***		0.021	
non-Euro, crisis	-0.027		0.026**	
non-Euro, interv.	-0.017		-0.008	
non-Euro, post interv.	0.014		-0.042***	
AR	0.038***		0.389***	
R^2 (%)	10.046		16.379	
Adj. R^2 (%)	9.394		15.098	
Sample	1667 observations		531 observations	
	56 banks		13 banks	

Table 10: **Secured vs. unsecured flows at European banks according to risk**

This table presents estimates from a linear regression analysis of the determinants of MMF flows at a bank surrounding the different ECB interventions. The regression is a pooled OLS regression where the dependent variable is the percentage change in principal amount at date t. The regression is augmented by deterministic interaction terms to account for changing parameters before the Sovereign debt crisis ("pre crisis"), during the crisis ("crisis"), during the intervention period ("intervention"), and post intervention ("post intervention"). Pre crisis period: Nov 2010 – May 2011; Crisis period: June 2011 – Dec 2011; Intervention period: Jan 2012 – Sept 2012; Post intervention period: Oct 2012 – Aug 2014. AR: autoregressive parameter; GIIPSexp: GIIPS gross direct exposure (percentage of total assets); CDS: CDS price updated before pre-crisis, crisis, intervention and post-intervention periods. ***, **, and * indicate significance (based on panel robust standard errors) at the 1%, 5%, and 10% levels, respectively.

	Unsecured			Secured		
CDS, pre-crisis	-0.065***		-0.071***	-0.019		0.002
CDS, crisis	-0.168***		-0.101**	-0.070		0.009
CDS, interv.	-0.024		-0.020	0.009*		0.007
CDS, post interv.	0.022**		0.014	0.019***		0.020***
GIIPSexp, pre-crisis		-0.346	0.522		-9.915***	-9.883
GIIPSexp, crisis		-4.903***	-3.267**		-17.432*	-17.694**
GIIPSexp, interv		-2.047	-1.508		3.116***	2.461**
GIIPSexp, post-interv.		1.631***	1.044		2.601*	0.842
pre-crisis	0.041**	-0.032	0.040	0.020	0.094*	0.092**
crisis	0.101***	-0.050**	0.055	0.070	0.150**	0.141
interv.	0.054	0.010	0.052	-0.019*	-0.012	-0.025**
post interv.	-0.025***	0.003	-0.016	-0.035***	-0.012	-0.042**
AR	0.534***	0.543***	0.522***	0.451***	0.345***	0.339***
R^2 (%)	43.418	42.971	44.256	19.649	28.762	28.985
Adj. R^2 (%)	42.877	42.426	43.453	17.555	26.905	26.172
Sample	846 observations			316 observations		
	29 banks			9 banks		

Table 11: **Secured vs. unsecured flows at Eurozone (non-GIIPS) banks according to risk**

This table presents estimates from a linear regression analysis of the determinants of MMF flows at a Eurozone (non-GIIPS) bank surrounding the different ECB interventions. The regression is a pooled OLS regression where the dependent variable is the percentage change in principal amount at date t. The regression is augmented by deterministic interaction terms to account for changing parameters before the Sovereign debt crisis ("pre crisis"), during the crisis ("crisis"), during the intervention period ("intervention"), and post intervention ("post intervention"). Pre crisis period: Nov 2010 – May 2011; Crisis period: June 2011 – Dec 2011; Intervention period: Jan 2012 – Sept 2012; Post intervention period: Oct 2012 – Aug 2014. AR: autoregressive parameter; GIIPSexp: GIIPS gross direct exposure (percentage of total assets); CDS: CDS price updated before pre-crisis, crisis, intervention and post-intervention periods. ***, **, and * indicate significance (based on panel robust standard errors) at the 1%, 5%, and 10% levels, respectively.

	Unsecured			Secured		
CDS, pre-crisis	-0.014		0.003	0.230		0.088
CDS, crisis	-0.221***		-0.199*	-0.087		-0.026
CDS, interv.	0.004		0.014	-0.001		-0.004
CDS, post interv.	0.001		0.004	0.014***		0.017***
GIIPSexp, pre-crisis		-1.179	-1.416		-10.007	-9.155
GIIPSexp, crisis		-9.117*	-3.157		-16.851*	-16.615**
GIIPSexp, interv		7.864	8.432**		2.582**	2.872***
GIIPSexp, post-interv.		2.263*	2.559**		0.868	0.372
pre-crisis	-0.048	-0.052	-0.053	-0.247	0.096	-0.004
crisis	0.127**	-0.066	0.129**	0.086	0.146*	0.176
interv.	0.037	0.003	-0.031	0.006	-0.006	0.004
post interv.	0.007	-0.005	-0.013	-0.022***	0.002	-0.029***
AR	0.470***	0.489***	0.462***	0.524***	0.396***	0.401***
R^2 (%)	38.661	37.419	39.158	25.674	34.371	34.609
Adj. R^2 (%)	37.419	36.151	37.291	22.959	31.974	30.959
Sample	404 observations			228 observations		
	15 banks			7 banks		

Table 12: **Gaining access to U.S. MMFs after ECB interventions**

This table presents estimates from a linear regression analysis of the determinants of access to MMF. The regression is a pooled OLS regression where the dependent variable is the change in number of securities at date t (Number of securities change). The regression is a pooled Probit regression where the dependent variable is the probability of gaining access to MMF when the bank does not have access at time t-1 (P(Gaining access to MMF)), or the probability of gaining access to one fund when the bank does not have access to the fund at time t-1 (P(Gaining access to one fund)). Panel A: GIIPS, Euro non-GIIPS, or non-Eurozone banks. Panel B: high or low risk banks according to November 2010 CDS prices. AR: autoregressive parameter. ***, **, and * indicate significance (based on panel robust standard errors) at the 1%, 5%, and 10% levels, respectively. R^2 is adjusted R^2 for OLS regressions, and Pseudo R^2 of McFadden for Probit regressions.

