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STUDY

Feasibility Check: Transition to a New Regime for Bank Sovereign Exposure?

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Provided at the request of the
Economic and Monetary Affairs Committee

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Provided in the context of Economic Dialogues with the President of the Eurogroup
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Abstract

Excessive sovereign debt exposures of banks contributed to the gravity of the financial and sovereign debt crisis in 2011 and 2012, as well as to the slow and asymmetric recovery of European countries. Various policies that improve banks' resilience were introduced in recent years, however the regulatory regime for the sovereign debt exposure of banks has not changed. We identify four criteria that a new regime for bank sovereign exposures should fulfil: (1) attenuate the home bias to the domestic sovereign, (2) break the doom loop, (3) avoid a flight-to-quality of assets, and (4) mitigate risk spillovers. We assess the implications for banks' balance sheets for five policy proposals, based on simulations on a sample of European banks. We show that none of the proposals would fulfil all four criteria in the absence of a safe asset. We conclude that a new regime for bank sovereign exposure should be conditional on restoring the value of sovereign bonds as a safe asset.

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LIST OF ABBREVIATIONS

AFS	Available for sale
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlement
CET1	Common Equity Tier 1
CRD	Capital Requirements Directive
CRR	Capital Requirements Regulation
CRA	Credit Rating Agency
EBA	European Banking Authority
ECB	European Central Bank
EFSF	European Financial Stability Facility
EFSM	European Stability Mechanism
FVO	Fair value options
GCEE	German Council of Economic Experts
HQLA	High quality liquid assets
HTM	Held to maturity
IRB	Internal Rating based Approach
LBRO	Long-term liquidity injections
LCR	Liquidity Coverage Ratio
LGD	Loss given default
MTB	Market to book
OMT	Outright Monetary Transactions
PD	Probability of Default
ROAE	Return on adjusted equity
RWA	Risk weighted assets
SBBS	Sovereign Bond-backed Securities
SA	Standardised Approach
SRM	Single Resolution Mechanism
VLAB	New York University's Volatility Lab

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EXECUTIVE SUMMARY

1. The accumulation of sovereign debt in the hands of poorly-capitalized banks contributed substantially to the worsening of the sovereign debt crisis in 2011 and 2012, as well as to the slow and asymmetric economic recovery of European countries. A diabolic feedback loop between banks and sovereigns developed in economically unstable countries. The flight-to-quality from distressed countries to safe countries reinforced the doom loop in the crisis countries. Moreover, due to banks' cross-country holdings of sovereign bonds, and as banks did not fund these exposures with capital, risks could spill over from risky to safe countries, creating feedback loops even in safer countries.
2. A new regime to regulate banks' sovereign bond holdings thus should meet four criteria: (1) attenuate the home bias to the domestic sovereign, (2) break the doom loop, (3) avoid a flight-to-quality, and (4) mitigate risk spillovers.
4. The resilience of the European banking sector has improved in the last several years due to new capital and liquidity requirements and, more broadly, to the introduction of the Basel III regulatory framework. Regulatory capital ratios have substantially improved as a result. However, the banking sector is still weak, as risk indicators (e.g., asset quality and profitability) suggest. Imposing additional capital requirements to further strengthen the European banking sector requires the planning of a transition period.
5. Banks have substantial exposures to eurozone sovereign bonds. But banks also have large exposures to public entities within a country (e.g., municipalities). A new regulatory regime should carefully define what type of exposures count towards the same concentration of risk and which exposures can be separated. This has important consequences with respect to possible capital shortfalls under concentration limits or risk weights, particularly for state-owned banks.
6. Removing sovereign debt privileges requires either the introduction of risk weights, the introduction of concentration limits or a combination of both. There are considerable disadvantages associated with each approach. For example, risk weights are highly procyclical, while diversification of sovereign risk in banks' portfolios due to concentration limits increases spillover risks. We present seven policy proposals and analyse the impact of five of them on banks' regulatory capital, based on simulations performed on a sample of 51 EU banks.
7. The reform proposals for a new regulatory regime discussed in this paper include: (1) the introduction of a 10% risk weight floor, (2) the removal of the carve out option, (3) the application of a 25% concentration limit on sovereign exposures, (4) the implementation of risk adjusted large exposure limits as suggested by the German Council of Economic Experts (GCEE), (5) Risk weights scaled by large exposures, (6) the introduction of Sovereign Bond Backed Securities (SBBS) as discussed by Brunnermeier et al. (2016), and (7) the implementation of the Eurozone basket as suggested by Matthes and Rocholl (2017).
8. Of these proposals, only the proposal by Brunnermeier et al (2016) fulfills the four criteria described above. This is because the proposal explicitly considers the creation of a safe asset through the introduction of SBBS, which is essential in fulfilling all four criteria. However, there are several questions about the viability of implementing SBBS.
9. A fiscal union might be the only solution that mitigates the problems associated with the bank-sovereign nexus and permanently restores the value of sovereign bonds as a risk-free asset (Acharya and Steffen, 2017).

1. INTRODUCTION

The strong interdependence of sovereign debtors and national banking systems that derives from the substantial sovereign debt holdings of banks was a key driver for the recent eurozone crisis. A deterioration in the creditworthiness of the sovereign eventually affected the solvency of domestic banks, which ultimately fed back into concerns regarding the stability of the sovereign.

In response to the financial and sovereign debt crisis, reforming bank regulation and severing the sovereign-bank nexus became a key concern for policy makers. Changes to the Basel rules were introduced to enhance bank resilience and improve the overall robustness of the financial sector. In the European Union, regulators started to address the nexus between banks and sovereigns with the introduction of the Banking Union in November 2014. The creation of a single supervisor and bank resolution framework is supposed to help avoid taxpayer bailouts in future banking crises. Importantly, however, regulators have yet to reform the regulatory framework governing the treatment of sovereign debt on banks' balance sheets. According to the current framework, sovereign debt on bank balance sheets enjoys a preferential treatment, resulting in a widespread use of zero risk weights for eurozone sovereign debt, and without concentration limits. Since 2008, this preferential regulatory treatment of sovereign debt vis-à-vis other asset classes has facilitated the increasing exposure of banks to sovereign debt, as well as the "home bias" towards domestic sovereign debt.

In this paper, we review the current regulatory framework for the treatment of sovereign debt in banks' prudential requirements, along with the reform proposals for a new regulatory regime. In addition, we introduce an alternative policy suggestion, which uses the excess sovereign exposure in a large exposure regime to determine the capital requirements. To quantify and assess the effects of all the proposals, we use data on sovereign debt exposures provided in the 2016 stress tests by the European Banking Authority (EBA).

Furthermore, we assess the impact of possible changes to the regulatory framework on banks. We also provide a quantitative assessment of the resilience of the European banking sector along two dimensions. First, we use key risk indicators to assess the capitalization, asset quality, profitability, and liquidity of European banks. We use haircuts on banks' sovereign bond portfolios and the resulting capital shortfalls to assess the resilience of the banking sector under stress.

In order to investigate the viability of potential regulatory reforms, we discuss seven reform proposals. These include (1) the introduction of a 10% risk weight floor, (2) the removal of the carve out option, (3) the application of a 25% concentration limit on sovereign exposures, (4) the implementation of risk adjusted large exposure limits as suggested by the German Council of Economic Experts (GCEE), (5) Risk weights scaled by large exposures, (6) the introduction of Sovereign Bond Backed Securities (SBBS) as discussed by Brunnermeier et al. (2016), and (7) the implementation of the Eurozone basket as suggested by Matthes and Rocholl (2017). For the first five proposals we model scenarios, which correspond to the implementation of possible regulatory adjustments, and analyse their impact on bank balance sheets.

2. IMPLICATIONS OF SOVEREIGN DEBT EXPOSURE

There are two different explanations in the literature as to why banks increase their sovereign bond holdings during financial crises. The first one is the “carry trade”: poorly capitalized banks increase their exposure to risky sovereign debt to gamble for resurrection (Acharya and Steffen, 2015; Crosignani, 2015). The second one is “moral suasion”: sovereign stress heightens the incentives of vulnerable governments to allow banks to hold risky domestic sovereign bonds (Uhlig, 2014; Altavilla et al., 2016; Becker and Ivashina, 2016; Ongena et al., 2016).

Kirschenmann et al. (2017) argue that zero risk weights and the lack of concentration limits facilitate the accumulation of sovereign debt and the increase in “home bias” (i.e., the exposure towards domestic sovereign debt) during a crisis. In the context of the European sovereign debt crisis, Acharya and Steffen (2015) and Altavilla et al. (2016) show empirically that the home bias increased substantially with the three-year long-term liquidity injections (LTROs) by the European Central Bank (ECB).

2.1. Doom loop

Acharya et al. (2014) study how sovereign-bank feedback loops develop in the banking sector and spill over to the domestic sovereign due to banks’ bailouts (“Irish-style” crisis). Gennaioli et al. (2014) show that an increase in sovereign risk affects the domestic banking sector due to its holdings of domestic sovereign bonds (“Greek-style” crisis). Both papers describe the importance of sovereign-bank linkages in crisis countries due to banks’ holdings of domestic sovereign bonds and discuss problems related to “home bias,” i.e., large holdings of sovereign exposures that created the “doom loop” in distressed countries, consistent with models in Farhi and Tirole (2016) and Leonello (2017).

Acharya et al. (2017b) show that the LTROs in 2011 and 2012 aggravated the diabolic loop, because it increased the concentration of sovereign debt particularly from Greece, Ireland, Italy, Portugal and Spain (GIIPS) in the portfolios of domestic banks, whose credit quality was deteriorating. This, in turn, increased sovereign bond yields: the high concentration of sovereign bonds in the portfolios of these banks increased the likelihood of fire sales, as in the model in Diamond and Rajan (2011).

2.2. Flight-to-quality

Pagano (2016) argues that the asymmetric distribution of safe assets, between core and periphery countries in the Eurozone, further aggravated the doom loop; Germany supplies 83% of the AAA-rated sovereign bonds in the eurozone. An increase in sovereign risk in one country triggers a capital flow to a safe asset. Moreover, this flight-to-safety decreases the yield of the safe asset while it further increases the funding costs of the riskier sovereign, which increases its fiscal problems and thus reinforces the doom loop.

2.3. Spillovers from peripheral to core countries

Acharya et al. (2014a) and Gennaioli et al. (2014) analyse sovereign-bank feedback loops in crisis countries, such as Ireland and Greece. In their theoretical model, Bolton and Jeanne (2011) analyse international spillovers between financially integrated economies. They show that financial integration allows banks to diversify their portfolios by holding sovereign debt from different countries. Because fiscally less stable countries do not internalize the costs of other (more stable) countries associated with higher financial fragility, they can eventually

extract fiscal concessions either in the form of transfers or when safer governments choose to recapitalise their domestic banking sectors. Building on this theoretical framework, Kirschenmann et al. (2017) show that a sovereign-bank loop might develop even in the banking sectors of safer countries because of exposure to non-domestic sovereign debt. This would increase the risk and funding costs of sovereigns because of zero risk weights. Moreover, the asymmetric distribution of safe assets in the eurozone can also aggregate the feedback loop in (originally) safer countries causing a propagation of shocks throughout the eurozone.

Ang and Longstaff (2013) evaluate the co-movement of sovereign default risk and find that financial linkages are likely to provide a channel for sovereign risk spillovers. Beltratti and Stulz (2016) and Kallestrup et al. (2016) argue that bank health in safer countries can be affected through banks' cross-border exposures.

2.5 Real effects

Banks holding sovereign bonds in their portfolio experienced a substantial decline in (market) equity value and increase in default risk (Acharya and Steffen, 2015). Consequently, they were forced to deleverage during the height of the sovereign debt crisis in 2011 until the summer of 2012, causing a reduction in bank lending to non-financial firms, which was particularly severe in countries hit hard by the crisis such as Greece, Ireland, Italy, Portugal, and Spain (the so-called GIIPS countries) as documented, for example, in Popov and Van Horen (2015), Acharya et al. (2016), and Altavilla et al. (2016). The economic effect was substantial. Altavilla et al. (2016) estimate that a 100 bps increase in the domestic sovereign premium translates into a 1.4 percentage point decline in loan growth of banks holding these bonds. They provide compelling evidence that the reduction is due to a reduction in loan supply that cannot be explained by a decline in demand from firms in crisis countries.

Acharya et al. (2017a) investigate the consequences of the announcement of the Outright Monetary Transactions (OMT) on August 2012. While the (market) equity value of banks with large exposure to sovereign debt declined during the height of the sovereign debt crisis, it significantly increased after the announcement of the OMT, when the yield spread differential to German bunds declined. These banks were (based on market values) recapitalized and increased lending, mainly to so-called "zombie firms." They remained under-capitalized ex post, thereby distorting their lending decisions. Firms that received loans did not increase investments, they started holding cash. Importantly, firms in industries with a large percentage of zombie firms suffered from this misallocation of credit, which further slowed the economic recovery in these countries.

Overall, this research suggests that banks' exposure to sovereign debt is key to understanding the recent financial crisis in Europe, as well as the weak and asymmetric recovery from the crisis across eurozone countries. Any change to the current regulatory treatment of sovereign debt exposure in banking regulation has to address the associated moral hazard of banks and governments that caused the toxic build-up of massive sovereign debt exposures. Importantly, our discussion already suggests that a simple redistribution of sovereign debt across bank portfolios in an attempt to reduce the home bias might not be feasible, as it increases sovereign risk spillovers across countries and the creation of doom loops even in safer countries. Moreover, proposals for a new regulatory framework should target the creation of an asset, which does not lose value during crises and is available to all Eurozone. This "safe asset" is key in preventing a flight-of-capital from risky to safe countries during crisis periods.

3. REGULATORY TREATMENT OF SOVEREIGN DEBT IN BASEL AND EU REGULATION

In this section, we provide an overview of the microprudential treatment of sovereign exposures according to both Basel and EU regulations. The majority of the current regulatory framework is laid out in Basel II and the European Capital Requirements Regulation (CRR). Regulation on sovereign exposures has for the most part not been directly addressed within Basel III, but both the leverage ratio and the Liquidity Coverage Ratio (LCR) have indirect effects on sovereign bond exposures.

