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Sovereign Collateral as a Trojan Horse: Why do we need an LCR+

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Abstract

Sovereign bonds are crucial for both sovereign funding and bank funding. Banks borrow in repo transactions against sovereign creditworthiness rather than their own creditworthiness. However, Basel III's current LCR does not address sovereign bond distress. Accordingly, currently compliant banks can be exposed to a neglected liquidity risk stemming from distressed sovereign debt moving through the collateral channel. This unaccounted risk can translate into a system wide liquidity shock. To gauge the potential damage caused by such a shock, we have developed a model in which sovereign distress triggers bank distress. Our model shows how deteriorating sovereign collateral can lead to an overall liquidity squeeze and non compliance with Basel III's liquidity standards. Since this risk is highly material, we conclude that LCR should address this event, and we call for an altered version - LCR+. LCR+ is the current LCR adjusted for the liquidity impact of sovereign distress. As envisioned, LCR+ could have better protected banks against the non-acceptance of Greek and Irish collateral by requiring them to maintain an additional reserve against just such an event.

Keywords: Sovereign distress, Collateral channel, Basel III, Liquidity Regulation

JEL classification: G21, C61.

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1 Introduction

Securitised sovereign debt, like sovereign bonds, is crucial for sovereign funding. Sovereign bonds are also crucial for bank funding operations[3] since banks borrow against sovereign creditworthiness rather than against their own creditworthiness by using sovereign bonds as collateral. Sovereign bonds serve as loss protection against counterparty default for interbank transactions. In this paper, we ask what happens if this loss protection mechanism is impaired because the creditworthiness of sovereign debtors deteriorates.

The initial effects of rapidly declining market prices are individual solvency effects.[4] But due to the system wide use of sovereign debt as collateral, devaluation can have systemic effects by transforming a sovereign shock into a system wide liquidity shock. The system is quite vulnerable to this kind of double shock, especially because banking regulation incentivizes the use of sovereign debt as collateral, and does not consider sovereign risk in its regulatory ratios.

While regulators do not appear to address these risks properly, and scholars (e.g. Barth et al. (2012), Merler and Pisani-Ferry (2012), Nouy (2012), Acharya et al. (2013), Korte and Steffen (2014), Acharya and Steffen (2015)) quite recently started to look at the interaction between banking regulation and sovereign risk, we focus exclusively on this nexus. In particular we examine how the incentivized reliance on sovereign collateral increases the risk of a systemic liquidity shock. Since Bonner and Hilbers (2015) argue that bank capital and liquidity are intrinsically linked concepts, we developed a model that can simulate the solvency and liquidity consequences of such a shock on capital adequacy ratios (CAR) and liquidity coverage ratios (LCR)[5]. We label the transmission channel which affects the CAR the "capital channel"[6], and we label the channel which affects the LCR the "liquidity channel".

In the model the triggering event is a sovereign shock which works through both channels and can result in non-compliance with Basel III. Our analysis reveals that while the capital channel is

[3] The importance of collateral for bank funding operations, especially in the euro area, was pointed out by the Committee on the Global Financial System (2013).

[4] This mechanism is extensively examined by the literature so far. See inter alia Peek and Rosengren (1994), Berger et al. (1995), Diamond and Rajan (2000), Chen (2001), von Peter (2004), or Kühl (2014).

[5] The LCR is a liquidity model that requires that at least 25% of potential stressed outflows of the next 30 days are covered by a liquidity reserve. The magnitude of potential, unexpected cash flows has been calibrated by the regulator (so called standardised approach). It builds on traditional liquidity "coverage ratio" methodologies used internally by banks to assess exposure to contingent liquidity events.

[6] While, for example, Korte and Steffen (2014) in particular look at the interaction of Basel II's zero risk weights for sovereign debt and sovereign risk which can transmit across EU member states, we look at how sovereign distress might devastate banks' CARs.

important, but not crucial for compliance, transmission of the shock through the liquidity channel can force banks into severe liquidity stress, and, even without liquidity stress, make banks non-compliant with Basel III's liquidity regulation. Since it was the initial intention that sovereign bonds used as collateral should reduce the systemic risk for banks, we show that sovereign collateral acts as a kind of Trojan horse because sovereign collateral magnifies systemic risk instead of reducing it. This clearly suggests a regulatory shortcoming. While others, like Hardy and Hochreiter (2014), are in favour of explicit macroprudential instruments, we propose an altered version of the LCR, henceforth "LCR+", in order to address sovereign-related issues which are currently neglected by liquidity regulation. We address this issue, particularly because the Basel Committee recommends that regulators should consider the monitoring of liquid collateral in the context of reducing systemic risk. The Basel Committee on Banking Supervision (2015) provides some insight into the state of credit risk management and the implications for regulatory and supervisory frameworks. Also, it recommends that regulators should consider appropriate steps to monitor and evaluate the availability of high-quality liquid collateral in their future work while also considering the objective of reducing systemic risk. Therefore, we believe to address, by now, one issue of future financial regulation.

The remainder of this paper is structured as follows: in Section 2, we give an overview of the relevant literature and explain the institutional framework in which our model is embedded. In Section 3, we introduce our model with its capital and liquidity channels. In Section 4, we describe our sample of large European banks. In Section 5, we present and discuss our findings. Finally, Section 7 concludes and derives policy recommendations.

2 Institutional Background & Literature Review

2.1 Institutional Background

Functioning repo markets[7] are a crucial part for both banks' funding strategies as well as the implementation of monetary policy. A stylized description of this mechanism and linkage with monetary policy is provided in figure 1. In a repo-transaction, a security is sold and repurchased on a later date at a higher price. The disposal of the security as well as the commitment to buy

[7] The term "repo" is a generic term for "sale and repurchase agreement".

it back on a later date take place at the same time. The difference between the sell-price and repurchase-price can be interpreted as the interest expense which can be charged by the security buyer for providing liquidity to the security seller.[8]

[Figure 1 around here]

In the wake of the financial crisis and sovereign debt crisis in Europe, repo transactions gained systemic importance in the European interbank market. This was in part driven by the change of regulation frameworks. While in the Basel II framework banks were required to hold a minimum amount of capital as a loss protection against a debtor's default, Basel III's framework indirectly requires banks to pledge collateral to creditors against their own default. As figure 2 shows, banks borrow against the creditworthiness of the collateral issuer rather than their own creditworthiness.

[Figure 2 around here]

In terms of credit risk and liquidity risk, the safest assets are sovereign bonds. But the European sovereign debt crisis played havoc with the overall assumption that sovereign debt of advanced economies per se is (credit) risk free. Within financial transactions, safety and acceptability of collateral are complementary: Acceptability is a question of safety, and the degree of safety is defined by the terms and conditions of the contracts supported by collateral.[9]

Although sovereign debt countries of European Monetary Union (EMU) features the same risk-weight in regulatory frameworks, there is heterogeneity regarding the actual creditworthiness of sovereign debt in the euro area. Given this inherent credit risk, the systemic risk of sovereign collateral condenses into a single risk as banks fund themselves. Here, we act on the assumption that the quality and characteristics of sovereign debt determine the extent of systemic or more precisely banks' funding risk which is incorporated in the collateral system. Basel III's liquidity regulations do not address liquidity risk stemming from sovereign collateral. The Basel Committee on Banking Supervision (2013a) assumes that secured funding transactions which are collateralized

[8] Vice versa, from the liquidity provider's perspective this type of transaction is called "reverse repo". See Hordahl and King (2008), p. 1.

[9] See Schmieder et al. (2012), p. 1. This brings about that sovereign bonds are largely used in private repo transaction rather than in funding transactions with the European central bank (ECB). During the course of the crisis the ECB expanded its collateral framework. One reasons was to allow banks the usage of assets in central bank funding which were no longer marketable for private funding operations. As a result, the overall percentage of government securities used as collateral for ECB funding has declined frequently since 2004. See table 1 in the appendix.

with sovereign debt can be rolled at any time during a liquidity crisis and therefore do not face the risk of run off as opposed to other assets used in secured funding transactions.

While sovereign debt appears to be omitted from various regulations[10], it is included in current national and international stress tests. According to the BIS' Market Committee (2013) and Basel Committee on Banking Supervision (2013b), national competent authorities (NCAs) use macro stress tests in their macroprudential supervision in order to assess system-wide liquidity risks. To the best of our knowledge, among European NCAs, only the Banca d'Italia considers downgrades on sovereign exposures as vital part of their bottom up liquidity stress tests. In addition to these rating downgrades, Italian banks must take the risks of widening credit spreads and loss of eligibility into account when they assess their own vulnerability. The liquidity stress tests considered most advanced by NCAs are those that are part of integrated frameworks that combine models of credit, market, and liquidity risks. Such a combination we carry out in our model.

2.2 Literature Review

General studies of sovereign debt crises and their contagion effects in integrated banking systems, such as Bolton and Oliver (2011), investigate theoretically contagion effects of downgrading sovereign debt collateral in financially integrated economies. Empirically, Acharya and Steffen (2015) show that bank risks between 2007-2013 can be understood as stemming from carry trades enabled by regulatory arbitrage, whereas Buch et al. (2013) present evidence that EMU banks invest heterogeneously in sovereign debt and shift their investment behaviour in accordance with macro-economic changes. Further, Angelini et al. (2014) provide a narrative of the different channels through which sovereign risk affects banking risk.

Regarding the relationship between banks' funding conditions and sovereign risk, Davis and Ng (2011) point out that, due to the role sovereign bonds in the financial system, deteriorating sovereign creditworthiness harms banks' funding conditions along four different channels: First are the losses stemming from marked down sovereign holdings. Second, these markdowns reduce the scope for interbank and central bank funding operations. Third, deteriorating sovereign creditworthiness of reduces banks' funding benefits from explicit or perceived government guarantees.

[10]While the Glass-Steagal Act only implicitly permits proprietary trading in sovereign debt, the Volcker-Rule explicitly allows proprietary trading in public debt. As the U.S. Securities and Exchange Commission (SEC) states, the Volcker Rule permits banks to trade in U.S. government, agency, state, and municipal securities. Even if more limited, proprietary trading is also allowed in foreign sovereign debt and other public debt securities. See Securities and Exchange Commission (2013).

Fourth reduced funding capability lowers bank ratings. While the last two of these channels are less important for our analysis, the first two channels will be revisited in our model description in section 3.

The findings by Davis and Ng (2011) are also highlighted by The Committee on the Global Financial System (2011). The decrease of market value of sovereign bonds cause losses in banks' government holdings and therefore deteriorates banks' balance sheets. This mechanism will be described in the capital channel of our model. In addition, this decline in market prices reduces the collateral value of sovereign assets used in secured funding transactions and therefore constrains bank's funding conditions. We address this mechanism in the liquidity channel of our model.

Surprisingly, the repo market literature tends not to focus on the interaction between sovereign credit risk and bank funding. It concentrates on the US repo market.[11] In comparison to the literature on the US repo market, the literature on the European repo market is far more manageable. To the best of our knowledge Dunne et al. (2010) are the first to look at the European repo market. They suggest that the ECB's monetary operations are reflected in the repo market conditions: According to the authors, yields more favourable than expected rise liquidity in the repo market. Their results support the conclusion that ECB's behaviour is key determinant of European repo markets. In another paper, Koulischer and Struyven (2014) who in principle do not study the repo market but the collateral used in the economy, reach a similar conclusion; easier monetary policy can have real implications in the form of lower interest rates. In their theoretical framework, the authors show that a fall in quality and quantity can increase interest rates in the economy. Similarly, easier monetary policy can have real implications in the form of lower interest rates. In addition to Dunne et al. (2010), Mancini et al. (2014) study more systematically the European repo market, finding that the CCP-based repo market works well during times of crisis. In particular, they show that repo rates, volumes, maturities, and haircuts were not negatively affected by the European debt crisis.[12] Also, ECB's liquidity provision seems to be a key driver of repo market activities.

It is to this strand of literature that we want to contribute. Rather than look at the repo market as a whole, we will focus on a single type of collateral, sovereign debt, and, as Koulischer

[11] The literature on the the US repo market can be subdivided into three categories: Theoretical papers like the one of Monnet and Narajabad (2012), empirical papers like those provided by Duffie (1996), Jordan and Jordan (1997), Duffie et al. (2002), Copeland et al. (2012), and Krishnamurthy et al. (2014), as well as narratives like Duffie (2013) or Copeland et al. (2014).

[12] This development is shown in figure 3 in the appendix.

and Struyven (2014) suggest, its role in the financial system. We believe our analysis contribute to, at least, three different but partially interrelated fields of research: In general, we contribute to the body of literature on the sovereign bank nexus. In particular, we contribute to the interconnection between sovereign (credit) risk and bank funding conditions and therefore market consequences. Further, we contribute to the growing literature on repo markets. Lastly, we expand the literature on the market consequences of banking regulation and liquidity stress testing.

One of the most recent studies on collateral was undertaken by Lennkh and Walch (2015) and looks theoretically and empirically at the consequences of transaction cost shocks on the value of collateral assets that banks pledge at the European Central Bank in order to participate in monetary policy operations. Since we have learned from the literature on market liquidity, there is diametric relationship between transaction costs and credit risk, and therefore collateral value, the findings of Lennkh and Walch (2015) are important for our analysis as well. The authors construct a model that captures how the price of collateral assets responds to changes in transaction costs. Looking at this interaction, Lennkh and Walch (2015) estimate first round and second round effects and show that an increase in transactions costs causes a decrease in the aggregate collateral value (first-round effect). Taking securities' turnover into account, the decrease in the collateral value is slightly weaker (second round effect). Lennkh and Walch (2015) show this for several asset classes, maturity buckets, and haircuts as well as the effects on different counterparty classes.

3 The Model

This section describes the implications of the liquidity channel and capital channel for the model banking sectors in our analysis. Our model builds on relevant prior literature, experiences from the European sovereign debt crisis, as well as regulatory requirements, market behaviour, and market practice. According to Adrian et al. (2013), increased haircuts can force market participants into bankruptcy if counterparties refuse to continue repo financing operations. This happened with the major defaults of banking corporations, e.g., Bear Stearns or Lehman Brothers, during the financial crisis. These bankruptcies were caused primarily by illiquidity or a broken liquidity channel, rather than by deadly capital shortfalls (broken capital channel). Therefore, we primarily focus on the liquidity channel in our model.

[Figure 4 around here]

As can be seen from figure 4 above, the starting point for the liquidity channel as well as the capital channel is an exogenous shock to our model banking sector in the form of market turmoil in the European sovereign debt market. Both channels lead to the same two potential endpoints - either a Basel III-compliance in terms of capital regulation and liquidity regulation or a Basel III-non-compliance. Therefore, the model simulates the compliance status with Basel III's regulatory regime under conditions of sovereign debt distress. Our model assumes that Basel III's capital regulation and liquidity regulation are fully in force. The main difference between the two analysed channels is that the liquidity channel predominantly is based on historical experiences and market practices while the dynamics of the capital channel mainly is based on Basel III's regulatory logic.

3.1 Liquidity Channel

The importance of the repo market for bank funding operations is, as pointed out by Deutsche Bundesbank (2013), unquestioned. Sharply declining prices for the underlying collateral directly impact liquidity. And, in extreme cases, rapidly increasing margin calls and bigger haircuts can bring the entire market to a halt. Our model framework incorporates this negative feedback mechanism in addressing the "run-on-repo" scenario described by Adrian et al. (2013). The model assumes that in the run up to what will eventually become a market crisis, sovereign yield spreads will widen with respect to their benchmarks. At the same time, the term premia as expressed in CDS will surge as well. These two effects combined form the initial exogenous shock of our model.