Panel A

	Number of securities change			P(Gaining access to MMF)		P(Gaining access to one fund)			
	All securities	Unsecured	Secured	Unsecured		Unsecured		Secured	
					Prob.		Prob.		Prob.
GIIPS, pre-crisis	-3.091**	-1.494*		-0.967**	16.67	-2.033***	2.10		
GIIPS, crisis	-4.359***	-3.573***				-2.963***	0.15		
GIIPS, interv.	-0.192	-0.163				-3.327***	0.04		
GIIPS, post interv.	0.408	0.341		-2.382***	0.86	-2.725***	0.32		
Euro nonGIIPS, pre-crisis	0.579	0.573	-0.136	-0.860	19.48	-2.194***	1.41	-2.554***	0.53
Euro nonGIIPS, crisis	-9.186***	-7.295***	-0.782*	-1.398	8.11	-2.733***	0.31	-2.878***	0.20
Euro nonGIIPS, interv.	1.329**	1.034**	0.376	-1.332	9.15	-2.690***	0.36	-2.850***	0.22
Euro nonGIIPS, post interv.	1.184***	0.731**	0.306*	-1.617	5.30	-2.611***	0.45	-2.808***	0.25
non-Euro, pre-crisis	6.383***	4.572***	1.135	-1.309	9.52	-1.896***	2.90	-2.177***	1.47
non-Euro, crisis	-0.217	-1.052	1.591	-1.732	4.17	-2.194***	1.41	-2.357***	0.92
non-Euro, interv.	-1.484	-1.395	0.108	-1.849	3.23	-2.247***	1.23	-2.418***	0.78
non-Euro, post interv.	-0.408	0.269	-0.929**	-2.244	1.24	-2.284***	1.12	-2.467***	0.68
AR	-0.038	0.118**	-0.324***						
Unconditional probability					5.80		0.80		0.43
R^2 (%)	2.43	4.68	10.84	9.86		4.32		3.70	
Observations	2,651	2,651	2,651	1,137		1,142,476		1,169,374	
Banks	61	61	61	63		63		63	

Panel B

	Number of securities change			P(Gaining access to MMF)		P(Gaining access to one fund)			
	All securities	Unsecured	Secured	Unsecured		Unsecured		Secured	
					Prob.		Prob.		Prob.
High risk bank, pre-crisis	-8.139**	-6.012***	-0.499	0.224	30.43	-0.221***	2.27	-0.553***	0.50
High risk bank, crisis	-2.047	-2.115	1.108	6.328***	7.69	-0.562***	0.35	-0.466***	0.24
High risk bank, interv.	1.333	1.361	-0.521	-0.047	3.61	-0.387***	0.48	-0.367***	0.28
High risk bank, post-interv.	1.669	0.720	1.131	0.505	3.74	-0.266***	0.59	-0.320***	0.34
pre-crisis	7.796**	6.033***	0.787	-0.736***	23.08	-1.779***	3.76	-2.026***	2.14
crisis	-8.950*	-6.299*	-1.567	-7.755***	0.00	-2.136***	1.63	-2.353***	0.93
interv.	0.023	-0.232	0.632	-1.751***	4.00	-2.200***	1.39	-2.403***	0.81
post interv.	0.533	0.389	-0.183	-2.287***	1.11	-2.254***	1.21	-2.389***	0.85
AR	-0.032**	0.158***	-0.340***						
Unconditional probability					5.76		1.20		0.67
R^2 (%)	2.78	6.57	11.49	14.82		4.30		3.53	
Observations	982	982	982	486		515,094		534,876	
Banks	29	29	29	34		30		30	

Panel C

	Number of securities change			P(Gaining access to MMF)		P(Gaining access to one fund)			
	All securities	Unsecured	Secured	Unsecured		Unsecured		Secured	
					Prob.		Prob.		Prob.
Bank CDS, pre-crisis	-3.163*	-2.374*	-0.109	-0.308	-10.80 (*)	-0.266***	-1.43 (*)	-0.364***	-0.82 (*)
Bank CDS, crisis	0.932	0.694	0.164	-0.279	-2.91 (*)	-0.592***	-0.44 (*)	-0.258***	-0.05 (*)
Bank CDS, interv.	1.000	0.639	0.336	-0.205	-0.11 (*)	-0.233***	0.00 (*)	-0.163***	0.00 (*)
Bank CDS, post-interv.	1.088*	0.529	0.493	-0.035	-0.01 (*)	-0.163***	0.00 (*)	-0.092***	0.00 (*)
pre-crisis	7.443**	5.818**	0.661	-0.180	42.86	-1.573***	5.78	-1.840***	3.29
crisis	-11.486***	-8.475***	-1.261	-0.990	16.11	-1.624***	5.22	-2.192***	1.42
interv.	-1.826	-1.201	-0.386	-1.026*	15.25	-1.754***	3.97	-2.115***	1.72
post interv.	-0.641	-0.219	-0.576	-1.760***	3.92	-2.036***	2.09	-2.322***	1.01
AR	-0.029	0.162***	-0.339***						
Unconditional probability					5.76		1.20		0.67
R^2 (%)	2.59	6.36	11.43	17.74		5.84		2.97	
Observations	982	982	982	486		515,094		534,876	
Banks	29	29	29	34		30		30	

(*) Change in probability corresponding to a 100 bps CDS spread increase for the median bank.

Table 13: **Maturities, yields, and principal amount of new MMF securities**

This table presents estimates from a linear regression analysis of the determinants of characteristics of new unsecured (Panel A) and secured (Panel B) MMF securities invested by one fund at a European bank. The regression is a pooled OLS regression where the dependent variable is the maturity (days), the yield spread (%), and log principal amount at date t. Yield spread is the difference between MMF yield and Euribor 1 month. The regression is augmented by deterministic interaction terms to account for changing parameters before the Sovereign debt crisis ("pre crisis"), during the crisis ("crisis"), during the intervention period ("interv."), and post intervention ("post interv."). Pre crisis period: Nov 2010 – May 2011; Crisis period: June 2011 – Dec 2011; Intervention period: Jan 2012 – Sept 2012; Post intervention period: Oct 2012 – Aug 2014. AR: autoregressive parameter. ***, **, and * indicate significance (based on panel robust standard errors) at the 1%, 5%, and 10% levels, respectively.

Panel A: Unsecured funding

	Maturity			Yield spread			Amount		
High risk bank, pre-crisis	-24.012**			0.668***			0.102		
High risk bank, crisis	-16.056*			0.081			0.081		
High risk bank, interv.	-29.374**			0.521**			0.329***		
High risk bank, post-interv.	-54.183***			0.101			0.467		
Bank CDS, pre-crisis		-25.911**	-24.667**		1.394***	1.445***		0.102	-0.023
Bank CDS, crisis		-39.791***	-36.230***		-0.097	-0.121		0.179	-0.079
Bank CDS, interv.		-36.319***	-38.468***		0.335*	0.357*		0.249***	-0.012
Bank CDS, post-interv.		-57.348***	-60.954***		0.262**	0.321***		0.352***	0.232**
pre-crisis	78.874***	95.622***	100.064***	1.298***	0.102	-0.695*	17.822***	17.758***	-0.030
crisis	44.723***	81.663***	83.650***	0.519***	0.610**	-0.062	17.551***	17.386***	-0.034
interv.	67.192***	137.773***	150.542***	1.820***	1.212**	0.439	17.410***	16.961***	-0.318
post interv.	89.257***	167.428***	181.023***	1.079***	0.638**	-0.231	17.210***	16.773***	-0.883***
Maturity				0.009***	0.009***	0.009***			
Fund size (2010)			-0.343			0.031***			0.796***
Fund risk (2010)			0.463			0.184*			1.454***
R^2 (%)	10.53	14.74	15.89	34.83	40.14	42.23	3.11	3.01	76.68
Adj. R^2 (%)	10.40	14.61	15.70	34.71	40.04	42.08	2.97	2.86	76.62
Observations	6108	6108	4854	5792	5792	4671	6110	6110	4856
Banks	30	30	30	30	30	30	30	30	30
Funds	183	183	144	182	182	144	183	183	144