The risk of holding assets is primarily addressed through two channels: risk weights and large exposure regime. Risk weights depend on the asset class and specify a percentage of the securities value that has to be funded with capital. Banks can use two methodologies to identify the appropriate risk weights: a standardised approach (SA) and an internal ratings-based (IRB) approach to calculate capital requirements. The second channel is based on a large exposure regime that establishes a maximum cap – a so called “concentration limit” - on exposures towards a single counterparty (or affiliated counterparties) relative to a bank’s regulatory capital.

3.1 The Standardised Approach

In the first channel, the SA relies on the country credit rating assigned by the credit rating agencies (CRAs) and links these ratings to risk weights, as shown in **Table 1**. Comparing the risk weights that are assigned to different rating buckets of sovereign debt with the risk weights assigned to corporate debt shows that risk weights for similarly rated corporate exposures are higher across all risk buckets. Nevertheless, **Table 1** indicates that the riskiness of sovereign exposures is acknowledged (at least for countries with a credit rating below AA- within the Basel II regulatory framework). However, paragraph 54 in the Basel II accords allows banks to assign zero risk weights to their sovereign exposures if the underlying security is denominated and funded in the domestic currency and the counterparty is their respective sovereign (or central bank), irrespective of their current rating. European regulatory authorities have even extended this rule to also apply to debt issued in the currency of any member of the EU. In practice, this (domestic) carve-out option allows European banks to assign zero risk weights to all their European sovereign debt holdings.

Table 1: Risk weights for debt exposures

Risk weights for exposures to sovereign debt						
Credit Rating	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Risk Weight	0%	20%	50%	100%	150%	100%
Risk weights for exposures to corporate debt						
Credit Rating	AAA to AA-	A+ to A-	BBB+ to BB-		Below BB-	Unrated
Risk Weight	20%	50%	100%		150%	100%

Source: BCBS

3.2 The internal ratings-based approach

The IRB approach is designed for large and globally active banks and is supposed to improve consistency across their various divisions. Banks that rely on the IRB approach are expected to refer to their own internal rating models to assess a borrower's credit risk. This internal system should account for various measures of risk, including the probability of default (PD), as well as loss given default (LGD), and establish a "meaningful differentiation of risk." However, both the rare occurrence of a sovereign default and the limited sample of high-quality sovereign bonds result in generally low risk weights assigned through the IRB approach. A study conducted by the BIS (2013) estimates a weighted mean PD for sovereign exposures of 0.1% based on data from 201 large banks. The lack of a data basis to robustly estimate the LGD decreases the IRB approach's appropriateness to measure the risk of exposures to sovereign debt. Furthermore, risk weights that are assigned through the IRB approach for the same counterparty differ substantially across banks (Behn, Haselmann, and Vig, 2016).

3.3 Moving from IRB to SA

The inconsistencies in risk weights assigned through the IRB approach for credit risk are a key concern in the current reform process of the regulatory capital framework. To achieve a harmonization of capital risk metrics across banks, the Basel Committee on Banking Supervision (BCBS) recently published a consultative document that proposes to move various customer segments and asset classes to the SA from the IRB approach. The ongoing discussion recognizes this problem, but the current version of the consultative document excludes sovereign exposures.

The EU regulations already (with permission of the competent authority) allow a "partial use" of the SA instead of the IRB approach for sovereign debt exposures. However, this further decreases the comparability across banks and limits the benefit of a consistent usage of IRB-based risk weights throughout all divisions of a firm. If banks decide to exercise the "partial use" option and assign risk weights to sovereign exposures via the SA, they can assign a zero risk weight to their sovereign debt holdings based on the regulatory setup described in the section on the SA. In practice, this allows European banks that use the IRB approach to also assign zero risk weights to all their euro-denominated sovereign debt holdings.

3.4 Large exposure regime and concentration limits

The second channel, the large exposure regime, accounts for the risk exposure of banks. These limits are designed to reduce the overall exposure of banks to a single counterparty (or connected counterparties). For corporates, a large exposure regime caps the exposure at 25% of the bank's Tier 1 capital (i.e., shareholders' capital and retained earnings) in the Basel regulation and "eligible capital" in the CRR. This restriction is related to concentration risk, which is part of the Pillar 2 supervisory review process, but under Pillar 1 serves as a supplement to ensure a harmonized framework to limit idiosyncratic risks in a bank's portfolio. European regulation provides more leeway on the corporate level as eligible capital consists of Tier 1 capital plus certain types of Tier 2 capital, which can be up to a maximum of 50% of the Tier 1 capital. However, similar to the regulatory framework for risk weights, exposures to sovereigns are exempted from concentration limits in both the Basel and EU regulations.

3.5 Haircuts for sovereign debt

Banks can reduce counterparty risk by demanding collateral in repurchase agreements (“repos”) and regularly use haircuts to account for the risk of the collateral. Sovereign debt is preferred as collateral because of lower haircuts compared to other assets, such as private debt. **Table 2** depicts the haircuts of highly-rated government debt with similarly rated private debt. In other words, using sovereign debt as securities in transactions is a cost-effective technique to reduce the credit exposure of banks, which incentivises them to hold sovereign debt as an asset basis for liquidity management.

Table 2: Standard supervisory haircuts: Securities issued by sovereign. vs other issuers

Residual terms of above AA-rated securities	<1 year	1-5 years	>5 years
Haircuts for sovereign debt	0.5%	2%	4%
Haircuts for private debt	1%	4%	8%

Source: BCBS

3.6 Leverage Ratio

The Basel III reform measures do not change the regulatory framework described above. However, a new leverage ratio of 3% will be binding in 2019. The leverage ratio requires banks to hold at least 3% of their total exposure in Tier 1 capital. As non-risk weighted exposure, which includes sovereign debt, is part of the denominator representing the total exposure, the leverage ratio may introduce a potentially binding quantity-based constraint to the sovereign exposure. The current risk-weighted minimum capital requirement of 8% in combination with the 3% leverage ratio imposes a 37.5% (fixed) risk weight on all exposures. To which degree this risk weight is going to be binding for sovereign exposures depends on the composition and riskiness of the total exposures of the banks and the average risk weight currently in place. For example, a bank that has substantial exposures to risky corporate debt with risk weights above 37.5% will be less affected by the introduction of the new leverage ratio, as the capital requirements from the IRB and SA approach are higher compared to the requirements that stem from the leverage ratio. A bank with substantial exposures to sovereigns will be affected relatively more, as the leverage ratio introduces capital requirements for the otherwise preferentially treated sovereign debt exposures.

3.7 Liquidity coverage ratio

An additional regulatory adjustment that is introduced in Basel III is the introduction of a liquidity coverage ratio (LCR) to ensure a sufficient liquidity basis. The ratio introduces a minimum percentage of liquid assets over an estimated cash outflow in a 30 day extreme stress scenario. The LCR was introduced in 2015 and initially required banks to fulfil a coverage of 60%, which annually increases by 10% up to 100% in 2019. Assets that are eligible as Level 1 liquid assets are included in the ratio without the application of a haircut and include sovereign bonds that are rated AAA to AA-, issued in the bank’s domestic currency or issued in the currency of the country where cash outflows will occur. Again, this means that euro-denominated sovereign debt is preferentially treated. In contrast, highly-rated corporate bonds and covered bonds are subject to a 15% haircut and can only account for a maximum of 40% of the total assets. The possible regulatory adjustments discussed below will have to consider the substantial contribution of sovereign debt holdings in fulfilling the regulatory requirements of the LCR and the impact that a reduction in sovereign debt holdings may have.

4. RESILIENCE OF THE EUROPEAN BANKING SECTOR TO SOVEREIGN STRESS

In this section, we provide evidence about the current risks in the European banking sector and its resilience to further shocks to eurozone sovereigns, based on banks' exposure to sovereign debt.

4.1 Risk indicators

The EBA published a list of 53 European banks that were part of the 2016 stress test, which comprises about 70% of the banking sector in each country;¹ 34 of these banks are publicly listed. Balance sheet information and market data are collected from SNL Financial and New York University's Volatility Lab (VLAB). We use market data as of 30 June 2017, as well as 30 June 2016 for comparison. Book data are the most recent available data. We use frequently used risk indicators to analyse the sampled banks along different dimensions: (1) capital adequacy, (2) asset quality, (3) profitability, and (4) liquidity. All indicators are summarized on a country level in **Table 3**, the last row shows either the sum (in case of euro amounts) or unweighted means across all countries. Results for individual banks are shown in Appendix 1. The 51 banks have total assets of €27 trillion.

Common Equity Tier 1 ratio (**CET 1 Ratio** in **Table 3** is Tier 1 common capital divided by risk-weighted assets (RWA).² The average CET 1 Ratio is 15.09% and, on average, all banks are well above the regulatory minimum (excluding surcharges). Italian and Spanish banks have the lowest CET 1 Ratio, followed by banks from Austria, France, and Germany. **Equity/Assets** is book equity divided by total assets and the average book Equity/Assets ratio is 7.25%. Germany and French banks are among the banks with the lowest Equity/Assets ratios. The average RWA over assets (**RWA/Assets**) ratio is 38.26% and exhibits some variation across countries. French and German banks, which have the largest banking sectors by asset size, are among the banks with the lowest RWA/Assets ratios. Italy, Ireland, and Spain have RWA of more than 40% relative to total assets, consistent with large and/or riskier loan portfolios of banks in these countries.³

Problem Loans/Loans are banks' problem loans as a percentage of customer loans. We observe a broad dispersion of asset quality among European banks and a high concentration of problem loans in the portfolios of banks, particularly in Italy and Ireland. There is a broad variability in the profitability among European banks. Return on adjusted equity (**ROAE**), for example, varies between -11.45% (Italian banks) and 15.48% (Hungarian banks), highlighting the problems in the Italian banking sector that is trying to clean up non-performing legacy assets. Moreover, bank profitability is challenged in a low interest rate environment with a relatively flat yield curve, especially when interest income is the most important income source.

The 30-day liquidity coverage ratio (**LCR**) is a minimum standard in the CRD IV and is supposed to promote short-term resilience to potential liquidity disruptions. The LCR requires

¹ A list of these banks is provided in Appendix 1. DZ Bank and National Bank of Greece were not tested.

² The fully loaded CET 1 is common equity Tier 1 capital as a percentage of risk-weighted assets using fully loaded or fully phased-in capital rules, as reported by the bank.

³ There is substantial cross-sectional heterogeneity in terms of Basel RWA among European banks, ranging from 20.59% of total assets (Sweden) to more than 68% (Poland). While Deutsche Bank AG (one of the largest banks in the stress test) reports a RWA/asset ratio of 22%, several large publicly listed banks have RWA/asset ratios below 20%, among others such as Credit Agricole, Handelsbanken, and Swedbank (Appendix 1).

banks to have a sufficient level of high-quality liquid assets (HQLA) to withstand a stressful funding scenario for 30 days.

At the EU level, the LCR framework introduced several features that differ from the Basel III LCR framework (e.g., related to the requirements for instruments that count as HQLA). The minimum requirement was set at 60% on 1 October 2015 and gradually increases, to reach 100% by January 2018. As of September 2017, the requirements are set at 80%.⁴ The average liquidity coverage is 1.2, well above the standard threshold defined as the liquidity coverage requirement for 2017 (80%). Not all banks seem to meet the requirements. Our data suggest that banks in Italy and the Netherlands, on average, do not meet the 80% LCR target. German and Spanish banks are barely meeting the minimum requirement.

Market data also reflect heterogeneity among eurozone banks (not tabulated). For example, the average market-to-book (MTB) ratio is 1.17 and varies substantially across countries. The MTB ratio of banks in some countries (France, Germany, Italy and Spain) is well below 1, which suggests that the market is heavily discounting the assets of these banks, at least in part due to the relatively high risk of some of the “riskless” assets relative to the markdowns taken on these assets against their book equity values.⁵

Even though some banks are still likely to have weak balance sheets, capital measures have, on average, improved since June 2016. MTB ratios increased from an average of 0.7 in 2016 to 1.17 in June 2017. Nonetheless, there is a substantial divergence between market-based measures of capital and regulatory-based measures.

In conclusion, European banks are still vulnerable and important drivers of risk are the exposure to low-quality (legacy) assets and business models that prove to be unprofitable in the current macroeconomic environment.

⁴ We do not have the new LCR for all banks, but document averages based on available data.

⁵ Notably, German banks have the lowest MTB (0.38), followed by Italian (0.77) and French banks (0.79). The banks with the lowest MTB are Banca Monte dei Paschi (0.07), Deutsche Bank (0.36), and UBI Banca (0.43).

Table 3: Risk indicators

Country	Number of Banks	Total Assets	CET1 Ratio	Capital Adequacy		Asset Quality	Profitability	Liquidity
				Equity/Assets	RWA/Assets	Problem Loans / Loans	ROAE	LCR
Austria	2	343,074	12.79%	7.69%	49.51%	6.40%	8.08%	1.45
Belgium	2	451,921	16.34%	5.83%	29.56%	5.66%	11.46%	1.34
Denmark	3	735,765	16.96%	4.94%	24.62%	2.48%	11.03%	2.04
Finland	1	133,747	20.12%	7.65%	32.97%	1.72%	9.42%	1.17
France	6	7,241,771	12.70%	5.03%	27.77%	4.67%	7.05%	1.07
Germany	9	3,224,895	12.91%	4.64%	26.50%	2.08%	-1.03%	0.88
Hungary	1	36,611	13.54%	12.56%	59.52%	8.98%	15.48%	
Ireland	2	218,751	16.30%	10.31%	48.03%	15.87%	9.51%	1.18
Italy	5	1,967,606	10.29%	5.88%	42.45%	15.49%	-11.45%	0.79
Netherlands	4	2,056,156	15.55%	5.56%	31.23%	2.92%	8.06%	0.55
Norway	1	292,273	17.55%	7.78%	36.12%	2.42%	9.90%	1.38
Poland	1	64,851	14.51%	11.40%	68.40%	5.86%	9.10%	1.36
Spain	6	2,969,268	12.60%	7.36%	45.06%	6.07%	5.43%	0.91
Sweden	4	1,388,479	20.89%	5.39%	20.59%	0.59%	12.06%	1.54
United Kingdom	4	5,565,948	13.25%	6.68%	31.63%	2.43%	1.00%	1.09
	51	26,691,116	15.09%	7.25%	38.26%	5.58%	7.01%	1.20

Source: Authors' calculations based on the EBA Bank sample, SNL data

4.2 Shortfall due to stress imposed on sovereign bond portfolios

To account for sovereign risk in the portfolios of European banks, we employ three stress scenarios: (1) a shock that increases sovereign bond yields to the highest level observed during the sovereign debt crisis, (2) a haircut based on the EBA 2011 baseline scenario, and (3) a haircut based on the EBA 2011 adverse scenario.