Mathematically, the spread widening in the sovereign debt market is accompanied by a decline of market value. It therefore reduces the collateral value of the respective sovereign bonds. As the European sovereign debt crisis revealed, increased market volatility and decline in bond prices foster central clearing counterparties (CCPs) to review their respective collateral frameworks, especially their haircut policies. A major trigger for changing haircuts are CDS premiums: As soon as CDS prices exceed certain internally determined thresholds, CCPs will change the haircuts for their acceptable collateral. Given increasing uncertainty, CCPs are likely to increase the haircuts of acceptable sovereign bonds collateral and, as a consequence, systemically devalue sovereign bonds as collateral. This mechanism will also be described in our framework in order to inidcate the system-wide impact of distress on sovereign collateral. In our analysis, we focus solely onto the home sovereign exposure.

The starting point of our analysis of the liquidity channel is the gross direct long exposure towards the banking sectors' i particular home sovereign bonds j, HSE_{ij}. This exposure is subdivided into securitised sovereign debt SSD_{ij} on the one hand and loans and advances LAA_{ij} on the other.

$$HSE_{ij} = SSD_{ij} + LAA_{ij} \tag{1}$$

While the latter is not marketable and therefore not applicable for the usage as collateral, the former is, indeed, tradable debt and can therefore be used as collateral in various channels. From a theoretical perspective, securitised debt held by banks should have a certain purpose, henceforth "collateral channels". In our approach, we consider five main collateral channels: Firstly, government bonds used to fulfill Basel III's liquidity regulation as being part of each bank's liquidity reserve - LAB collateral.[13] Secondly and thirdly, government bonds serve as collateral for both, trading with central counterparties (CCP) - CCP collateral, and "classic" over-the-counter (OTC) trading - OTC collateral.[14] Fourthly and fifthly, tradable sovereign debt is used for funding transactions either with repurchase agreements (repos) - repo collateral, or directly with the European Central Bank (ECB) - ECB collateral. This asset encumbrance results in certain percentages for each of the aforementioned collateral channels, at which SSD_LAB_{ij} expresses the percentage of securitised sovereign debt allocated to banks' liquid asset buffers (LAB_{ij}) to fulfill Basel's liquidity regulations. In addition to this, SSD_CCP_{ij} and SSD_TOTC_{ij} define the share of sovereign debt which is either used for CCP-trading or OTC-trading operations. Lastly, SSD_ROTC_{ij} reflects the share of government debt used for secured short-term refinancing transactions, and SSD_ECB_{ij} defines the share of sovereign bonds which are pledged as collateral at the ECB.

All of these channels are under different haircut regimes: Given Basel's III liquidity provisions, government debt used in liquid asset buffers faces no haircuts at all and equals the initial haircut for sovereign bonds in banks' liquid asset buffers IHC_LAB_j to zero.[15] If a bank wants to trade or hedge via central counterparties in order to reduce counterparty risks, they are required to post collateral at the respective CCP. Each CCP has its own collateral regime and therefore its own haircut policy. For our analysis, we mainly rely on the collateral regime of the London-based

[13] We later discuss the functionality of government bonds in fulfilling Basel's Liquidity Coverage Ratio – LCR.

[14] In OTC trading, government bonds are subject to bilateral CSA agreements. A Credit Support Annex, CSA agreement, covers all terms of a collateral arrangement between two counterparties.

[15] See Basel Committee on Banking Supervision (2013a), p. 34.

clearing house LCH.Clearnet[16] in order to derive realistic assumptions on CCP-haircuts. Hence, IHC_CCP_{ij} reflects the average haircut per government debt j – see table 2 in the appendix.[17] Since Singh and Aitken (2009), Singh (2011), and Singh (2014) describe the re-use of collateral "rehypothecation" in much detail, we also employ the ECB-haircut IHC_ECB_{ij} as the haircut used for both OTC-trading operations IHC_TOTC_{ij} and the haircut required for secured funding transactions IHC_ROTC_{ij}. The rational behind this decision is that collateral receivers often rehypothecate the pledged collateral for own trading or funding purposes in the OTC-market. For this market, it is market practice that haircuts are linked to the ECB's official haircut IHC_ECB_{ij} for the respective securities. The ECB's official haircut again depends on the actual rating of the respective EMU country – see 3 in the appendix. The actual ECB haircuts on EMU sovereign debt are reported in table 4 in the appendix.

Based on market-experience, table 5 reports our assumption of how much of sovereign assets are encumbered in which of the aforementioned categories.

[Table 5 around here]

Given the amount of marketable sovereign debt and its same encumbrance in the banking sectors as well as the respective haircuts in the aforementioned collateral channels, we are able to calculate the single exposures EXP which are collateralised, simply by

$$\begin{aligned}
EXP_LAB_{ij} &= SSD_{ij} \times SSD_LAB_{ij} \times (1 - IHC_LAB_{ij}) \\
EXP_CCP_{ij} &= SSD_{ij} \times SSD_CCP_{ij} \times (1 - IHC_CCP_{ij}) \\
EXP_TOTC_{ij} &= SSD_{ij} \times SSD_TOTC_{ij} \times (1 - IHC_TOTC_{ij}) \\
EXP_ROTC_{ij} &= SSD_{ij} \times SSD_ROTC_{ij} \times (1 - IHC_ROTC_{ij}) \\
EXP_ECB_{ij} &= SSD_{ij} \times SSD_ECB_{ij} \times (1 - IHC_ECB_{ij})
\end{aligned} \tag{2}$$

Altogether, these single exposures amount up to EXP_SSD_{ij}, the exposure which is collaterlised by marketable debt of the home sovereign:

[16] LCH.Clearnet serves major international exchanges and is the seconds largest global clearer of fixed income securities and repurchase agreements. It is also Europe's larges derivatives clearer.

[17] In particular, LCH.Clearnet requires a maturity-adjusted haircut for each accepted government debt. Since we do not look at remaining maturities, we use the average haircut for per sovereign assets.

$$EXP\_SSD_{ij} = EXP\_LAB_{ij} + EXP\_CCP_{ij} + EXP\_TOTC_{ij} + EXP\_ROTC_{ij} + EXP\_ECB_{ij} \tag{3}$$

As can be seen from these equations, the amount of posted collateral is a function of the overall size of home sovereign bond holdings with its percentage of encumbrance in the trading or funding areas respectively and with the respective initial haircuts. The ineligibility of the home sovereign bonds in all channels except the ECB funding channel causes additional funding needs. The dropped-out funding needs to be, at last, absorbed by ECB-funding operations. In an ideal world, the ECB would cover these additional funding needs with a 0% haircut. But since we have learned from the financial crisis, the ECB also set haircuts for pledged assets. Since in our model banking sectors have no unencumbered assets available, any funds which cannot be raised from the ECB need to be covered from liquid asset buffers. The effective funding shortfall, and therefore the loss of LCR assets, for our model bank derives from the difference of funds to be raised (after haircut widening) and the market value of the home sovereign exposure.

So far, we have build the framework for our further analysis. Having these single exposures of how much of marketable sovereign debt is pledged at what haircuts in which collateral channel at hand, we are able to simulate any kind of liquidity stress. The aforementioned market turmoil and the subsequent loss of market value will directly affect only three of the five collateral channels in our framework: CCP collateral, OTC trading collateral, and OTC repo collateral.

While the initial haircut assumptions only hold in a tranquil market environment, haircuts are likely to rise during market turmoil. Based on previous events during the European sovereign debt crisis, we estimate a rise in haircuts of up to 100% which effectively means a non-acceptance of sovereign collateral in CCP-related transactions as well as in OTC-trading or OTC-funding operations. As soon as haircuts are increased, banks need to remargin the pledged collateral. The difference between the already posted collateral (sovereign bonds and cash) and the now required haircuts has to be funded by cash. Therefore, the banking sector will effectively lose its pledged government bonds as collateral for trading purposes and funding sources since repo transactions in place with now non-acceptable collateral need to be remargined, and new transactions with this particular collateral cannot be executed.[18] Unwinding the collateralised CCP-positions and

[18] Even though, the collateral is still eligible with high haircuts, banks need to alterate their funding operations. As the example of Ireland demonstrates, haircuts of 75% definitely harm secured funding transactions.

OTC positions is not market-practice. All positions with the same government debt will be held until maturity and will be remargined with cash. The exact liquidity effect of the ceased funding is derived by remargining the difference between the originally posted collateral which is the exposure EXP and the now by cash equivalent required CER in the CCP collateral EXP_CCP_{ij}, OTC-collateral EXP_TOTC_{ij}, and repo collateral EXP_ROTC_{ij}:

$$CER_i = EXP\_CCP_{ij} + EXP\_TOTC_{ij} + (EXP\_ROTC_{ij} \times (1 + \Delta MV_{ij})) \tag{4}$$

while we assume a haircut of 100% for EXP_CCP_{ij} and EXP_ROTC_{ij} which effectively means non-acceptance as collateral and full re-margining, EXP_ROTC_{ij} needs to be adjusted by the percentage change in market value ΔMV_ij of the government debt in the course of the sovereign distress. As previously implied, the extent of the change in market value was derived from observations of the behaviour of bond prices during the European sovereign debt crisis. Therefore, the expected shortfall SF_i is defined as the difference between the sum of the exposures of CCP collateral, OTC collateral, and repo collateral reduced by the ECB's haircut. It can be written as:

$$SF_i = CER_i - (MV^*_{ij} \times (1 - SHC\_ECB_{ij})) \tag{5}$$

in which

$$MV^*_{ij} = (EXP\_CCPij + EXP\_TOTC_{ij} + EXP\_ROTC_{ij}) \times 1 + \Delta MV_i \tag{6}$$

and SHC_ECBij is the new stress ECB haircut.

This shortfall causes effective liquidity constraints for banks since they loose the liquidity formerly provided by the sovereign collateral at the same time as they are forced to raise additional cash to satisfy margin calls from other collateral channels. In short, the respective banking sectors are faced with severe cash outflows. Since a large portion of sovereign bonds is now worthless from a liquidity point of view, the bank must now turn to the unsecured money market. In just such an environment, we believe that it is highly unlikely that unsecured funding will be readily available to affected banks. We have learned from the financial crisis that banks which are affected by systemic contagion effects hoard liquidity rather than provide liquidity. Therefore, the ECB, either by normal funding operations or by the Emergency Liquidity Assistance (ELA), will be the

only source of reliable funding in this market situation. In order to receive central bank funding, banks need - again - to pledge securities as collateral.[19]

Since any kind of instant short-term funding source (secured repo transactions, unsecured wholesale deposit taking, and issuance of short-term papers like commercial deposits) severely limited in our framework, this shortfall SF_i can only be backed by selling sovereign debt securities held in the banks' liquid asset buffers. Since a large amount of bonds is locked in CCP funding transactions and unsecured funding is not available, banks fall back to their liquid asset buffers. To counteract effective cash outflows, banks are likely to sell securities of the liquid asset buffers. Transforming these liquid asset buffers into Basel III's liquidity regulation framework, they can be interpreted as the numerator of the liquidity coverage ratio - LCR.

$$LCR_i = \frac{\text{Stock of HQLA}}{\text{Total net cash outflows over the next 30 calendar days}} \geq 100\%^{20} \tag{7}$$

Depending on the magnitude of the liquidity stress, the LCR might drop below its regulatory threshold of 100%. Sales from the stock of High Quality Liquid Assets (HQLA) / liquid asset buffer automatically reduce the numerator of the LCR and therefore decrease the LCR ratio. Given the initial ratio (LCR in tranquil times) and the magnitude of the shortfall during sovereign distress, the sale of sovereign bonds can result in non-compliance of the banking sector with Basel III's liquidity regulation.

Due to the fact that haircuts for banks' liquid assets are determined by Basel III's liquidity regulation, the LAB collateral channel will not be directly affected by market turmoil in the first place. The same is true for the ECB collateral channel since the ECB acts as the acceptor of the last resort in such market situation.[21] In order to replicate this mechanism, we calculated the size of the liquid asset buffers held by the banking sectors LAB_i as followed:

$$LAB_i = LCR_i * NCO_i * TA_i \tag{8}$$

The liquidity coverage ratio for each banking sector is denoted by LCR_i and calculated by

[19] Here, as Bonner and Hilbers (2015) point out, central bank eligibility is a key determinant of an asset's liquidity.

[20] For detailed description of the calculation methodology of the liquidity coverage ratio see Basel Committee on Banking Supervision (2013a).

[21] As we have learned from recent events of the sovereign debt crisis, even the ECB may decide not to accept certain kinds of sovereign debt anymore. Even thought the euro system as a whole will not accept sovereign debt anymore, the respective national central banks would still accept their own government bonds, making the ECB collateral always reliable as the acceptor of the last resort of sovereign debt.

equation 7.[22] The difference of LCR's total outflow and total inflow as a percentage of the size of the banking sectors balance sheet, the net cash outflow assumption, is given by NCO_i. Finally, the banking sector's total asset size is denoted by TA_i. While we have derived TA_i from the balance sheet data included in the EBA stress test, we had to make some assumption regarding the LCR_i and NCO_i. For both, we resorted to the Basel Committee on Banking Supervision (2014). In particular, we assumed three different target ratios for the respective LCR: an aggressive target ratio with LCR_i set at 110%, an economic target ratio with LCR_i at 120%, and a conservative target ratio with LCR_i set at 130%. In this monitoring report, the participating banks feature LCRs between 100% and up to 130%. Regarding the net cash outflow assumption NCO_i in our framework, we use the outflow assumption made by the Basel Committee on Banking Supervision (2014). Hence, we set the outflow assumption at constantly 14% of the balance sheet size.

3.2 Capital Channel

In addition to the just described liquidity stress scenario, we measure Basel-compliance through the capital channel as well. In comparison of the liquidity channel, the mechanism of the capital channel is more closely bounded to accounting and regulatory logic than it is in the liquidity channel. Hence, the capital channel provides an elaboration of these mechanisms rather than a depiction of financial market mechanisms.

As with the liquidity channel, sovereign spread widening causes a decline in market value. Since all banks in the EBA stress tests are held to international accounting standards, these standards affect each and every bank alike and require that every loss in market value is backed with an equivalent amount of bank equity. Hence, a reduction in market value causes an immediate decline in the bank's Capital Adequacy Ratio - CAR, since the reduction of bond values is compensated with the bank's equity. Due to compensation of market losses, the decline in capital can cause a decrease in the CAR's numerator and therefore provoke a decline in the ratio as a whole. A potential sovereign downgrade fosters the magnitude of this scenario. The downgrade might lead to a reallocation of the sovereign bonds into another, less favourable risk weighted asset level, and, as a consequence, increase the amount of risk weighted assets while lowering the CAR. Both scenarios of the capital channel can cause a break of the bank's capital ratio and therefore result

[22] Here, we follow The Basel Committee on Banking Supervision (2014).

in a possible non-compliance with the Basel III's capital regulations.