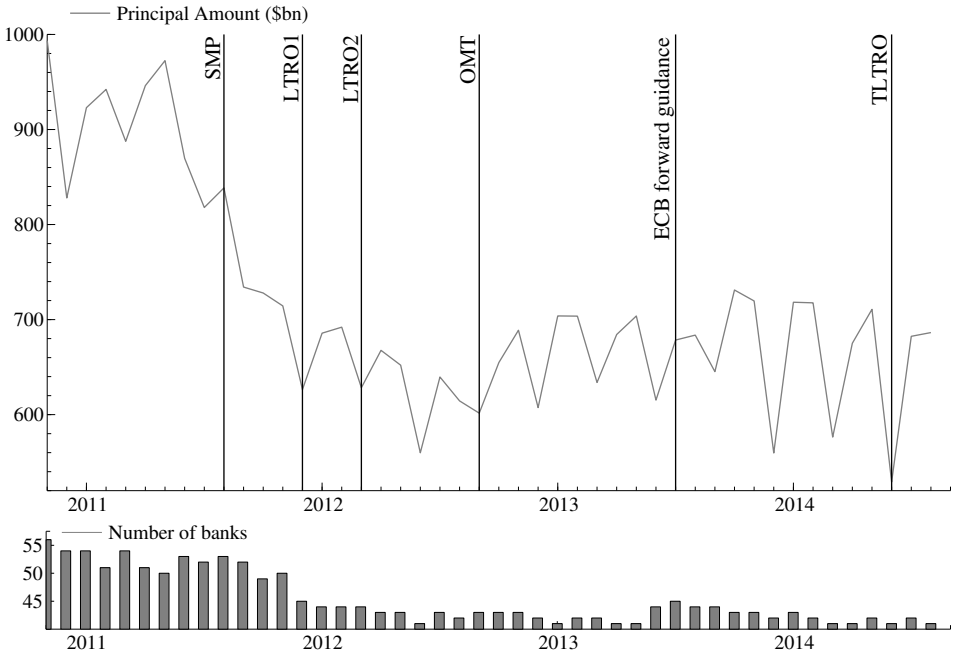
Panel B: Secured funding

	Maturity			Yield spread			Amount		
High risk bank, pre-crisis	-1.046*			-0.415***			-0.236*		
High risk bank, crisis	-0.583*			-0.094			0.827***		
High risk bank, interv.	-0.895			0.024			0.422***		
High risk bank, post-interv.	-3.037**			-0.123			0.486***		
Bank CDS, pre-crisis		2.677	2.654		-0.634	-0.687		-0.667	-0.956
Bank CDS, crisis		0.866	0.769		-0.128	-0.109		0.469	0.477*
Bank CDS, interv.		-0.676	-0.686		0.127*	0.096		0.195	-0.023
Bank CDS, post-interv.		-0.888	-0.829		-0.171***	-0.188***		0.500***	0.430***
pre-crisis	2.944***	0.089	2.961	1.015***	1.549***	1.083**	18.719***	19.330***	7.356***
crisis	1.708***	0.606	3.538	-0.272**	-0.143	-0.663**	18.333***	17.994***	5.844***
interv.	2.519***	3.839***	6.786*	1.265***	0.984***	0.537***	18.274***	17.958***	6.089***
post interv.	4.652***	5.396	8.023	1.077***	1.360***	0.897***	18.031***	17.257***	5.131***
Maturity				0.007	0.008	0.009			
Fund size (2010)			-0.130			0.021**			0.560***
Fund risk (2010)			0.316			0.181***			0.202***
R^2 (%)	1.18	0.73	0.69	29.96	29.30	29.31	4.30	3.58	34.43
Adj. R^2 (%)	0.93	0.48	0.34	29.75	29.08	29.02	4.06	3.33	34.19
Observations	3543	3543	3126	3296	3296	2943	3545	3545	3128
Banks	9	9	9	9	9	9	9	9	9
Funds	264	264	221	260	260	218	264	264	221

Figure 1: **Money Market Funds investments at European banks**

The graphs show the principal amounts of unsecured (Panel A) vs. secured funding (Panel B) invested at GIIPS, Eurozone non-GIIPS, and non Eurozone banks ($bn). Vertical bars indicate ECB interventions: SMP (08/2011), LTRO 1 (12/2011), LTRO 2 (03/2012), OMT (09/2012), ECB forward guidance (07/2013), TLTRO (06/2014).