In our empirical approach, we mark all sovereign bond holdings to market, including held-to-maturity (HTM) (“full impairment”) focusing on peripheral countries (Greece, Italy, Ireland, Portugal, and Spain).⁶ As our market data (stock prices, MTB, and SRISK) are as of 30 June 2017, we also collect yields of 10-year sovereign bonds as of this day. The yields and spread over German 10-year government bonds are reported in **Table 4**. We calculate bond prices based on these yields following the approach in Acharya and Steffen (2015) and document the lowest bond price for each government bond that we observe during the sovereign debt crisis. We then calculate the percentage change between the current and the lowest historical bond price and use this percentage change as a haircut in our first stress scenario. For example, Greek sovereign bonds have to decline by 92.78% to reach the lowest bond price that we observed during the height of the sovereign debt crisis.

The other two stress scenarios are based on haircuts applied in the 2011 EBA stress tests, in the baseline and the adverse scenario. Strikingly, the EBA considered a far less severe scenario even in their adverse scenario as compared with the actual bond price decline during the sovereign debt crisis. The haircuts are between 50% and 100% more severe if we use historical data and bond price declines.

Table 4: Stress scenarios: sovereign bond prices

	Yield (10-year) 30 June 2017	Yield Spread over German Bunds (10-year)	Bond Price (10-year)	Lowest Bond Price during Financial Crisis (10-year)	Stress Scenarios		
					Haircut Historical Bond Prices	EBA Haircut Baseline Scenario (2011)	EBA Haircut Adverse Scenario (2011)
Greece	5.42%	4.95%	58.97	4.26	92.78%	8.80%	42.20%
Italy	2.16%	1.69%	80.77	49.61	38.58%	2.30%	12.30%
Ireland	0.90%	0.43%	91.43	26.79	70.70%	2.70%	16.60%
Portugal	3.03%	2.56%	74.21	20.12	72.89%	6.50%	26.60%
Spain	1.54%	1.07%	85.84	48.98	42.94%	8.30%	21.70%

Source: Authors’ calculations based on EBA bank sample and SNL data

For each stress scenario, we calculate individuals’ bank’s impairment based on the haircuts shown in **Table 4** and each bank’s exposure to GIIPS sovereign bonds. The impairment charges are reported in **Table 5** at the country level at the country level. Given domestic banks’ substantial exposure to domestic sovereign debt (“home bias”) in Italy and Spain, we find the largest impairments for banks in both countries varying between €1.2 billion (EBA Baseline scenario) and €18.2 billion (historical bond prices).

To calculate a potential capital shortfall due to sovereign stress, we need to define a hurdle rate. We use a 10% CET1 ratio as the hurdle rate. The hurdle rate includes the CRR minimum of 4.5% plus a pillar 2 add-on, a buffer accounting for the systemic importance of SRM banks and a countercyclical buffer. This hurdle can effectively be well above 10%; however, some buffers are not phased in until 2020.

⁶ Alternatively, we could recognize only impairments on the “fair value portfolio,” i.e., available for sale (AFS), fair value options (FVO), and trading and phase-in only 60% of the AFS-related impairments, following the CRD IV and its definition of common equity Tier 1 capital as of 31 December 2016 (“partial impairment”).

Table 5: Impairment in sovereign bond stress tests

Country	Impairment Historical Bond Prices	Impairment EBA Baseline 2011	Impairment EBA Adverse 2011
Austria	580	63	222
Belgium	1,903	181	684
Denmark	508	53	186
Finland	-	-	-
France	3,478	344	1,291
Germany	1,353	140	509
Hungary	-	-	-
Ireland	7,477	344	1,874
Italy	15,218	1,161	5,205
Netherlands	822	103	337
Norway	-	-	-
Poland	-	-	-
Spain	18,237	3,155	8,707
Sweden	15	1	5
United Kingdom	1,504	137	537
Total	51,095	5,684	19,556

Source: Authors' calculations based on EBA bank sample and SNL data

We calculate the drop in CET1 capital due to sovereign debt impairment for each of these three stress scenarios, along with the amount of capital needed to increase CET1 capital to 10% of RWA.⁷ We find that some banks still do not meet a 10% CET1 hurdle rate. For these banks, the capital shortfall will consist of a “leverage component” (to increase capital to 10% of RWA even without sovereign stress) and the “sovereign stress component,” which increases with their exposure to peripheral sovereign debt. We report the capital requirements under all three scenarios in **Table 6**. The CET1 column reports banks' current CET1 capital to facilitate the comparison of the shortfall with respect to current capital levels.

Table 6: Capital requirements in sovereign bond stress tests

Country	Capital Requirement (Historical Bond Prices)	Capital Requirement (EBA Baseline 2011)	Capital Requirement (EBA Adverse 2011)	CET 1
Austria	0	0	0	22,198
Belgium	0	0	0	22,254
Denmark	0	0	0	30,585
Finland	0	0	0	9,479
France	187	0	0	261,571
Germany	1,676	0	139	142,651
Hungary	0	0	0	3,433
Ireland	9,058	0	659	17,700
Italy	62,546	7,179	18,743	97,227
Netherlands	0	0	0	97,520
Norway	0	0	0	18,001
Poland	0	0	0	7,157
Spain	85,520	3,616	28,343	161,544
Sweden	0	0	0	59,702
United Kingdom	0	0	0	231,436
	158,987	10,795	47,885	1,182,459

Source: Authors' calculations based on EBA bank sample and SNL data

The total capital requirement for all banks in our sample is €159 billion if sovereign bond prices decline to the level seen during the sovereign debt crisis in 2011. If bond prices decline as assumed in the adverse scenario of the EBA 2011 stress test, the capital requirement drops to about €48 billion. Italian and Spanish banks require the largest recapitalizations under each scenario.

⁷ Appendix 1 includes the CET1 ratio for each bank at the most recent date.

Taken together, in the event of a worsening of the sovereign debt crisis, the main problems for banks will be localized in the GIIPS countries, particularly Italy and Spain. Given Italian banks low capital levels, bad assets, lack of profitability, and liquidity problems, the Italian banking sector is the most fragile in the eurozone. This has different implications. First, given banks' exposure to sovereign debt, banks in Ireland, Italy, and Spain have insufficient capital to withstand a new sovereign debt crisis. Second, this lack of capital makes the transition to a new regulatory regime very difficult. It is unclear as to who should provide the capital to strengthen their balance sheets [both with respect to sovereign debt exposures, as well as huge amounts of bad loans (particularly in Italy)] and, more importantly, whether the domestic governments agree to a new regime that puts a lot of pressure both on the banks and the sovereign itself. In other words, a transition period will be needed so banks can continue to strengthen their balance sheets.

5. REVIEW OF POSSIBLE REGULATORY ADJUSTMENTS

In this section, we review possible regulatory adjustments to the current treatment of sovereign exposures in the EU legislation, recognising that sovereign exposures in the eurozone are not necessarily risk-free. The 2015 ESRB report and Calzolari et al. (2016) provide comprehensive reviews of the most prominent regulatory reform proposals.

The regulatory adjustments suggested in recent studies can be broadly assigned into three categories. First, an assignment of non-zero risk weights to sovereign bonds to reflect their risk. Second, a full or partial removal of the exception of sovereign exposures from concentration limits. Third, transferring the preferential treatment to a “safe asset” for the eurozone that is not affected by idiosyncratic country risk. The most popular suggestion that falls into the third category foresees the creation of sovereign bond-backed securities (SBBS). These securities are backed by the senior tranche of a representative portfolio of European sovereign bonds. They represent a risk-free substitute for the current sovereign debt holdings, as theoretically discussed by Brunnermeier et al. (2016). An alternative suggestion was presented by Matthes and Rocholl (2017), who advocate a regulatory setup in which European banks are encouraged to hold a diversified portfolio of European sovereign debt—the eurozone basket (EZB).

5.1 Policy reform targets

In this subsection, we discuss several challenges for a new regime of banks’ sovereign exposures. Besides correctly accounting for the risk of sovereign exposures through capital requirements, the new regime should: (1) attenuate the home bias to the domestic sovereign, (2) break the doom loop, (3) avoid a flight-to-quality, and (4) mitigate risk spillovers. Below we summarise the determinants for a regulatory regime that incorporates these four criteria to establish a benchmark for our assessment of the policy reform suggestions.

At the bank level, the reform should:

- Increase resilience to sovereign risk by enforcing adequate capital buffers that represent the underlying risk of these exposures;
- Reduce excessive exposures to sovereign debt and encourage diversification of debt holdings across multiple countries;
- Provide banks with access to a safe asset; and
- Minimize adverse effects on bank profitability.

At the country and cross-country level, the reform should:

- Reduce systemic risks in the banking sectors and across countries by preventing commonality and the potential for spillovers;
- Avoid procyclical regulation that unnecessarily worsens the financing conditions of vulnerable countries during crisis periods;
- Aim for establishing a safe asset that does not lose value in crisis periods;
- Limit the effect of a flight-to-safety;
- Implement market-based solutions that limit price distortions in the sovereign bond market;
- Warrant the liquidity of sovereign debt markets, particularly against the background of banks’ market-making capacities;
- Remain consistent with other prudential regulations; and
- Minimize adverse effects on the real economy.

5.2 Binding risk weights

The previous section on the current situation of the regulatory environment introduced risk weights as a key regulatory tool to improve bank resilience against credit risks. There are two commonly discussed policy reform options that would introduce a binding risk weight. The first policy suggests the implementation of a non-zero risk weight floor, with a uniform applicable risk weight to all exposures.

In the second policy option, risk weights are assigned according to credit risks. In fact, both the SA and the IRB approach would fall under this category. The introduction of non-zero risk weights, which vary according to the underlying credit risks, could be achieved through the removal of the carve-out option (paragraph 54 of the Basel II accords and EU regulation CRR article 114(4)).

If risk weights are assigned that reflect the credit risk of a sovereign, banks would likely move from risky to less risky sovereign bonds to meet their liquidity requirements, resulting in a flight to safety. This trend would be particularly pronounced during crisis periods, during which an increase in risk would incentivize banks to sell their exposures of a distressed sovereign. This in turn would put more downward pressure on yields, amplifying the financing problems of the sovereign.

5.3 Large exposure regime

The introduction of a large exposure regime for sovereign debt is another tool to increase banks' resilience and to weaken the sovereign-bank nexus. The introduction of a large exposure regime would reduce concentration and directly address the home bias, while encouraging diversification in sovereign risk exposures. The default reform option for the implementation of a large exposure regime for sovereign debt exposures is the 25% concentration limit for corporate debt, as specified in the Basel II regulation. With regard to the current high concentrations of sovereign debt on bank balance sheets and the home bias, assigning a fixed cap to the exposure can be expected to have a substantial impact on the composition of bank balance sheets. An expectation for portfolio diversification is driven by the interaction of large exposure limits with the liquidity requirement. Sovereign debt, through its classification as the most liquid asset type, provides a substantial contribution to the liquidity requirement for banks. Depending on the constraints (Table 3) imposed by the LCR, banks can be expected to respond to the introduction of large exposure limits by substituting their excess exposures towards one sovereign with debt issued by other sovereigns.

5.4 Risk weight & large exposure limit: hybrid solutions

A hybrid solution, which includes both risk weights and large exposure limits, is offered by Andritzky et al. (2016), representing the proposal of the German Council of Economic Experts (GCEE). The large exposure limits for sovereign debt suggested in the GCEE proposal are assigned on the basis of the credit rating buckets, similar to those used in the SA of Basel II, and combined with the removal of the carve-out option.

Table 7 shows that the exposure limits for the countries with the highest credit rating is capped at 100%, while the countries in the worst risk bucket face a large exposure limit of 25%. This approach is strongly procyclical, as a strong deterioration in fiscal balances is also likely to result in a reduction in credit ratings.

Table 7: German Council of Economic Expert's proposal for large exposure limits and risk weights

Credit rating	Member states	Basel risk weight for sovereigns	Large exposure regime	Basel risk weight for corporations
AAA to AA-	AT, BE, DE, EE, FI, FR, LU, NL	0%	100%	20%
A+ to A-	IE, SK, LT, LV, SI, MT	20%	90%	50%
BBB+ to BBB-	ES, IT	50%	75%	100%
BB+ to BB-	CY, PT	100%	50%	
B+ to B-	GR			
CCC+ to CCC-	/	150%	25%	150%

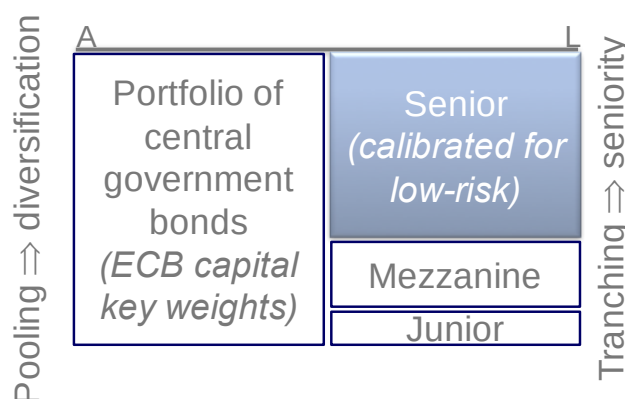
Credit Ratings as of July 1st 2017; AT - Austria, BE - Belgium, DE – Germany, EE – Estonia, FI – Finland, FR – France, LU – Luxembourg, NL – Netherlands, IE – Ireland, SK – Slovakia, LT – Lithuania, LV – Latvia, SI – Slovenia, MT – Malta, ES – Spain, IT – Italy, CY – Cyprus, PT – Portugal, GR – Greece

Source: Andritzky et al. (2016) and Bloomberg data on credit ratings

5.5 Sovereign bond-backed securities

The only proposal currently debated by academics and policy makers that addresses both the doom loop and the asymmetric distribution of safe assets is by Brunnermeier et al. (2016), who propose the introduction of sovereign-backed securities (SBBS). The reform proposal proffers the establishment of a European safe asset through securitisation of a sovereign debt portfolio. According to the authors' estimates, the introduction of senior SBBS would more than double the supply of AAA-rated safe assets relative to the status quo, in which only sovereign bonds issued by Germany, the Netherlands, and Luxembourg enjoy such a credit rating.