In order assess the impact of sovereign distress on the capital base of the hypothetical banking systems, we calculated the regulatory capital measures before and after the sovereign distress: Firstly, we denote the total capital ratio or Total Regulatory Capital TRC per respective banking sector i as

$$TRC_i = \underbrace{CET1_i + AT1_i}_{\text{Total Tier 1 Capital}} + T2C_i \tag{9}$$

in which $CET1$ is the total amount of Common Equity Tier 1, and $AT1$ expresses the Additional Tier 1 capital held by the banking sector. In addition, $T2C$ expresses the amount of supplementary, loss absorbing Tier 2 Capital. Taken together, $CET1$ and $AT1$ form a banking sectors' i Total Tier 1 capital $T1C$. Also having the bank sectors' risk-weighted assets RWA at hand, we are able to calculate the average capital ratios for the banking sectors by dividing the average type of capital by the average risk-weighted assets.[23] Doing so, we strictly follow the approach of the Basel Committee on Banking Supervision (2011).

[Table 6 around here]

As shown in table 6, the Basel Committee on Banking Supervision (2011) sets the following restrictions: the Common Equity Tier 1 ratio must be at least 7.0% of risk-weighted assets at any time, whereas the Tier 1 Capital ratio must be above 8.5% of risk-weighted assets at all times, and finally the Capital Adequacy Ratio also must be at least equal or higher than 10.5% of risk-weighted assets at all times. Therefore, to be compliant with Basel III's capital regulation, the hypothetical banking sectors must satisfy these thresholds at any time.[24]

All of the capital ratios are linear constraints implying simple setups in which the objective function is also linear. In contrast to the liquidity channel in which regulatory compliance is primarily based on the behaviour of the LCR's numerator, all ratios also have the risk in their denominators. Therefore, the higher the capital base in the numerator, or the higher ratios are, and, as a consequence of this, the higher the bank's capital resilience towards sovereign distress.

[23] We are aware of the concerns raised by Le Leslé and Avramova (2012) regarding the calculation risk-weighted assets. But since we use a standardized data set provided by the European Banking authority (see section 4), we believe that potential short-comings in the calculation of risk-weighted assets do not harm the result of our analysis.

[24] Since Tier 2 should, according to the Basel Committee on Banking Supervision (2011), "only" provide loss absorption on a gone-concern basis (insolvency of a bank) and is not expected to absorb losses during a bank's normal business operations (going concern), there is no capital ratio to fulfill for Tier 2 Capital.

Finally, the capital ratios are weighted balance sheet ratios in which the weights reflect "higher risk" in terms of higher RWAs.

Subsequently, we calculated how sovereign distress influences the capital base of the model banking sectors: To quantify the impact of losses in market value on the banking sectors' capital, we derived the assumed losses (L) in absolute terms from the marketable debt exposure of the respective home sovereign for each banking sector. As with the liquidity channel, the amount of securitised sovereign debt in the banking sector SSD_{ij} and the the percentage change in market value of the respective government debt $\Delta MV_i j$:

$$L_{ij} = SSD_{ij} \times \Delta MV_{ij}. \tag{10}$$

Given this, we calculate the capital bases after sovereign distress as followed: The Common Equity Tier 1 capital after sovereign distress $CET1^*$ with

$$CET1_i^* = max(CET1_i - L_{ij}, 0) \tag{11}$$

and the respective Tier 1 Capital, $T1C^*$ with

$$T1C_i^* = max(T1C_i - L_{ij}, 0).^{25} \tag{12}$$

Before deriving the new capital ratios, we calculate the new risk-weighted assets. In the course of a sovereign downgrade, we believe that the overall amount of risk-weighted assets will increase - shift of assets held into a worse risk category. Hence, the risk-weighted assets of the banking sector after sovereign distress, RWA^*, can be derived from the initial risk-weighted assets, RWA, the change in risk-weighted assets in percentage terms, ΔRWA_i, and the total home sovereign exposure HSE:

$$RWA_i^* = RWA_i + (\Delta RWA_i \times HSE_{ij}) \tag{13}$$

Therefore, the capital ratios after sovereign distress are simply calculated by dividing the respective type of capital by the risk-weighted assets after sovereign distress for each banking sector i: Hence, the new Common Equity Tier 1 $CETR^*$ ratio is derived as:

[25] Since we assume only Common Equity Tier 1 in our hypothetical banks, banks' total tier 1 capital fully consist of Common Equity Tier1.

$$CETR_i^* = \frac{CET1_i^*}{RWA_i^*}, \tag{14}$$

whereas the Tier 1 Capital ratio $T1R^*$ is derived as followed:

$$T1R_i^* = \frac{T1C_i^*}{RWA_i^*}. \tag{15}$$

Finally, the Capital Adequacy Ratio after sovereign stress CAR^* is derived by

$$CAR_i^* = \frac{(T1C_i^* + T2C_i)}{RWA_i^*} \tag{16}$$

Unlike the compliance with Basel's liquidity provisions, the compliance with Basel's respective capital regulations is determined by both numerator (amount of disposable capital) and denominator (increase of risk weighted assets). The above-mentioned approach was conducted for the banking sectors which also were under examination in the 2014 EBA stress test.[26] The data we use for this purpose is described in section 4.

3.3 Main Assumptions

In order to derive the results for analysis, we initially examine at the behaviour of government bonds of countries of the European Monetary Union which were actively traded in the market between 2011 and 2014. In particular, we look at the movement of bond prices and bond yields during this period and, more precisely, at prices and yields around a downgrade of these countries. For our stress scenario, we use the weekly change in bond prices. We estimate the highest loss in market value during one calender week (5 trading days) by 16,04% for the period between 2011 and 2014.

For the capital channel, we assume that the hypothetical banking sectors do not have any Additional Tier 1 Capital. With that assumption, we follow a projection of the Basel Committee on Banking Supervision (2014).

4 Data

To conduct our analysis we largely resorted to bank-level data from the EU–wide stress test of 123 banks performed by the European Banking Authority (EBA) in 2014. According to the European Banking Authority (2014), the EU–wide stress test contains a sample of 123 banking groups from

[26] Since our analysis assumes a going-concern scenario, we do not derived banks' Tier 2 capital anew.

22 countries with a total asset volume of approximately EUR 28tn. The data used in the EU-wide stress test bases of balance sheet data as of end 2013 and covers more than 70% of total banking assets in the EU. The stress test was performed at the highest level of consolidation where the scope of consolidation was, according to the European Banking Authority (2014), the perimeter of the banking group as defined by the CRR/CRD IV. The EBA selected the sample insofar to cover at least 50% of national banking sectors, directly or via subsidiaries of parent companies included in the sample, in each EMU country and Norway, as expressed in terms of total consolidated assets as of end of 2013.

Albeit the EBA data reveals the sovereign bond holdings as well as the total asset exposures of all 123 banks included in the EBA stress test, we consider only data from euro area banks (101 banks in total). From these banks included in the stress test, we took only data from the exposures to central and regional and local governments (public debt exposures). We do not include any other exposures to public-sector related entities, like municipal utility companies of the respective countries. Further, we only took sovereign holdings from other EUR-countries into account. In addition to the EBA data, we use balance sheet data from the 2013 annual reports of the respective 101 banks collected from BankScope.

[Table 7 around here]

With this data we were able to construct the average financial sovereign creditor per euro area country, henceforth: model banking sector. The variables and parameter we use for this are reported in 7. The sovereign exposure of the model banking sector splits into two distinctive parts: exposure to the home sovereign and exposure to other public and non-public debtors. We define the home sovereign as the "key sovereign" for the respective model banking sector. Lastly, we illustrate the importance of sovereign debt holdings by placing them in the context of risk weighted assets of the respective banking sector. The sovereign debt holdings as a percentage of total assets are reported in table 8.

[Table 8 around here]

Finally, market data was taken from Bloomberg L.P. In consistence with prior studies (e.g. Korte and Steffen (2014)), we use 10-year sovereign benchmark yields in order to assure liquidity and comparability.

5 Results

5.1 Capital Channel

Based on balance sheet data provided by the 2014 EBA stress test, we calculated the average amounts of banks' capital (Common Equity Tier 1 (CET1), Tier 1 Capital (T1C), Tier 2 (T2C)), and the Total Regulatory Capital (TRC) for the investigated EMU banking sectors. A hypothetical banking sector were constructed for each EMU-country in the EBA sample, no matter how many banks actually were examined by the stress test.[27] Also, we calculated the average total risk weighted assets (RWA) and extracted the RWAs which are related to the home sovereign holdings.

[Table 9 and table 10 around here]

As can be seen in tables 9 and 10, the banking sectors in the EMU are, except the ones of Cyprus and Greece, well capitalised: With 16,37% Ireland exhibits the highest CETR and T1R within the sample and is followed by Slovenia and Luxembourg with 15.89% and 15,87% respectively. Contrary, Cyprus exhibits the lowest CETR and T1R (6,19%). Beside Cyprus, Italy, Latvia, and Greece have the lowest CETR and T1R in the sample (9,24%, 9,75%, and 9,92%, respectively). Regarding the Capital Adequacy Ratios (CAR), Belgium and Ireland show the most resilient bankings sector with 19,27%, and 19,12% respectively. Featuring CARs of 7,1% and 10,27%, the banking sectors of Cyprus and Greece are the most vulnerable ones in terms of total regulatory capital. While Greece fails to meet only the CAR threshold of 10,5%, Cyprus completely falls short of Basel III's capital requirements.

In addition to the absolute amount of the various types of capital and the respective ratios, table 11 also reports the percentages of the banking sectors' total regulatory capital which accounts for Tier 1 Capital and for Tier 2 Capital. With 100,00%, 96,65%, and 91,81%, from a going-concern perspective, Slovenia, Greece and Portugal have the highest percentages of Tier 1 Capital in comparison total capital. As a consequence, these countries face the lowest percentages Tier 2 Capital. In contrast, Latvia, Italy, and Austria exhibits the lowest percentages of Tier 1 Capital and therefore the highest ones in Tier 2 Capital.

[27] At this point, we are well aware of the fact that EBA data on sovereign exposure does not cover the entire banking sector for each country.

Measuring the home sovereign exposure towards total size of risk-weight assets of the hypothetical banking systems in our framework, Malta, Ireland, and the Netherlands exhibit the highest exposures towards their respective home sovereign with 59,66%, 47,27% and 36,06%, respectively on the one hand. On the other, Cyprus, Luxembourg, Germany, have the least exposed banking sectors with 6,28%, 9,44%, and 9,41%.

As discussed in 3.3, we assume a loss of the sovereign holding of 16% and an increase of home sovereign-related RWAs by 30% for the stress scenario of the capital channel. With these assumptions, we heckle both numerator and denominator of capital ratios at the same time in order to ensure a realistic scenario. As table 12 and table 13 report, the results of this shock scenario are dissimilar: While the gross of the countries are still compliant with the Basel III's capital regulations after the shock, several other countries fall below some or even all of Basel's capital-ratio thresholds. As before, Cyprus is still non-compliant. In our analysis, non of the banking sectors were forced into bankruptcy.

[Table 12 and table 13 around here]

Among the countries which are compliant with Basel's capital regulation, only Italy and Malta instantly miss all of Basel III's capital thresholds. In addition to this, Portugal's and Spain's banking sectors fall short of their T1Rs and CARs, but not their CETRs. Lastly, Germany, Greece, Latvia, and the Netherlands miss their T1Rs but are still compliant with the other capital ratios. In the cases of Italy and Malta, the banking systems of both countries are capitalised enough to fulfill Basel's capital regulations, in the case of Italy, 9,24% for each CETR and T1R and 12,77% for CAR and 10,71% for each CETR and T1R and 13,88% for Malta's CAR; but not sufficiently capitalised to withstand a sovereign distress as our assumed one. TWe believe this has come about for the following reasons: Even though the banking systems are compliant with Basel III in the first place, they are only just fulfilling these requirements. The cushion between the capital threshold and the actual ratio is simply too low in comparison with the share of the home sovereign exposure towards the respective risk-weighted assets. Regarding the example of Italy, countries with similiar ratios of sovereign exposures, like Slovenia, Ireland, and Belgium exhibit far higher (total) capital ratios, e.g., CARs of 15,89%, 15,10%, 19,27% vs. Italy's 12,77%. For the sake of completeness, we have to point out that Malta has by far the highest home sovereign exposure of the whole sample and could be treated as an outlier.

Countries that are partially compliant with Basel III's capital regulations can be sub-divided into two groups, countries which are incompliant with just one ratio, and countries which are non-compliant with two ratios. Among the countries which partially missed compliance with Basel's capital regulation, Portugal and Spain are quite alike. They exhibit CETRs and T1Rs of 11,55% and 10,56% as well as CARs of 12,14% and 12,54% respectively. Also both countries have roughly the same home sovereign exposure towards total risk-weighted assets: 26,90% for Portugal and 20,52% for Spain. As measured capital ratio, the CETR was high enough to withstand our simulated sovereign distress. The T1Rs and CARs for both countries, were not sufficient enough to ensure a complete compliance with Basel III's capital regulation. In contrast to this, banking sectors which solely fall short with just one of the ratios, like the ones of Germany, Latvia, and the Netherlands, miss to meet their T1R. In terms of CETR and CAR, they are still compliant with Basel's regulation. Here, it is interesting to observe that compliance with capital regulation is not driven either by the cushion between actual ratios and regulatory required ratios or the extent of the home sovereign exposure in comparison to the overall risk-weighted assets of the banking system but by the composition of the banking sector's capital itself: As table 11 reports, Germany, Latvia, and the Netherlands feature completely different initial capital ratios and even more different home sovereign exposures. In the hypothetical German banking sector, Tier 2 Capital accounts for more than one fifth of the total capital (21,14%). Something near this can also be seen in Latvia and the Netherlands with 38,10% and 28,55%, respectively. In contrast to this, the T2C of the banking sectors for Spain or Portugal are much lower with 8,19% for Portugal and 15,78% for Spain.

We learn the following from these results: By analysing the mechanisms of the capital channel of the our framework, we revealed that three different features of the capital basis of banks are important in order to be compliant with current capital regulation: Firstly, the cushion between the actual capital ratio and the required capital ratio is an important factor to be compliant with Basel's capital regulation. Secondly, the overall amount of held sovereign debt as portion of total risk-weighted assets is important. Lastly, the ratio between a banking sectors' T1C and T2C is important to assess whether banks are vulnerable to a sovereign shock.

5.2 Liquidity Channel

In order to derive the liquidity-related consequences of stressed sovereign collateral, we firstly calculated the liquid asset buffers of the respective banking sectors on the basis of equation 8.

Based on total assets and the assumptions made by the Basel Committee on Banking Supervision (2014), we calculated the liquidity buffers as well as the LCRs for the respective banking sectors. The assumption and specification of our liquidity stress scenario led to interesting results that are summarized in tables 14, 15, and 16. Depending on the LCR target ratios chosen, the results of the liquidity stress also reveal the magnitude non-compliance for the respective banking sectors. This magnitude of non-compliance clearly results from the target ratios pursued by the banking sectors. Albeit the effective shortfalls in cash-terms is the same in each and every target ratios scenario, the compliance or non-compliance is driven by the size of the initial liquidity ratio.

As outlined in section 3.1, we conduct our analysis under the assumption that the hypothetical banking sector pursues three different steering approaches: First, an aggressive steering approach with liquidity coverage ratios at 110%. In this approach banks have just enough HQLA available to be compliant with Basel III's liquidity provision. It is the most inexpensive of all three approaches. Second, the banking sector pursues an economic steering approach with LCRs at 120%. Within this approach, banks have enough HQLA available to be compliant with Basel's liquidity provisions, even under market stress. We labelled this approach "economic" since it provides the best trade-off between protection against liquidity stress and the cost of this very protection. In the last approach, our hypothetical banking sectors exhibit LCRs of 130% to withstand even severe market stresses. Since HQLA feature low returns due their quality, it is the most expensive of all approaches.