(a) MMF investments ($bn) - All securities



(b) MMF investments ($bn) - Secured (repo) vs. unsecured funding

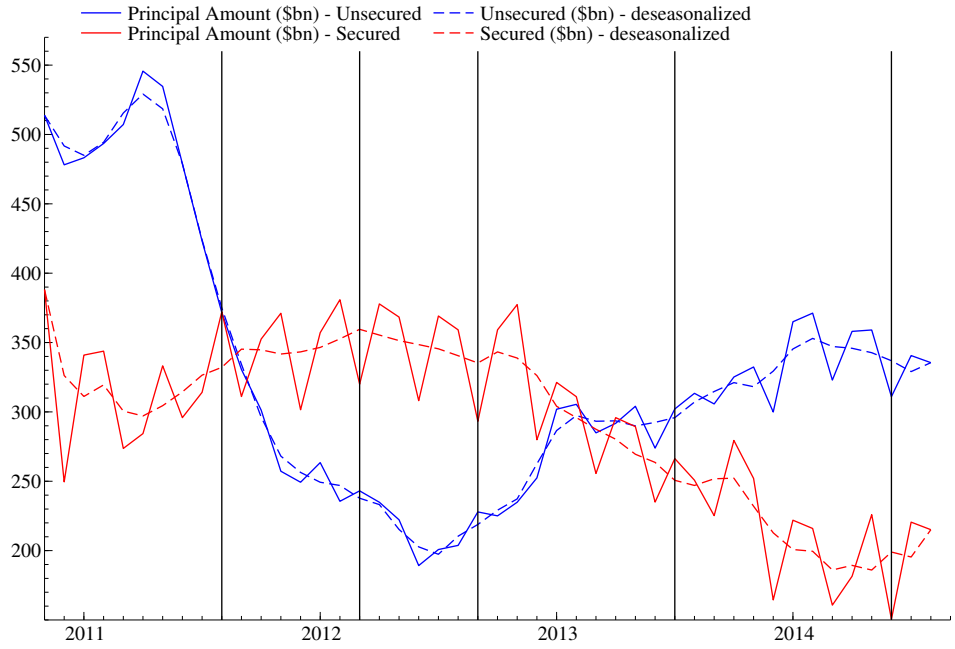
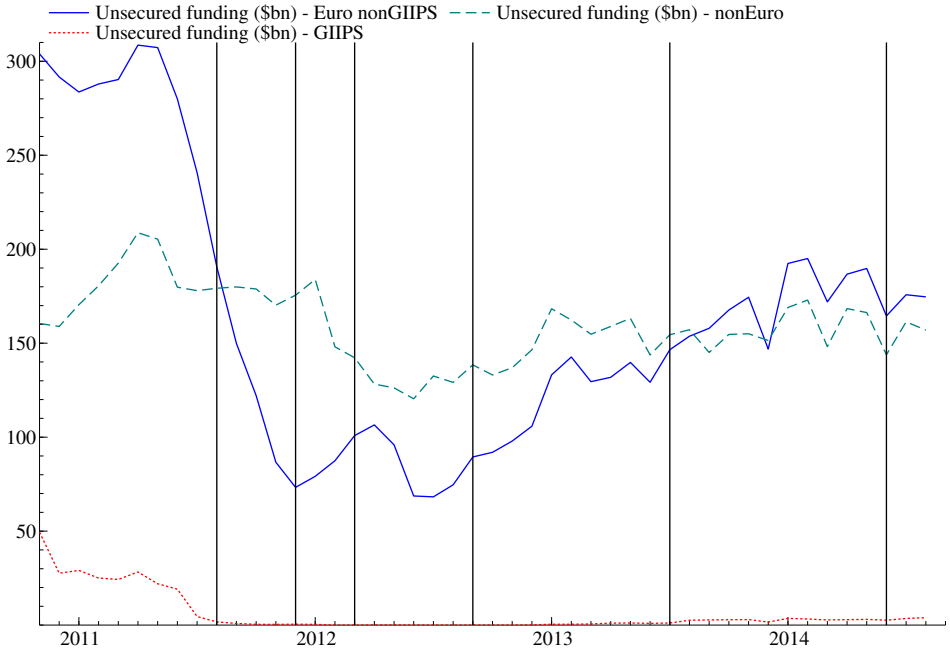


Figure 2: **MMF investments in Eurozone, non-Eurozone and GIIPS banks**
The graphs show the principal amounts of unsecured (Panel A) vs. secured funding (Panel B) invested at GIIPS, Eurozone non-GIIPS, and non Eurozone banks ($bn). Vertical bars indicate ECB interventions: SMP (08/2011), LTRO 1 (12/2011), LTRO 2 (03/2012), OMT (09/2012), ECB forward guidance (07/2013), TLTRO (06/2014).

(a) Unsecured funding



(b) Secured funding

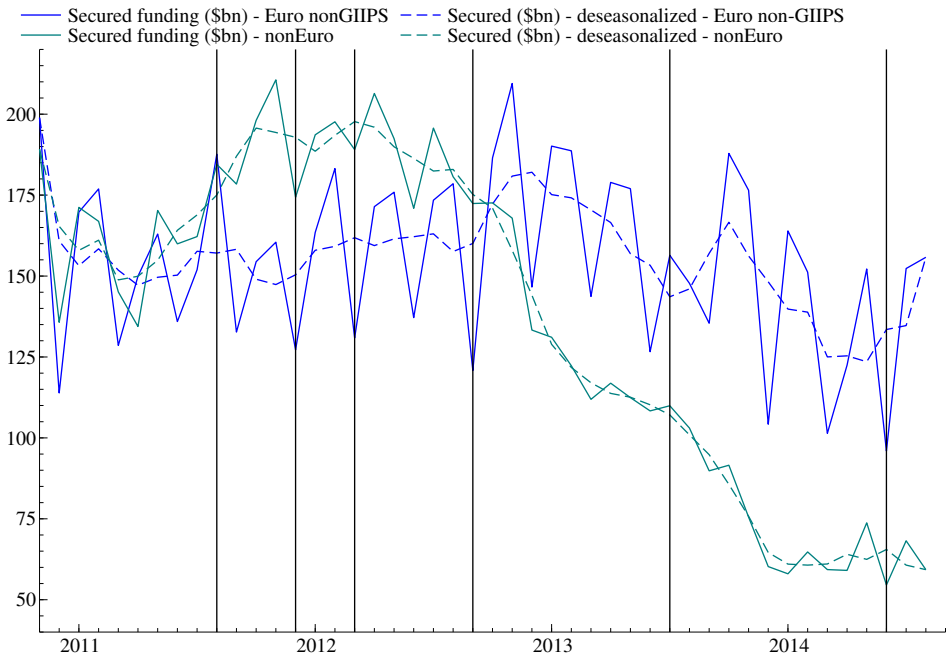
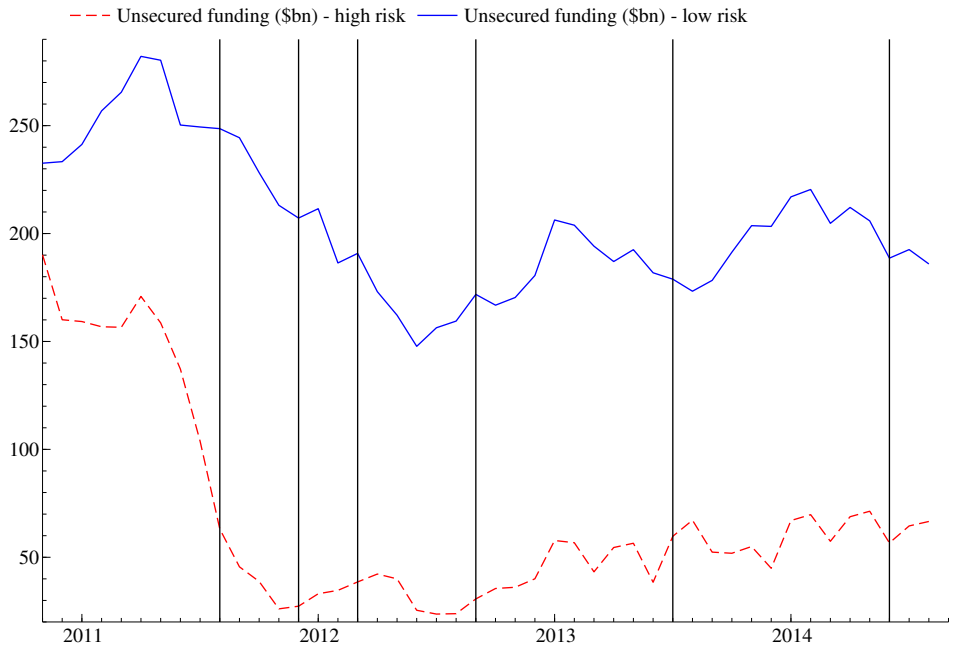


Figure 3: **The role of bank risk in MMF investments**

The graphs show the principal amounts of unsecured (Panel A) vs. secured funding (Panel B) invested at European banks ($bn), according to the CDS price of a bank in November 2010. "high (low) risk": principal amount at banks with 2010 CDS price higher (lower) than the median of CDS prices in November 2010. Vertical bars indicate ECB interventions: SMP (08/2011), LTRO 1 (12/2011), LTRO 2 (03/2012), OMT (09/2012), ECB forward guidance (07/2013), TLTRO (06/2014).