Senior SBBS are the senior tranche of a diversified portfolio of euro area sovereign bonds. An entity purchases a diversified portfolio of euro area sovereign bonds according to, for example, the capital contributions to ECB capital of each country. The purchases are financed through the issuances of two types of bonds: a senior SBBS and a junior SBBS. The tranching structure of the SBBS is flexible and allows various numbers of tranches catering to different investors in subordinated SBBS. For example, one could imagine including a mezzanine tranche that is senior to the junior SBBS (and thus less risky) but junior to the safe senior bonds (**Figure 1**).

Figure 1: Securitization of sovereign bond-backed securities

Source: Langfield (2017)

Tranching is key in the design of SBBS. Losses on a diversified portfolio of sovereign bonds are first absorbed by the junior SBBS and, once the junior tranche is wiped out, by the senior SBBS bondholders. Increasing the size of the junior tranche thus increases the safety of the senior bondholder. This does, however, reduce the supply of senior bonds that can be held as a safe asset. Brunnermeier et al. (2016) estimate that the senior bonds are as safe as German bunds if the junior tranche is 30% thick. In other words, it is highly unlikely that the senior tranche suffers any loss.

SBBS and a new regulatory framework

SBBS have to be embedded in a larger overhaul of the current regulatory framework with respect to the treatment of sovereign debt. Senior SBBS are assets for which the preferential treatment on the basis of a risk-free assumption would actually apply. To ensure that the regulatory framework correctly accounts for the underlying credit risk in sovereign exposures, the implementation of SBBS must be accompanied by an end to the preferential treatment of other types of sovereign debt. As described above, under the status quo, directly held sovereign bonds receive a zero or low risk weight independent of the risk of the security. Moreover, liquidity regulation favours the use of sovereign debt (particularly domestic) to meet liquidity requirements under a stress scenario. The GCEE proposal advocates that senior SBBS (the safe asset) receives a zero risk weight. The junior tranche is risky and the risk weight depends on the average risk weight (in the absence of preferential treatment) of directly held sovereign bonds and the share of the junior tranche in the securitization structure.

The advantage of SBBS comes from both pooling and tranching. Brunnermeier et al. (2016) define a security as a risk-free asset, if the expected loss rate is equal to or below 0.5%. This corresponds approximately to an AAA-rated security. According to this definition, only German, Dutch, Luxembourgish, Austrian, and Finnish bonds are considered safe, leading to a safe asset supply of €2.43 trillion.

Brunnermeier et al. (2016) assess three combinations of pooling and/or tranching and the effect on the expected loss rate of the portfolio or tranches, as well as the extent to which a safe asset supply is generated. Specifically, they discuss a) pure pooling, (b) tranching of sovereign bonds at the national level, and (3) pooling and tranching (i.e., the creation of SBBS).

It is shown that pure *pooling* does not generate a risk-free asset. Pooling without tranching results in an expected loss rate of about 2.8%; thus, pooling (and the attempt to diversify at the individual institution) is substantially larger than the required hurdle of 0.5%. Consequently, in the event of a crisis, pure pooling does not prevent a flight to a safe asset. *Tranching* of sovereign bonds at the national level is an improvement over the status quo. Simulations show that a supply of safe assets of €3.8 billion can be generated if national sovereign bonds are tranching such that sufficient subordination (i.e., junior bonds) ensures that the senior tranche has a 0.5% expected default rate. If sovereign bonds are *pooled and tranching* into a junior and senior SBBS tranche, a senior tranche that has a 0.5% expected loss rate could be generated with a junior tranche that is 16% of the overall portfolio. Thus, SBBS would generate €5 trillion of safe assets. With a 30% subordination (and a 0.09% expected loss rate, comparable to German bunds), pooling and tranching would generate more than 40% of additional safe assets, compared to national tranching alone, and about two times the amount of safe assets under the status quo.

Adverse scenario

The authors use contagion assumptions between countries in the adverse scenario. Under these assumptions, only German bunds are safe assets, thus the safe asset supply falls to €1.7 trillion. Pooling, however, would not increase safe asset supply, as the expected default rate increases to 3.84%. Tranching at the national level would only raise the supply of safe assets to €1.86 trillion, if the junior tranche of French government bonds is 50% of the overall securitization structure. Pooling

and tranching of sovereign bonds would generate €4.22 trillion in safe assets and the expected loss rate of the senior SBBS would increase marginally to 0.42% (still slightly safer than German bunds). The expected loss rate of the junior tranche increases to 11.81% with 30% subordination. It would be possible to carve out a 15% thick mezzanine tranche with an investment-grade rating, which would increase the expected loss rate of the remaining 15% junior SBBS to 17.24%.

Discussion of SBBS

The SBBS concept is widely discussed among policy makers who raise substantial concerns regarding the overall concept. We do not discuss those arguments here, but mention them for completeness, as they help provide an understanding of why the SBBS concept might not be politically/practically feasible. At what prices can these tranches be sold in secondary markets? And at what prices does the entity purchase securities from the governments? What is the pricing mechanism? Would there be sufficient demand for the junior tranche even during crises? Is this a step into the mutualisation of debt in the eurozone? Does this concept contain moral hazard issues for banks and governments? Why should we end privileges for some securities (i.e., government bonds) and introduce new privileges for SBBS tranches? Why should governments and national debt management agencies agree to a concept that requires them to issue bonds for securitization purposes, not based on government demand for funding? These are only some questions that are regularly mentioned in policy discussions and highlight that this discussion is challenging.

5.6 The Eurozone Basket

A new proposal that combines the concept of risk weights and concentration limits is discussed in Matthes and Rocholl (2017). They suggest keeping the preferential treat of sovereign exposures as long as banks hold a portfolio of European sovereign debt—named “Eurozone Basket (EZB)” —and penalize a deviation from such a portfolio with capital requirements. The composition of this basket is based on the ECB capital key (**Figure 2**), which itself is determined by the GDP and population of the eurozone countries. As a result, banks could freely choose the magnitude of their total sovereign debt exposure, which will be subject to the current preferential treatment as long as the debt holdings are structured according to the ECB capital key. If, however, the debt share of one country in the portfolio exceeds the ECB capital key, the standard Basel regulation (without the carve-out option) would apply to the excess sovereign debt holdings. This would encourage banks to diversify their sovereign debt holdings and reduce their exposures to their domestic sovereign by imposing a cost in the form of risk weights to excess exposures. The cost is based on the standard Basel/CRR regulation (IRB or SA) and thus also accounts for the risk of sovereign debt. In the proposal, Matthes and Rocholl also suggest the introduction of a concentration limit that would be equal to the underlying ECB capital key plus a buffer.⁸

The ECB capital key constitutes a general benchmark for the sovereign exposures of European banks that mimics the theoretical composition of a eurozone bond. In comparison with the proposal by Brunnermeier et al. (2016), the EZB avoids potential liquidity problems and the establishment of a securitizing institution that would be associated with the securitisation process of SBBS.

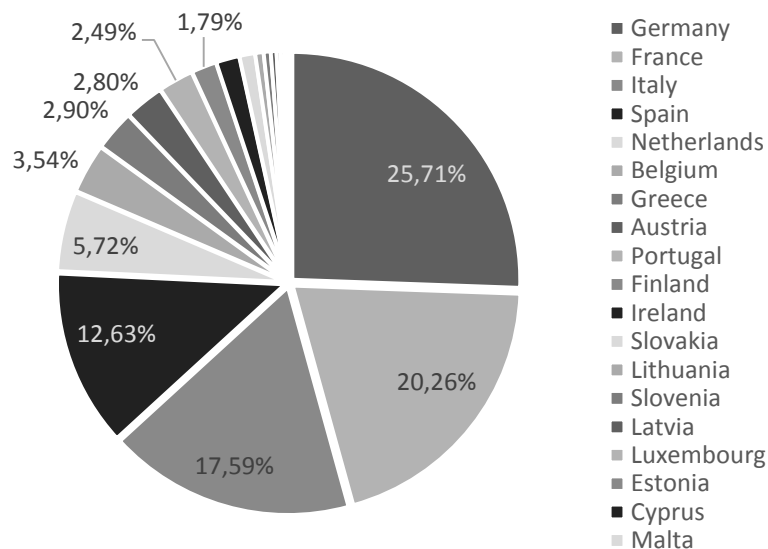
An important drawback in the proposal by Matthes and Rocholl is that sovereign exposures are effectively treated as a risk-free asset, on which neither concentration limits nor risk weights are applied as long as the banks hold the EZB. However, Brunnermeier et al. (2017) show that pooling sovereign debt securities according to GDP results in expected loss rates well exceeding the loss rate of the German bund as a benchmark for a safe asset. In the absence of tranching, individual exposures to the sovereigns remain risky and lose value during a crisis.

⁸ The size of the buffer in the current version of the proposal has not been further specified, which prevents us from including the proposal into the quantitative impact analysis in the next section.

A key question that remains unanswered in the proposal is the calibration of the capital buffer that regulates the threshold for a large exposure limit (capital key + capital buffer). If the capital buffer is chosen such that sovereign debt holdings can substantially deviate from the EZB, this would allow banks to increase their holdings of sovereign exposure above the shares prescribed by the capital key, with little or no changes to their capital requirements as long as the sovereign bonds are highly rated.

The asymmetric distribution in the quality of sovereign debt is likely to persist and would be further enforced through flight-to-quality tendencies during crisis times. The potential for a deviation from the distribution prescribed by the ECB capital key is also problematic if a pattern emerges similar to the European sovereign debt crisis. During the crisis, the cross-border exposures of banks to fiscally unstable countries resulted in substantial risk spillovers as discussed above, and by Brunnermeier et al., 2016 and Kirschenmann et al., 2017. These risk spillover were particularly pronounced for the countries in the Eurozone periphery. On the other hand, calibrating the capital buffer such that the potential for deviating from the capital key is reduced in a meaningful way would force some banks to substitute safe sovereign debt on their balance sheets for exposures to riskier sovereign debt, making these banks riskier.

Figure 2: ECB capital key 2015



Source: European Central Bank

6. FIVE POLICY REFORM SCENARIOS

In this section, we present five scenarios that correspond to the implementation of different regulatory proposals presented in Section 5. The policy reforms for which we estimate these scenarios include: (1) the introduction of a 10% risk weight floor, (2) the removal of the carve out option, (3) the application of a 25% concentration limit on sovereign exposures, (4) the implementation of risk-adjusted large exposure limits as suggested by Andritzky et al. (2016), (5) Risk weights scaled by large exposures.⁹ We evaluate the impact on bank balance sheets and the composition of sovereign debt holdings by estimating the required adjustment that would follow from complying with the regulatory change. For the analysis, we use the same 51 European banks that are part of the 2016 stress test of the EBA and SNL data. This allows for a quantitative assessment of the impact of reforms at the bank balance sheet level, as well as an aggregation at the country level. The impact that the reform suggestions would have on the bond market, the financing conditions of sovereigns, and the real economy is discussed qualitatively. For each scenario, we provide a short overview of the advantages and disadvantages of the respective policy regimes.

We make some assumptions for the calculations in the impact assessments of the five scenarios:

- We assume that banks did not account for sovereign exposures within their regulatory capital. While this might not be the case for all banks, it ensures that we calculate an upper bound in all scenarios.
- We assume that the leverage ratio is not binding for the sovereign exposure of banks.¹⁰
- We use the standardized approach to derive the risk weights.
- We use the Basel Minimum Tier 1 Capital Requirement of 6% to estimate the lower bound of additional capital Tier 1 capital, which is necessary for bank to conform to the regulatory adjustments.

For each scenario, we assess the impact on the balance sheet of our 51 sample banks. We report the sovereign exposures aggregated at the country level in **Table 8** and show the total exposure in the last row.¹¹ In the sample, the total European sovereign exposure is €1,948 billion and on average the sovereign debt holdings contribute 7.16% to the total assets of banks. The countries with the highest exposures include France, Germany, and the United Kingdom.

The substantial sovereign debt exposures that built up in the absence of capital requirements are become clear once the holdings of sovereign debt are related to the Tier 1 capital. On average, banks' sovereign debt exposures correspond to 146.7% of their Tier 1 capital.

Table 8 shows the low diversification and large home bias (63.54% on average) in the sovereign debt holdings. The combination of generally high exposures relative to the Tier 1 capital and the strong home bias highlights the high concentration of exposures to the domestic sovereign. For all other counterparties, this concentration is capped at 25% through the large exposure limit.

⁹ Note that we do not estimate scenarios for the proposals by Brunnermeier et al. (2016) and Matthes and Rocholl (2017). The implementation of SBBS in the proposal by Brunnermeier et al. (2016) does not directly impose capital requirements on bank balance sheet, while the proposal by Matthes and Rocholl (2017) does not specify the calibration of the concentration limits, which is a necessary input for our estimations.

¹⁰ The leverage ratio of 3% in combination with the minimum capital ratio of 8% indirectly introduces an average risk weight of 37.5%. However, depending on the balance sheet composition, the leverage ratio may be already fulfilled by regulatory capital for risky assets that are unrelated to the sovereign exposures and have risk weights that exceed the 37.5% implied risk weight floor of the leverage ratio. In this case, even a 10% risk weight floor for sovereign exposures would be a binding constraint for required regulatory capital.

¹¹ Bank level exposure data are reported in Appendix 2.

Table 8 also reports the share of exposures that are loans and receivables and not sovereign bonds, of which a majority might be municipal debt. For example, in Germany, the “Landesbanken” have different exposures to the government, to the different states (“Bundesländer”) or to municipalities. Loans and receivables contribute €509 billion (26.12%) to sovereign debt exposure in the sample. At the bank level (see Appendix 2), the holdings of loans and receivables are asymmetrically distributed, with the majority being on the balance sheets of state-owned banks.