Even though all banking sectors are compliant with Basel III's liquidity regulations in the first place and given our assumed market stress outlined above, an aggressive LCR target ratio of 110% seems to be the less favourable for the banking sectors in our analysis. Even though the ECB does not implement stress haircuts for the trouble sovereign bond holding, which effectively means, that it takes them at market prices, all of the banking sectors in our sample will be immediately non-compliant with Basel's liquidity regulation - see table 14.

[Table 14 around here]

The economic approach yields a different result. While in the aggressive target ratio scenario all of the banking sectors miss the required 100%-LCR, four banking sectors (Austria, France, the Netherlands, and Spain) are constantly compliant with Basel III's liquidity regulation. This is so even if the ECB set the haircuts for the troubled sovereign bonds at 100%. Only two banking sectors (Italy and Slovenia) are non-compliant in the first place. Since most of the banking sectors are compliant with Basel III's liquidity provisions and the selected size for the LCR therefore seems

sufficient enough, this is somehow surprising. But looking closer at the size of held sovereign bonds in relation to the total assets of the banking sector, table 8 reveals that the banking sectors of Italy and Slovenia feature the highest percentages of sovereign bond holdings in comparison to their total assets (10,57% and 12,48% respectively).

[Table 8 around here]

Despite the fact that sovereign bond holding account for 12,23% of total assets of the Maltese banking sector, Malta does not face the liquidity stress scenario Italy and Slovenia faces. In contrast to this, countries with small percentages of sovereign bond holdings in comparison to their total assets feature a higher Basel III compliance. Therefore, the compliance of the other banking depends on the stress haircuts set by the ECB and the relation between sovereign bond holdings and total assets: While the hypothetical Portuguese banking sector (sovereign bond holdings represent 8,17% of total assets) is only compliant with Basel's liquidity regulation without any ECB stress haircuts, Irish banks are only compliant if the ECB leaves its stress haircut at 10% or lower (5,83% of total assets are sovereign bonds). All other banking sectors are non-compliant as soon as they set their stress haircut higher than 50%.

[Table 15 around here]

Contrary to the two aforementioned scenarios, conducting the liquidity coverage ratio at a conservative level of 130% brings about the safest degree of compliance within our framework. Within conservative target ratios of 130%, eight out of the fifteen banking sectors are constantly compliant with Basel's liquidity provisions. All of these banking sectors, see table 8, feature less than 4,00% of their total assets as bond holdings of their respective home sovereign. Regarding the whole sample, non of the banking sectors are non-compliant with ECB stress haircuts below 25%. Only for three banking sectors, Italy, Malta, and Slovenia are non-compliant with ECB stress haircuts of 25%. Again, these are the countries with the highest portion of sovereign bond holdings in comparison to the bankings sectors' totals assets. Non-compliance ensues with ECB stress-haircuts of 25% or above and the Portuguese and Spanish banking sector, non-compliance ensues at ECB haircuts of 50% of above, while Irish banks are non-compliant with ECB stress haircuts of 75% or above. Lastly, only the Belgium banking sector exhibits non-compliance with Basel III, given non-central bank eligibility.

[Table 16 around here]

We interpret these results as follows: Firstly, although we employ only one market stress, a decrease of sovereign assets by 16,04%, we can say that sufficiently high liquid asset buffers protect banking sectors from severe liquidity stresses and non-compliance with liquidity regulation.[28] Secondly, our results quickly lead to the conclusion that both the absolute size and the relative size of the liquidity buffer matter greatly, whether banks face a severe liquidity stress or "just" non-compliance Basel III's liquidity regulation. The same specific relation between sovereign bond holdings and liquid asset buffers, since the latter is a function of cash flow assumptions and total assets, might lead to the conclusion that the relationship between the size sovereign bond holdings and the size of liquidity buffers matter in assessing the vulnerability of banking sectors towards system-wide liquidity stresses. However, we set the size of the respective LCRs, not on an individual, but an average basis, with the result that, in comparison to sovereign bond holdings, higher LCRs help banks to avoid severe liquidity stresses.

Our results are related to those of Lennkh and Walch (2015) who show that the vast majority of banks only experiences a small collateral loss due to a positive transaction cost shock while some others may suffer larger collateral losses. In their study, the authors attribute this to different sizes of collateral buffers: These banks which are more constraint can post, if available, additional collateral or reduce its outstanding liquidity position towards the ECB. The same is true for the size of banks' liquid assets buffers and the respective LCRs in our analysis.

So what do these high needed LCRs implicate? As with the Basel Committee on Banking Supervision (2013a), liquidity risk stemming from sovereign assets is explicitly neglected since the liquidity run-off assumption for sovereign debt-related secured funding transactions is 0%. Given this regulatory assumption and our model results, we believe that banks' LCRs are far lower than they should be since the assets included in the LCR are much riskier in terms of liquidity than the definition by the regulatory framework suggest. Therefore, we propose a sovereign risk adjusted liquidity coverage ratio which includes the actual liquidity risk of sovereign assets in funding transactions. Since this proposal can be interpreted as an add-on to the current LCR, we call our adjusted LCR, "LCR+". The advantage of LCR+ would be a systematically sovereign-related adjustment of the outflow assumption of the current LCR.

[28] In order to confirm these results, we performed some robustness checks. See **??**

6 Robustness Checks

The objective function of our analysis is based on parameters that bank outsiders need to estimate. The solutions of linear programs can be very sensitive to parameter changes.

6.1 Capital Channel

In order to check whether the results which are provided in section 5.1 are robust, we performed our model with the 99% and 97,5% quantile of our market observations. In contrast to section 5.1, in which we presume a drop of 16,04% in market prices, we run our model again with decrease of market prices by 9,29% (99% quantile) and 5,54% (97,5% quantile). The result are reported in table **??** in the appendix.

Using the 99% quantile, the results change slightly: Italy and Spain are still non-compliant with Basel's capital ratios as before. Germany Latvia and the Netherlands turned out to be compliant with Basel III's capital regulation. The banking system of Malta is now compliant with its CETR (7,15%) but still not with its T1R (7,15%) and CAR (9,84%). Lastly, Portugal improves its T1R to 8,79% and is therefore compliant with Basel's treshold on the Tier 1 Capital Ratio but still not with its CAR.

Turning to the 97,5% quantile, only Italy is least compliant and misses the T1R and CAR thresholds. The model banking sectors of Malta and Portugal are still partially non-compliant with Basel. The Maltese banking sector misses the T1R threshold (7,93%), and the Portuguese banking sector falls short on its CAR (9,71%).

Throughout the analysis, Cyprus and Greece were non-compliant with Basel's capital regulation.

6.2 Liquidity Channel

Like with the capital channel, we performed our model with the 99% and 97,5% quantile of our market observations for the aggressive steering scenario, economic steering scenario, and conservative steering scenario. In contrast to section 5.2, in which we presume a drop of 16,04% in market prices, we run our model again with decrease in market prices by 9,29% (99% quantile) and 5,54% (97,5% quantile). The results are reported in tables 17, 18, 19, and 20 in the appendix.

Performing our model with a decrease of market value by 9,29% (99% quantile) and 5,54% (97,5% quantile) respectively in the aggressive steering scenario only leads to the aforementioned

results: Non of the banking sectors in our sample are compliant with Basel's liquidity regulation, neither at the 99% quantile, nor at the 97,5% quantile level. The results only differ in so far from our base line scenario that the banking sectors exhibit better but not sufficient liquidity ratios.

Looking at the economic target ratio scenario and the conservative scenario, the model results are almost the same as our baseline scenario: Regarding both scenarios a decrease in market prices by 9,29% (99% quantile) and 5,54% (97,5% quantile) only causes the banking sectors to be non-compliant with Basel III's liquidity regulation at a ECB stress haircut higher than our baseline scenario. Overall, the robustness checks lead to the conclusion that the higher the targeted Liquidity Coverage Ratio is and the less the market downturn, the higher is the probability that the banking sectors are compliant with Basel III's liquidity regulation.

7 Conclusions & Implications

In comparison to other assets such as cash or lesser quality debt securities, sovereign collateral plays an important role for banks: Firstly, in non central bank-related transactions and secondly, for regulatory purposes. Our simulation is based on a model bank which constitutes the average sovereign creditor among financial institutions in the euro area. We find that EMU banks are exposed to a high systemic sovereign risk through various collateral channels and their interdependencies in terms of liquidity but not in terms of bank capital. Based on these two preliminary findings, we can estimate to what extent sovereign collateral drives systematic risk in terms of bank liquidity. Since the major defaults in the financial sector were caused by illiquidity, rather than by insolvency due to a lack of sufficient capital, our findings are consistent with recent experience.

Based on our findings, we might ask what the policy implications are. Our analysis revealed the importance of sovereign collateral for the financial system in the EMU and the respective systemic risks which accompany this importance. Our model bank reflects some important implications for banks, regulators, and central bankers. First, the liquidity managers of banks can easily understand the foundations and implications of our model bank. In the context of a market wide liquidity stress scenario which arises from market turmoil and the downgrade of the respective home sovereign, banks are likely to be non-compliant with Basel III's liquidity regulation. Second, regulators, especially the Basel Committee, need to consider whether the assumptions on liquidity outflows and inflows, especially in the LCR, reflect actual market stresses and adjustments under the current liquidity regulations accordingly. Last, the liquidity stress simulation of our model bank indicates

how important a central bank's collateral policy is for liquidity provision to the banking system.

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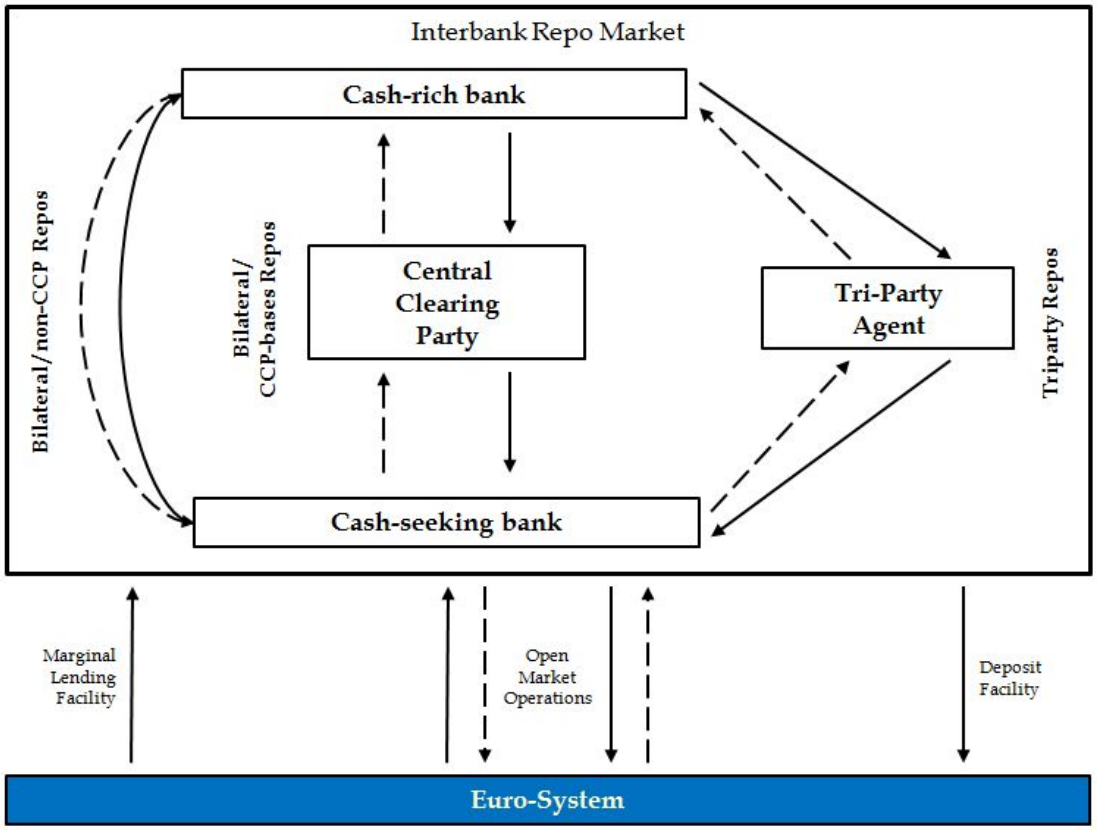
8 Appendix

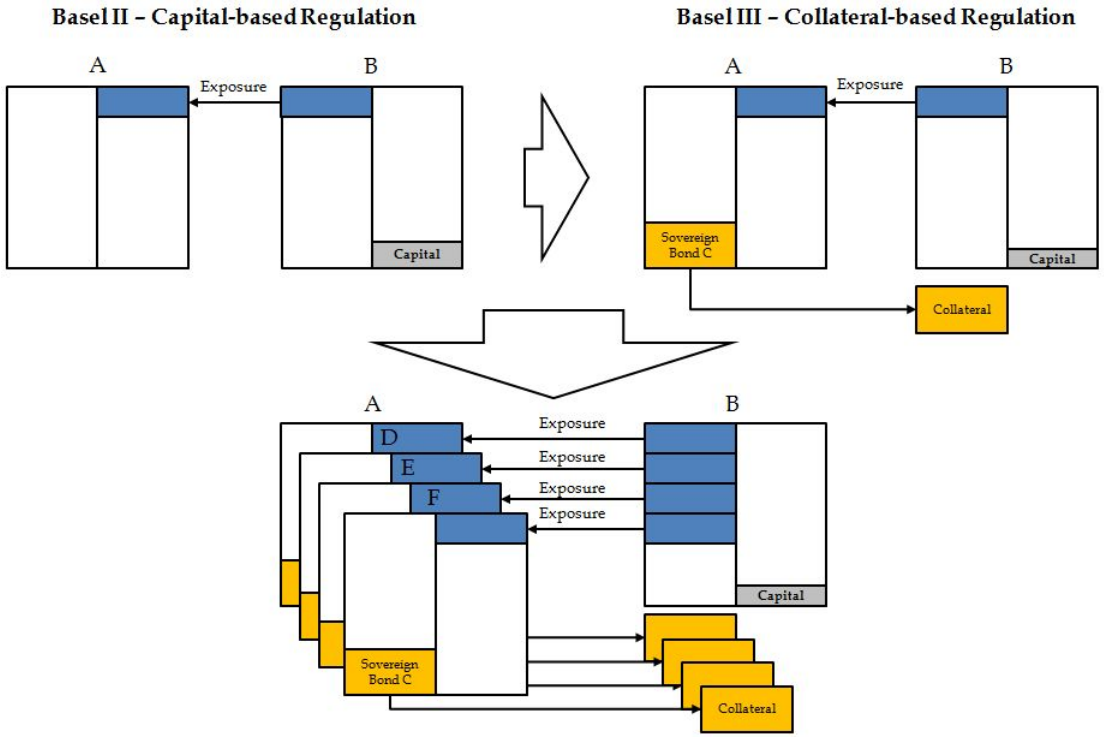
Figure 1: EUR Repo Market



This figure present a stylized description of the interbank repo market in the EMU and its linkage to monetary policy. Market participants are in the black-edged boxes. Within the interbank repo market, transaction are executed between cash-seeking banks (liquidity receiver) and cash-rich banks (liquidity provider). These repo transactions are bilateral repos or repo with an intermediary eiter a central counterparty (CCP) or a tri party agent. The solid lines represent real cash flows between the market participants where are the dotted lines are represent movements of securities in the respective repo transactions. The Eurosystem's monetary policy has direct influence (open market operations with cash-seekings banks) and indirect influence (marginal lending facility and deposit facility) on the interbank repo market.