(a) Unsecured funding



(b) Secured funding

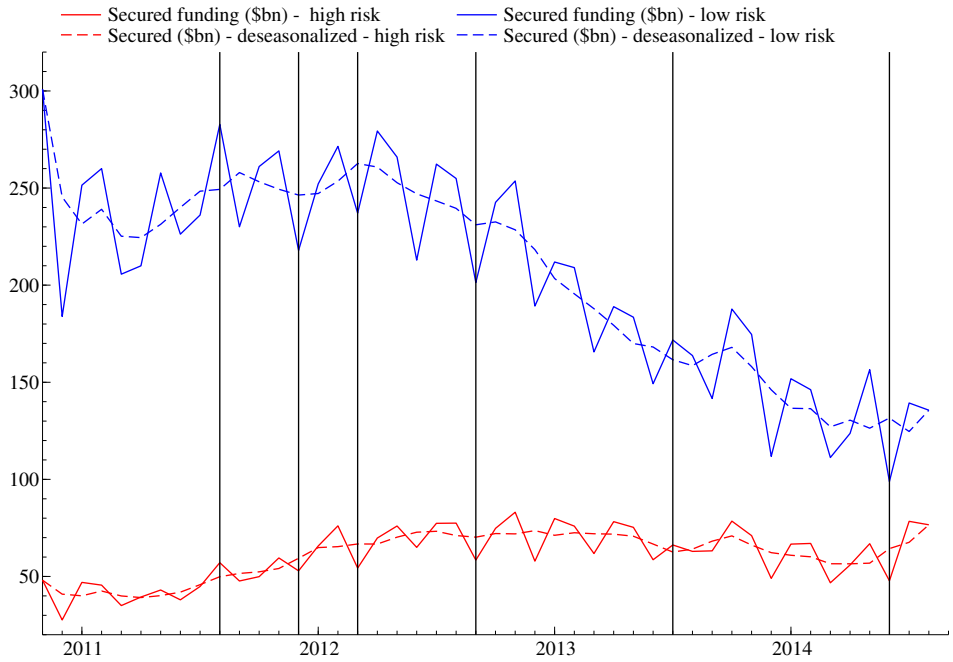
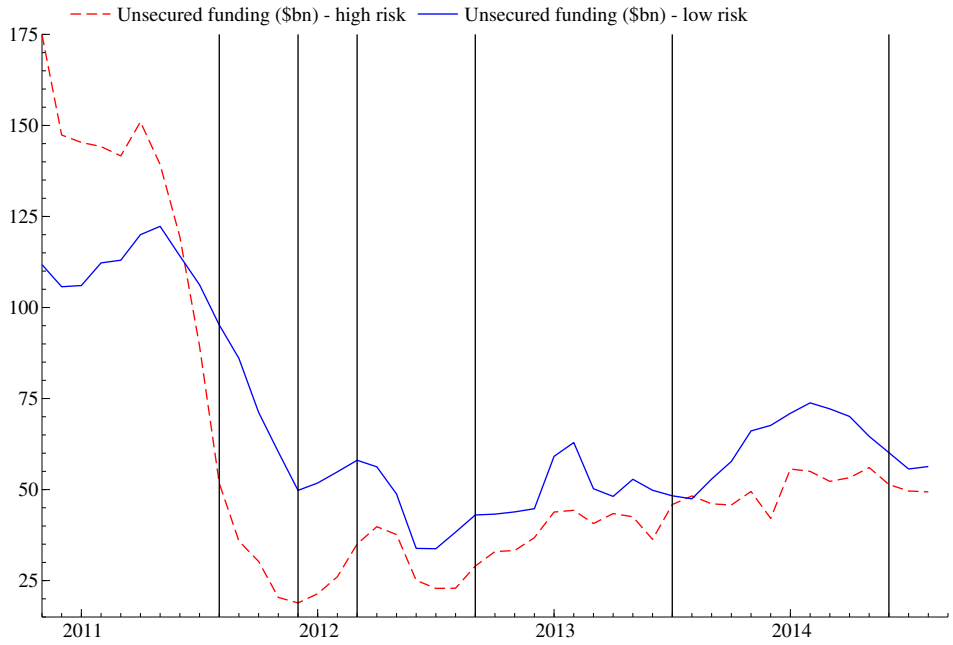


Figure 4: **The role of bank risk in MMF investments at Eurozone banks**

The graphs show the principal amounts of unsecured (Panel A) vs. secured funding (Panel B) invested at Eurorozone banks ($bn), according to the CDS price of a bank in November 2010. "high (low) risk": principal amount at banks with 2010 CDS price higher (lower) than the median of CDS prices in November 2010. Vertical bars indicate ECB interventions: SMP (08/2011), LTRO 1 (12/2011), LTRO 2 (03/2012), OMT (09/2012), ECB forward guidance (07/2013), TLTRO (06/2014).