These banks also exhibit extremely high exposure concentrations. For example, La Banque Postale and NV Bk Nederlandse Gemeenten have exposure concentrations that are 1,348% and 1,145% respectively and are extreme outliers even among the other state-owned banks in our sample.¹²

Our results show that in all policies introducing some type of large exposure regimes, state-owned banks with high exposure concentrations are particularly affected. This raises an important question: How should the regulator treat different types of sovereign exposures? That is, should exposure to the government (through government bond holdings) and exposure to a municipality be treated as the same exposure, thus increasing the concentration of exposures in a bank’s portfolio? Or should they be treated as separate exposure types, thus relaxing a possible large exposure constraint? Given the size of these exposures, this is an important issue to consider when designing a new regulatory framework.

Table 8: European sovereign debt exposures

Country	Total Exposure (€m)	Total Exposure /Total Assets (%)	Total Exposure /Tier 1 capital (%)	Home Bias (%)	Loans & Receivables (€m)	Loans & Receivables/ Total Exposure (%)
Austria	44,613	13.00	227.44	21.91	333	0.75
Belgium	77,053	17.05	347.55	62.70	29,600	38.42
Denmark	27,911	3.79	84.08	21.89	5,169	18.52
Finland	4,725	3.53	56.82	19.49	778	16.46
France	402,621	5.56	149.43	67.77	157,473	39.11
Germany	309,895	8.30	191.64	70.20	139,562	45.04
Hungary	6,567	17.94	237.69	91.31	142	2.16
Ireland	25,792	11.79	145.92	74.76	5,721	22.18
Italy	277,031	14.08	260.06	62.07	50,433	18.20
Netherlands	164,005	7.98	159.07	46.35	46,233	28.19
Norway	5,196	1.78	28.87	87.95	-	-
Poland	10,328	15.93	179.92	100.00	635	6.15
Spain	264,759	8.92	154.07	79.87	72,281	27.30
Sweden	48,806	3.52	76.91	35.03	20,660	42.33
United Kingdom	279,140	5.02	85.88	59.40	9,683	3.47
Total	1,948,442	7.16	146.7	63.54	509,102	26.1287

Source: Authors’ calculations based on EBA bank sample and SNL data

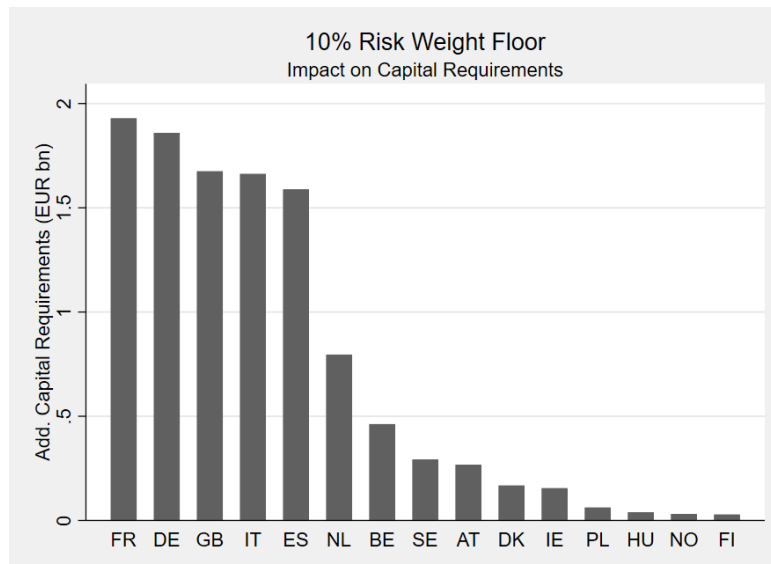
6.2 Scenario 1: Introducing a non-zero risk weight floor

In Scenario 1, we impose a 10% risk weight on all sovereign exposures. The introduction of a minimum risk weight corresponds to the notion that sovereign debt cannot be entirely risk-free, even if highly rated. The choice for the implementation of a 10% risk weight is based on a similar analysis in the 2015 ESRB report. For comparison, debt exposures to corporations are assigned a minimum risk weight of 20%. In line with the current Basel II regulations, we multiply the risk-weighted exposures with the minimum Tier 1 capital ratio of 6% to assess the impact that the policy reform would have on the minimum capital requirements for banks.

¹² To reduce the impact that these two banks have on our analysis, we only consider their sovereign bond holdings, as the extreme concentration mostly derives from loans and receivables, rather than sovereign bond holdings. With the exception of La Banque Postale and NV Bk Nederlandse Gemeenten, we do not differentiate between those two types of sovereign exposures.

Figure 3 depicts the impact of this proposal on the capital requirements of banks aggregated at the country level. We find that the required regulatory capital is proportional to the economic size of the country: France, Germany, United Kingdom, Italy and Spain are the countries affected most in absolute terms. They would face increases in required regulatory capital that range between €1.618 and €1.972 billion. The banks that are affected most by the risk weight floor include the Italian UniCredit, the British HSBC Holdings, and the French Groupe BPC. An implementation of the risk weight floor would require these banks to hold €0.851 billion (1.89% of Tier 1 capital), €0.522 billion (0.37% of Tier 1 capital), and €0.494 billion additional Tier 1 capital (0.95% of Tier 1 capital), respectively.

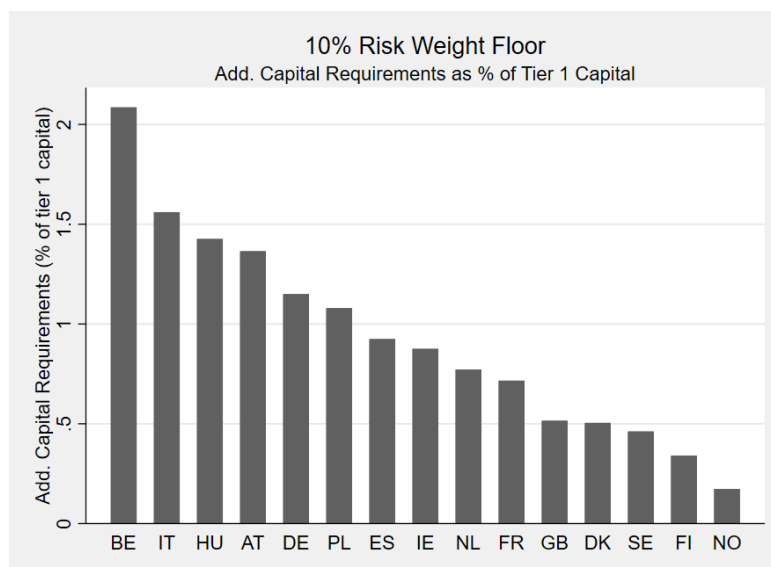
Figure 3: Additional capital requirements (€bn): 10% risk weight floor



Source: Authors' calculations based on the EBA bank sample and SNL data

Considering the impact of the 10% risk weight floor as a percentage of the current Tier 1 capital of banks, we again find a moderate effect, as shown in **Figure 4**. Banks in Belgium, Italy, and Hungary would be affected the most. On average, they would have to increase their Tier 1 capital by 2.08%, 1.56% and 1.42%, respectively. These results further indicate that banks in these three countries are the banks with the lowest Tier 1 capital to sovereign exposure ratios.

Figure 4: Additional capital requirements (% of Tier 1): 10% risk weight floor



Source: Authors' calculations based on EBA bank sample and SNL data

The introduction of a fixed risk weight floor applies the same capital requirements on all exposures and, consequentially, does not differentiate between the different underlying credit risks. On the one hand, this would prevent a procyclical change in capital requirements and a reinforcement of flight-to-quality trends during crisis periods. On the other hand, it hampers the enforcement of capital buffers that reflect the risk of sovereign debt exposures. The lack of flexibility in relating risk weight to credit risk imposes the question of the optimal level risk weight floor. In the absence of any additional regulatory constraints, the level of the risk weight floor should be calibrated such that the risk weights protect banks from sovereigns with high credit risks, while not excessively punishing the holdings of sovereign debt issued by less risky sovereigns.

The 10% risk weight floor under Scenario 1 imposes capital requirements that are low and can be difficult to justify as an adequate capital buffer to shield banks against the losses of a sovereign defaulting. A 10% risk weight in combination with the minimum tier 1 capital requirement of 6% means that banks are required to hold 0.6% of their sovereign debt exposure in Tier 1 capital. The 10% risk weight floor could be increased; however, there are inherent problems associated with a uniform application of risk weights. For example, an increase of the risk weight floor up to 20% would double the capital requirements to 1.2% of banks' total sovereign exposures, which would still be insufficient to effectively limit the vulnerability of banks to the default of a sovereign. Further increasing the risk weight floor would imply that the debt of fiscally stable countries is charged with regulatory requirements, which are higher than for companies in the best credit rating bucket (20% risk weights). In other words, using the standardized approach might be more effective than introducing a risk weight floor.

Advantages of Scenario 1

- Easy to implement.
- Accounts for a general minimum risk in sovereign exposures.

Disadvantages of Scenario 1

- No impact on the home bias or encouragement for cross-border sovereign exposures.
- All exposures are treated the same and the requirements of regulatory capital are unrelated to the underlying credit risk of sovereigns.
- Flight-to-quality.

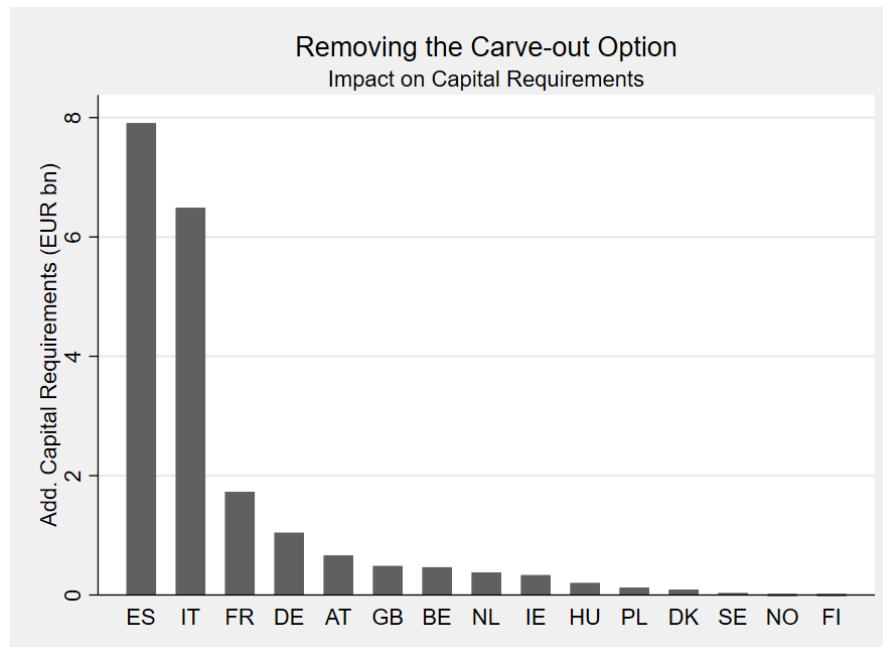
6.3 Scenario 2: Removing the carve-out option

In Scenario 2, we assume that banks may not make use of paragraph 54 in Basel II to account for their sovereign exposure with a 0% risk weight, and instead account for the risk of their sovereign exposures via the standardized approach (see Section 2 for a detailed discussion of the standardized approach). A key advantage of this type of policy reform is the consistency with the current Basel and CRR regulations. Removing the carve-out option forces banks to rely on the existing regulatory setup for the SA or IRB approach to account for the risk of their sovereign bond exposures.

In **Figure 5**, we identify a severe difference between the regulatory capital requirements for Spanish and Italian banks, increasing to €7.907 billion and €6.488 billion respectively, and the remaining countries. France, the country that would be the third most affected, would face a required increase in Tier 1 capital of €1.730 billion. This difference is the result of the combination of the home bias in sovereign debt holdings and the different risk weights that are assigned based on the credit ratings of sovereigns in the SA. In Scenario 1, 10% risk weight is applied to all exposure independent of the underlying credit risks. In Scenario 2, credit risk, measured using credit ratings, determines the risk weight. An overview of current credit ratings and the corresponding risk buckets with the respective

risk weights is provided in Table 7. Sovereign debt issued by Italy and Spain, with credit ratings of BBB+ and BBB, is part of the third risk bucket and would be assigned risk weights of 50%. France, Germany, and United Kingdom are, based on their credit ratings, part of the first risk bucket and banks can assign 0% risk weights to their exposures to these sovereigns. The 0% risk weight for debt issued by countries with credit ratings of A+ or better implies that that regulatory capital requirements in countries with a credit rating of A+ or better derive from banks' foreign sovereign debt exposures.

Figure 5: Additional capital requirements (€bn): 10% risk weight floor

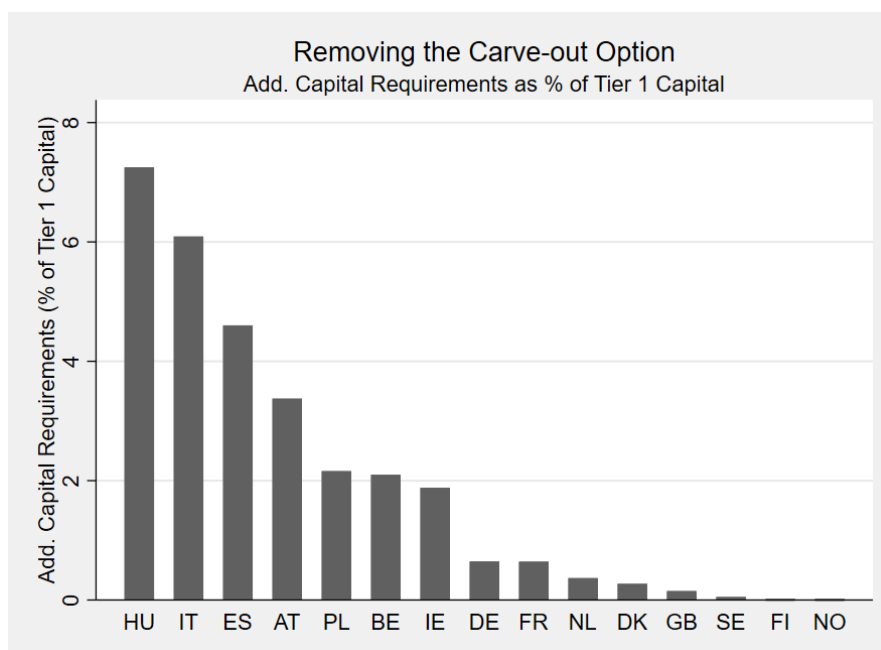


Source: Authors' calculations based on EBA bank sample and SNL data

In line with the policy impact at the country level, the banks that are affected the most in nominal terms are mainly Italian and Spanish banks. All six Spanish and five Italian banks are among those that would face the highest additional capital requirements under Scenario 2, including UniCredit, Banco Bilbao Vizcaya Argentaria (BBVA), and Banco Santander. These banks would have to increase their Tier 1 capital by €2.810 billion (6.26% of Tier 1 capital), €2.216 billion (4.56% of Tier 1 capital), and €2.208 billion (2.99% of Tier 1 capital), respectively.