Source: Based on Mancini et al. (2014), p. 7.

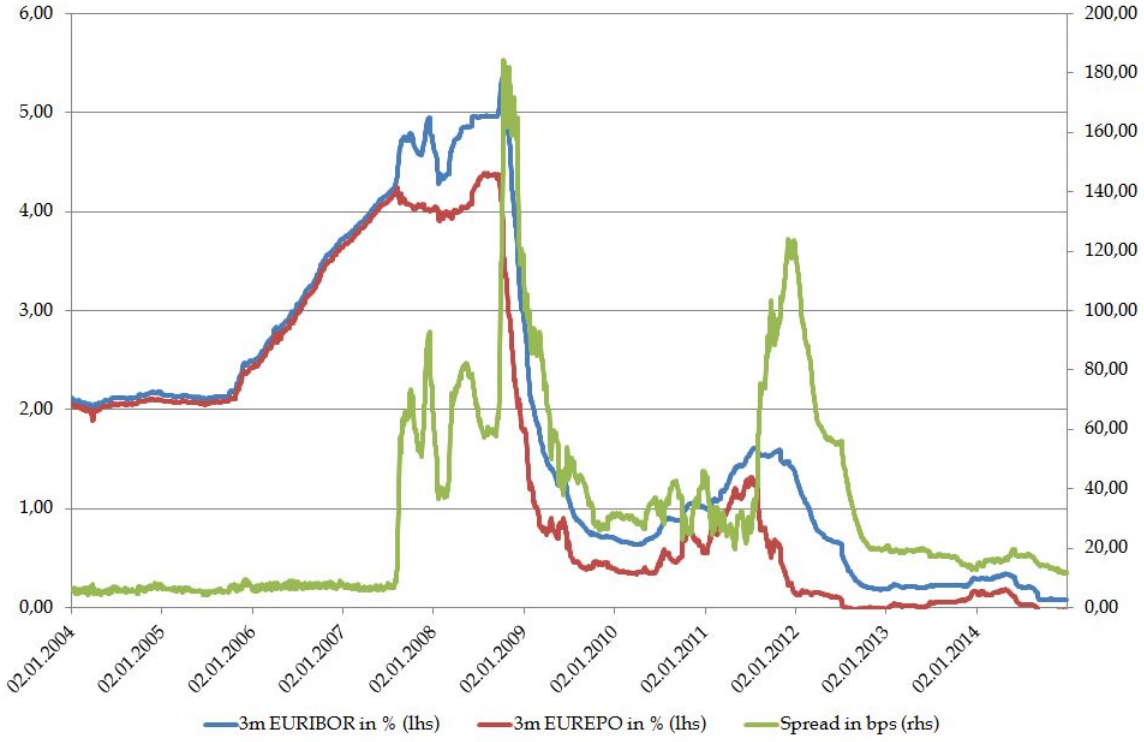
Figure 2: Shift in Regulatory Frameworks



This figure presents a stylized overview on capital-based and liquidity-based regulatory frameworks. In the capital-based framework under Basel II, bank A receives unsecured funds from bank B. As a loss protection against default of bank A, Bank B holds a regulatory predetermined amount of (minimum) capital. In the collateral-based framework under Basel III, bank A pledges collateral (Sovereign bond C) as loss protection for its own default. However, in a broader banking system, bank B not only lends money on secured basis not only to bank A but also bank D, E, F, and so forth. Thus, making sovereign bond C to systemic-relevant collateral of the banking system. Given this situation, a exogenous shock to the sovereign collateral C will have system-wide effect.

Figure 3: EUR secured and unsecured Money Market

This graphs reports the development of the secured and unsecured money market in the euro area between 2004 and 2014. The unsecured money market fixing rate, 3-month EURIBOR (blue line), and its equivalent for secured money market, 3m EUREPO (red line), are depicted on the left vertical axis, whereas the spread between both money market fixings (green line) is depicted on the right vertical axis. Before the outbreak of the financial crisis, the interest rate differential between both market was neglectable low. With the outbreak of the financial, market participants became aware of the inherent credit risks in the money market and started to trade unsecured deposits at largely higher rates than secured money market transactions, repos. The spread peaked twice: in the financial crisis and in the European sovereign debt crisis, implying the high credit risk perceptions and a move from unsecured to secured interbank funding transactions. According to the Deutsche Bundesbank (2013) market participants became also discriminating with regard to quality and of eligible collateral and counterparties and therefore acceptance of certain euro are countires. However, the share of government debt in repo transaction remained stable between 2009 and 2012.



Source: Bloomberg L.P. 2015

Figure 4: Collateral Model and Compliance Framework

This figure shows how our model framework operates. The flow chart shows the model's functionality as a whole. The black-edged boxes are exogenous events which potentially affect the liquidity-channel and the capital-channel of our model bank. The liquidity channel is given in the orange-edged boxes, whereas capital channel is arranged in the purple-edged boxes.

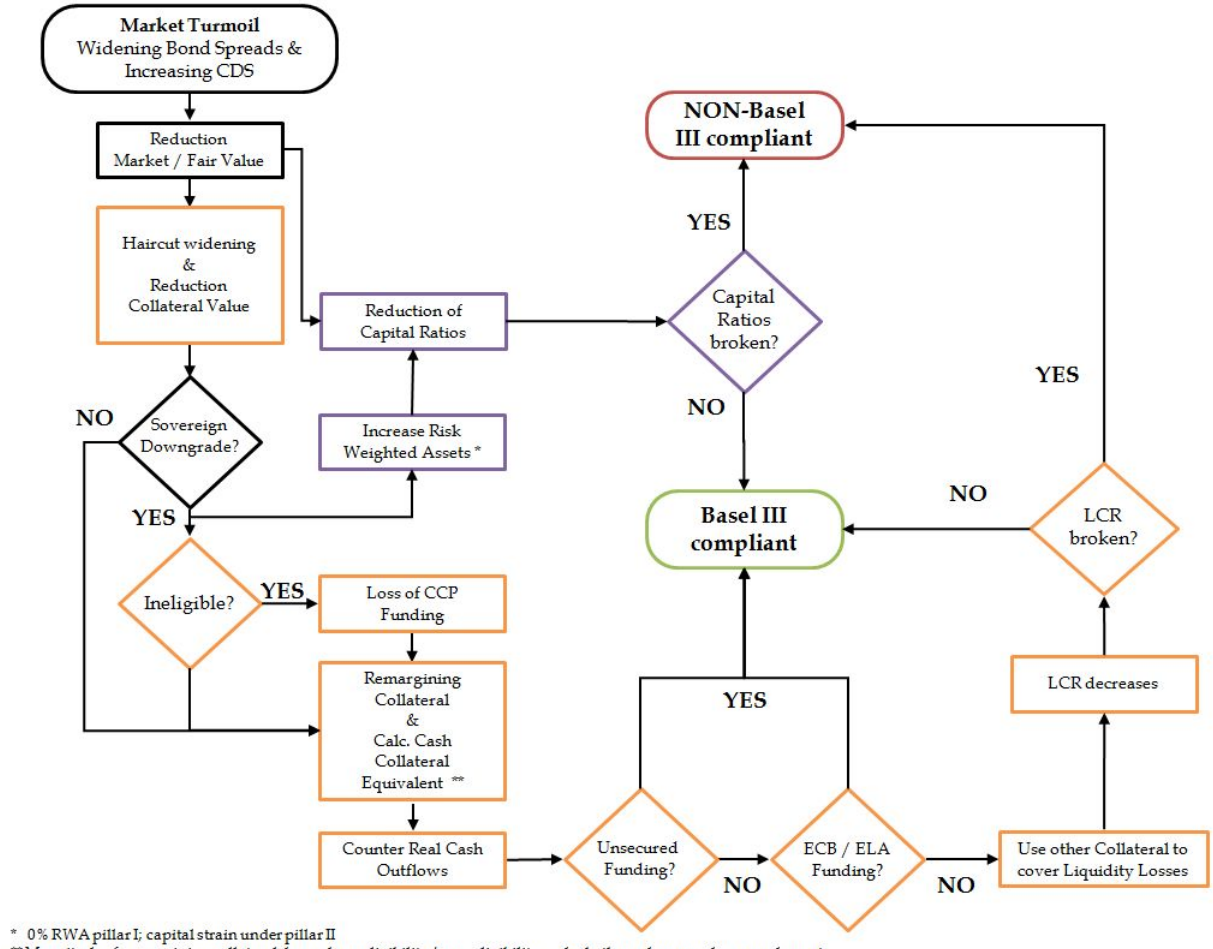


Table 1: Pledged Collateral at ECB

This table reports the development pledged collateral at the ECB from 2004 to 2015 - for 2015, only data for the first quarter exists. Albeit the total amount of central government debt increased by 46%from 2004 to 2015, the relative amount of central government debt dropped from 31% in 2004 to 20% in 2015. At the same time, the overall amount of pledged collateral increased by more than 120%, implying that the actual amount of public debt pledged at the ECB remained considerably stable.

Type of Security	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015*
Central government securities	252,4	233,5	205,5	176,9	158,2	224,9	261,5	255	374,3	331,3	372,6	364,9
Regional government securities	57,7	64,8	61,3	53,4	62,2	70,5	71	82,1	100,6	95,7	98,9	97,3
Uncovered bank bonds	169,3	226,5	294,1	370,6	439,6	562,1	430,2	269,2	328,8	282,2	180,9	166,7
Covered bank bonds	213,3	190,1	172,5	162,8	173,9	272,8	264,5	287,8	498,8	402,4	333,4	324,0
Corporate bonds	27,0	44,2	60,0	76,5	95,8	115,2	101,7	95,7	85,3	119,9	74,2	72,4
Asset-backed securities	45,0	83,5	109,3	182,1	443,6	473,6	490,0	358,0	352,7	324,8	309,2	304,1
Other marketable assets	19,5	22,0	19,9	16,2	15,8	21,0	32,7	57,8	81,2	117,5	117,2	101,3
Non-marketable assets	33,5	35,4	36,3	109,3	190,1	294,8	358,5	418,7	656,5	535,9	362,1	370,0
Total	817,6	900,0	958,9	1147,8	1579,2	2034,9	2010,1	1824,3	2478,2	2209,7	1848,5	1800,7

Source: European Central Bank 2015.

Table 2: Margin Collateral Haircut Schedule – LCH Ltd.

This table reports the haircuts of EMU country government securities and respective term pledged at LCH Ltd. The table also reports the average unweighted haircut per country and the average haircut over whole country sample.

Country	Government Security	Term	Base Haircut
Austria	Austrian Treasury Bill	> 4d <= 1y	0,25%
	Austrian Government Bond	> 1y <= 3y	1,00%
		> 3y <= 7y	2,75%
		> 7y <= 11Y	3,00%
		> 11y <= 30Y	6,50%
		> 30y	6,50%
		Average	3,33%
Belgium	Belgium Treasury Bill	> 4d <= 1y	1,00%
	Belgium Government Bond	> 1y <= 3y	2,75%
		> 3y <= 7y	5,50%
		> 7y <= 11Y	7,25%
		> 11y <= 30Y	10,25%
		> 30y	10,50%
		Average	6,21%
France	Bond du Trésor à Fixe et Intérêt Précompté	< 4d	0,00%
	Bond du Trésor à Fixe et Intérêt Annuel	> 4d <= 1y	0,50%
	Obilgations Assimilable du Trésor	> 1y <= 3y	1,00%
		> 3y <= 7y	2,00%
		> 7y <= 11Y	2,50%
		> 11y <= 30Y	6,00%
		> 30y	8,75%
		Average	3,46%
Germany	German Treasury Bill	> 3d <= 1y	0,25%
	Bundesschatzanweisung	> 1y <= 3y	0,88%
	Bundesobligationen	> 3y <= 7y	2,00%
	Deutsche Bundesrepublik	> 7y <= 11Y	2,75%
		> 11y <= 30Y	6,38%
		> 30y	6,38%
		Average	3,11%
Italy	Buoni del Tesoro	> 4d <= 1y	1,75%
	Buoni del Poliennali	> 1y <= 3y	3,75%
	Certificati di Credito del Tesoro	> 3y <= 7y	7,75%
		> 7y <= 11Y	9,00%
		> 11y <= 30Y	9,25%
		> 30y	9,25%
		Average	6,79%
Luxembourg	Luxembourgois Government Bond	> 5d <= 1y	0,50%
		> 1y <= 3y	1,25%
		> 3y <= 7y	2,00%
		> 7y <= 11Y	2,88%
		> 11y <= 30Y	6,25%
		> 30y	6,25%
		Average	3,19%
Netherlands	Dutch Treasury Certificate	> 10d <= 1y	0,25%
	Dutch Government Bond	> 1y <= 3y	0,88%
		> 3y <= 7y	2,00%
		> 7y <= 11Y	2,25%
		> 11y <= 30Y	6,75%
		> 30y	6,75%
		Average	3,15%
Spain	Spanish Lettras del Tesoro	> 3d <= 1y	1,25%
	Spanish Government Bond	> 1y <= 3y	3,50%
		> 3y <= 7y	7,75%
		> 7y <= 11Y	9,75%
		> 11y <= 30Y	12,50%
		> 30y	12,50%
		Average	7,88%
		Average EMU Countries	4,36%

Source: LCH Ltd. 2015.

Table 3: Current EMU-country Ratings

This table reports he current ratings of countries of the European Monetary Union analysed in this analysis. The table reports the ratings of the three major global ratings agencies Standard & Poors, Moody's Investors Services, Fitch ratings.

	S&P	Outlook	Moody's	Outlook	Fitch	Outlook
Austria	AA+	stable	Aaa	stable	AA+	stable
Belgium	AA	stable	Aa3	stable	AA	negative
Cyprus	B+	positive	B3	positive	B+	positive
Estonia	AA-	stable	A1	stable	A+	stable
France	AA	negative	Aa1	negative	AA	stable
Germany	AAA	stable	Aaa	stable	AAA	stable
Greece	CCC+	negative	Caa1	–	CCC	–
Ireland	A	stable	Baa1	stable	A-	stable
Italy	BBB-	stable	Baa2	stable	BBB+	stable
Latvia	A-	stable	A3	stable	A-	stable
Lithuania	A-	stable	Baa1	positive	A-	stable
Luxembourg	AAA	stable	Aaa	stable	AAA	stable
Malta	BBB+	stable	A3	stable	A	stable
Netherlands	AA+	stable	Aaa	stable	AAA	stable
Portugal	BB	positive	Ba1	stable	BB+	positive
Slovakia	A	positive	A2	stable	A+	stable
Slovenia	A-	stable	Baa3	stable	BBB+	stable
Spain	BBB	stable	Baa2	positive	BBB+	stable

Source: Bloomberg L.P.

Table 4: ECB Haircuts

This table reports the current haircuts for fixed-rate sovereign bonds from EMU required by the European Central Bank. In contrast to other collateral acceptors, like clearinghouses, there is no particular distinction between the actual issuer (country) of sovereign debt. The only distinction is made by maturities buckets in years.

	Credit Quality	
Residual Maturities	AAA - A-	BBB+ - BBB-
0 - 1	0,50%	6,00%
1 - 3	1,00%	7,00%
3 - 5	1,50%	9,00%
5 - 7	2,00%	10,00%
7 - 10	3,00%	11,50%
$>$ 10	5,00%	13,00%
Average	2,17%	9,42%

Source: European Central Bank 2015.