(a) Unsecured funding at Eurozone banks



(b) Secured funding at Eurozone banks

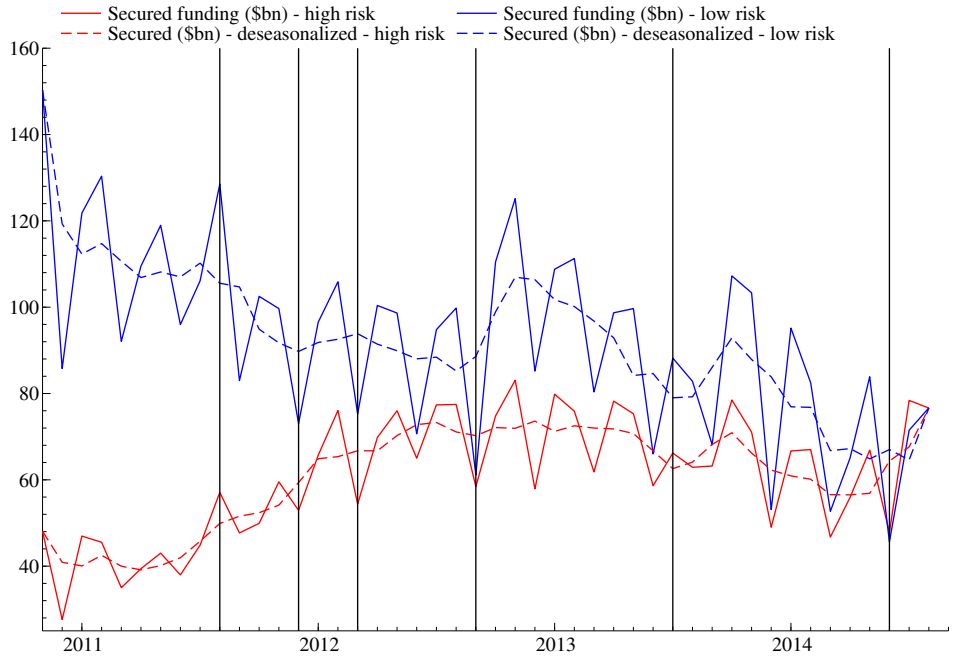
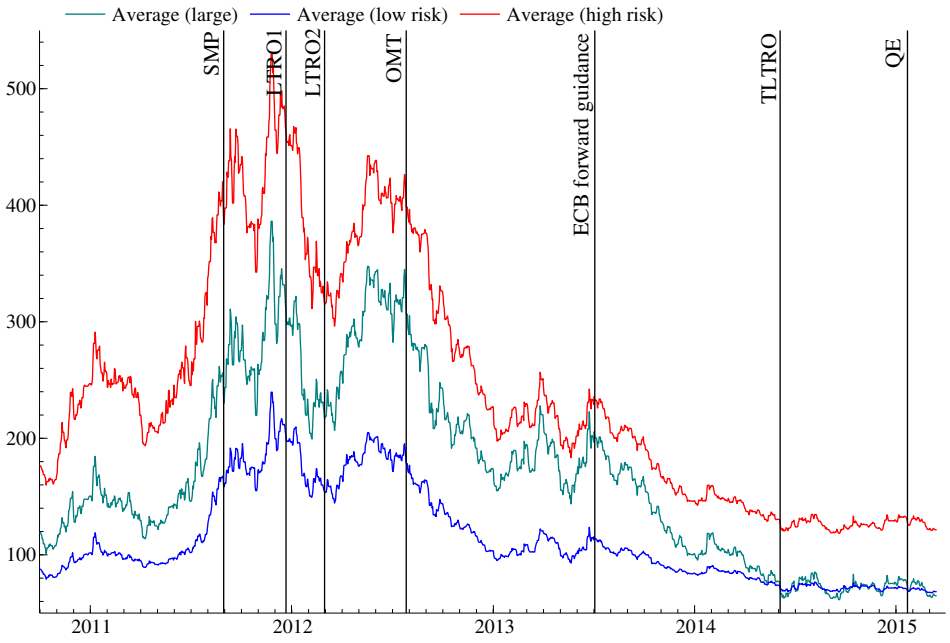


Figure 5: **Bank risk evolution**

The graphs show the evolution of average CDS prices of large banks "high risk" and "low risk" banks (Panel A) and the rank correlation of CDS prices at time t with CDS prices as of November 30, 2010 (Panel B). "high (low) risk": principal amount at banks with 2010 CDS price higher (lower) than the median of CDS prices in November 2010.

(a) Average CDS prices



(b) Rank correlation with 2010 CDS prices

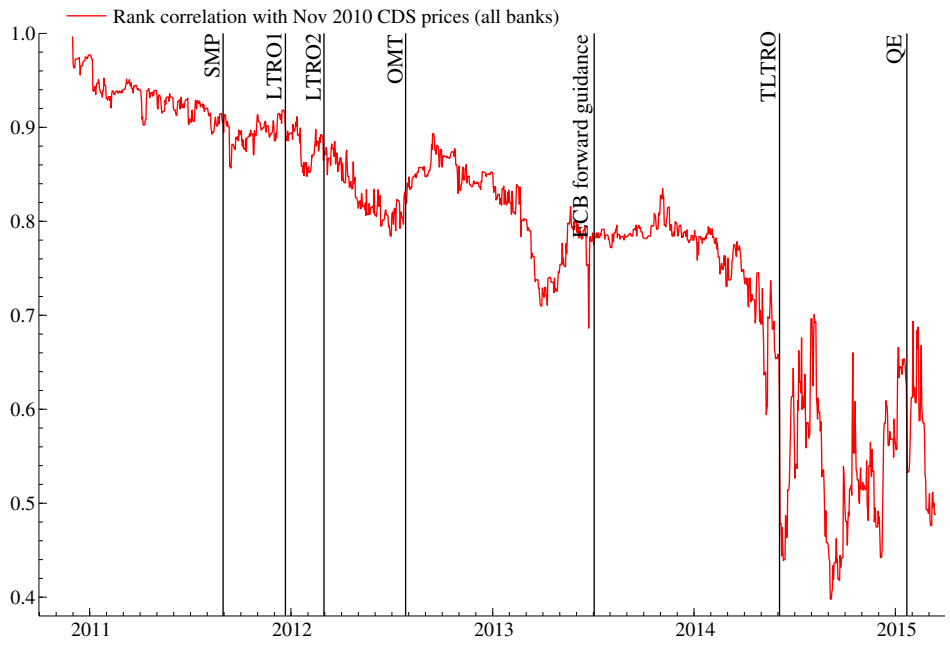
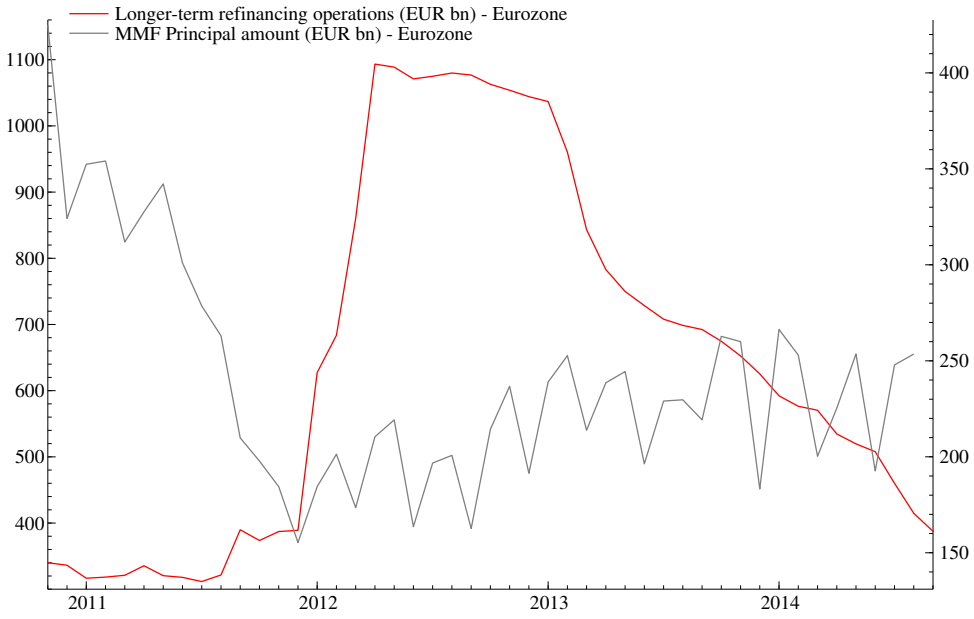