Figure 6 shows the capital requirements with respect to the currently available funding. The Hungarian OTP faces the biggest gap in minimum regulatory capital requirements, amounting to 7.25% of its Tier 1 capital. Banks in Italy and Spain rank second and third and would have to increase their Tier 1 capital by 6.09% and 4.60% on average to correctly account for their sovereign bond exposures under Scenario 2. Obviously, removing the carve-out has a substantially higher and more heterogeneous impact on capital requirements when compared to the application of the 10% risk weight floor. In this scenario, banks that hold the debt of countries with worse credit ratings have to fulfil higher capital requirements.

Figure 6: Additional capital requirements (% Tier 1): Removing the carve-out option



Source: Authors' calculations based on EBA bank sample and SNL data

The loss absorption capacity of capital required when applying the risk weights under Scenario 2 are still relatively low. The banks that would be required to hold 6% of their domestic sovereign debt exposures as Tier 1 capital are from Greece, Portugal, and Malta, while it would be 3% for banks in Spain and Italy, and between 0% and 1.2% for banks in the remaining European countries in our sample. Depending on the exposure concentrations, the costs incurred by banks through a default may well exceed the regulatory capital buffer assigned through the risk weights.

If the removal of the carve-out is considered as standalone policy, it would neither address home bias nor encourage a diversification in sovereign debt holdings. In fact, banks from countries with high credit ratings may have incentives to reduce capital requirements by selling sovereign debt with lower credit ratings, which would actually increase home bias, albeit in safer countries.

Another concern within this policy regime is the possible impact on the sovereign of a deterioration in credit risk. As previously discussed, credit ratings are highly procyclical and a downgrade as proposed in this scenario would both increase the regulatory burden of holding sovereign debt and signal an increase in credit risk. The credit ratings assigned by the CRAs should serve as a regulation mechanism for governments that penalises fiscally unstable policy making. However, credit ratings failed to account for the fiscal imbalances ahead of the recent financial crisis and the downgrades mostly occurred when the countries were already economically and fiscally distressed. This is particularly problematic as credit ratings also serve as benchmarks for the risk evaluation of local firms and securities. A rating downgrade through this channel would adversely affect the domestic economy and banking sector. Using credit ratings as determinants for regulatory capital would, should a downgrade occur, disincentivize or prevent banks from holding the sovereign debt of the distressed country even more. This would likely limit the liquidity and availability of financing sources to the sovereign, while further constraining banks' capacity as a potential lender of last resort. Given the strong interdependence between credit ratings and the fiscal stability of a sovereign, it is questionable whether procyclical credit ratings are the right tool to determine the capital requirements for sovereign debt. Behn, Haselmann, and Wachtel (2016) show that increases in capital requirements adversely affect lending to companies. Showing the problem of procyclical policies, which increase capital

requirements during crisis periods, as tightening capital requirements can have significant negative effects on the real economy.

Advantages of Scenario 2

- Capital requirements are assigned based on credit risks
- Aligns well with existing regulations

Disadvantages of Scenario 2

- No impact on the home bias or encouragement for cross-border lending
- Cliff effects
- Procyclical
- Flight-to-quality

6.4 Scenario 3: Introducing a 25% concentration limit

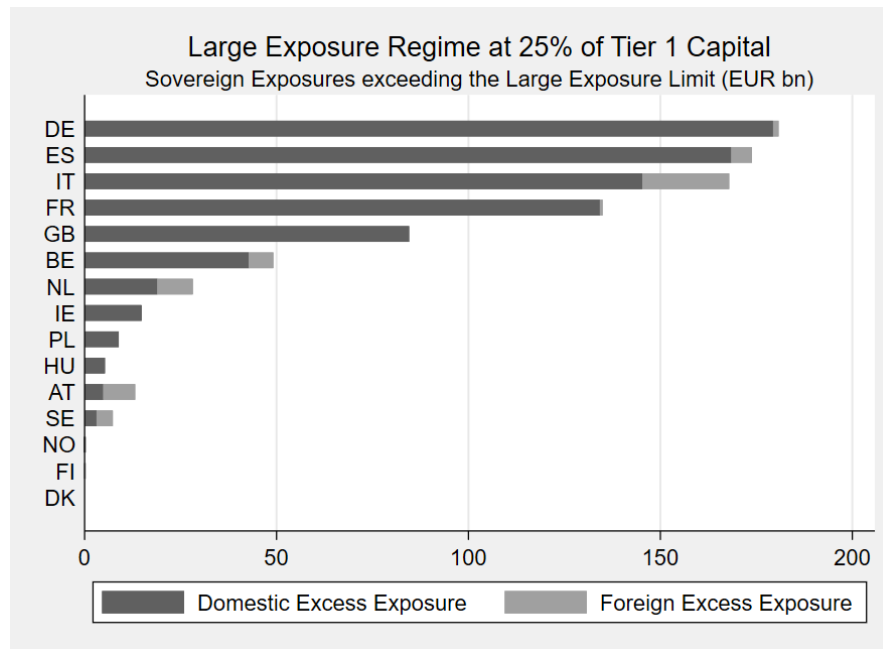
The main tool in both Basel and EU regulations to limit the exposure of banks towards one entity is the large exposure regime, which applies a concentration limit to cap the exposure at 25% of Tier 1 capital.¹³ As discussed, sovereign debt exposures are excluded from this limit. In Scenario 3, we drop this regulatory exemption and analyse the effect that a 25% concentration limit would have on bank balance sheets.

In contrast to Scenarios 1 and 2, introducing a large exposure regime in this scenario has different implications. Depending on the business model and the type of the bank, the exposures to sovereigns differ substantially. State-owned banks in particular have a substantially higher exposure to their domestic sovereign. In the most extreme cases, the exposures towards the sovereign amounts to almost 400% of Tier 1 capital. Again, this highlights the importance of the questions of how to treat the exposures to sovereign and municipality level (as described above), and whether they should count towards the same concentration limit.

In **Figure 7**, we compare the exposures that exceed the 25% limit across countries and differentiate between domestic and foreign exposures. Our results show that excess exposures are proportional to the size of the domestic economies. German banks have the highest combined excess exposures, amounting to €181.463 billion (58.55% of German sovereign exposures). Similarly to Scenarios 1 and 2, Spain and Italy are part of the three countries that would be affected the most by such a policy reform, with respective excess exposures of €174.537 billion (65.92% of Spanish sovereign exposures) and €168.281 billion (60.75% of Italian sovereign exposures). These exposure are even higher than the excess exposures of larger countries, such as France and the U.K. which indicates a disproportionately high exposure of Spanish and Italian banks even in the absence of risk-based measures consistent with the analysis in Acharya, Pierret, and Steffen (2017). At the bank level, our simulation identifies UniCredit S.p.A., Groupe BPCE, and the Lloyds Banking Group with respective excess exposures of €73.483 billion (8.55% of total assets), €57.325 billion (4.64% of total assets), and €56.913 billion (5.94% of total assets) as the three banks that would have the highest total excess exposures under Scenario 3.

¹³ The current CRR framework imposes an exposure limit of 25% of eligible capital. Eligible capital consists of Tier 1 capital and certain Tier 2 capital. The EBA, in a recent review of the regulatory setup of the large exposure limit in 2016, recommended an adaptation of the Basel requirements, which limit the maximum exposure to 25% of Tier 1 capital. The approach specified in the Basel regulation that relies on Tier 1 capital is also followed in the estimation in Scenario 3.

Figure 7: Large exposure regime at 25% of Tier 1 capital



Source: Authors' calculations based on EBA bank sample and SNL data

By comparing domestic excess exposures to foreign ones, we find that most risk concentrations exceeding the 25% threshold derive from domestic debt. The total foreign excess exposures are €58.408 billion, of which 49.3% is excess sovereign debt exposure to German bonds. In terms of absolute excess exposures, Unicredit S.p.A. exhibits the highest debt holding at €22.633 billion, which exceed the 25% threshold and represent the entire foreign excess exposure of Italy (**Figure 7**). The excess foreign exposure consists of 73% German sovereign debt, 19%, Spanish sovereign debt, and 8% Austrian sovereign debt. The countries for which foreign excess exposures contribute more than 15% of total exposure include Austria (63.5%), Finland (100%), the Netherlands (32.7%), and Sweden (57.7%).

A 25% exposure limit prevents banks from having extremely high exposure concentrations of a single sovereign and, by construction, limits the home bias of banks as well. The resilience of banks' balance sheets would be improved by limiting the maximum share of Tier 1 capital that is at risk if a country defaults. Given that sovereign debt fulfils an important function as collateral and contributes a substantial share to the liquid assets that are required to fulfil the LCR, banks can be expected to respond by substituting sovereign excess exposures with other sovereign debt. This on the one hand would ensure a diversification in the sovereign exposure but, in the absence of a risk free-asset, would also increase spillover risks.

The exposure limit is less procyclical. The absence of credit risk measures as a determinant for the capital requirements ensures that the policy does not constrain banks' lending capacity to their sovereign more when the country faces an economic downturn. The disadvantage, however, is that differentiation according to a sovereigns' credit risk is not possible. A large exposure regime also does not mitigate the adverse effects of a flight-to-quality on a sovereigns financing conditions.

Advantages of Scenario 3

- Encourages portfolio diversification and limits home bias
- Aligns well with existing regulations

Disadvantages of Scenario 3

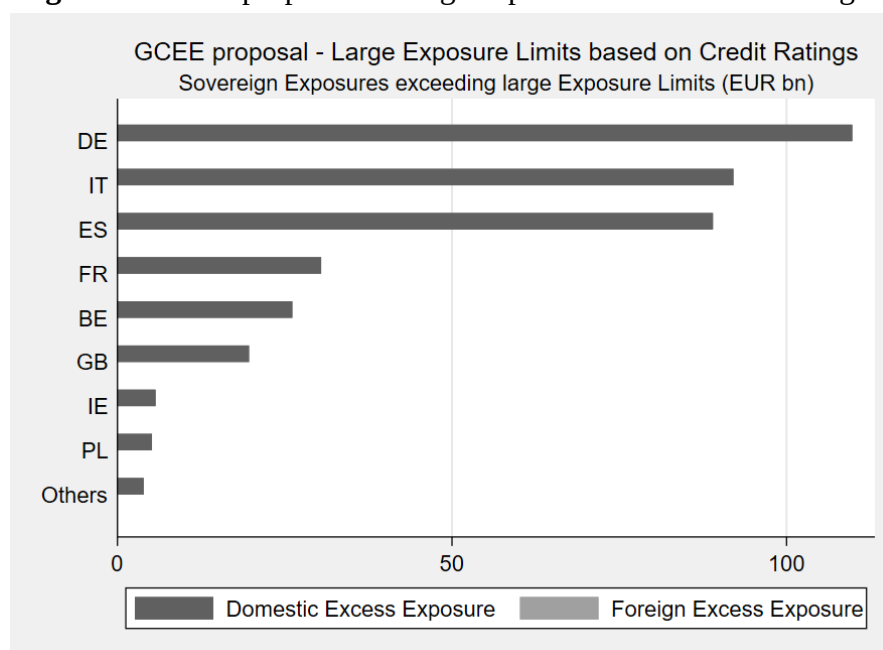
- Substantial implications for bank balance sheets and the ownership distribution of sovereign debt
- Spillover risks
- No differentiation between the sovereigns' credit risks
- Flight-to-quality

6.5 Scenario 4: GCEE Proposal: Rating-based exposure limits

In Scenario 4, we test the impact of large exposure limits that depend on the credit ratings of the sovereigns, as proposed by GCEE (2016).¹⁴ The applicable large exposure limits are based on the categorisation of the sovereign debt into risk buckets, as shown in **Table 7**. The policy reform would thus combine both large exposure regime and risk weights, conditional on the underlying credit risks of the sovereign exposures.

Figure 8 depicts the excess exposure aggregated at the country level that derives from implementing the risk-adjusted large exposure using current credit ratings. Similar to Scenario 3, we find that Germany, Italy, and Spain have the highest aggregate excess exposures at €109.832 billion, €92.147 billion, and €89.039 billion, respectively. As the lowest large exposure in the GCEE proposal caps the exposure at 25%, it is not surprising that the excess exposures are generally smaller in Scenario 4 compared to Scenario 3. The foreign excess exposures observed in Scenario 3 are not observed in Scenario 4 due to the overall increase in the concentrations limits.

Figure 8: GCEE proposal for large exposure limits and risk weights



Source: Authors' calculations based on EBA bank sample and SNL data

¹⁴ Note that removal of the carve-out option is also suggested in the GCEE proposal. The impact of this policy reform is analysed in isolation in Scenario 2. As the composition of sovereign exposures can be expected to change substantially due to the exposure limits, it is not feasible without making strong assumptions to calculate the changes in required regulatory capital when both the carve-out is removed and the risk-based exposure limits are implemented. As both would increase the capital requirements, the effect of the combined implementation will be substantially lower than the combination of the estimated standalone impact of the two policies. Given that we already show and discuss the effect of a carve-out removal in Scenario 2, we estimate only the impact of the risk-adjusted exposure limits in Scenario 4.

Three Italian and Spanish banks, UniCredit, BBVA, and Bankia, exhibit the highest excess exposures (€26 billion - €28 billion). Italian and Spanish banks have the most restricting concentration limit (50%) in the sample.¹⁵ Four German state-owned banks, including the Norddeutsche Landesbank, the Landesbank Hessen-Thüringen, the Bayrische Landesbank and the NRW Bank, also have extremely high excess exposures (€22 billion - €24 billion). As German sovereign debt is subject to the highest exposure limit (100%) in the GCEE proposal, this indicates an extremely high exposure concentration for German banks that is primarily driven by state-owned banks—the so called “Landesbanken”. As previously discussed and illustrated in **Table 8** and **Appendix 2**, these excess exposures are mainly driven by loans and receivables rather than bond holdings. The GCEE proposal, through its suggested implementation of risk-adjusted large exposure limits and risk weights, would ensure that capital requirements reflect both the underlying sovereign risk and incentivise a reduction in home bias.