Table 5: Asset Encumbrance

Based on market practice, this table reports the encumbrance of marketable sovereign debt in the hypothetical banking sectors in our model framework.

LCR	Trading		Repo	
	CCP	OTC	OTC	ECB
SSD_LAB_{ij}	SSD_CCP_{ij}	SSD_TOTC_{ij}	SSD_ROTC_{ij}	SSD_ECB_{ij}
20%	10%	25%	30%	15%

Source: Own Estimations.

Table 6: Basel III Capital Ratios [29]

This table reports the Basel III's final capital ratios as required by the Basel Committee on Banking Supervision (2011) which are incorporated in our model framework.

Basel III Capital Ratio	CET-1-Ratio	Tier-1-Ratio	Capital Adequacy Ratio
Abbreviation	CETR	T1R	CAR
Threshold to keep	>7,0 %	>8,5%	>10,5%

Source: Basel Committee on Banking Supervision (2011)

Table 7: Variable Descriptions

This table reports the descriptions of the variables used in our model framework.

Variable	Variable Name	Description
AT1	Additional Tier 1 Capital	Preferred shares and non–controlling interests
CAR	Capital Adequacy Ratio	TRC divided by RWA
CCP	Central clearing counterparty	Clearing House
CER	Required cash equivalent	Cash required in a market stress
CET1	Common Equity Tier 1 Capital	Going concern capital
EL	Expected Loss	SSD times change MV
ELA	Emergency Liquidity Assistance	Liquidity Provision mechanism for illiquid banks in the EMU
EXP	Collateralised Exposure	Exposure which is backed by collateral in a market Stress
HQLA	High Quality Liquid Assets	Securities which can be easily and immediately converted into cash at little or no loss of value.
HSE	Home Sovereign Exposure	Bank's exposure towards its' home sovereign
IHC	Initial Haircut	Haircut set by CCP or ECB
LAA	Loans & Advances	Non-securitised sovereign debt
LAB	Liquidity Asset Buffer	Adequate stock of unencumbered HQLA
LCR	Liquidity Coverage Ratio	Short-term
MV	Market Value	Market Value of the SSD
NCO	Net Cash Outflow	Net cash flow assumption in
OTC	Over the counter	Direct Bilateral trading between two counterparties
ROTC	Repo OTC Collateral	Collateral used for OTC repos
RWA	Risk Weighted Assets	A bank's exposure to potential losses
SF	Shortfall	Difference between actual and required funding
SHC	Stress Haircut	Haircut in stress scenario
SSD	Securitised Sovereign Debt	Sovereign Bonds
T1C	Tier 1 Capital	Sum of CET1 and AT1
T1R	Tier 1 Capital ratio	T1C divided by RWA
T2C	Tier 2 Capital	Gone-Concern capital
TA	Total Assets	Sum of a bank's balance sheet
TOTC	Trading OTC	Collateral used for OTC Trading
TRC	Total Regulatory Capital	Sum of T1C and T2C

Table 8: Total Assets Sizes, Sovereign Holdings and Percentages

This table reports the total assets, average home sovereign exposures as well as the average holdings of securitised sovereign debt (all in million Euro terms) The table also provides the shares of the total home sovereign exposure and home sovereign bond holdings with respect to total assets of the respective banking sectors.

				Share of Total Assets	
	Total Assets	Total Sov. Exposure	Sov.Bond Holdings	Total Sov. Exposure	Sov.Bond Holdings
Austria	78.501,33	4.250,83	2.110,67	5,41%	2,69%
Belgium	137.344,60	11.274,20	5.695,00	8,21%	4,15%
Cyprus	40.250,00	1.589,33	1.289,00	3,95%	3,20%
France	574.323,09	26.102,45	17.688,00	4,54%	3,08%
Germany	192.640,63	14.986,54	7.589,25	7,78%	3,94%
Greece	88.555,75	5.245,25	3.117,25	5,92%	3,52%
Ireland	95.825,00	5.631,00	5.582,67	5,88%	5,83%
Italy	147.506,13	18.698,60	15.586,74	12,68%	10,57%
Latvia	2.331,00	86,00	86,00	3,69%	3,69%
Luxembourg	24.294,00	1.325,00	309,00	5,45%	1,27%
Malta	7.258,00	897,00	888,00	12,36%	12,23%
Netherlands	400.918,50	16.917,67	8.004,00	4,22%	2,00%
Portugal	74.911,83	7.742,67	6.123,00	10,34%	8,17%
Slovenia	7.080,33	968,67	883,33	13,68%	12,48%
Spain	206.986,87	17.606,07	13.188,73	8,51%	6,37%

Table 9: Average Home Sovereign Exposures and new Capital Ratios after Stress

This table reports the average home sovereign exposures of the banking sectors of the below listed countries. The total sovereign exposures (Home Public Exposures) are divided into non-securitised debt (Loand & Advances) and securitised debt (bonds). The loss in EUR is derived from the assumption of a 16,04% loss in fair value of in our stress scenario. These losses causes a decline of capital in the respective banking sectors (CET1*, T1C*, T2C*). With the decline of market value, we also assume a rise of risk weighted assets by 30% regarding the sovereign assets of the respective banking sectors in our stress scenario. These two effects cause a decline in of capital ratios.

		Austria	Belgium	Cyprus	France	Germany	Greece	Ireland
Total Home Public Exp.	HSE	4.250,83	11.274,20	1.589,33	26.102,45	14.986,54	5.245,25	5.631,00
Loans and Advances	LAA	2.140,17	5.579,20	300,33	8.414,45	7.397,29	2.128,00	48,33
		0,50	0,49	0,19	0,32	0,49	0,41	0,01
Bonds	SSD	2.110,67	5.695,00	1.289,00	17.688,00	7.589,25	3.117,25	5.582,67
		49,65%	50,51%	81,10%	67,76%	50,64%	59,43%	99,14%
Loss of sovereign positions in %	%	16,04%	16,04%	16,04%	16,04%	16,04%	16,04%	16,04%
Loss of sovereign positions in EUR	?MV	681,83	1.808,38	254,93	4.186,83	2.403,84	841,34	903,21
Common Equity Tier 1	CET1*	4.202,00	4.097,82	502,74	19.514,62	5.089,53	4.275,91	4.972,45
Tier 1 Capital after Sovereign Distress	T1C*	4.202,00	4.097,82	502,74	19.514,62	5.089,53	4.275,91	4.972,45
Tier 2 capital after Sovereign Distress	T2C*	1.857,33	2.194,00	111,67	5.862,18	2.008,50	177,50	827,00
Total Regulatory Capital after Sovereign Distress	TRC*	6.059,33	6.291,82	614,40	25.376,80	7.098,03	4.453,41	5.799,45
Increased risk weight/ RWA	?RWA	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%
RWA, total		46.297	42.045	40.564	210.104	58.314	51.567	44.380
RWA, of exposures against home Sovereign		5.615	11.464	2.546	43.263	5.485	8.798	13.486
Risk-weighted assets after Sovereign Distress	RWA*	47.981,28	45.484,20	41.327,90	223.083,15	59.959,55	54.206,58	48.425,70
Common Equity Tier 1-Ratio after sovereign Distress	CETR*	8,76%	9,01%	1,22%	8,75%	8,49%	7,89%	10,27%
Tier 1 Capital-Ratio after sovereign Distress	T1R*	8,76%	9,01%	1,22%	8,75%	8,49%	7,89%	10,27%
Capital Adequacy Ratio after Sovereign distress	CAR*	12,63%	13,83%	1,49%	11,38%	11,84%	8,22%	11,98%
Stress Basel III Compliance	CETR	YES	YES	NO	YES	YES	YES	YES
	T1R	YES	YES	NO	YES	NO	NO	YES
	CAR	YES	YES	NO	YES	YES	NO	YES

Table 10: Average Home Sovereign Exposures and new Capital Ratios after Stress II

This table reports the average home sovereign exposures of the banking sectors of the below listed countries. The total sovereign exposures (Home Public Exposures) are divided into non-securitised debt (Loand & Advances) and securitised debt (bonds). The loss in EUR is derived from the assumption of a 16,04% loss in fair value of in our stress scenario. These losses causes a decline of capital in the respective banking sectors (CET1*, T1C*, T2C*). With the decline of market value, we also assume a rise of risk weighted assets by 30% regarding the sovereign assets of the respective banking sectors in our stress scenario. These two effects cause a decline in of capital ratios.

		Italy	Lativa	Luxembourg	Malta	Netherlands	Portugal	Slovenia	Spain
Total Home Public Exp.	HSE	18.698,60	86,00	1.325,00	897,00	16.917,67	7.742,67	968,67	17.606,07
Loans and Advances	LAA	3.111,86	-	1.016,00	9,00	8.913,67	1.619,67	85,33	4.417,33
		0,17	-	0,77	0,01	0,53	0,21	0,09	0,25
Bonds	SSD	15.794,20	86,00	309,00	888,00	8.004,00	6.123,00	883,33	4.546,07
		83,36%	100,00%	23,32%	99,00%	47,31%	79,08%	91,19%	74,91%
Loss of sovereign positions in %	%	16,04%	16,04%	16,04%	16,04%	16,04%	16,04%	16,04%	16,04%
Loss of sovereign positions in EUR	?MV	2.999,26	13,79	212,53	143,88	2.713,59	1.241,92	155,37	2.824,01
Common Equity Tier 1	CET1*	4.257,01	142,21	1.577,47	248,12	9.857,41	3.627,74	455,29	7.984,19
Tier 1 Capital after Sovereign Distress	T1C*	4.257,01	142,21	1.577,47	248,12	9.857,41	3.627,74	455,29	7.984,19
Tier 2 capital after Sovereign Distress	T2C*	2.774,60	96,00	197,50	116,00	5.022,33	434,67	-	2.024,73
Total Regulatory Capital after Sovereign Distress	TRC*	7.031,61	238,21	1.774,97	364,12	14.879,74	4.062,41	455,29	10.008,92
Increased risk weight/ RWA	?RWA	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%
RWA, total		78.562	1.600	11.277	3.661	108.800	43.694	3.844	102.305
RWA, of exposures against home Sovereign		24.182	435	1.065	2.184	39.229	11.752	1.324	20.998
Risk-weighted assets after Sovereign Distress	RWA*	85.816,98	1.730,50	11.595,85	4.316,20	120.569,13	47.219,70	4.241,20	108.604,58
Common Equity Tier 1-Ratio after sovereign Distress	CETR*	4,96%	8,22%	13,60%	5,75%	8,18%	7,68%	10,73%	7,35%
Tier 1 Capital-Ratio after sovereign Distress	T1R*	4,96%	8,22%	13,60%	5,75%	8,18%	7,68%	10,73%	7,35%
Capital Adequacy Ratio after Sovereign distress	CAR*	8,19%	13,77%	15,31%	8,44%	12,34%	8,60%	10,73%	9,22%
Stress Basel III Compliance	CETR	NO	YES	YES	NO	YES	YES	YES	YES
	T1R	NO	NO	YES	NO	NO	NO	YES	NO
	CAR	NO	YES	YES	NO	YES	NO	YES	NO

Table 11: Average capital bases, risk weighted assets, home sovereign exposures, and ratios EMU banking sectors.

This table reports the average capital basis and risk weighted assets (RWA) of the banking sectors in the below listed countries. Regarding the capital basis, the Tier 1 Capital Ratio, the Common Equity Tier 1 (CET1), Additional Tier 1 (AT1), Tier 1 Capital (T1C), the Tier 2 Capital (T2C), and the Total Regulatory Capital (TRC) are reported. The table also reports the composition of total capital and shows which percentage of total capital accounts for Tier 1 Capital (T1C/TC) and which accounts for Tier 2 capital (T2C/TC). For the banking sectors' risk weighted assets, the total risk-weighted assets (RWA), the home sovereign related risk-weighted assets (HS RWA), and the respective difference between the former is reported. The table also reports the respective ratios: The Common Equity Tier 1 ratio (CETR), the Tier 1 Capital Ratio (T1R) and the Capital Adequacy Ratio (CAR). Finally, the table reports the share of home sovereign related risk-weighted assets as of total risk-weighted assets (HSR) in percentage terms. The table also provides information whether the respective banking sectors are compliant with Basel III's capital regulation. The last three rows (C_CETR, C_T1R, C_CAR) simply provide digital information ("YES", "NO") whether the banking sectors' CETR, T1R, and CAR are compliant with the Basel III's provisions: CETR >7,0 %, T1R >8,5%, and CAR >10,5%.

Variable Abbr.	Austria	Belgium	Cyprus	Ireland	France	Germany	Greece	Ireland
CET1	4.884	5.906	758	6.640	23.701	7.493	5.117	5.876
AT1	-	-	-	-	-	-	-	-
T1C	4.884	5.906	758	6.640	23.701	7.493	5.117	5.876
T2C	1.857	2.194	112	1.116	5.862	2.009	178	827
TRC	6.741	8.100	869	7.756	29.564	9.502	5.295	6.703
T1C/TC	72,45%	72,91%	87,15%	85,61%	80,17%	78,86%	96,65%	87,66%
T2C/TC	27,55%	27,09%	12,85%	14,39%	19,83%	21,14%	3,35%	12,34%
RWA	46.297	42.045	12.243	40.564	210.104	58.314	51.567	44.380
HS_RWA	5.615	11.464	2.546	5.787	43.263	5.485	8.798	13.486
NHS_RWA	40.682	30.581	38.018	6.456	166.842	52.829	42.770	30.894
HSR	12,13%	27,27%	6,28%	47,27%	20,59%	9,41%	17,06%	30,39%
CETR	10,55%	14,05%	6,19%	16,37%	11,28%	12,85%	9,92%	13,24%
T1R	10,55%	14,05%	6,19%	16,37%	11,28%	12,85%	9,92%	13,24%
CAR	14,56%	19,27%	7,10%	19,12%	14,07%	16,29%	10,27%	15,10%
C_CETR	YES	YES	NO	YES	YES	YES	YES	YES
C_T1R	YES	YES	NO	YES	YES	YES	YES	YES
C_CAR	YES	YES	NO	YES	YES	YES	NO	YES

Variable Abbr.	Italy	Latvia	Luxembourg	Malta	Netherlands	Portugal	Slovenia	Spain
CET1	7.256	156	1.790	392	12.571	4.870	611	10.808
AT1	-	-	-	-	-	-	-	-
T1C	7.256	156	1.790	392	12.571	4.870	611	10.808
T2C	2.775	96	198	116	5.022	435	-	2.025
TRC	10.031	252	1.988	508	17.593	5.304	611	12.833
T1C/TC	72,34%	61,90%	90,06%	77,17%	71,45%	91,81%	100,00%	84,22%
T2C/TC	27,66%	38,10%	9,94%	22,83%	28,55%	8,19%	0,00%	15,78%
RWA	78.562	1.600	1.277	3.661	108.800	43.694	3.844	102.305
HS_RWA	24.182	435	1.065	2.184	39.229	11.752	1.324	20.998
NHS_RWA	54.380	1.165	10.212	1.477	69.571	31.942	2.520	81.307
HSR	30,78%	27,19%	9,44%	59,66%	36,06%	26,90%	34,44%	20,52%
CETR	9,24%	9,75%	15,87%	10,71%	11,55%	11,14%	15,89%	10,56%
T1R	9,24%	9,75%	15,87%	10,71%	11,55%	11,14%	15,89%	10,56%
CAR	12,77%	15,75%	17,63%	13,88%	16,17%	12,14%	15,89%	12,54%
C_CETR	YES	YES	YES	YES	YES	YES	YES	YES
C_T1R	YES	YES	YES	YES	YES	YES	YES	YES
C_CAR	YES	YES	YES	YES	YES	YES	YES	YES

Source: European Banking Association 2014; BankScope; Authors' own calculations.