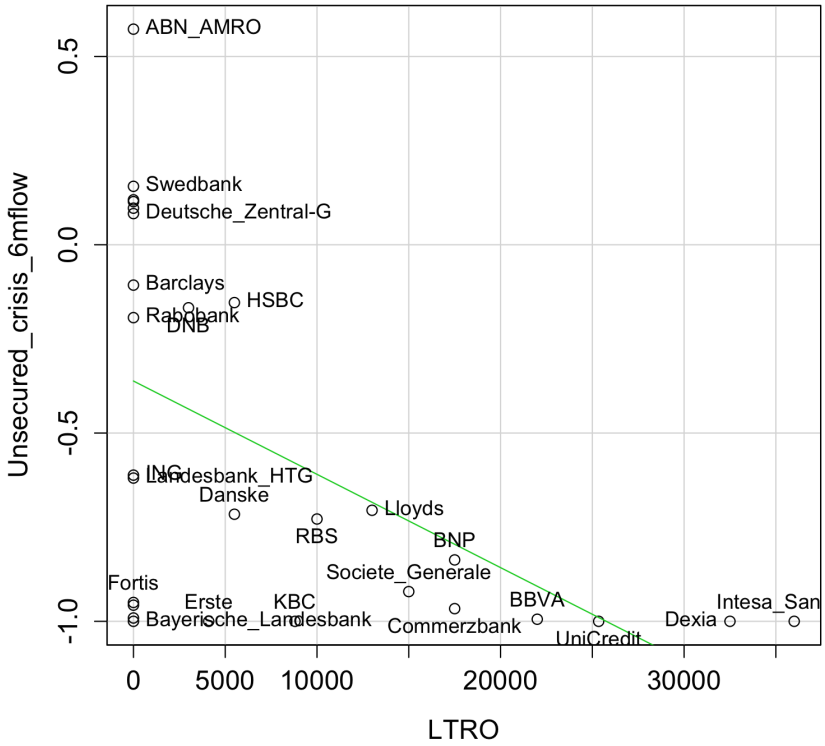
Figure 6: **Long-Term Refinancing Operations (LTRO)**

The graphs show the evolution of U.S. MMF funding vs. ECB funding (Panel A) and the correlation between banks unsecured flows through U.S. MMFs during the crisis and the amount of LTRO funding received (Panel B).

(a) U.S. MMF vs. ECB funding



(b) Unsecured U.S. MMF flows against LTRO funding (EUR mn)



A Sample of banks

Table 14: Sample of banks

Bank name (SNL)	SNL ID	Ticker	EBA ID	CDS
Societe Generale SA	113818	GLE	FR016	yes
Credit Suisse Group AG	113824	CSGN		yes
Deutsche Bank AG	113830	DBK	DE017	yes
UBS AG	113831	UBSN		yes
HSBC Holdings Plc	113876	HSBA	GB089	yes
Banco Bilbao Vizcaya Argentaria, SA	113904	BBVA	ES060	yes
Banco Santander SA	113983	SAN	ES059	yes
Commerzbank AG	113985	CBK	DE018	yes
Barclays Plc	114508	BARC	GB090	yes
BNP Paribas SA	3001689	BNP	FR013	yes
Royal Bank of Scotland Group Plc	3001937	RBS	GB088	
ABN AMRO Group NV	4000991		NL049	yes
Allied Irish Banks, Plc	4002079	AIB		yes
AXA	4009223	CS		yes
Prudential Public Limited Company	4023122	PRU		
Dexia SA	4024522	DEXB	BE004	yes
Lloyds Banking Group Plc	4041848	LLOY	GB091	yes
Bank of Ireland	4041921	BIR	IE038	yes
Standard Chartered Plc	4041955	STAN		
Bayerische Landesbank	4048275		DE021	yes
UniCredit SpA	4055762	UCG	IT041	yes
Landesbank Baden-Wurttemberg	4073469			yes
Alliance & Leicester Plc	4079602			
Danske Bank A/S	4080954	DANSKE	DK008	yes
Credit Agricole Group	4085960	ACA	FR014	yes
Falcon Pvt. Bank Ltd.	4087342			
Erste Group Bank AG	4089743	EBS	AT001	yes
ING Bank NV	4092030	INGA	NL047	yes
Intesa Sanpaolo SpA	4100801	ISP	IT040	yes
Nordea Bank AB	4108919	NDA	SE084	yes
Landesbank Hessen-Thuringen Girozentrale	4120106		DE026	yes
DNB ASA	4142645	DNB	NO051	yes
Deutsche Zentral-Genossenschaftsbank	4142663		DE020	yes
Svenska Handelsbanken AB	4144846	SHB.A	SE086	yes
Skandinaviska Enskilda Banken AB	4144847	SEB.A	SE085	yes

Bank name (SNL)	SNL ID	Ticker	EBA ID	CDS
Oesterreichische Kontrollbank AG	4145033			
KBC Group NV	4145062	KBC	BE005	
Nationwide Building Society	4145082			
Rabobank Group	4145124		NL048	yes
NORD/LB Norddeutsche Landesbank Girozentrale	4145342		DE022	yes
Swedbank AB	4153551	SWED.A	SE087	yes
Allianz Group	4174043	ALV		yes
KfW Bankengruppe	4182748			
Clydesdale Bank Plc	4183593			
Nederlandse Waterschapsbank NV	4186955			
Banque Fédérative du Crédit Mutuel SA	4216441			
Banque et Caisse d'Epargne de l'Etat, Luxembourg	4224076		LU045	
Credit Industriel et Commercial	4238541	CC		
Groupe BPCE	4239955		FR015	
Eksportfinans ASA	4242177			
Fortis Bank (Nederland) NV	4242187			
Kommunalbanken AS	4242212			
Landeskreditbank Baden-Wurttemberg Forderbank	4242220			
NRW.BANK	4242234			
Caisse des Depots et Consignations	4251084			
Dreyfus Sons & Co Ltd, Banquiers	4260242			
European Investment Bank	4261613			
Erste Abwicklungsanstalt	4377953			
SBAB Bank AB (publ)	4397921			
Kommuninvest i Sverige Aktiebolag	4397927			
Caisse d'Amortissement de la Dette Sociale	4398177			
NV Bank Nederlandse Gemeenten	4400227			
Nordic Investment Bank	4400301			