Comparing our results with the quantitative impact analysis in the GCEE proposal itself, we find that the impact on bank balance remains substantial but less severe across all measures in our calculations. This is likely driven by the positive development in credit ratings, but also by the reductions in exposures and the increasing Tier 1 capital of banks. These improvements, however, underline the procyclicality inherent to this policy reform proposal.

A key problem of this policy suggestion is the severe impact of credit rating downgrades that would shift a sovereign into a lower risk bucket. Compared to Scenario 2, the change in credit rating in this policy reform does not per se increase the required regulatory capital, but reduces the maximum amount of sovereign debt that banks are allowed to hold. While in both cases the required change can be achieved through an increase in Tier 1 capital, the jumps are much more severe, in the case of a large exposure limits.

For example, if a country moved from the second to the third bucket due to a credit rating downgrade based on the risk weights in Scenario 2, it would imply an increase in the minimum Tier 1 capital requirements equal to 1.8% of the exposures to the downgraded sovereign. The same downgrade from bucket 2 to bucket 3 in this scenario would require the bank to either increase its Tier 1 capital by 20%, sell approximately 17% of their excess exposure or a mixture of both.

In the adverse scenario described above, banks that cannot substantially increase their Tier 1 capital would be forced to reduce their debt exposure to the downgraded sovereign by up to 50% and the fire sale of excess exposures would result in high losses to the banks. This illustrates how a procyclicality in combination with “cliff effects”, which are inherent in the suggested regulatory adjustments, can induce the vicious cycle of the sovereign bank nexus. The GCEE partially addresses this point by suggesting that the regulatory requirements should be calculated on the basis of the long-term averages of credit ratings, as well as bank equity. This can indeed mitigate the initial impact of a credit rating change and allows for a smoother reduction in banks’ excess sovereign exposures. The exposure limit cap, however, still prevents the domestic banking sector from stepping in as a lender of last resort to mitigate a flight-to-quality, and using a long-term average might further slow the recovery of the sovereign.

Advantages of Scenario 4

- Capital requirements are assigned based on a credit risks
- Incentivises diversification of sovereign debt holdings and restricts home bias
- Compatible with current regulatory setup

¹⁵ Greece and Malta would be countries with lower credit ratings and even lower exposure limits, but there are no banks from these countries in the EBA bank sample.

Disadvantages of Scenario 4

- Procyclical
- Flight-to-quality
- Cliff effects
- Substantial interference in the supply and demand of sovereign debt

6.6 Scenario 5: Risk weights scaled by excess exposures

In Scenario 5, we propose a policy reform that determines risk weights as a function of the excess exposures in a large exposure regime. The risk weights are scaled by exposures above a specified concentration limit. This corresponds to the notion that an increase in a sovereign exposure should also gradually increase a bank's risk. Instead of introducing a binding cap to the exposure, this policy reform would allow banks to increase their exposure above the large exposure limit of 25%, but disincentives them to do so by introducing increasing risk weights as costs to their excess sovereign exposures. This policy provides flexibility in shaping the incentive structure for banks, depending on the functional form and parameters chosen for scaling the risk weights.

Table 9 presents a set of linear and exponential functional forms, with varying parameters, and demonstrates their effect on the relation between excess exposure and assigned risk weights. The third row specifies a set of different functions that relate the sovereign risk concentration (x) in the first column (1) to calculate the corresponding risk weights. Comparing the different risk weights across a given concentration level illustrates the variation in different functional forms and parameter choices.

Table 9: Linear and exponential scaling of risk weights

Risk Concentration		Linear Scaling of Risk Weights			Exponential Scaling of Risk Weights		
		Risk weight =					
x	EBA Sample	0.5(x-0.25)	(x-0.25)	2(x-0.25)	exp[(x-0.25)/3]-1	exp[(x-0.25)/2]-1	exp(x-0.25)-1
0.25	Median	0	0	0	0	0	0,00
0.26		0.01	0.01	0.02	0.00	0.01	0,01
0.30		0.03	0.05	0.10	0.02	0.03	0,05
0.50		0.13	0.25	0.50	0.09	0.13	0,28
0.75		0.25	0.50	1.00	0.18	0.28	0,65
0.91	Mean	0.33	0.66	1.32	0.25	0.39	0,93
1.00		0.38	0.75	1.50	0.28	0.45	1,12
1.25		0.50	1.00	2.00	0.40	0.65	1,72
1.32		0.54	1.07	2.14	0.43	0.71	1,92
1.50		0.63	1.25	2.50	0.52	0.87	2,49
2.00	Maximum	0.88	1.75	3.50	0.79	1.40	4,75
3.00		1.38	2.75	5.50	1.50	2.96	14,64
3.50		1.63	3.25	6.50	1.95	4.08	24,79
3.93		1.84	3.68	7.36	2.41	5.30	38,65

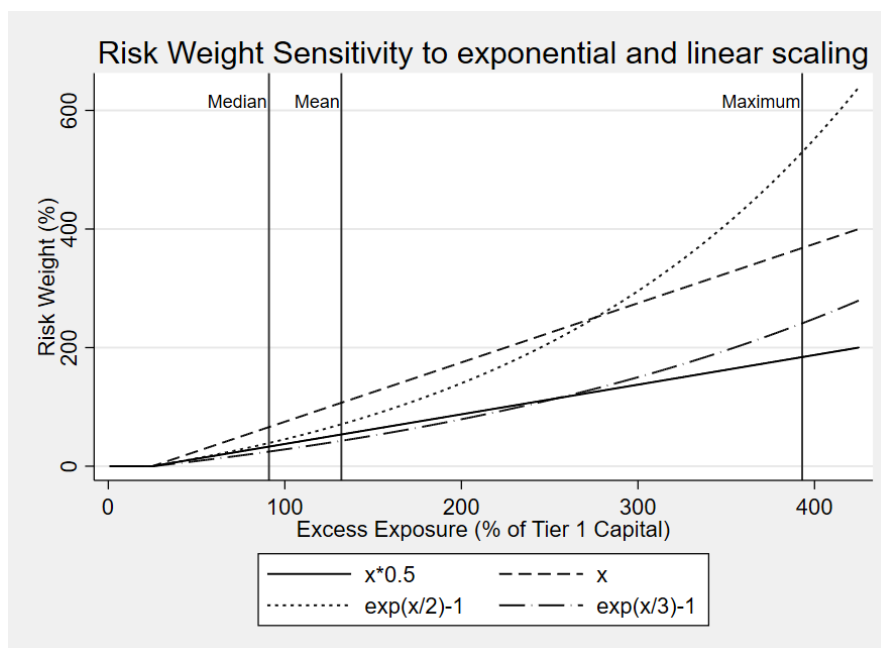
Source: Authors' calculations

The functional forms that relate excess exposure to risk weights correspond to a choice between linear functions (with a steady increase in risk weights independent of the existing excess exposure) and exponential functions (that increase the assigned risk weights as excess exposures increase). The variation of the parameters in the functions provides some initial insights on the impact of the possible calibrations on banks.

Figure 9 shows two linear functions, and two exponential functions, as examples of lower and upper bound benchmarks that assign risk weights, that relative to sample mean, median and maximum, reasonably account for the credit risk of the 51 banks in the EBA sample. If risk weights are assigned according to the lower (upper) linear scaling benchmark, the median bank would have to apply 33%

(66%) risk weights and the bank with the highest concentration would have to apply risk weights of 184% (368%) to their exposures. If risk weights are calculated according to the exponential lower (upper) scaling benchmark, the median bank would use 25% (39%) risk weights and the bank with the highest concentration would be required to apply a 241% (530%) risk weight. To further assess the implication of these lower and upper bound functions, we use the sovereign excess exposures from Scenario 3 (i.e. risk weights start increasing for concentrations above 25%) as inputs to calculate the risk weights assigned to sovereign exposures for each respective function. Based on these risk weights, we then identify the additional capital requirements that would derive from using the respective function to regulate sovereign exposures.

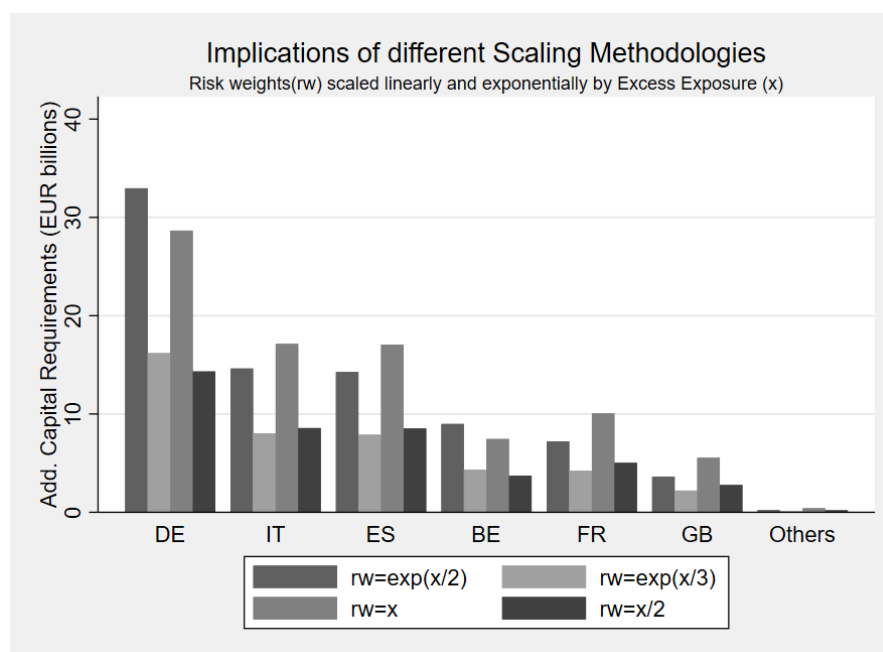
Figure 9: Exponential and linear scaling



Source: Authors' calculations

Figure 10 presents the impact of the four previously identified upper and lower bound benchmark functions on the capital requirements of banks, aggregated at the country level. In line with the other scenarios, Germany, Italy, and Spain are the countries that are affected the most by the regulatory reform. The substantially higher capital requirements of Germany are driven by the high excess exposures of the state-owned banks. Looking at the extreme exponential upper limit case, the two banks with the highest additional capital requirements are Norddeutsche Landesbank, with additional requirements for regulatory capital of €10.06 billion (126% of current Tier 1 capital), and the Landesbank Hessen-Thüringen, with additional capital requirements €8.92 billion (109% of current Tier 1 capital). Belgium also would face a comparatively high change to its capital requirements, driven by the Belfius Banque, which contributes €7.96 billion in additional capital requirements (106% of current Tier 1 capital).

Figure 10: Capital Requirements: linear and exponential scaling



Source: Authors' calculations based on EBA bank sample and SNL data

The projected additional capital requirements in this scenario are at levels that are similar to Scenario 2, where we tested the impact of removing the carve-out and apply the Basel II standardized approach. The exceptions primarily consist of Germany and Belgium, which can be traced back to the previously discussed extreme excess exposures of state-owned banks in both of these countries.¹⁶

The excess exposures in Scenario 5 are by definition the same as in scenario 3, in which we analyse the introduction of a 25% exposure limit. However, in this scenario, the sovereign excess exposures do not have to be sold or reduced to the same extent as in scenario 3 and 4. The impact on the regulatory capital derives from the risk weights implied by the excess exposures. Banks can reduce the required regulatory capital by either reducing their excess exposures or increasing their regulatory capital. With regard to the achievability of the capital requirements, an increase in Tier 1 capital not only helps fulfil the requirement, but also decreases the excess exposures, thereby reducing the requirements themselves.

This policy reform directly addresses the problem of the procyclical nature of credit ratings by introducing an alternative determinant for risk weights that is not directly related to market trends and third-party measures of creditworthiness. Establishing the risk weights through a continuous function ensures that “cliff effects”, which are otherwise inherent to both large exposure regimes and risk weights assigned through a categorization into risk buckets, are avoided. The large exposure limit imposed by the Basel accord, which was discussed in Scenario 3 as well as the large exposure limits assigned through the GCEE proposal in scenario, assign a fixed cap to large exposures, which in the case of the GCEE proposal depends on the credit ratings of the sovereigns. This scenario introduces a price to excess exposures instead of simply capping exposure, which leaves banks with a flexible

¹⁶ For France and the Netherlands, the inclusion of the full credit exposures for La Banque Postale and NV Bk Nederlandse Gemeenten as the main holders of government credit would be difficult to graphically represent and reasonably interpret the results given the extreme exposures both of these banks face. They would also be the ones that would have to increase their Tier 1 capital by 393.04% and 72.387%, respectively. This is the result of the exponential scaling of risk weight. These numbers, nevertheless, illustrate the extreme exposures that these two banks have towards their respective sovereigns.

choice regarding their sovereign exposures, trading of higher exposure concentrations for higher capital requirements

Advantages of Scenario 5

- Encourages portfolio diversification and limits home bias
- Represents the increasing risk that derives from increasing exposures
- Smooth increase and decrease in the required regulatory capital

Disadvantages of Scenario 5

- Does not account for the difference in the credit risk
- Flight-to-quality
- More complex implementation

7. CONCLUSION

The excessive sovereign debt exposures of banks contributed to the gravity of the sovereign debt crisis in 2011 and 2012, as well as to the slow and asymmetric recovery of countries in the eurozone. While banks' resilience has improved through various policies in recent years, the regulatory regime for the sovereign debt exposure of banks has not changed. We identify four criteria that constitute the basis for a new regime for bank sovereign exposures: (1) attenuate the home bias to the domestic sovereign, (2) break the doom loop, (3) avoid a flight-to-quality, and (4) mitigate risk spillovers.