Table 12: Average Home Sovereign Exposures and new Capital Ratios after Stress

This table reports the average home sovereign exposures of the banking sectors of the below listed countries. The total sovereign exposures (Home Public Exposures) are divided into non-securitised debt (Loand & Advances) and securitised debt (bonds). The loss in EUR is derived from the assumption of a 16,04% loss in fair value of in our stress scenario. These losses causes a decline of capital in the respective banking sectors (CET1*, T1C*, T2C*). With the decline of market value, we also assume a rise of risk weighted assets by 30% regarding the sovereign assets of the respective banking sectors in our stress scenario. These two effects cause a decline in of capital ratios.

		Austria	Belgium	Cyprus	France	Germany	Greece	Ireland
Total Home Public Exp.	HSE	4.250,83	11.274,20	1.589,33	26.102,45	14.986,54	5.245,25	5.631,00
Loans and Advances	LAA	2.140,17	5.579,20	300,33	8.414,45	7.397,29	2.128,00	48,33
		0,50	0,49	0,19	0,32	0,49	0,41	0,01
Bonds	SSD	2.110,67	5.695,00	1.289,00	17.688,00	7.589,25	3.117,25	5.582,67
		49,65%	50,51%	81,10%	67,76%	50,64%	59,43%	99,14%
Loss of sovereign positions in %	%	16,04%	16,04%	16,04%	16,04%	16,04%	16,04%	16,04%
Loss of sovereign positions in EUR	?MV	681,83	1.808,38	254,93	4.186,83	2.403,84	841,34	903,21
Common Equity Tier 1	CET1*	4.202,00	4.097,82	502,74	19.514,62	5.089,53	4.275,91	4.972,45
Tier 1 Capital after Sovereign Distress	T1C*	4.202,00	4.097,82	502,74	19.514,62	5.089,53	4.275,91	4.972,45
Tier 2 capital after Sovereign Distress	T2C*	1.857,33	2.194,00	111,67	5.862,18	2.008,50	177,50	827,00
Total Regulatory Capital after Sovereign Distress	TRC*	6.059,33	6.291,82	614,40	25.376,80	7.098,03	4.453,41	5.799,45
Increased risk weight/ RWA	?RWA	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%
RWA, total		46.297	42.045	40.564	210.104	58.314	51.567	44.380
RWA, of exposures against home Sovereign		5.615	11.464	2.546	43.263	5.485	8.798	13.486
Risk-weighted assets after Sovereign Distress	RWA*	47.981,28	45.484,20	41.327,90	223.083,15	59.959,55	54.206,58	48.425,70
Common Equity Tier 1-Ratio after sovereign Distress	CETR*	8,76%	9,01%	1,22%	8,75%	8,49%	7,89%	10,27%
Tier 1 Capital-Ratio after sovereign Distress	T1R*	8,76%	9,01%	1,22%	8,75%	8,49%	7,89%	10,27%
Capital Adequacy Ratio after Sovereign distress	CAR*	12,63%	13,83%	1,49%	11,38%	11,84%	8,22%	11,98%
Stress Basel III Compliance	CETR	YES	YES	NO	YES	YES	YES	YES
	T1R	YES	YES	NO	YES	NO	NO	YES
	CAR	YES	YES	NO	YES	YES	NO	YES

Table 13: Average Home Sovereign Exposures and new Capital Ratios after Stress II

This table reports the average home sovereign exposures of the banking sectors of the below listed countries. The total sovereign exposures (Home Public Exposures) are divided into non-securitised debt (Loand & Advances) and securitised debt (bonds). The loss in EUR is derived from the assumption of a 16,04% loss in fair value of in our stress scenario. These losses causes a decline of capital in the respective banking sectors (CET1*, T1C*, T2C*). With the decline of market value, we also assume a rise of risk weighted assets by 30% regarding the sovereign assets of the respective banking sectors in our stress scenario. These two effects cause a decline in of capital ratios.

		Italy	Lativa	Luxembourg	Malta	Netherlands	Portugal	Slovenia	Spain
Total Home Public Exp.	HSE	18.698,60	86,00	1.325,00	897,00	16.917,67	7.742,67	968,67	17.606,07
Loans and Advances	LAA	3.111,86	-	1.016,00	9,00	8.913,67	1.619,67	85,33	4.417,33
		0,17	-	0,77	0,01	0,53	0,21	0,09	0,25
Bonds	SSD	15.794,20	86,00	309,00	888,00	8.004,00	6.123,00	883,33	4.546,07
		83,36%	100,00%	23,32%	99,00%	47,31%	79,08%	91,19%	74,91%
Loss of sovereign positions in %	%	16,04%	16,04%	16,04%	16,04%	16,04%	16,04%	16,04%	16,04%
Loss of sovereign positions in EUR	?MV	2.999,26	13,79	212,53	143,88	2.713,59	1.241,92	155,37	2.824,01
Common Equity Tier 1	CET1*	4.257,01	142,21	1.577,47	248,12	9.857,41	3.627,74	455,29	7.984,19
Tier 1 Capital after Sovereign Distress	T1C*	4.257,01	142,21	1.577,47	248,12	9.857,41	3.627,74	455,29	7.984,19
Tier 2 capital after Sovereign Distress	T2C*	2.774,60	96,00	197,50	116,00	5.022,33	434,67	-	2.024,73
Total Regulatory Capital after Sovereign Distress	TRC*	7.031,61	238,21	1.774,97	364,12	14.879,74	4.062,41	455,29	10.008,92
Increased risk weight/ RWA	?RWA	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%
RWA, total		78.562	1.600	11.277	3.661	108.800	43.694	3.844	102.305
RWA, of exposures against home Sovereign		24.182	435	1.065	2.184	39.229	11.752	1.324	20.998
Risk-weighted assets after Sovereign Distress	RWA*	85.816,98	1.730,50	11.595,85	4.316,20	120.569,13	47.219,70	4.241,20	108.604,58
Common Equity Tier 1-Ratio after sovereign Distress	CETR*	4,96%	8,22%	13,60%	5,75%	8,18%	7,68%	10,73%	7,35%
Tier 1 Capital-Ratio after sovereign Distress	T1R*	4,96%	8,22%	13,60%	5,75%	8,18%	7,68%	10,73%	7,35%
Capital Adequacy Ratio after Sovereign distress	CAR*	8,19%	13,77%	15,31%	8,44%	12,34%	8,60%	10,73%	9,22%
Stress Basel III Compliance	CETR	NO	YES	YES	NO	YES	YES	YES	YES
	T1R	NO	NO	YES	NO	NO	NO	YES	NO
	CAR	NO	YES	YES	NO	YES	NO	YES	NO

Table 14: Liquidity Stress Scenario – Aggressive Target Ratio

This table reports in principle the results of our liquidity stress scenario with a aggressive target ratio. As with the capital channel, we assume a drop of 16,04% in market value of the respective sovereign bond holdings for each banking sector. We show the initial LCRs of the banking sectors as well as the LCRs in several ECB haircut scenarios. In addition to changing LCRs, we also report the actual liquidity short fall in million EUR terms.

			ECB Stress-Haircut					
		Initial	0%	10%	25%	50%	75%	100%
Austria	Shortfall		290,08	408,04	584,98	879,88	1.174,78	1.469,68
	LCR	110%	96,29%	94,77%	92,51%	88,73%	84,95%	81,17%
Belgium	Shortfall		785,59	1.105,39	1.585,09	2.384,58	3.184,08	3.983,57
	LCR	110%	96,29%	94,77%	92,51%	88,73%	84,95%	81,17%
Cyprus	Shortfall		189,68	266,65	382,09	574,51	766,92	959,33
	LCR	110%	96,94%	95,70%	93,84%	90,73%	87,63%	84,52%
France	Shortfall		2.431,34	3.420,09	4.903,20	7.375,07	9.846,93	12.318,79
	LCR	110%	97,25%	96,13%	94,46%	91,66%	88,87%	86,07%
Germany	Shortfall		1.042,74	1.466,74	2.102,73	3.162,71	4.222,70	5.282,69
	LCR	110%	96,49%	95,06%	92,91%	89,34%	85,77%	82,19%
Greece	Shortfall		458,72	644,85	924,04	1.389,35	1.854,67	2.319,99
	LCR	110%	96,64%	95,27%	93,22%	89,81%	86,40%	82,99%
Ireland	Shortfall		768,25	1.080,77	1.549,56	2.330,87	3.112,18	3.893,49
	LCR	110%	94,79%	92,68%	89,50%	84,21%	78,91%	73,62%
Italy	Shortfall		2.300,50	3.234,73	4.636,07	6.971,64	9.307,21	11.642,78
	LCR	110%	89,87%	85,76%	79,59%	69,31%	59,03%	48,75%
Latvia	Shortfall		11,83	16,65	23,87	35,91	47,94	59,98
	LCR	110%	96,70%	95,36%	93,35%	90,00%	86,64%	83,29%
Luxembourg	Shortfall		42,46	59,73	85,62	128,79	171,95	215,11
	LCR	110%	98,87%	98,40%	97,71%	96,56%	95,40%	94,25%
Malta	Shortfall		45,47	63,92	91,60	137,72	183,85	229,97
	LCR	110%	95,93%	94,28%	91,81%	87,68%	83,55%	79,43%
Netherlands	Shortfall		1.099,78	1.546,98	2.217,77	3.335,75	4.453,74	5.571,73
	LCR	110%	98,22%	97,49%	96,41%	94,60%	92,79%	90,98%
Portugal	Shortfall		901,04	1.266,63	1.815,02	2.729,01	3.643,00	4.556,99
	LCR	110%	92,19%	89,02%	84,27%	76,34%	68,42%	60,50%
Slovenia	Shortfall		121,56	171,01	245,18	368,81	492,43	616,06
	LCR	110%	88,85%	84,32%	77,51%	66,18%	54,84%	43,50%
Spain	Shortfall		1.949,26	2.741,16	3.929,01	5.908,77	7.888,53	9.868,29
	LCR	110%	93,88%	91,40%	87,67%	81,46%	75,25%	69,04%

Table 15: Liquidity Stress Scenario – Economic Target Ratio

This table reports in principle the results of our liquidity stress scenario with a conservative target ratio. As with the capital channel, we assume a drop of 16,04% in market value of the respective sovereign bond holdings for each banking sector. We show the initial LCRs of the banking sectors as well as the LCRs in several ECB haircut scenarios. In addition to changing LCRs, we also report the actual liquidity short fall in million EUR terms.

			ECB Stress-Haircut					
		Initial	0%	10%	25%	50%	75%	100%
Austria	Shortfall		290,08	408,04	584,98	879,88	1.174,78	1.469,68
	LCR	120%	106,69%	105,72%	104,25%	101,81%	99,37%	96,93%
Belgium	Shortfall		785,59	1.105,39	1.585,09	2.384,58	3.184,08	3.983,57
	LCR	120%	105,38%	103,86%	101,60%	97,82%	94,04%	90,26%
Cyprus	Shortfall		189,68	266,65	382,09	574,51	766,92	959,33
	LCR	120%	106,03%	104,79%	102,93%	99,82%	96,72%	93,61%
France	Shortfall		2.431,34	3.420,09	4.903,20	7.375,07	9.846,93	12.318,79
	LCR	120%	106,34%	105,22%	103,55%	100,75%	97,96%	95,16%
Germany	Shortfall		1.042,74	1.466,74	2.102,73	3.162,71	4.222,70	5.282,69
	LCR	120%	105,58%	104,15%	102,00%	98,43%	94,86%	91,28%
Greece	Shortfall		458,72	644,85	924,04	1.389,35	1.854,67	2.319,99
	LCR	120%	105,73%	104,36%	102,32%	98,90%	95,49%	92,08%
Ireland	Shortfall		768,25	1.080,77	1.549,56	2.330,87	3.112,18	3.893,49
	LCR	120%	103,88%	101,77%	98,59%	93,30%	88,00%	82,71%
Italy	Shortfall		2.300,50	3.234,73	4.636,07	6.971,64	9.307,21	11.642,78
	LCR	120%	98,96%	94,85%	88,68%	78,40%	68,12%	57,84%
Latvia	Shortfall		11,83	16,65	23,87	35,91	47,94	59,98
	LCR	120%	105,79%	104,45%	102,44%	99,09%	95,74%	92,38%
Luxembourg	Shortfall		42,46	59,73	85,62	128,79	171,95	215,11
	LCR	120%	107,96%	107,49%	106,80%	105,65%	104,49%	103,34%
Malta	Shortfall		45,47	63,92	91,60	137,72	183,85	229,97
	LCR	120%	105,02%	103,37%	100,90%	96,77%	92,64%	88,52%
Netherlands	Shortfall		1.099,78	1.546,98	2.217,77	3.335,75	4.453,74	5.571,73
	LCR	120%	107,31%	106,59%	105,50%	103,69%	101,88%	100,07%
Portugal	Shortfall		901,04	1.266,63	1.815,02	2.729,01	3.643,00	4.556,99
	LCR	120%	101,28%	98,11%	93,36%	85,44%	77,51%	69,59%
Slovenia	Shortfall		121,56	171,01	245,18	368,81	492,43	616,06
	LCR	120%	97,94%	93,41%	86,60%	75,27%	63,93%	52,59%
Spain	Shortfall		1.949,26	2.741,16	3.929,01	5.908,77	7.888,53	9.868,29
	LCR	120%	102,98%	100,49%	96,76%	90,55%	84,34%	78,13%

Table 16: Liquidity Stress Scenario – Conservative Target Ratio

This table reports in principle the results of our liquidity stress scenario with a conservative target ratio. As with the capital channel, we assume a drop of 16,04% in market value of the respective sovereign bond holdings for each banking sector. We show the initial LCRs of the banking sectors as well as the LCRs in several ECB haircut scenarios. In addition to changing LCRs, we also report the actual liquidity short fall in million EUR terms.