B Robustness checks

Table 15: **Banks sovereign bond holdings and MMF flows**

This table presents estimates from cross-sectional regressions of banks sovereign bond holdings on their future MMF flows at various EBA disclosures. Dependent variable: MMF flows at a bank from date t to t+m (t is EBA measurement date, m is a number of months). Explaining variables: Eurozone or GIIPS gross direct exposure (percentage of total assets) and a constant. Heteroscedasticity-robust standard errors in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

		Exposure to Eurozone		**Exposure to GIIPS**	
		Flow period		Flow period	
Exposure as of	Sample	3-month	6-month	3-month	6-month
12/31/10	33	-0.300	-6.445***	-4.878***	-8.152***
		(1.641)	(1.245)	(2.455)	(2.525)
09/30/11	29	-0.406	2.225	-12.402***	-14.741***
		(1.842)	(3.274)	(3.368)	(3.953)
12/31/11	25	3.853	1.238	18.617	-0.633
		(2.265)	(2.265)	(20.273)	(10.622)
06/30/12	23	-0.613	4.716	-0.034	9.194
		(2.752)	(6.615)	(16.565)	(25.468)
12/31/12	23	-0.782	-2.839	14.532	10.906
		(2.235)	(1.815)	(14.165)	(18.145)
06/30/13	23	5.413*	3.445*	31.063***	16.563***
		(3.030)	(1.830)	(11.623)	(5.343)

Table 16: **Unsecured flows according to risk: alternative risk measures**

This table presents estimates from a linear regression analysis of the determinants of MMF flows at a bank surrounding the different ECB interventions. The regression is a pooled OLS regression where the dependent variable is the percentage change in principal amount at date t. The regression is augmented by deterministic interaction terms to account for changing parameters before the Sovereign debt crisis ("pre crisis"), during the crisis ("crisis"), during the intervention period ("intervention"), and post intervention ("post intervention"). Pre crisis period: Nov 2010 – May 2011; Crisis period: June 2011 – Dec 2011; Intervention period: Jan 2012 – Sept 2012; Post intervention period: Oct 2012 – Aug 2014. AR: autoregressive parameter; CDS: CDS price updated before pre-crisis, crisis, intervention and post-intervention periods; Lvg: market leverage updated before pre-crisis, crisis, intervention and post-intervention periods; T1CR: Tier 1 capital ratio updated before pre-crisis, crisis, intervention and post-intervention periods. ***, **, and * indicate significance (based on panel robust standard errors) at the 1%, 5%, and 10% levels, respectively.

	Unsecured				
AR	0.567***	0.599***	0.596***	0.537***	0.559***
CDS, pre-crisis	-0.066***			-0.056***	-0.072***
CDS, crisis	-0.175***			-0.160***	-0.117**
CDS, interv.	-0.017			-0.058*	-0.030
CDS, post-interv.	0.020**			0.029***	0.022***
Lvg, pre-crisis		-0.123**		-0.067***	
Lvg, crisis		-0.359***		-0.172*	
Lvg, interv.		0.159***		0.214***	
Lvg, post-interv.		<0.001		-0.026	
T1CR, pre-crisis			0.336		-0.458*
T1CR, crisis			3.587***		2.263***
T1CR, interv.			-0.491		-0.879
T1CR, post-interv.			-0.156		0.033
pre-crisis	0.072***	0.042***	-0.049	0.088***	0.136***
crisis	0.109***	-0.012	-0.569***	0.133***	-0.255
interv.	0.036	-0.082***	0.062	0.024	0.184
post interv.	-0.024**	0.009	0.033	-0.026**	-0.031**
R^2 (%)	50.34	49.31	49.43	52.20	51.20
Adj. R^2 (%)	49.79	48.74	48.87	51.40	50.37
Sample	725 observations				
	23 banks				

Table 17: **Unsecured flows according to risk: robustness to common factors**

This table presents estimates from a linear regression analysis of the determinants of MMF flows at a bank surrounding the different ECB interventions. The regression is a pooled OLS regression where the dependent variable is the percentage change in principal amount at date t. The regression is augmented by deterministic interaction terms to account for changing parameters before the Sovereign debt crisis ("pre crisis"), during the crisis ("crisis"), during the intervention period ("intervention"), and post intervention ("post intervention"). Pre crisis period: Nov 2010 – May 2011; Crisis period: June 2011 – Dec 2011; Intervention period: Jan 2012 – Sept 2012; Post intervention period: Oct 2012 – Aug 2014. AR: autoregressive parameter; CDS: CDS price updated before pre-crisis, crisis, intervention and post-intervention periods; Eurostoxx: Eurostoxx log return; Euribor: Euribor log return; Exchange rate: effective exchange rate log return. ***, **, and * indicate significance (based on panel robust standard errors) at the 1%, 5%, and 10% levels, respectively.

	Unsecured			
AR	0.531***	0.539***	0.531***	0.535***
CDS, pre-crisis	-0.065***	-0.066***	-0.065***	-0.068***
CDS, crisis	-0.169***	-0.167***	-0.169***	-0.170***
CDS, interv.	-0.023	-0.021	-0.021	-0.018
CDS, post-interv.	0.022**	0.021**	0.022**	0.022***
Eurostoxx (t-1)	0.452***	0.523***		
Euribor (t-1)		-0.074**		
Exchange rate (t-1)		-0.945**		
Eurostoxx (t-1), pre-crisis			0.527	-0.489
Eurostoxx (t-1), crisis			0.075	0.066
Eurostoxx (t-1), interv.			1.144**	0.722
Eurostoxx (t-1), post-interv.			0.331	0.401
Euribor (t-1), pre-crisis				-0.082
Euribor (t-1), crisis				0.149
Euribor (t-1), interv.				-0.267**
Euribor (t-1), post-interv.				0.055***
Exchange rate (t-1), pre-crisis				-7.395
Exchange rate (t-1), crisis				-0.468
Exchange rate (t-1), interv.				-0.470
Exchange rate (t-1), post-interv.				-0.741
pre-crisis	0.030	0.045**	0.028	0.144***
crisis	0.118***	0.114**	0.104***	0.102***
interv.	0.049	0.021	0.041	-0.033
post interv.	-0.030**	-0.028**	-0.029**	-0.026**
R^2 (%)	43.92	44.47	44.39	46.38
Adj. R^2 (%)	43.32	43.74	43.59	45.08
Sample	846 observations			
	29 banks			