In our analysis of five policy scenarios, we estimate the impact on banks' balance sheets of proposals aimed at ending the preferential treatment of banks' sovereign exposures. The variation in the capital requirements that would follow from the implementation of these proposals is quite substantial. Acknowledging that the balance sheet impact of the policy proposals can be adjusted through recalibration, we also analyse the structural advantages and disadvantages of the policy suggestions. The key criteria in this assessment are the four criteria of a new regulatory regime that we identified. Table 10 below provides an overview of this structural assessment. Looking at the structural implications of Scenarios 1 and 3, we find that the application of fixed risk weight and exposure limits is too restrictive to allow for an adequate differentiation of the capital requirement across banks and sovereigns. Varying risk weights and exposure limits are crucial to providing flexibility in regulating sovereign bank exposures. This flexibility also allows for more leeway in the calibration.

Risk weights and large exposure limits are introduced in Scenarios 2 and 4 that vary according to the credit rating of the sovereign. These policies thus allow for risk weights and large exposure limits that correspond to both the risk of the sovereign and a bank's capital. The proposals in these scenarios, however, have considerable other disadvantages. Both the variation in credit risk and large exposure limit are procyclical and the diversification in sovereign credit risk following from the exposure limits increases spillover risks. These trade-offs between advantages and disadvantages can be found across all proposals. The policy proposals that account for credit risk are all procyclical and encourage a flight-to-quality, while a diversification in sovereign bond exposures and a reduction in home bias is in all cases associated with risk spillovers.

In fact, none of the proposals features all of the four criteria that a new regime for banks' sovereign debt exposures requires. These criteria would be inherent to a regulatory regime that introduces a European safe asset, as the SBBS in the proposal by Brunnermeier et al. (2016). However, policymakers have substantial concerns regarding the viability of suggested SBBS. Nevertheless, a safe European asset should constitute the basis for a new regime for bank sovereign debt exposure.

Acharya and Steffen (2017) argue that a Fiscal Union and a completed Banking Union are both required to restore the status of the sovereign bonds of all eurozone countries as risk-free assets. A Fiscal Union is required as, in addition to budgetary discipline, an ex-post risk-sharing arrangement across eurozone countries has to be in place when a member country is in distress. The completion of the Banking Union is required as a single supervisor and single resolution mechanism help to reduce sovereign-bank linkages and forbearance by national regulators. The important difference between the Brunnermeier et al. (2016) SBBS proposal compared to a solution that relies on a completed Fiscal and Banking Union is that the risk-sharing mechanism is not accomplished via capital markets and the junior SBBS tranche, but on a sovereign level. While this removes the disadvantages associated with the SBBS proposal (and the tranching in particular) as discussed above, a fiscal union requires a political union and consensus across all eurozone countries for further fiscal integration. However, this might be the only feasible way to effectively reduce the sovereign-bank nexus and avoid the spillovers into other capital markets, as discussed extensively in Acharya and Steffen (2017).

TABLE 10: POLICY OVERVIEW

Policies	Advantage	Disadvantage
Fixed risk weights [Scenario 1]	Accounts for a minimum risk inherent to sovereign exposures	- Flight-to-quality - Does not attenuate home bias
Varying risk weights using credit ratings (or similar measures such as GDP) [Scenario 2]	Varies with underlying credit risk	- Flight-to-quality - Procyclical - Cliff effects
Fixed large exposure limits [Scenario 3]	- Attenuates home bias - Encourages diversification of sov. exposure	- Flight-to-quality - Risk spillovers - Substantial impact on sovereign bond market
GCEE Proposal [Scenario 4] (Varying large exposure limits, varying risk weights, accounting for credit risk via credit ratings,)	- Attenuates home bias - Encourages diversification of sov. Exposure - Varies with underlying credit risk	- Flight-to-quality - Risk spillovers - Procyclical - Cliff effects - Substantial impact on sovereign debt markets
Risk weights scaled by excess exposures [Scenario 5] (Varying risk weights, varying large exposure limits)	Encourages portfolio diversification	- Flight-to-quality - Risk-spillovers - No variation with underlying credit risk
Eurozone basket (Varying large exposure limits, varying risk weights, accounting for credit risk via credit ratings or other procyclical measures)	- Encourages portfolio diversification - Varies with underlying credit risk - Encourages holdings of a quasi-safe asset portfolio	- Flight-to-quality - Risk spillovers - Procyclical - Cliff effects
Sovereign Bond-backed Securities (SBBS)	- Ensures diversification of European sovereign bond holdings - Establishes a European safe asset	- Substantial impact on sovereign debt market - Complex implementation

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APPENDIX 1: BANKS SUMMARY STATISTICS

This table is a list of all 51 banks participating in the 2016 stress tests and for which data are available from SNL Financial as of Q1 2017.

Bank	Country	Ticker	Total Assets (€m)	CET 1 (%)	Equity/Assets (%)	RWA/Assets (%)
Erste Group Bank	Austria	EBS	208,227	13.36	7.97	48.89
Raiffeisen Zentralbank	Austria		134,847	11.92	7.26	50.47
KBC Group	Belgium	KBC	275,200	16.15	6.31	31.57
Belfius Banque	Belgium		176,721	16.62	5.10	26.44
Danske Bank	Denmark	DANSKE	468,501	16.28	4.78	23.40
Nykredit Realkredit	Denmark		188,361	18.85	5.07	24.94
Jyske Bank	Denmark	JYSK	78,903	16.52	5.54	31.05
OP Financial Group	Finland		133,747	20.12	7.65	32.97
BNP Paribas	France	BNP	2,076,959	11.61	5.07	30.73
Crédit Agricole SA	France	ACA	1,524,232	12.09	4.19	19.73
Société Générale	France	GLE	1,382,241	11.80	4.75	25.72
Groupe BPCE	France		1,235,240	14.14	5.60	31.65
Crédit Mutuel Group	France		793,522	15.74	6.36	33.51
La Banque Postale	France		229,577	13.73	4.28	25.93
Deutsche Bank	Germany	DBK	1,590,546	13.41	4.08	22.40
DZ BANK AG	Germany		509,447	14.48	4.49	23.25
Commerzbank	Germany	CBK	480,450	13.91	6.16	39.66
Landesbank Baden-Württemberg	Germany		243,620	15.55	5.39	31.77
Bayerische Landesbank	Germany	BLB59U	212,150	14.67	5.21	30.74
NORD/LB	Germany		174,797	11.27	3.46	34.27
Landesbank Hessen-Thüringen	Germany		165,164	14.26	4.75	32.00
NRW.BANK	Germany		142,066	41.76	13.23	31.00
Volkswagen Financial Svcs AG	Germany		130,148	11.69	13.02	91.98
DekaBank Deutsche Girozentrale	Germany		85,955	17.70	5.92	27.70
National Bank of Greece	Greece	ETE	78,531	16.26	9.66	52.37
OTP Bank	Hungary	OTP	36,611	13.54	12.56	59.52
Governor and Co. of the bank	Ireland	BIRG	123,129	14.20	7.64	41.28
Allied Irish Banks	Ireland	AIB1	95,622	19.00	13.75	56.72
UniCredit	Italy	UCG	859,533	8.15	5.02	45.04
Intesa Sanpaolo	Italy	ISP	725,100	12.65	6.80	39.16
Banca Monte dei Paschi	Italy	BMPS	153,178	8.17	4.22	42.77
Banco Popolare	Italy		117,411	12.97	6.51	33.33
UBI Banca	Italy	UBI	112,384	11.48	8.06	52.93
ING Groep	Netherlands	INGA	845,081	14.15	5.96	37.19
Rabobank	Netherlands		662,593	14.02	6.12	31.88
ABN AMRO Group	Netherlands		394,482	17.06	4.80	26.42
NV Bk Nederlandse Gemeenten	Netherlands		154,000	25.96	2.91	8.01
DNB ASA	Norway	DNB	292,273	17.55	7.78	36.12
PKO Bank Polski	Poland	PKO	64,851	14.51	11.40	68.40
Banco Santander	Spain	SAN	1,339,125	12.53	7.67	43.92
BBVA	Spain	BBVA	731,856	12.18	7.57	53.15
CaixaBank	Spain	CABK	347,927	13.19	6.77	38.76
Banco de Sabadell	Spain	SAB	212,508	12.00	6.16	40.50
Bankia SA	Spain	BKIA	190,167	15.08	6.75	40.47
Banco Popular Español	Spain		147,686	11.53	7.34	42.75
Nordea Bank	Sweden	NDA	615,659	18.43	5.26	21.63
Handelsbanken	Sweden	SHB.A	274,322	25.12	5.19	17.46
Skandinaviska Enskilda Banken	Sweden	SEB.A	273,598	18.76	5.38	23.28
Swedbank	Sweden	SWED.A	224,901	25.04	6.02	18.30
HSBC Holdings	United Kingdom	HSBA	2,251,962	13.60	7.69	36.09
Barclays	United Kingdom	BARC	1,420,808	12.36	5.88	30.14
Lloyds Banking Group	United Kingdom	LLOY	957,796	13.59	5.97	26.36
Royal Bank of Scotland Group	United Kingdom	RBS	935,382	13.42	6.19	28.58

APPENDIX 2: BANK EXPOSURE TO EUROPEAN SOVEREIGNS

This table is an overview of the exposures of all 51 banks participating in the 2016 stress tests and for which data are available from SNL Financial as of 2017:Q1.

Bank	Country	Exposure (€m)	Exposure/ T1 Capital (%)	Home Bias (%)	Loans and Receivables (€m)	Loans and Receivables/ Exposure (%)
Erste Group Bank AG	Austria	29,498	243.07	23.33	14.78	0.05
Raiffeisen Zentralbank	Austria	15,115	202.08	19.13	318.41	2.11
Belfius Banque SA	Belgium	31,840	425.74	87.89	25,102.88	78.84
KBC Group NV	Belgium	45,213	307.75	44.95	4,497.24	9.95
Danske Bank	Denmark	25,837	124.79	16.93	4,497.78	17.41
Jyske Bank	Denmark	1,114	28.46	77.20	670.74	60.22
Nykredit Realkredit	Denmark	960	11.19	91.13	-	-
OP Osuuskunta	Finland	4,725	56.82	19.49	777.55	16.46
BNP Paribas	France	70,157	91.29	13.34	2,568.71	3.66
Groupe BPCE	France	82,343	157.72	85.48	54,074.97	65.67
Groupe Crédit Agricole	France	53,442	127.59	71.70	1,245.75	2.33
Groupe Crédit Mutuel	France	31,294	77.04	71.39	8.13	0.03
La Banque Postale	France	107,295	1,348.81	94.45	81,227.02	75.70
Société Générale S.A.	France	58,091	116.35	53.56	18,348.91	31.59
Bayerische Landesbank	Germany	34,812	322.78	92.31	23,614.69	67.84
Commerzbank AG	Germany	43,887	160.74	34.60	22,124.13	50.41
DekaBank Deutsche Girozentrale	Germany	9,630	213.76	84.13	2,186.82	22.71
Deutsche Bank AG	Germany	61,619	105.83	45.96	17,059.69	27.69
Landesbank Baden-Württemberg	Germany	30,669	237.17	85.18	15,786.00	51.47
Landesbank Hessen-Thüringen	Germany	32,659	399.70	94.41	21,006.60	64.32
NRW.BANK	Germany	56,289	306.18	75.70	15,686.30	27.87
Norddeutsche LB Girozentrale	Germany	37,403	443.16	88.85	21,617.12	57.80
Volkswagen Financial Services AG	Germany	2,927	22.57	33.73	480.57	16.42
OTP Bank Nyrt.	Hungary	6,567	237.69	91.31	142.10	2.16
Allied Irish Banks plc	Ireland	17,898	183.03	81.05	5,616.02	31.38
Bank of Ireland	Ireland	7,894	99.96	60.50	104.65	1.33
Banca Monte dei Paschi	Italy	23,480	257.98	99.57	3,252.27	13.85
Banco Popolare	Italy	19,156	325.47	99.99	-	-
Intesa Sanpaolo	Italy	73,532	187.53	65.97	22,707.16	30.88
UniCredit	Italy	141,921	315.94	43.67	23,868.09	16.82
UBI Banca	Italy	18,943	255.68	100.00	605.88	3.20
ABN AMRO Group	Netherlands	25,205	138.29	32.38	1,441.00	5.72
Rabobank	Netherlands	27,252	77.75	83.19	2,062.93	7.57
ING Groep	Netherlands	72,464	156.13	15.86	11,261.38	15.54
N.V. Bank Nederlandse Gemeenten	Netherlands	39,084	1,145.48	86.22	31,467.69	80.51
DNB Bank Group	Norway	5,196	28.87	87.95	-	-
PKO Bank Polski	Poland	10,328	179.92	100.00	635.47	6.15
BFA Tenedora de Acciones	Spain	40,226	356.32	85.96	5,134.56	12.76
Banco Bilbao	Spain	74,426	153.29	85.36	26,691.17	35.86
Banco Popular Español	Spain	23,074	234.78	94.98	5,675.39	24.60
Banco Santander	Spain	72,364	98.48	67.29	13,551.80	18.73
Banco de Sabadell	Spain	22,071	216.18	61.34	7,099.52	32.17
Criteria Caixa,	Spain	32,598	176.34	89.62	14,128.07	43.34
Nordea Bank	Sweden	26,571	100.21	34.61	10,154.45	38.22
Skandinaviska Enskilda Banken	Sweden	12,592	95.03	19.55	5,606.56	44.52
Svenska Handelsbanken	Sweden	4,171	33.98	49.09	2,181.50	52.30
Swedbank	Sweden	5,471	47.94	61.99	2,717.63	49.67
Barclays Plc	United Kingdom	77,206	108.10	49.43	5,144.52	6.66
HSBC Holdings	United Kingdom	87,067	61.69	44.19	4,538.01	5.21
Lloyds Banking Group Plc	United Kingdom	70,278	141.72	98.55	-	-
Royal Bank of Scotland	United Kingdom	44,588	70.90	44.66	-	-
Erste Group Bank AG	Austria	29,498	243.07	23.33	14.78	0.05
Raiffeisen Zentralbank	Austria	15,115	202.08	19.13	318.41	2.11



Европейски парламент Parlamento Europeo Evropský parlament Europa-Parlamentet Europäisches Parlament
Euroopa Parlament Ευρωπαϊκό Κοινοβούλιο European Parliament Parlement européen Parlaimint na hEorpa
Europski parlament Parlamento europeo Eiropas Parlaments Europos Parlamentas Európai Parlament
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