			ECB Stress-Haircut					
		Initial	0%	10%	25%	50%	75%	100%
Austria	Shortfall		290,08	408,04	584,98	879,88	1.174,78	1.469,68
	LCR	130%	115,78%	114,81%	113,34%	110,90%	108,46%	106,02%
Belgium	Shortfall		785,59	1.105,39	1.585,09	2.384,58	3.184,08	3.983,57
	LCR	130%	114,47%	112,96%	110,69%	106,91%	103,13%	99,35%
Cyprus	Shortfall		189,68	266,65	382,09	574,51	766,92	959,33
	LCR	130%	115,12%	113,88%	112,02%	108,91%	105,81%	102,71%
France	Shortfall		2.431,34	3.420,09	4.903,20	7.375,07	9.846,93	12.318,79
	LCR	130%	115,43%	114,31%	112,64%	109,84%	107,05%	104,25%
Germany	Shortfall		1.042,74	1.466,74	2.102,73	3.162,71	4.222,70	5.282,69
	LCR	130%	114,67%	113,24%	111,09%	107,52%	103,95%	100,38%
Greece	Shortfall		458,72	644,85	924,04	1.389,35	1.854,67	2.319,99
	LCR	130%	114,82%	113,45%	111,41%	107,99%	104,58%	101,17%
Ireland	Shortfall		768,25	1.080,77	1.549,56	2.330,87	3.112,18	3.893,49
	LCR	130%	112,98%	110,86%	107,68%	102,39%	97,09%	91,80%
Italy	Shortfall		2.300,50	3.234,73	4.636,07	6.971,64	9.307,21	11.642,78
	LCR	130%	108,05%	103,94%	97,77%	87,49%	77,21%	66,93%
Latvia	Shortfall		11,83	16,65	23,87	35,91	47,94	59,98
	LCR	130%	114,88%	113,54%	111,53%	108,18%	104,83%	101,47%
Luxembourg	Shortfall		42,46	59,73	85,62	128,79	171,95	215,11
	LCR	130%	117,05%	116,59%	115,89%	114,74%	113,59%	112,43%
Malta	Shortfall		111,54	154,55	219,06	326,58	434,09	541,61
	LCR	130%	108,20%	104,35%	98,58%	88,96%	79,34%	69,73%
Netherlands	Shortfall		1.099,78	1.546,98	2.217,77	3.335,75	4.453,74	5.571,73
	LCR	130%	116,40%	115,68%	114,59%	112,78%	110,97%	109,16%
Portugal	Shortfall		901,04	1.266,63	1.815,02	2.729,01	3.643,00	4.556,99
	LCR	130%	110,37%	107,20%	102,45%	94,53%	86,60%	78,68%
Slovenia	Shortfall		121,56	171,01	245,18	368,81	492,43	616,06
	LCR	130%	107,03%	102,50%	95,70%	84,36%	73,02%	61,68%
Spain	Shortfall		1.949,26	2.741,16	3.929,01	5.908,77	7.888,53	9.868,29
	LCR	130%	111,56%	108,87%	104,83%	98,10%	91,37%	87,22%

Table 17: Liquidity Stress Scenario – Economic Target Ratio - 99% Quantile

This table reports in principle the results of our liquidity stress scenario in an economic target ratio. As with the capital channel, we assume a drop of 9,29% in market value of the respective sovereign bond holdings for each banking sector. We show the initial LCRs of the banking sectors as well as the LCRs in several ECB haircut scenarios. In addition to changing LCRs, we also report the actual liquidity short fall in million EUR terms.

			ECB Stress-Haircut					
		Initial	0%	10%	25%	50%	75%	100%
Austria	Shortfall		195,24	322,69	513,85	832,46	1.151,07	1.469,68
	LCR	120%	107,48%	106,42%	104,84%	102,20%	99,57%	96,93%
Belgium	Shortfall		528,49	874,00	1.392,26	2.256,03	3.119,80	3.983,57
	LCR	120%	106,59%	104,96%	102,51%	98,42%	94,34%	90,26%
Cyprus	Shortfall		127,81	210,96	335,69	543,57	751,45	959,33
	LCR	120%	107,03%	105,69%	103,68%	100,32%	96,97%	93,61%
France	Shortfall		1.636,44	2.704,67	4.307,03	6.977,61	9.648,20	12.318,79
	LCR	120%	107,24%	106,03%	104,22%	101,20%	98,18%	95,16%
Germany	Shortfall		701,87	1.159,95	1.847,07	2.992,28	4.137,48	5.282,69
	LCR	120%	106,73%	105,18%	102,86%	99,00%	95,14%	91,28%
Greece	Shortfall		309,09	510,18	811,81	1.314,54	1.817,26	2.319,99
	LCR	120%	106,82%	105,35%	103,14%	99,45%	95,77%	92,08%
Ireland	Shortfall		517,00	854,64	1.361,12	2.205,24	3.049,36	3.893,49
	LCR	120%	105,59%	103,30%	99,87%	94,15%	88,43%	82,71%
Italy	Shortfall		1.549,42	2.558,76	4.072,76	6.596,10	9.119,44	11.642,78
	LCR	120%	102,27%	97,83%	91,16%	80,05%	68,95%	57,84%
Latvia	Shortfall		7,96	13,17	20,97	33,97	46,97	59,98
	LCR	120%	106,87%	105,42%	103,25%	99,63%	96,01%	92,38%
Luxembourg	Shortfall		28,58	47,23	75,21	121,85	168,48	215,11
	LCR	120%	108,33%	107,83%	107,08%	105,83%	104,59%	103,34%
Malta	Shortfall		30,64	50,57	80,47	130,30	180,14	229,97
	LCR	120%	106,35%	104,57%	101,89%	97,43%	92,97%	88,52%
Netherlands	Shortfall		740,26	1.223,40	1.948,12	3.155,99	4.363,86	5.571,73
	LCR	120%	107,89%	107,11%	105,94%	103,98%	102,02%	100,07%
Portugal	Shortfall		607,12	1.002,10	1.594,58	2.582,05	3.569,52	4.556,99
	LCR	120%	103,83%	100,40%	95,27%	86,71%	78,15%	69,59%
Slovenia	Shortfall		81,80	135,23	215,37	348,93	482,49	616,06
	LCR	120%	101,59%	96,69%	89,34%	77,09%	64,84%	52,59%
Spain	Shortfall		1.312,60	2.168,17	3.451,52	5.590,45	7.729,37	9.868,29
	LCR	120%	104,97%	102,29%	98,26%	91,55%	84,84%	78,13%

Table 18: Liquidity Stress Scenario – Economic Target Ratio - 97,50% Quantile

This table reports in principle the results of our liquidity stress scenario in an economic target ratio. As with the capital channel, we assume a drop of 5,54% in market value of the respective sovereign bond holdings for each banking sector. We show the initial LCRs of the banking sectors as well as the LCRs in several ECB haircut scenarios. In addition to changing LCRs, we also report the actual liquidity short fall in million EUR terms.

			ECB Stress-Haircut					
		Initial	0%	10%	25%	50%	75%	100%
Austria	Shortfall		135,53	268,95	469,07	802,61	1.136,14	1.469,68
	LCR	120%	107,97%	106,87%	105,21%	102,45%	99,69%	96,93%
Belgium	Shortfall		366,61	728,31	1.270,85	2.175,09	3.079,33	3.983,57
	LCR	120%	107,36%	105,65%	103,08%	98,81%	94,53%	90,26%
Cyprus	Shortfall		88,85	175,90	306,47	524,09	741,71	959,33
	LCR	120%	107,66%	106,25%	104,15%	100,64%	97,12%	93,61%
France	Shortfall		1.135,94	2.254,23	3.931,65	6.727,37	9.523,08	12.318,79
	LCR	120%	107,81%	106,54%	104,65%	101,48%	98,32%	95,16%
Germany	Shortfall		487,25	966,79	1.686,11	2.884,97	4.083,83	5.282,69
	LCR	120%	107,45%	105,83%	103,41%	99,37%	95,33%	91,28%
Greece	Shortfall		214,87	425,38	741,15	1.267,43	1.793,71	2.319,99
	LCR	120%	107,52%	105,97%	103,66%	99,80%	95,94%	92,08%
Ireland	Shortfall		358,80	712,27	1.242,47	2.126,14	3.009,81	3.893,49
	LCR	120%	106,66%	104,26%	100,67%	94,68%	88,70%	82,71%
Italy	Shortfall		1.076,52	2.133,15	3.718,09	6.359,65	9.001,22	11.642,78
	LCR	120%	104,35%	99,70%	92,72%	81,09%	69,47%	57,84%
Latvia	Shortfall		5,53	10,97	19,14	32,75	46,37	59,98
	LCR	120%	107,55%	106,03%	103,76%	99,97%	96,17%	92,38%
Luxembourg	Shortfall		19,84	39,37	68,66	117,48	166,30	215,11
	LCR	120%	108,56%	108,04%	107,26%	105,95%	104,65%	103,34%
Malta	Shortfall		21,30	42,17	73,47	125,63	177,80	229,97
	LCR	120%	107,19%	105,32%	102,52%	97,85%	93,18%	88,52%
Netherlands	Shortfall		513,89	1.019,67	1.778,35	3.042,81	4.307,27	5.571,73
	LCR	120%	108,26%	107,44%	106,21%	104,16%	102,11%	100,07%
Portugal	Shortfall		422,05	835,55	1.455,79	2.489,52	3.523,25	4.556,99
	LCR	120%	105,43%	101,85%	96,47%	87,51%	78,55%	69,59%
Slovenia	Shortfall		56,77	112,70	196,59	336,41	476,24	616,06
	LCR	120%	103,88%	98,75%	91,06%	78,24%	65,41%	52,59%
Spain	Shortfall		911,74	1.807,40	3.150,88	5.390,02	7.629,15	9.868,29
	LCR	120%	106,23%	103,42%	99,21%	92,18%	85,16%	78,13%

Table 19: Liquidity Stress Scenario – Conversative Target Ratio - 99% Quantile

This table reports in principle the results of our liquidity stress scenario with a conservative target ratio. As with the capital channel, we assume a drop of 9,29% in market value of the respective sovereign bond holdings for each banking sector. We show the initial LCRs of the banking sectors as well as the LCRs in several ECB haircut scenarios. In addition to changing LCRs, we also report the actual liquidity short fall in million EUR terms.

			ECB Haircut					
		Initial	0%	10%	25%	50%	75%	100%
Austria	Shortfall		195,24	322,69	513,85	832,46	1.151,07	1.469,68
	LCR	130%	116,57%	115,51%	113,93%	111,30%	108,66%	106,02%
Belgium	Shortfall		528,49	874,00	1.392,26	2.256,03	3.119,80	3.983,57
	LCR	130%	115,68%	114,05%	111,60%	107,52%	103,43%	99,35%
Cyprus	Shortfall		127,81	210,96	335,69	543,57	751,45	959,33
	LCR	130%	116,12%	114,78%	112,77%	109,41%	106,06%	102,71%
France	Shortfall		1.636,44	2.704,67	4.307,03	6.977,61	9.648,20	12.318,79
	LCR	130%	116,33%	115,12%	113,31%	110,29%	107,27%	104,25%
Germany	Shortfall		701,87	1.159,95	1.847,07	2.992,28	4.137,48	5.282,69
	LCR	130%	115,82%	114,27%	111,96%	108,10%	104,24%	100,38%
Greece	Shortfall		309,09	510,18	811,81	1.314,54	1.817,26	2.319,99
	LCR	130%	115,92%	114,44%	112,23%	108,54%	104,86%	101,17%
Ireland	Shortfall		517,00	854,64	1.361,12	2.205,24	3.049,36	3.893,49
	LCR	130%	114,68%	112,39%	108,96%	103,24%	97,52%	91,80%
Italy	Shortfall		1.549,42	2.558,76	4.072,76	6.596,10	9.119,44	11.642,78
	LCR	130%	111,36%	106,92%	100,25%	89,14%	78,04%	66,93%
Latvia	Shortfall		7,96	13,17	20,97	33,97	46,97	59,98
	LCR	130%	115,96%	114,51%	112,34%	108,72%	105,10%	101,47%
Luxembourg	Shortfall		19,84	39,37	68,66	117,48	166,30	215,11
	LCR	130%	117,65%	117,13%	116,35%	115,04%	113,74%	112,43%
Malta	Shortfall		88,05	145,33	231,26	374,47	517,68	660,89
	LCR	130%	110,30%	105,18%	97,49%	84,68%	71,87%	59,05%
Netherlands	Shortfall		740,26	1.223,40	1.948,12	3.155,99	4.363,86	5.571,73
	LCR	130%	116,98%	116,20%	115,03%	113,07%	111,11%	109,16%
Portugal	Shortfall		607,12	1.002,10	1.594,58	2.582,05	3.569,52	4.556,99
	LCR	130%	112,92%	109,50%	104,36%	95,80%	87,24%	78,68%
Slovenia	Shortfall		81,80	135,23	215,37	348,93	482,49	616,06
	LCR	130%	110,68%	105,78%	98,43%	86,18%	73,93%	61,68%
Spain	Shortfall		1.312,60	2.168,17	3.451,52	5.590,45	7.729,37	9.868,29
	LCR	130%	114,06%	111,38%	107,35%	100,64%	93,93%	87,22%

Table 20: Liquidity Stress Scenario – Conversative Target Ratio - 97,50% Quantile

This table reports in principle the results of our liquidity stress scenario in a conservative target ratio. As with the capital channel, we assume a drop of 5,54% in market value of the respective sovereign bond holdings for each banking sector. We show the initial LCRs of the banking sectors as well as the LCRs in several ECB haircut scenarios. In addition to changing LCRs, we also report the actual liquidity short fall in million EUR terms.

			ECB Haircut					
		Initial	0%	10%	25%	50%	75%	100%
Austria	Shortfall		135,53	268,95	469,07	802,61	1.136,14	1.469,68
	LCR	130%	117,06%	115,96%	114,30%	111,54%	108,78%	106,02%
Belgium	Shortfall		366,61	728,31	1.270,85	2.175,09	3.079,33	3.983,57
	LCR	130%	116,45%	114,74%	112,17%	107,90%	103,62%	99,35%
Cyprus	Shortfall		88,85	175,90	306,47	524,09	741,71	959,33
	LCR	130%	116,75%	115,34%	113,24%	109,73%	106,22%	102,71%
France	Shortfall		1.135,94	2.254,23	3.931,65	6.727,37	9.523,08	12.318,79
	LCR	130%	116,90%	115,63%	113,74%	110,58%	107,41%	104,25%
Germany	Shortfall		487,25	966,79	1.686,11	2.884,97	4.083,83	5.282,69
	LCR	130%	116,54%	114,92%	112,50%	108,46%	104,42%	100,38%
Greece	Shortfall		214,87	425,38	741,15	1.267,43	1.793,71	2.319,99
	LCR	130%	116,61%	115,06%	112,75%	108,89%	105,03%	101,17%
Ireland	Shortfall		358,80	712,27	1.242,47	2.126,14	3.009,81	3.893,49
	LCR	130%	115,75%	113,36%	109,76%	103,77%	97,79%	91,80%
Italy	Shortfall		1.076,52	2.133,15	3.718,09	6.359,65	9.001,22	11.642,78
	LCR	130%	113,44%	108,79%	101,81%	90,19%	78,56%	66,93%
Latvia	Shortfall		5,53	10,97	19,14	32,75	46,37	59,98
	LCR	130%	116,64%	115,13%	112,85%	109,06%	105,27%	101,47%
Luxembourg	Shortfall		19,84	39,37	68,66	117,48	166,30	215,11
	LCR	130%	117,65%	117,13%	116,35%	115,04%	113,74%	112,43%
Malta	Shortfall		61,21	121,18	211,13	361,05	510,97	660,89
	LCR	130%	112,71%	107,34%	99,29%	85,88%	72,47%	59,05%
Netherlands	Shortfall		513,89	1.019,67	1.778,35	3.042,81	4.307,27	5.571,73
	LCR	130%	117,35%	116,53%	115,30%	113,25%	111,21%	109,16%
Portugal	Shortfall		422,05	835,55	1.455,79	2.489,52	3.523,25	4.556,99
	LCR	130%	114,52%	110,94%	105,56%	96,60%	87,64%	78,68%
Slovenia	Shortfall		56,77	112,70	196,59	336,41	476,24	616,06
	LCR	130%	112,98%	107,85%	100,15%	87,33%	74,51%	61,68%
Spain	Shortfall		911,74	1.807,40	3.150,88	5.390,02	7.629,15	9.868,29
	LCR	130%	115,32%	112,51%	108,30%	101,27%	94,25%	87,22%